ALPINE-WESTERN BALKAN RAIL FREIGHT CORRIDOR

TRANSPORT MARKET STUDY

2024 UPDATE

Funded by the European Union

CONTENTS

LIST OF FIGURES

LIST OF TABLES

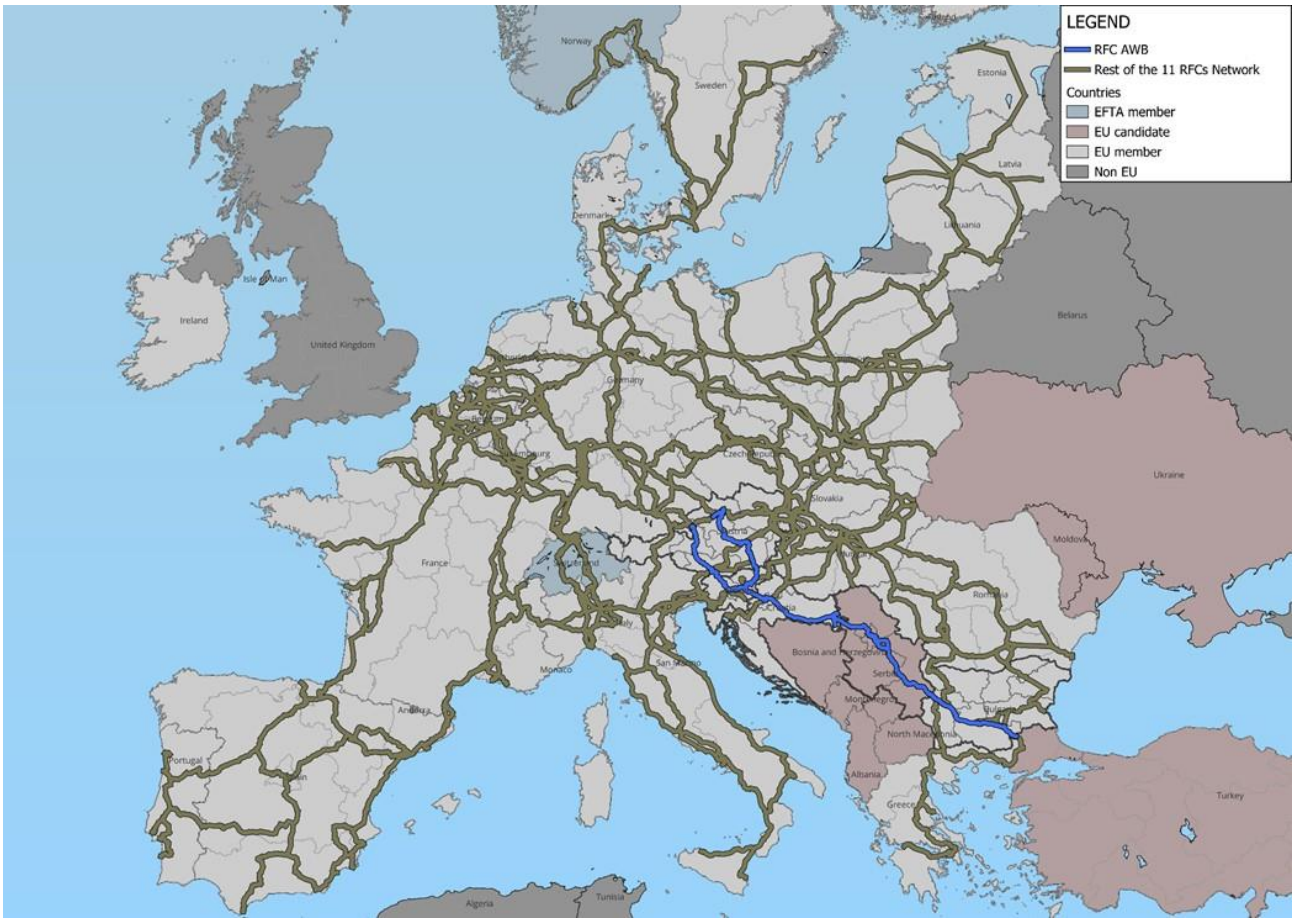
EXECUTIVE SUMMARY

RFC AWB 2024 TMS UPDATE RESULTS WITHIN THE 2024 JOINT TMS UPDATE OF THE 11 RAIL FREIGHT CORRIDORS BELONGING TO THE EUROPEAN RAIL NETWORK FOR COMPETITIVE FREIGHT

The Rail Freight Corridor Alpine-Western Balkan (RFC AWB) is one of the 11 RFCs currently in operation, established under the scope Regulation (EU) 913/2010 concerning a *European rail network for competitive freight*. According to Article 9.3 of Regulation (EU) 913/2010, the Management Board of the RFC shall carry out and periodically update a Transport Market Study (TMS) related to the observed and expected changes in the traffic on the freight corridor as a consequence of the RFC being established.

Over the past decade, RFCs elaborated first TMSs and, in most cases, TMS updates. However, these studies were carried out without a common approach or a shared methodological framework. To support the RFCs in achieving compliance with the above requirement in a coordinated and harmonised manner, the Management Boards of the 11 RFCs decided to execute a Joint TMS Update under the coordination of RailNetEurope (RNE). This main findings and results of the 2024 TMS Update for the RFC AWB are summarised in the following paragraphs.

The RFC AWB within the 11 RFCs Network



Source: Authors based on CIP

For the analysis of the current and future transport markets along the 11 RFCs, a European-wide transport model has been used – the NEAC Model – which combines socio-economic, trade and transport statistics

with traffic flows for different transport modes. The geographic scope of the model covers the European Union and the non-EU countries crossed by the 11 RFCs and involved in their catchment areas. The model has been calibrated to the year 2022 (Model Base Year). Future scenarios have been elaborated for the 2030 time horizon.

Due to the adoption of a common, network-wide approach and use of an EU-wide network model, the analysis of the individual RFCs has been performed within the framework of the 11 RFCs Network and overall European policy and market trends. This approach is also appropriate considering that the 11 RFCs share many infrastructure components, i.e. corridor lines, logistics nodes and Border Crossing Points, as well as their catchment areas. Also, regulatory, policy and economic backgrounds and developments, as well as most available statistics on the sector, generally concern the country or EU territorial scale.

Specifically concerning the study policy background, the 2024 11 RFCs Joint TMS Update has been conducted in the framework of the rail sector specific milestones introduced by the European Commission in its Smart and Sustainable Mobility Strategy to support the achievement of the ambitious target of the European Green Deal, of reducing transport emissions by 90% by 2050 (compared to 1990 levels), i.e., doubling passenger high-speed rail traffic by 2030 and tripling it by 2050, while increasing rail freight by 50% by 2030 and doubling it by 2050 (compared to 2015 levels). With reference to the 50% target growth set in the EU policies for the period 2015-2030, the following table provides transport volume figures in million tkm for the EU27 in 2015, and 2022. Data show that the gap to be filled between 2023 and 2030 is significant, especially for the international segment.

Freight volume (million tkm) in 2015 and 2022

	2015	2022	Var. % '15-22
International rail freight transport	155,289	149,032	-4%
National rail freight transport	181,811	199,830	10%
Total rail freight transport	337,100	348,862	3%

Source: Eurostat [rail_go_typepas]; Notes: (1) Data for Belgium are excluded from the total as they are not available for 2015 and 2022. (2) Data are limited to main undertakings

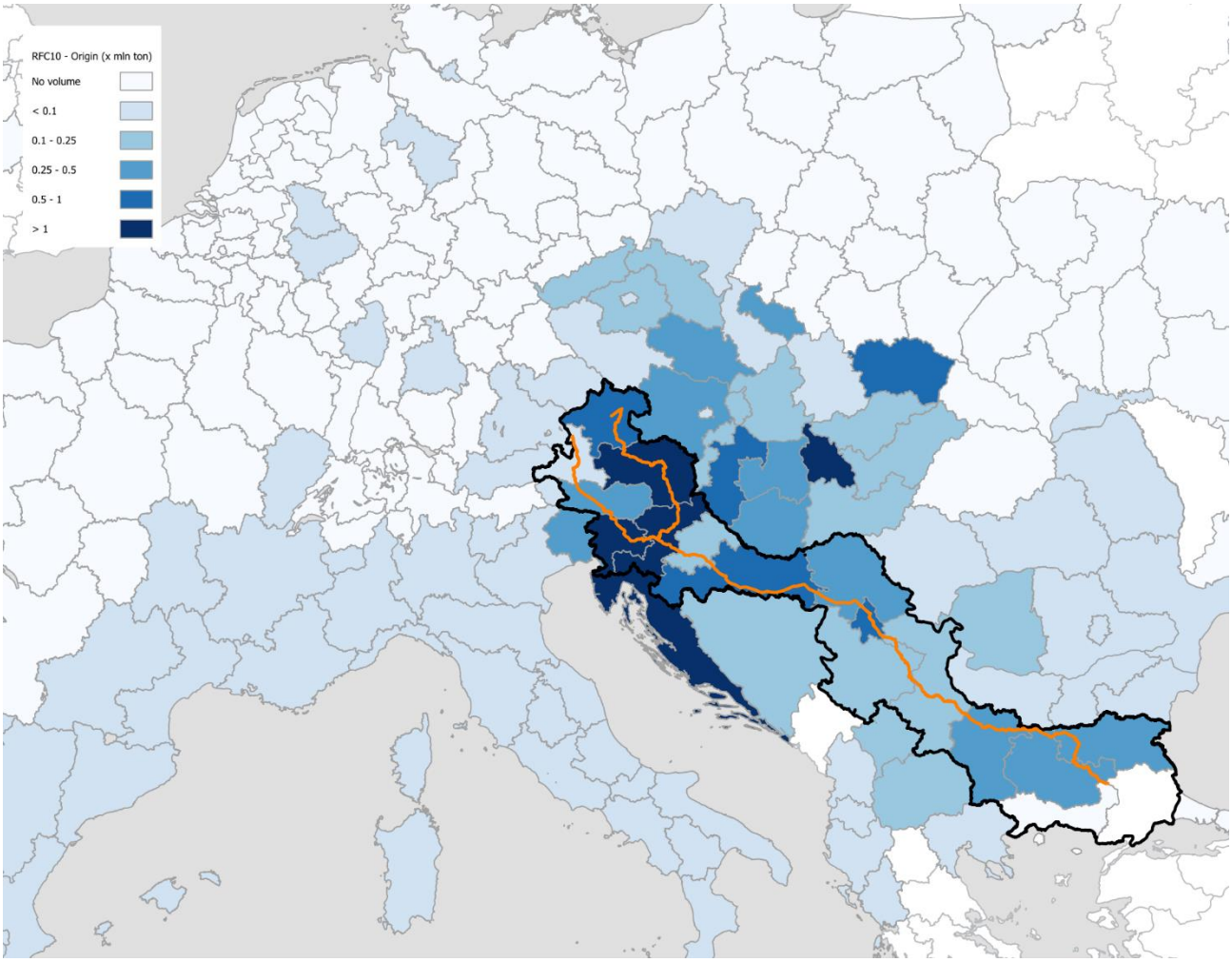
For the analysis of the current market (Base year scenario), train data from the Train Information System (TIS) managed by RNE have been used, which combined with available trade and economic data available at the NUTS2[1] area, served as a basis to define the RFC AWB catchment area and main origin and destinations, prior to estimate the volumes of the transported goods and the modal share by land transport mode.

The catchment area for international rail freight transport of the RFC AWB - namely the NUTS 2 regions where trains crossing at least one RFC AWB BCP have either their origin and/or destination – exceeds the corridor area, i.e. the area crossed by the corridor infrastructure(see overview in the overleaf figures). The RFC AWB catchment area captures large parts of Austria, Slovenia, Croatia, Serbia, and Bulgaria. A large proportion of the rail freight transport uses the RFC AWB, and its border crossing points, to ship freight by rail from different origins to different destinations. The picture below shows the origins of the RFC AWB, with important origins

[1] A NUTS 2 zone refers to a level within the Nomenclature of Territorial Units for Statistics (NUTS), a hierarchical system developed by the European Union to divide the economic territory of the EU into territorial units for the purpose of collecting, developing, and harmonising statistical information. NUTS 2 forms basic regions for the application of regional policies, often used for regional development and structural funding. These zones are generally composed of regions with a population between 800,000 and 3 million people, although there can be exceptions. The precise structure and the number of NUTS 2 zones can vary between countries, depending on national administrative structures and the size and population of the country.

such as Koper/Ljubljana, Eastern Slovenia, Linz, and Zagreb. Also, outside the corridor area different zones can be seen that contribute to the RFC AWB, such as Budapest or Adriatic Croatia. Note that outside the corridor it often concerns small amounts of volume.

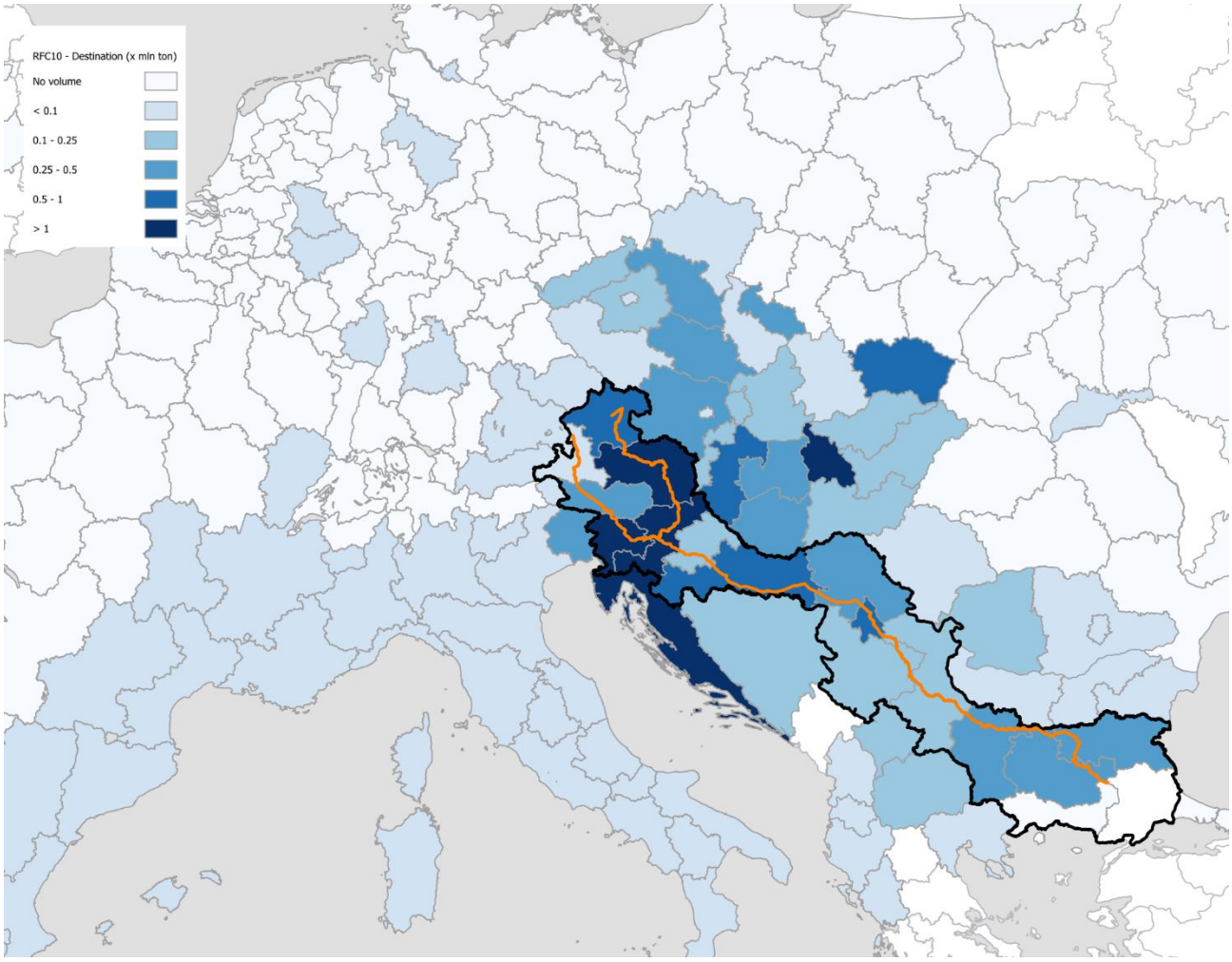
Origins of international rail freight volume (in million tonnes) that use the RFC AWB rail network and the delineation of the potential RFC AWB catchment area



Legend: Orange = rail tracks of RFC AWB. Blue = Volume by origin. Black = Delineation of potential catchment area

The next figure presents the destinations within the RFC AWB catchment area. The figure highlights similar zones as the origins that exhibit the high freight volumes dispatched from these destinations. It is evident from the figure that numerous zones benefiting from RFC AWB's services fall outside the corridor area, such as areas in the rest of Italy, France, and Romania. Within the corridor area, there are also a few zones with limited rail volumes for international transport such as in Greece.

Destinations of international rail freight volume (in million tonnes) that use the RFC AWB rail network and the delineation of the potential RFC AWB catchment area



Legend: Orange = rail tracks of RFC AWB. Blue = Volume by origin. Black = Delineation of potential catchment area

For the purposes of the 2024 Joint TMS Update, future scenarios have been built only considering socio-economic and infrastructure developments. This solution reflects the decision to develop only short-term forecasts up to 2030 and adopt a pragmatic and, as far as possible concrete approach, thus omitting the simulation of the possible effects associated with potential policy developments currently under discussion, such as: the weights and dimension directive, and electrification of HGV; the internalization of external costs of road transport (road pricing), or incentives to rail/combined transport operations; technological/operational improvements of intermodal transport solutions and logistics chains; market sensitivity to climate and energy transition. In line with this approach, the following scenarios have been defined, all of them at the 2030 time horizon:

- *Reference or background scenario*: It describes the economic developments (in terms of GDP changes), which have the most important impacts on the future of rail transport. The base for this is the EU reference 2020-2050 scenario and the World Economic Outlook 2023.
- *Projects scenario*: It provides an overview of the impacts resulting from the expected developments in the rail transport system. Actually, a number of projects are ongoing and/or planned for the improvement of the railway infrastructure belonging to the 11 RFCs Network. Such projects were first identified in the 11 RFCs Implementation Plans, which were further confirmed by the 11 RFCs.

Furthermore, the list of the investments planned for the development of the 9 TEN-T Core Network Corridors was consulted to integrate the information available from the RFCs. The ongoing and planned investments differ in size. Some are big projects such as Rail Baltica or the Fehmarnbelt. But there are also many investments related to the modernisation and rehabilitation of railway lines to meet the TEN-T standards, improve network interoperability or increase capacity by upgrading railway lines and nodes. Not all projects have been considered for future scenarios simulation purposes. First of all projects have been selected which are assumed to be completed before or in 2030. Second, only major projects were considered which should be able to 'translate' into a time gain or cost reduction. This approach reflects the purpose of the study and nature of the model, limited to freight market analysis and thus transport volumes and modal share estimation by land transport mode, excluding network capacity simulation and assessment, and looking at the short-term time horizon.

- *Sensitivity scenario: the completion of the TEN-T network at standard in 2030*: It provides an overview of what would happen if – in addition to the investments included in the projects scenario - ERTMS is fully introduced, 740 meter long trains are allowed to operate anywhere on the whole network, 22.5 tonnes axle load is achieved on the entire network, intermodal loading gauge is also possible along the RFCs and if the rail gauge in Spain and Portugal meets European standards (the Rail Baltica initiative, providing UIC and more generally TEN-T standard interconnectivity to the three Baltic States with Europe is already considered in the *Projects scenario*). This TEN-T completion scenario should be considered as a sensitivity analysis, as the projects required to reach the TEN-T standards will not be fully implemented before 2030.

In the absence of a consistent historical series of data and information on the operations along the 11 RFCs – worth also considering that the RFCs were established and entered into operation in different years between 2013 and 2020, and their alignment adjusted over time to reflect market needs – an e-survey was conducted as part of the 2024 Joint TMS Update – *2023 11 RFCs Joint TMS Update Survey* – to assess the occurred and expected changes associated with their establishment on three main areas: occurred and expected impact of the RFCs, occurred and expected market developments along the RFCs, and market drivers. The survey involved the Railway Undertakings Advisory Groups (RAGs) and Terminal Advisory Groups (TAGs) of the 11 RFCs.

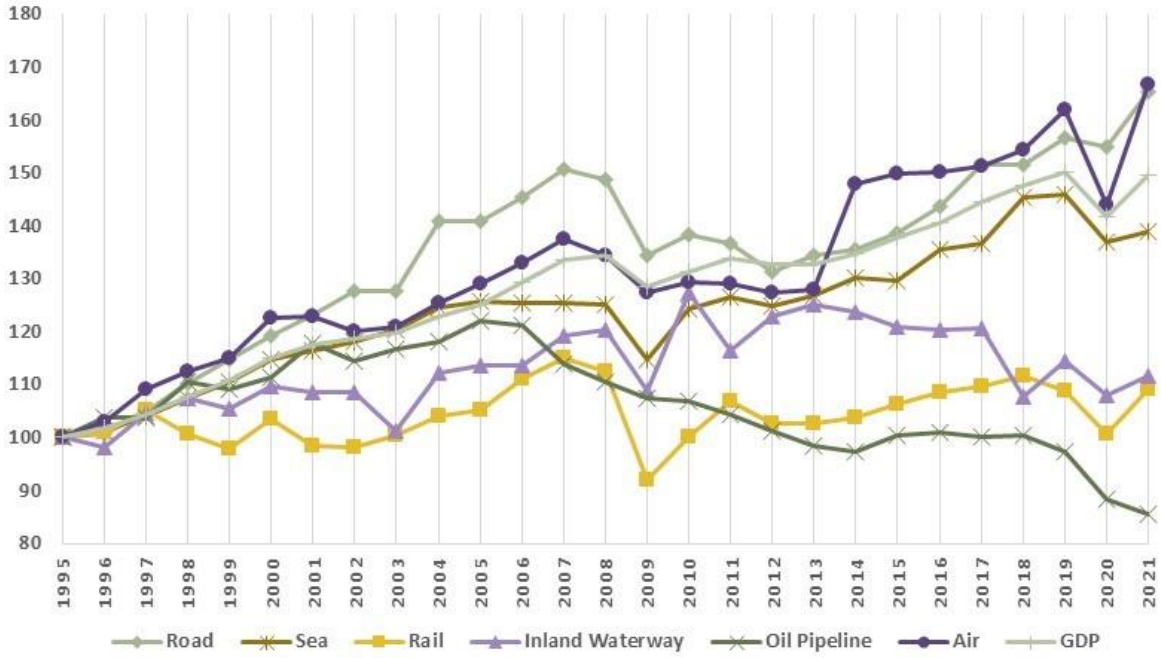
KEY STUDY FINDINGS ON RAIL FREIGHT MARKET IN EUROPE AND ALONG THE RFC AWB

OVERALL MARKET TRENDS AND SECTOR DEVELOPMENTS

The data available from the European Commission DG MOVE/Eurostat (Statistical Pocketbook 2023 and Rail Market Monitoring Report) and from the Independent Regulators Group (IRG) (Rail Market Monitoring Reports) provide an overview of the development of the European rail freight sector since mid of the 1990s when the rail freight market liberalization started, allowing monitoring trends before and after the 2008 credit crunch, which is considered the second major financial crisis after the 1930s Great Depression, and which was followed by additional adverse events during the past 10-15 years when the 11 RFCs were gradually established and entered into operation. The statistical data available from the above mentioned sources are not available for the Republic of Serbia, nonetheless they are useful to provide a statistical background to the RFC AWB updated transport market study. Key findings from the statistical analysis are as follows:

- The period between the entry into force of the rail freight regulation has indeed been marked by a number of socio-economic, health and geopolitical events, which negatively impacted trade and transport flows at the global and European scale. The statistical review shows that the above-mentioned 2008 financial crisis basically altered the economic and transport developments experienced by Europe over the previous decades. EU27 long-term series over the past 30 years show that the effects of this crisis are persisting: albeit positive, the trend of GDP and most transport modes of the following period stands indeed at lower growth rates. Overall, the European rail freight market grew modestly over the last decade, contrasting with the strong development experienced between 2001 and 2008. The EU economy and transport markets were more recently further impacted by the 2020-2021 COVID-19 pandemic and by the current geopolitical crisis that started in 2022 with the Russian-Ukrainian war and deteriorated with the Israel-Gaza conflict and Red Sea crisis.

Transport trends in billion tkm EU27 (1995=100)



Source: EC – DG MOVE – Statistical Pocketbook 2023

- Rail freight transport between 2013 and 2021 marginally grew in the EU27 from about 385 billion tkm to 410 billion tkm, i.e. 7%, which is only half the rate of growth of total transport volumes and GDP. However, over the same period combined transport more than doubled from about 41 billion tkm to 100 billion tkm. Trends for the RFC AWB concerned countries are similar to the EU ones, specifying that the growth of rail freight transport registered higher rates. In the RFC AWB concerned countries rail freight transport grew indeed from about 31 to 38 billion tkm, i.e. 19%.
- The RFC AWB countries are among the ones registering relatively high rail modal share in the EU. Two out of four RFC AWB countries (Austria and Slovenia) are indeed positioned within the ten first-ranking EU countries for rail modal share in 2022. However, Austria is also among the ones that are registering a high decline in rail modal share over time. A trend that is likely related to the change in the commodity basket trade.

At both EU 27 and RFC AWB concerned country levels, there is an underlying stagnation or decline of dry and liquid bulk commodities (originating even from before the mid of the 1990s), associated with a growth of intermodal transport, a market segment that is apparently growing with the gradual opening of the rail freight market and greening of logistics chains. The market share of rail transport is slightly declining in Austria, and stable or slightly growing in the other countries.

- The COVID-19 pandemic seems to have had different impacts at the EU27 scale on rail freight traffic measured in net tkm, with either increases or decreases in transport volumes between 2019 and 2021. The impact has been apparently significant in the Baltic States, Denmark, Luxembourg, Portugal, and Romania, whereas Bulgaria and Greece experienced about 20% growth. The RFC AWB concerned countries seem to have registered positive variations during the pandemic period.
- Since the start of the rail freight liberalisation process late 1990's and 2000's, the market share of the domestic incumbent railway undertakings gradually declined in most EU Member States, whereas the market share of non-incumbents increased together with the operations of foreign incumbents. As a general pattern, common to the EU27 and RFC AWB concerned countries, the trend of the market share by domestic incumbents continued to decline in the period 2013-2021. In the RFC AWB concerned countries, the market share of the domestic incumbent in 2021 was about 65%.

ANALYSIS OF THE CURRENT AND FUTURE FREIGHT TRANSPORT MARKET ALONG THE 11 RFCS NETWORK

The total volume of international freight transport over land for the 11 RFCs Network catchment area is 1,439 million tonnes. The volume of international rail freight transport is 265 million tonnes (about 440 thousand international trains[2]), which is 18% of the total amount of transport to, from, and within the catchment area of the 11 RFCs Network. The share and volume of inland shipping (IWW) is 17% (240 million tonnes), and the share of road transport is 65% (934 million tonnes).

Concerning the cargo types[3], the category *Other* (general cargo, including intermodal transport and container) dominates the international freight transport for the 11 RFCs Network, by 845 million tonnes of volume. This is about 59% of all international freight transport. This cargo type is mostly transported by road (about 69%). *Dry bulk* is the second largest cargo type at 32% (465 million tonnes). *Liquid bulk* has as share of 9% (128 million tonnes) in the total volume of international freight transport over all land modes.

[2] Using an average of 600 tonnes per train

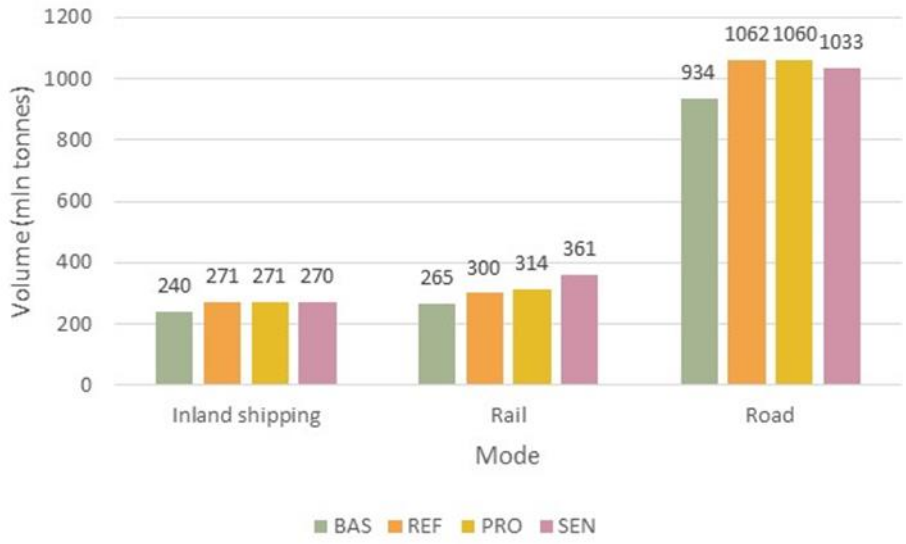
[3] We distinguish dry bulk, liquid bulk, and other (general cargo and container). Dry bulk comprises commodities such as sand, ores and coal. Liquid bulk comprises mainly oil(products) and liquid chemicals. General cargo concerns a broad range of products such as cars, machinery, and electronics. Containers concern intermodal transport. The content is often unknown.

Estimated volume (million tonnes) and share of international freight transport over land by mode and cargo type within the catchment area of the 11 RFCs Network

Source: NEAC estimations

The three future scenarios (Reference, Projects and Sensitivity) show an increase in international freight transport in general. Within the 11 RFCs Network catchment area, due to economic growth (EU Reference and UN), the increase in general is about 18%. This is in line with the GDP growth for the EU27, which is 17%. Inland shipping shows a growth of 13% (from 240 to 271 million tonnes), road has a growth of 14% (from 934 to 1062 million tonnes) and rail transport of 13% (from 265 to 300 million tonnes). In the absence of further developments, the rail freight market is expected to grow at a slower pace compared to GDP and to the overall transport sector, therefore losing market share. This is due to the changing trends in the basket of transported commodities and differentiated geographic demand growth distribution. For all land freight transport, the projects scenario and the sensitivity scenario have a limited impact on the overall growth of international freight transport.

Development of volume (in million tonnes) by mode and scenario for the 11 RFCs Network catchment area



Source: NEAC estimations; Legend: BAS Base year scenario; REF Reference scenario, PRO Projects scenario; SEN: Sensitivity scenario

Focusing on international rail freight transport, the reference scenario expects a growth of 13%, which is approximately 35 million tonnes extra compared to the 2022 situation. Both the Projects scenario and the Sensitivity scenario show the impact of the different rail projects and rail measures. In the Projects scenario, rail transport grows an extra 4% compared to the reference scenario (300 million tonnes to 313 million tonnes) due to projects. In total this is approximately 13 million tonnes of extra international rail freight transport.

The hypothetical Sensitivity scenario shows that compared to the reference, there is a potential of 61 million tonnes extra rail freight transport due to longer trains, 22.5 t axle load, ERTMS, and standard gauge on the whole 11 RFCs network. The total expected rail freight transport volumes in this scenario reaches 361 million tonnes, corresponding to a 20% growth compared to the Reference scenario.

Considering both economic and infrastructure developments, the Sensitivity scenario can be regarded as a potential maximum growth for rail transport across the 11 RFCs Network. Compared to the 2022 base year, transport volumes would increase from 265 to 361million tonnes i.e. by 36%, out of which around 1/3 is due to economic development and 2/3 to infrastructure investments.

As a result of the analysis performed, it is possible to conclude that the major planned projects along the 11 RFCs Network assumed to be completed by 2030, and the modernisation of railway lines and cross-border sections in the Eastern European corridor countries, are fundamental to removing infrastructure bottlenecks and reducing travel times and transport costs. Such initiatives are expected to increase competitiveness of rail transport on the 11 RFCs Network, and thus on each RFC, including the RFC AWB. Further to these projects, completing the 11 RFCs Network in line with the TEN-T requirements is key to increase the rail market share.

With reference to the 50% growth set in the EU policies for the period 2015-2030, the combined observed growth for the period 2015-2022 and expected for the time frame 2023-2030 (+36%) still lags below the target. Therefore, the development of a high-quality and interoperable network does not seem to be sufficient to achieve the ambitious targets set in the relevant European transport policies.

Such targets remain challenging to meet in the absence of a significant change in the structure of the costs of road and rail transport. Internalising external costs of road transport, and or incentives to reduce the costs of rail transport might be needed. The potentially negative impacts on rail market share of measures such as improving the efficiency of road transport shall also be considered, as also reported in a recent study by the Community of European Railway and Infrastructure Companies (CER) – *Study on Weights and Dimensions: Impacts of the Proposed Amendments to the Weights and Dimensions Directive on Combined Transport and Rail Freight Transport*[4]. Market opening appears also to be relevant in increasing the competitiveness of rail transport. A recent study by the European Rail Freight Association (ERFA) – *The European Rail Freight Market; Competitive Analysis and Recommendations*[5] – considers how non-incumbent operators, focussing on the fast-growing intermodal and logistics train segments, are likely to experience further growth in market share in the 2020s. According to the study, competition amongst railway undertakings has made rail more attractive compared with road, which can be partially explained by the business model of non-incumbents, more

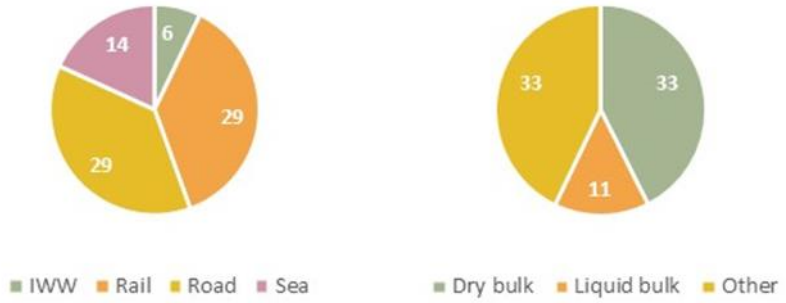
[4] https://www.cer.be/cer-reports/study-on-weights-and-dimensions
[5] https://erfarail.eu/news/the-european-rail-freight-market-competitive-analysis-and-recommendations

focused (i.e., intermodal and logistics, block trains, and international traffic), lean and agile, and cost competitive, able to offer better service levels consistently.

ANALYSIS OF THE CURRENT AND FUTURE FREIGHT TRANSPORT MARKET ALONG THE RFC AWB

International freight transport across all modes in the catchment area of the RFC AWB amounts to 78 million tonnes. Overall, most transport concerns both cargo type *Dry Bulk* (43%) and *Other* (43%). The cargo type *Other* is mostly transported by road, while rail has a large share in the international transport of dry bulk (58%).

Estimated volume (million tonnes) and share of *all* international freight transport over land by mode and cargo type in the *catchment* area of RFC AWB



Source: NEAC estimations

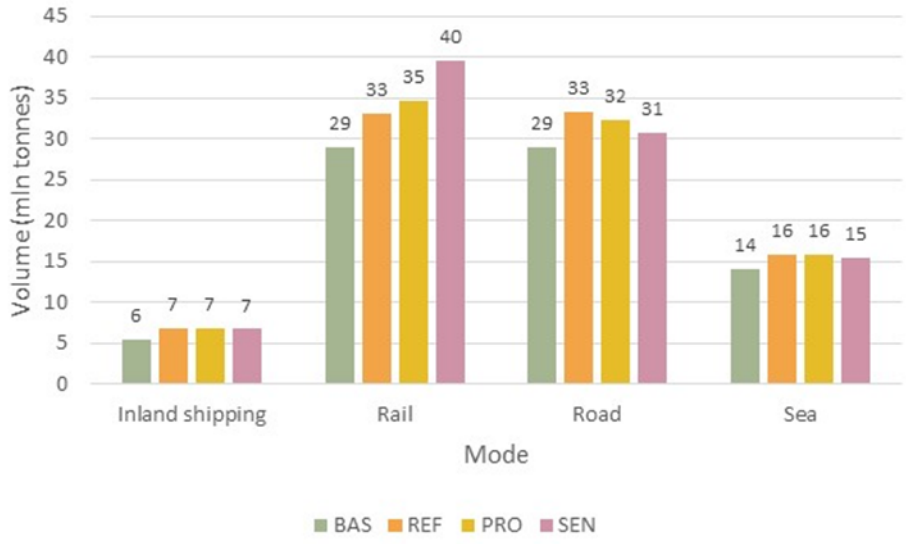
On relations within the catchment area of RFC AWB, rail freight transport has a share of 37% in the total amount of international freight transport. This is a volume of 29 million tonnes. The total amount of international rail freight transport of 29 million tonnes relates to approximately 29,000 trains within the corridor area of RFC AWB.

Looking within the corridor area, rail transport amounts to 8 million tonnes. This is equivalent to approximately 8.000 trains from and to locations within the corridor area of the RFC AWB.

The most important rail transport origins and destinations can be found in Slovenia and Austria, in locations such as Koper and Linz. The port of Koper serves as a gateway to the hinterland (mainly Austria) in the RFC AWB. The most important relation is between Koper/Ljubljana and Linz.

The three future scenarios (Reference, Projects and Sensitivity) show an increase in international freight transport in the RFC AWB in line with what expected at the European level. Mainly due to autonomous economic growth, the increase in general is about 13%, in the RFC AWB slightly more at 15%. This is in line with the GDP growth for the EU27 which is 17%. In the RFC AWB, rail has a growth of 14%, inland shipping shows a growth of 23%, road has a growth of 15%, and sea shipping 12%. In the absence of further developments, the rail freight market is expected to grow at the same pace compared to GDP and to the overall transport sector, therefore slightly losing market share. For all land freight transport, the Projects scenario and the sensitivity scenario have an impact on the overall growth of international freight transport, especially in the RFC AWB.

Development of volume (in million tonnes) by mode and scenario for the corridor area of RFC AWB



Source: NEAC estimations; Legend: BAS Base year scenario; REF Reference scenario, PRO Projects scenario; SEN: Sensitivity scenario

In the RFC AWB, for the Reference scenario, a growth of international rail transport is expected at 14%, which is approximately 4 million tonnes extra compared to the 2022 situation. This would be (rounded) 4,000 extra international freight trains in the RFC AWB. In the RFC AWB in 2022 the total amount of unique international freight trains is estimated at about 29,000. The total number of international trains would then be some 33,000 trains in the Reference situation in 2030.

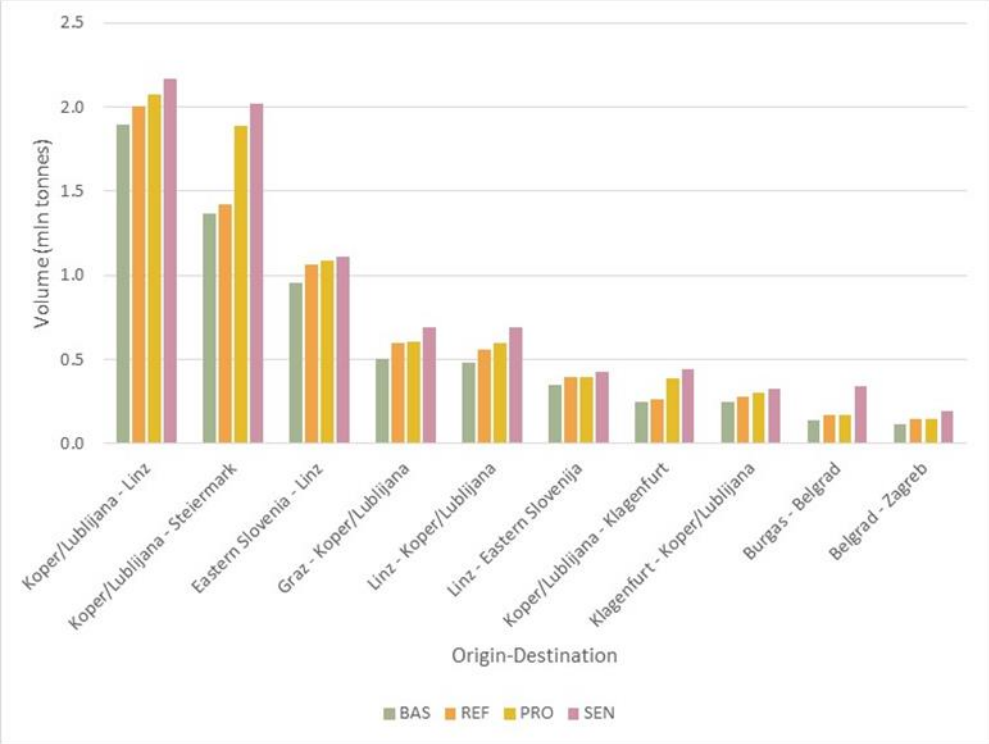
The Projects scenario shows the impact of the different rail projects and rail measures. Rail transport grows an extra 6% compared to the reference scenario. In total it is estimated that this is approximately 2 million tonnes of extra international rail freight transport. This gives (rounded) 2,000 extra trains in the RFC AWB. Together with the Reference scenario results, this would be approximately 35,000 trains for the RFC AWB.

The hypothetical TEN-T standards interoperability scenario shows that there is another potential of 5 million tonnes extra rail freight transport due to longer trains, ERTMS, and standard gauge in Spain and Portugal. The total number of unique international freight trains would then be around 35,000. Compared to the 29,000 unique trains in 2022, this is a growth of around 21%. This figure can be regarded as a potential maximum growth.

Overall, the sensitivity scenario can be regarded as a potential maximum growth for rail, considering both economic and infrastructure developments. Compared to the 2022 base year, transport volumes would increase from 29 to 40 million tonnes i.e. by 38%.

The figure below shows the top 10 most important international rail freight transport relations within corridor area of the RFC AWB. The main relation is between Koper/Ljubljana and Linz at 2 million tonnes. This relation is important for dry bulk. In second place comes Koper/Ljubljana - Graz, also with dry bulk as main cargo type. Another important relation concerns Eastern Slovenia to Graz. The other relations show similar volumes of around 0.5 million tonnes of volume. As can be seen Koper is an important port for this RFC, Linz is an important inland location in the RFC AWB.

Development of volume (in million tonnes) of all international rail freight transport by the top 10 relations within the catchment area of RFC AWB

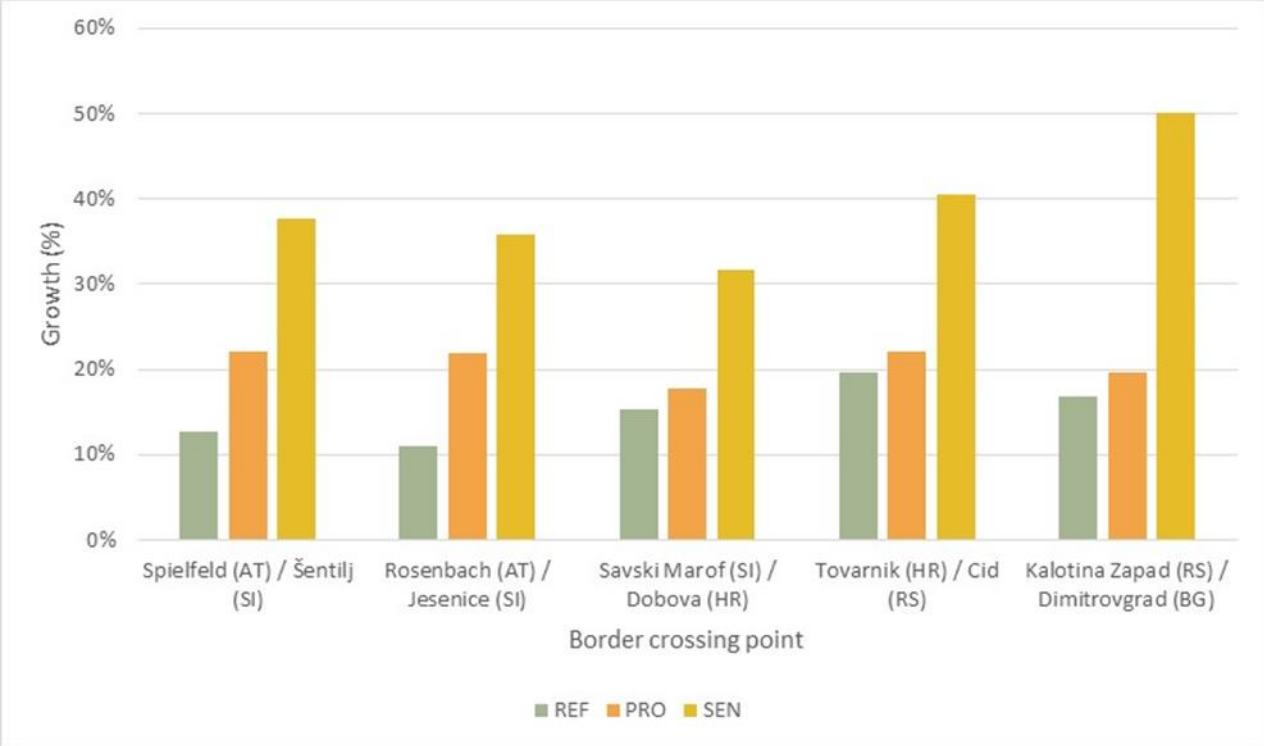


Source: NEAC estimations; Legend: BAS Base year scenario; REF Reference scenario, PRO Projects scenario; SEN: Sensitivity scenario

The different border crossing points in the RFC AWB each show different growth between the 2022 Base year and 2030 Reference, Projects and Sensitivity scenarios. Overall, the Reference shows growth in volume of 14% on the BCPs. This is in line with the general growth for rail transport between the 2022 Base year and 2030 Reference scenarios. The completion of different projects by 2030 leads to different growth patterns; on average, the growth in relation to the base is 21% more volume, which translates into 21% more trains on average. The sensitivity scenario leads to 37% more volume, which is 37% more trains compared to 2022. Due to the extra train length, there is less growth in number of trains. Furthermore, interesting is the fact that the growth differentiates by BCP. Interesting to see is that the sensitivity has most impact on the BCPs between Bulgaria and Greece. Keep in mind that the volumes on these BCPs are relatively low. But there seems to be potential for growth.

The total amount of unique trains on some BCPs in 2022 in the graph below is estimated at 29.000 trains. In the Reference situation this would be approximately 33,000. In the Projects scenario, this is 35,000 trains, while in the Sensitivity scenario, this is 35,000 trains (due to extra volume per train, the same as the Projects scenario). Keep in mind that the number of reported trains is higher, but this is due to double counts (some trains pass more than 1 BCP).

Development of volume (in million tonnes) of international rail freight transport on important border crossing points of the RFC AWB



Source: NEAC estimations; Legend: REF Reference scenario, PRO Projects scenario; SEN: Sensitivity scenario

OCCURRED AND EXPECTED CHANGES DUE TO THE ESTABLISHMENT OF THE RFCS

The e-survey conducted to collect the opinion of the 11 RFCs RAGs and TAGs members on the occurred and expected impact of the establishment of the RFCs, involved 42 representatives of the RAGs and 30 members of the TAGs, who submitted valid questionnaires between September 2023 and January 2024. Whereas the overall number of responses makes the survey outcome meaningful for the analysis of the occurred and expected changes at the 11 RFCs Network scale, an analysis specific to each individual RFC would not be statistically significant. The survey results are accordingly used in the 2024 11 RFCs Joint TMS Update for the 11 RFCs Network. It is worth noticing that the survey responses reflect the views of the respondents at the time of submission of the questionnaire (Autumn 2023/January 2024). They furthermore represent a partial view of the market as the sample of the respondents is not representative of the market universe; and may contrast with the findings from the statistical review presented in the previous section above, as the opinions relate to the corridors and international trains, whereas national statistics refer to the whole country network and national as well as international traffic. The main findings from the survey are summarised in the following bullet points for each of the three investigated areas.

Occurred and expected impact of RFCs, in the areas of governance, operational efficiency and capacity management

- The opinion of the 11 RFCs RAGs and TAGs members about the changes within the governance area is positive, especially in terms of cooperation with the market, including but not limited to RUs and terminal operators, as well as concerning facilitation of discussion among Member States about the issues affecting the competitiveness of international rail freight transport. The opinion about the

progress made regarding cooperation between RFCs and Core Network Corridors (CNCs)/ERTMS horizontal priority is less favourable. The market opinion is unfavourable about the progress made on harmonising international freight rail services' legislative, regulatory, procedural and operational aspects. The expectations of the market players concerning the future impact of the programmes and activities of the RFCs are relatively positive concerning all aspects. Respondents consider the cooperation between RFCs and an EU Network of Infrastructure Managers (ENIM) as assumed in the proposal for the new capacity regulation, to be the best governance solution for bringing issues forward.

- The stakeholders' opinion about the changes that occurred within the operational efficiency area is also generally positive, except for the progress made in the promotion of technical and operational harmonisation of the European railway transport system towards its interoperability. The respondents' expectations concerning the future impact of the programmes and activities of the RFCs are relatively positive concerning all the assessed issues related to operational efficiency. Cooperation between RFCs and an EU Network of Infrastructure Managers (ENIM) is also considered the best-fitting governance solution to bring operational efficiency issues forward.
- The respondents' opinions about the changes that occurred within the capacity management area are predominantly unfavourable. Notwithstanding the market's negative opinion of the progress made since the establishment of the RFCs in this area, the expectations on the future impact of the programmes and activities by the RFCs are rather positive with regard to all the investigated aspects related to capacity management. The best governance solution for capacity management improvements is deemed to be the cooperation between the RFCs and an EU network of Infrastructure Managers (IMs).

Occurred and expected market developments

- The vast majority of the e-survey respondents operated or still operate rail services or manage/operate terminals serving trains across at least one border crossing point on any of the RFCs. Most of them also operated or served international rail freight transport before the establishment of the RFCs. The majority of the respondents declare they experienced an increase in their operations since 2013, and most of them also have a positive expectation about the future, expecting overall market growth.
- Most RUs declare the market trend is stable since 2013 on the AWB but have positive expectations about the future. The variation in traffic experienced by terminal operators since 2013 and the expected growth tends to be slightly pessimistic.
- The prevailing type of international trains operated on the RFCs Network consists of intermodal trains, followed by conventional block trains and single-wagon load trains. Most RUs and terminal operators experienced growth in intermodal train operations in the past years, whereas the trend for conventional block and single-wagon load trains is predominantly stable. Most respondents have a positive expectation for the future in terms of traffic growth for all market segments.
- Concerning traffic between logistics nodes, most operations relate to Port to Rail-Road Terminal (RRT) transport, followed by RRT to RRT services and Port to Port operations. Experienced variations by RUs were mostly positive for the Port to RRT or RRT to RRT segments and stable for the Port to Port one. Terminal operators have predominantly experienced growing trends in all market segments in the past years. The vast majority of RUs and terminal operators are expecting positive future trends for the three market segments.

- Regarding service distances, most operations cover distances between 300 km and 900 km, followed by services covering distances longer than 900 km and below 300 km. RUs experienced mostly positive variations for services covering distances longer than 300 km and declared the market is stable for operations below 300 km. Terminal operators have predominantly experienced growing trends in all market segments in the past years. The vast majority of RUs and terminal operators are expecting positive future trends for the three market segments.

Market drivers

- RUs and terminal operators have very similar views about the effects of the main market drivers on the growth of international rail freight transport in the short term, i.e., up until 2030. Most identified drivers are expected to have positive effects as they are assumed to improve rail transport's competitiveness. At the same time, the geopolitical context and socio-economic outlook, as well as the shortfall of the labour force, are perceived as threats.
- The socio-economic outlook is ranked first by the market, followed by infrastructure development and interoperability, policy and economic incentives to promote shift to rail. Increased performance of rail freight services and harmonisation of procedures and national legislation to improve cross-border operations are the two most relevant market drivers, according to the respondents, if considering both first- and second-ranking options.
- Although indicated as having a potential negative impact on the market, labour shortages and geopolitical context are not ranked among the most critical market drivers. Finally, technological improvements towards better integration and increased efficiency of multimodal logistics chains, better-integrated corridors and terminal capacity management do not seem to be considered priority issues by the RUs and terminal operators.

RECOMMENDATIONS ON FACILITATING AND FOSTERING THE RAIL FREIGHT MARKET ALONG THE 11 RFCS AND THE RFC AWB

In line with the overall study approach aimed at conducting the 2024 RFC AWB TMS Update as part of a Joint TMS Update of the 11 RFCs, study recommendations are primarily formulated focussing on the short-term development of the 11 RFCs belonging to the European rail network for competitive freight. RFCs share indeed both infrastructure and market, and more importantly a same EU policy background and overall socio-economic and geopolitical challenges despite some differences between Eastern and Western as well as Northern and Southern European countries. The 2024 11 RFCs Joint TMS Update allows for an estimation of the current market with reference to the RFCs catchment areas based on a common approach and tool, and for an overall assessment of the impact of the development of the 11 RFCs Network towards the development an completion of the TEN-T network at standard. In line with the methodology decided to be adopted for the 2024 11 RFCs TMS Update, no assessment of the current and future capacity was performed as part of the study and no detailed quantitative assessment of the current and future market operations by the operators along the individual RFCs and with reference to the expansion or new construction of individual projects and logistics nodes. The adopted approach albeit appropriate for an assessment of the market and modal share of the individual RFCs as part of the 11 RFCs Network, does not allow capturing RFCs specific market elements, especially the ones related to operational aspects. Study recommendations have been formulated around two main areas: market developments and targets and institutional and operational developments.

MARKET DEVELOPMENTS AND TARGETS

The simulations made in the study demonstrate that major projects, and particularly the completion of the TEN-T network at standard, would significantly increase the competitiveness of rail freight transport. The post-COVID recovery and the recent geopolitical crises caused delays in the implementation and completion of the projects needed to complete an high quality and interoperable TEN-T network. Price increases and shortages of construction materials particularly affected the advancement of ongoing and planned projects. A high-quality and interoperable network might, furthermore, not be sufficient to achieve the ambitious targets set in the relevant European transport policies, in the absence of a significant change in the structure of the costs of road and rail transport. The following recommendations are proposed to support market development towards the achievement of the EU policy targets:

- *Timely complete the development of a high-quality, interoperable network:*
  - *Building missing links and removing infrastructure bottlenecks* increasing infrastructure capacity by adding new tracks and lines where needed, increasing their speed and improving their gradient, can solve congestion problems, save energy and reduce transport costs as well as improve travel times. Such developments are relevant at the network level, but produce effects also at the individual corridor scale;
  - *Achieving the requirements set in the TEN-T Regulation towards a Single European Railway Area*, i.e. 740 meter long trains, ERTMS, 22.5 tonnes axle load, intermodal loading gauge, UIC gauge, electrification, is fundamental to support the development of a Single European Railway Area;
  - *Support intermodal and combined transport*. The intermodal market is the most promising international rail freight market segment, requiring improvement of interconnectivity between main railway lines and terminals, increasing the capacity of the existing terminal infrastructure, investing in technologies to facilitate and speed up transport and transhipment operations, and tracking and making more reliable the transport of intermodal units along logistics chains and within logistics clusters;
  - *Stronger cooperation between all involved parties for better effectiveness in the availability and use of funds and the definition of investment implementation strategies focussed on those sections of the network with higher market potential*. For over a decade, the sector has benefited from a stronger TEN-T policy with a dedicated Connecting Europe Facility Fund. Among the different transport modes involved in the TEN-T network, rail and rail cross-border initiatives are treated as a priority. However, the available financial resources are limited overall compared to the financial needs that would be necessary to complete all projects. Investing in infrastructure might not be sufficient, e.g. to be operational, ERTMS also requires rolling stock to be equipped with onboard units.
- *Introduce market regulatory and policy measures to increase the competitiveness of rail freight transport*. Although not a specific subject of this study, regulatory and policy measures might be necessary to facilitate and foster the rail freight market in Europe towards the achievement of higher market shares and EU policy targets. Rail freight transport is generally more expensive and less flexible compared to road transport. Internalising external costs of road transport, and/or creating incentives to reduce the costs of rail transport would increase its competitiveness and support the achievement of the ambitious EU policy targets. In this respect, policymakers shall also

consider the potential effects on the modal share of measures improving the efficiency of road transport. As emphasised in the above-mentioned study by ERFA[6] regulatory measures facilitating market opening appear also to be relevant in increasing the competitiveness of rail transport (e.g. enforcement of antitrust regulations; unbundling of subsidised public service operations from open market business; and ending direct subsidies to or recapitalization of state-owned freight railway undertakings).

INSTITUTIONAL AND OPERATIONAL DEVELOPMENTS

Recommendations on institutional and operational developments are formulated as follows, according to the findings from the market consultation (2023 11 RFCs Joint TMS Update Survey), conducted as part of the 2024 11 RFCS Joint TMS Update:

- *Improve capacity management*. Capacity management is considered by the market and also by the analyses and studies at the basis of the proposal for the new capacity regulation, a key area for improvement. Progress was made in the management of Temporary Capacity Restrictions, however, capacity planning remains an issue. Digital Capacity Management as an integral part of the European program "Timetable Redesign (TTR) for Smart Capacity Management" is at the core of the proposal for the new capacity regulation, and it is paramount to reaching Green Deal targets for the transport sector and the rail freight segment within it.
- *Monitor operational performance*. The revised TEN-T regulation identifies new operational requirements, related to punctuality and dwell times at borders. Furthermore, some infrastructure requirements also depend on operations, such as 740 meter long trains. Investing in infrastructure, albeit needed, is long-lasting and capital-intensive. The competitiveness of international rail freight transport also depends on the improvement of cross-border operations and integrated/coordinated planning and management of the rail network at the European scale. An RFCs common KPI framework is already in place, and RNE is also already monitoring infrastructure KPIs. Such activities might be continued in light of the new set of requirements foreseen in the revised TEN-T Regulation (EU) 1679/2024 and RFC governance structure, also defined in the Art. 67 of this regulation.
- *Balance network and corridor governance approach*. The analysis of the RFC catchment areas shows that international trains using at least one corridor BCP may actually use more than one RFC. A network approach is more fitting to the planning and management of the network capacity. Geographical specificities and logistics clusters and chains exist that still make the corridor concept useful, especially to support discussion and coordination among IMs and Member States and for a customer-oriented approach aimed at involving RUs and Terminal Operators. This consideration also seems to be in line with the opinions expressed by the 11 RFCs RAGs and TAGs members in the survey conducted as part of this study.

[6] https://erfarail.eu/news/the-european-rail-freight-market-competitive-analysis-and-recommendations

1 INTRODUCTION

1.1 LEGAL BASIS AND PURPOSE OF THE TRANSPORT MARKET STUDY

Regulation (EU) 913/2010 concerning a *European rail network for competitive freight* stipulates the implementation of Rail Freight Corridors (RFCs) and a package of measures to improve the competitiveness of rail freight services along these corridors. 11 RFCs have been established under the scope of this regulation since it entered into force and are currently operational. According to Article 9.3 of Regulation (EU) 913/2010, the Management Board of the RFC shall carry out and periodically update a Transport Market Study (TMS) related to the observed and expected changes in the traffic on the freight corridor as a consequence of the RFC being established. Over the past decade, RFCs elaborated first TMSs and, in most cases, TMS updates. However, these studies were carried out without a common approach or a shared methodological framework.

To support the RFCs in achieving compliance with the above requirement in a coordinated and harmonised manner, the Management Boards of the 11 RFCs decided to execute a Joint TMS Update under the coordination of RailNetEurope.

This report provides the results of the 2024 TMS Update for the Rail Freight Corridor Alpine-Western Balkan (RFC AWB).

1.2 COMMON METHODOLOGY FOR A JOINT TMS UPDATE

For the analysis of the current and future transport markets along the 11 RFCs, a European-wide transport model has been used – the NEAC Model – which combines socio-economic, trade and transport statistics with traffic flows for different transport modes. The geographic scope of the model covers the European Union and the non-EU countries crossed by the 11 RFCs and involved in their catchment areas. The model has been calibrated to the year 2022 (Model Base Year). Future scenarios have been elaborated for the 2030 time horizon. A short overview of the model is provided in Annex 1 of this report.

The scope of the current market analysis covers the alignment of the RFCs in operation at the time of the start of the contract (June 2023). The future market analysis concerns these lines and any possible expected lines that are currently foreseen to be operational in 2030.

Due to the adoption of a common, network-wide approach and use of an EU-wide network model, the analysis of the individual RFCs is presented within the framework of the 11 RFCs Network and overall European policy and market trends. This approach is also appropriate considering that the 11 RFCs share many infrastructure components, i.e. corridor lines, logistics nodes and Border Crossing Points, as well as their catchment areas. Also, regulatory, policy and economic backgrounds and developments, as well as most available statistics on the sector, generally concern the country or EU territorial scale.

1.3 REPORT STRUCTURE

Further to this introductory chapter, the present report includes six additional sections:

- Chapter 2, describing the RFC alignment and infrastructure, the existing bottlenecks and the ongoing and planned projects to solve current gaps with reference to the TEN-T requirements and capacity constraints, as well as an overview of the operational performance of the RFC with particular reference to the international trains and the managed capacity;
- Chapter 3, providing background information to the TMS update, including a summary of the main trends related to rail freight transport in Europe and along the RFC;
- Chapter 4, describing the current transport market along the RFC;
- Chapter 5, illustrating the analysis of the future transport market along the RFC;
- Chapter 6, reporting on the outcome of a market survey conducted as part of this joint TMS update, i.e. 2023 11 RFCs Joint TMS Update Survey;
- Chapter 7, summarising key findings and providing recommendations on facilitating and strengthening the rail freight traffic along the RFC.

1.4 LIST OF ACRONYMS

AB	Allocation Body
BCP	Border Crossing Point
CID	Customer Information Document
CIP	Customer Information Platform
CNC	Core Network Corridor
CRD	Central Reference File Database
EC	European Commission
EU	European Union
GDP	Gross Domestic Product
IM	(Railway) Infrastructure Manager
IRG	Independent Regulators' Group
km	Kilometre
KPI	Key Performance Indicator
ETCS	European Train Control System
ERTMS	European Rail Traffic Management System
PaP	Pre-arranged Path
PCS	Path Coordination System
RAG	Railway Undertaking Advisory Group
RFC	Rail Freight Corridor
RFC AMBER	Rail Freight Corridor Amber
RFC ATL	Rail Freight Corridor Atlantic
RFC AWB	Rail Freight Corridor Alpine-Western Balkan
RFC BA	Rail Freight Corridor Baltic-Adriatic
RFC MED	Rail Freight Corridor Mediterranean
RFC NS-B	Rail Freight Corridor North Sea-Baltic
RFC NSM	Rail Freight Corridor North Sea-Mediterranean
RFC OEM	Rail Freight Corridor Orient/East-Med
RFC RALP	Rail Freight Corridor Rhine-Alpine
RFC RD	Rail Freight Corridor Rhine-Danube

RFC SCANMED	Rail Freight Corridor Scandinavian-Mediterranean
RFP	Rail Facilities Portal
RINF	Register of Infrastructure
RIS	Railway Infrastructure System
RNE	RailNetEurope
RU	Railway Undertaking
TAG	Terminal Advisory Group
TCR	Temporary Capacity Restriction
TIS	Train Information System
tkm	tonne-kilometre
TMS	Transport Market Study
UIRR	International Union for Road-Rail Combined Transport

A general glossary which is harmonised over all RFCs is also available under the following link: https://rne.eu/downloads/.

2 CORRIDOR PRESENTATION

2.1 CORRIDOR CHARACTERISTICS

The Rail Freight Corridor Alpine Western Balkans (onwards RFC AWB) crosses four Member States of the European Union, namely Austria, Slovenia, Croatia and Bulgaria, and Serbia. For the purposes of the Joint TMS Update, the description of the RFC AWB lines focusses on the principal and diversionary lines currently in operation, excluding the connecting lines A and B, as well as the expected lines not in operation. The RFC AWB only involves principal lines for a total length of 2,129 km. Most of the RFC AWB network is located in Serbia (577km) and Austria (540 km), followed by Bulgaria (372 km), Croatia (345 km), and Slovenia (294 km).

Table 1 Corridor extent by Member State/Country (principal lines)

Member State	Length in km
Austria	539.67
Slovenia	293.65
Croatia	345.34
Serbia	577.85
Bulgaria	372.18
Total	**2,128.69**

Source: Authors based on CIP

2.1.1 CORRIDOR LINES

The following table summarises the length of the RFC AWB principal lines providing details for the whole RFC and overlapping sections.

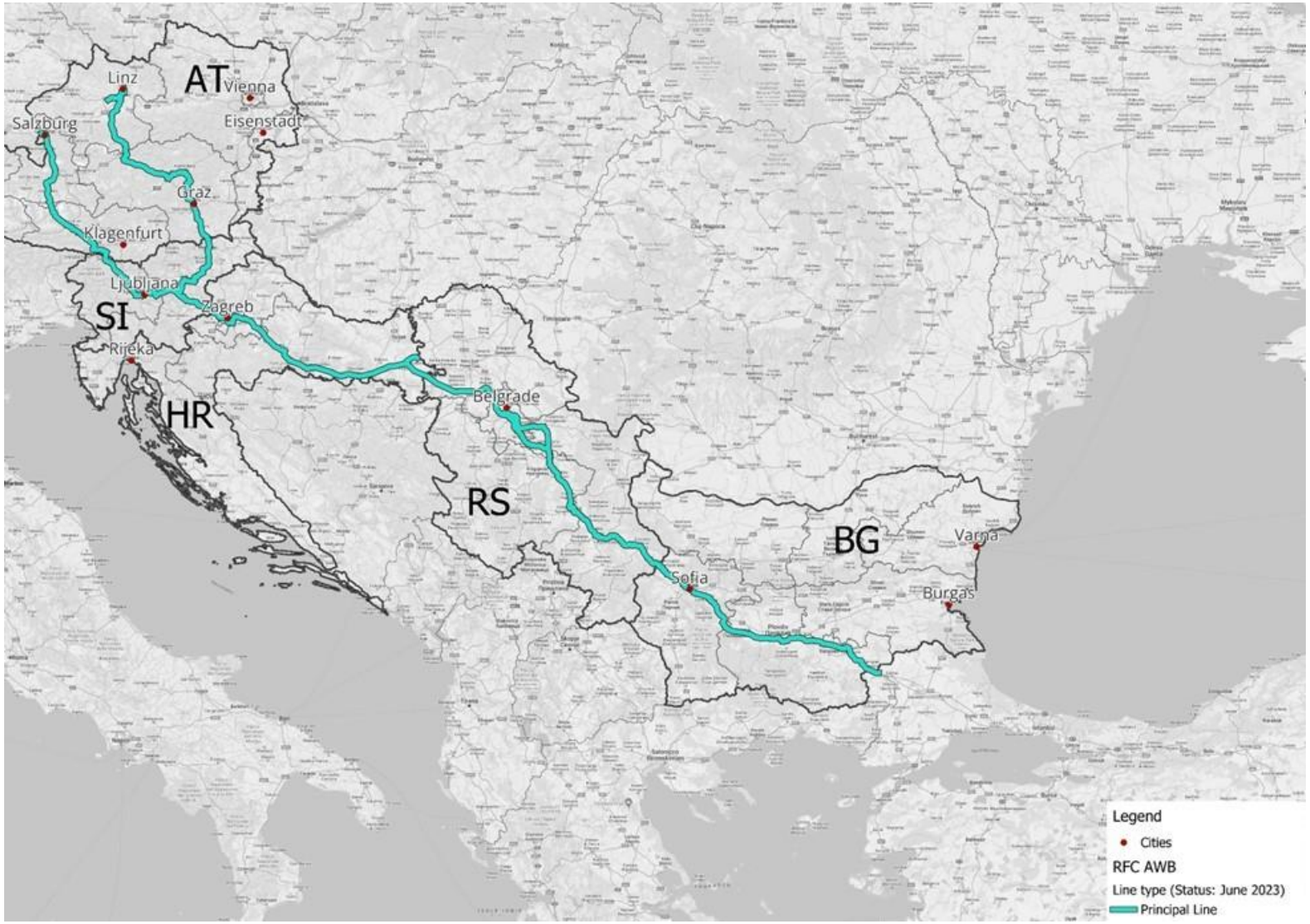
Table 2 RFC AWB - Type of RFC lines and overlapping RFCs

Rail Freight Corridor	Principal Line
AWB	**1,352.14**
OEM	**323.21**
BA	**166.14**
RD	**42.32**
MED	**108.29**
BA, MED, Amber	**136.59**
Total	**2,128.69**

Source: Authors based on CIP

The RFC AWB shares its network with other corridors such as Baltic-Adriatic, Orient/East-Med, Amber, Mediterranean, Rhine-Danube. The longest overlapping is with Orient/East-Med corridor.

Figure 1 RFC AWB - Type of RFC lines



Source: Authors based on CIP

2.1.2 CORRIDOR TERMINALS

The table below lists the terminals active along the RFC AWB, also indicating overlapping corridors where applicable. 25 terminals are in operation on the RFC AWB.

Table 3 List of terminals on the RFC AWB

Name	Country	Common to other RFCs according to CIP
Cargo Center Graz	Austria	BA
Container Terminal LINZ AG	Austria	RD
Container Terminal Salzburg	Austria	RD
Terminal Lambach	Austria	RD
Terminal St. Michael (CCT)	Austria	BA
Terminal Villach Süd (CCT)	Austria	BA
Terminal Wels (CCT)	Austria	RD
Terminal Wels (ROLA)	Austria	RD
Kontejnerski terminal Celje	Slovenia	BA, MED, AMBER
Ljubljana Moste KT	Slovenia	BA, MED, AMBER
Ljubljana Zalog ranžirna	Slovenia	BA, MED, AMBER
Kontejnerski terminal Maribor Tezno	Slovenia	BA
Kontejnerski Terminal Vrapče	Croatia	MED
Luka Slavonski Brod	Croatia	
Luka Vukovar	Croatia	
Robni Terminali Jankomir	Croatia	MED
Robni Terminali Žitnjak	Croatia	MED
ROLA Terminal Spačva	Croatia	
Zagreb Ranžirni Kolodvor	Croatia	MED
Leget	Serbia	
Nelt Co Beograd	Serbia	
ŽIT Beograd	Serbia	
MBOX Terminal	Serbia	
IMT Plovdiv	Bulgaria	OEM
Intermodal Terminal Dragoman	Bulgaria	

Source: Authors based on CIP

2.1.3 CORRIDOR BORDER CROSSING POINTS

Border Crossing Points (BCPs) are of particular relevance for RFCs as their remit is dedicated to the promotion of international traffic across the borders of the European Union Member States. Trains crossing BCPs are accordingly one of the monitored KPIs by the RFCs. According to the current alignment of the RFC AWB, there are in total 5 BCPs identifiable along the corridor as detailed in the following table.

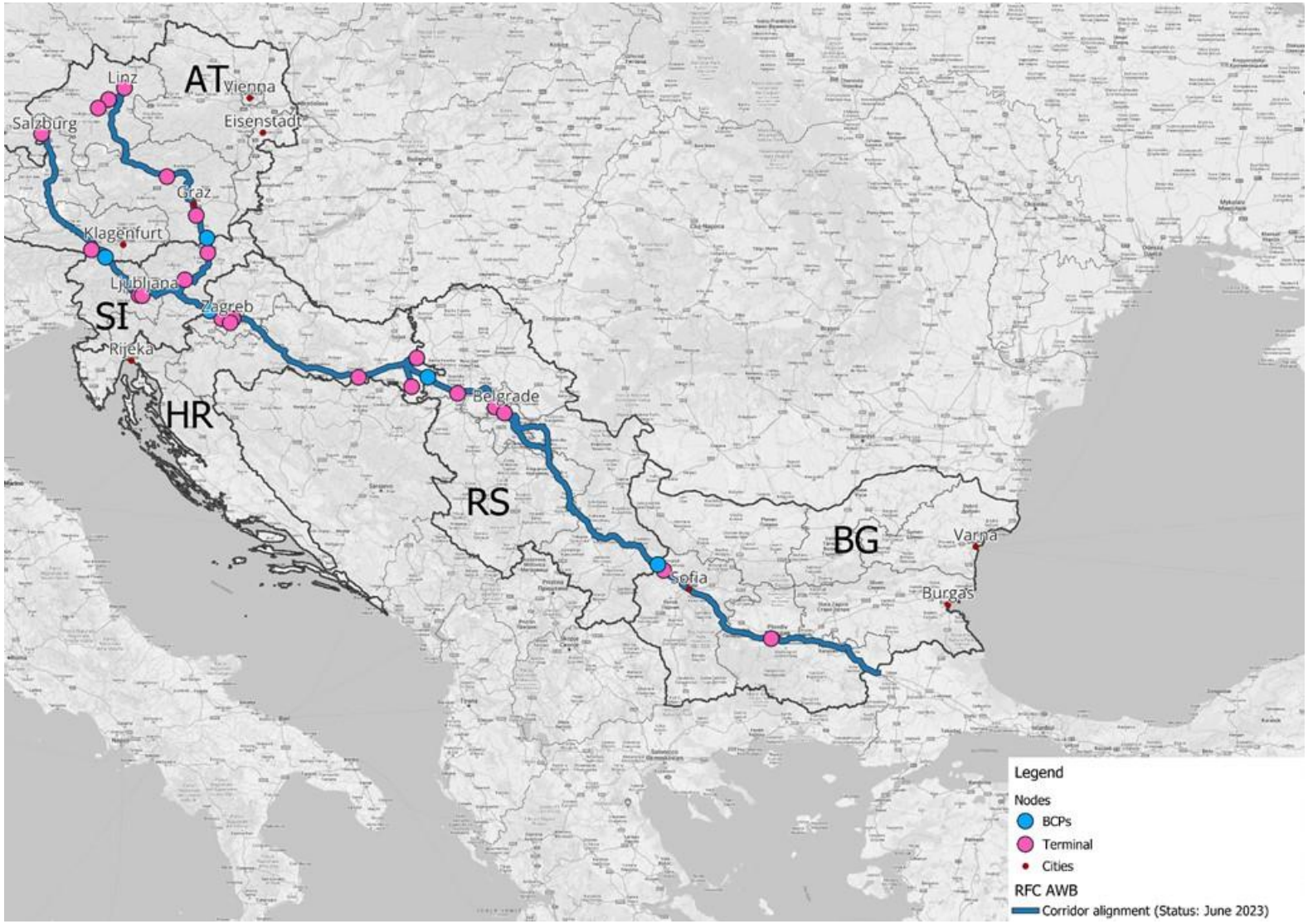
Table 4 RFC AWB BCPs

Bordering Member States		Border Crossing Point
AT	SI	Rosenbach/Jesenice
AT	SI	Spielfeld-Straß/Šentilj
SI	HR	Savski Marof/Dobova
HR	RS	Tovarnik/Šid
RS	BG	Kalotina Zapad/Dimitrovgrad

Source: Authors based on CIP

The map in the figure overleaf illustrates the alignment of the RFC AWB, its terminals and cross-border nodes, also identifying the sections overlapping with other RFCs.

Figure 2 RFC AWB alignment, terminals and cross-border nodes



Source: Authors based on CIP

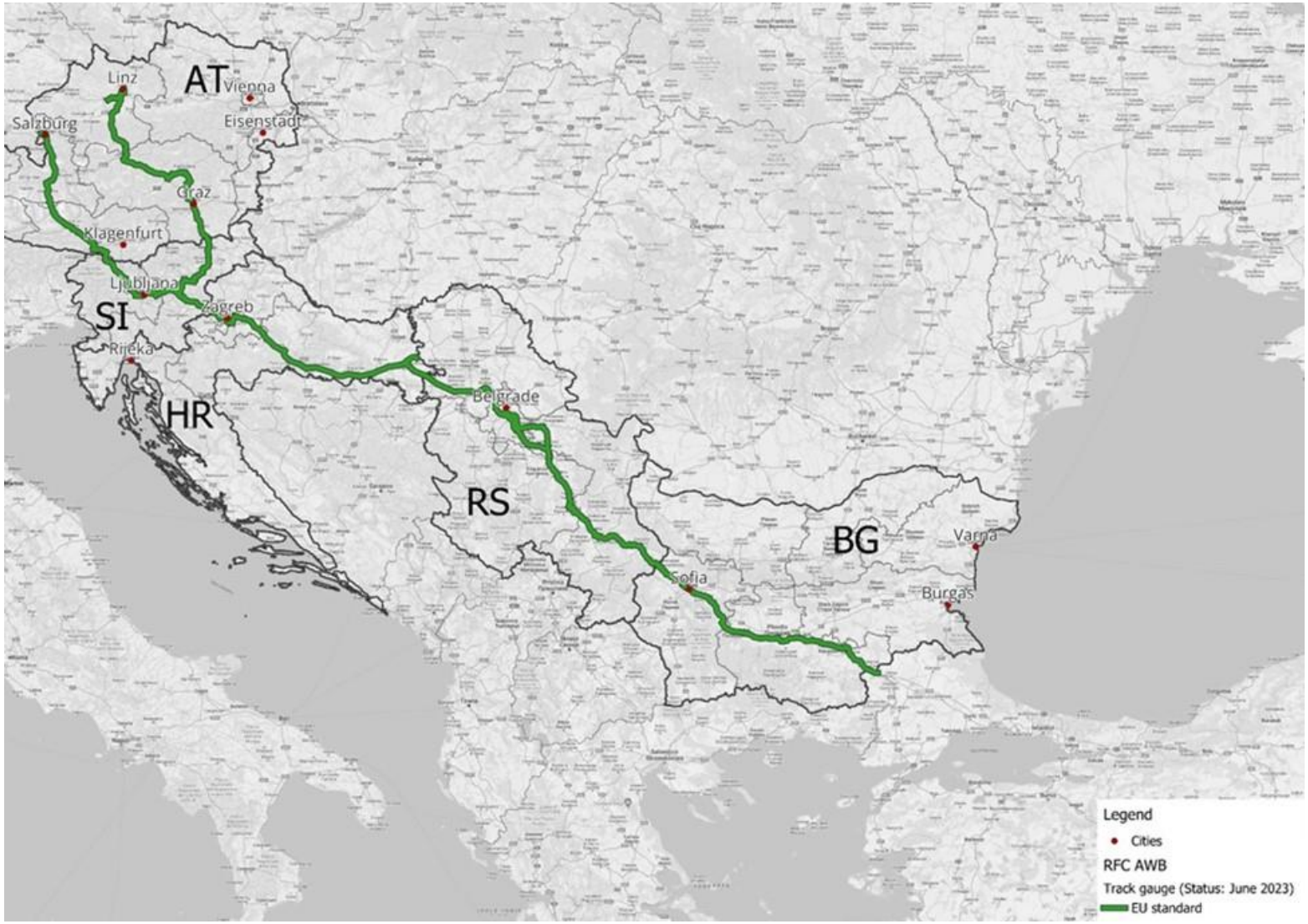
2.1.4 CORRIDOR INFRASTRUCTURE PARAMETERS

An analysis of the main characteristics of the corridor lines has been performed with reference to the rail infrastructure requirements set in Regulation (EU) 1315/2013 on Union guidelines for the development of the trans-European transport network and repealing Decision No 661/2010/EU, i.e. EU track gauge (1435 mm), electrification, maximum line speed (100 km/h), axle load (22.5 t), train length (740 m) and ERTMS (Class A or Class A+B). Such an exercise has been conducted, focussing on the principal and diversionary lines of the RFC. Data have been primarily sourced from the Customer Information Platform (CIP). The information was extracted in August 2023, and it is assumed to reflect the status of the infrastructure in June 2023. For some sections, data from the CIP database have been integrated with information from the Network Statements of the corridor concerned Infrastructure Managers.

On the basis of this analysis, compliance maps have been elaborated, which are provided overleaf for each parameter:

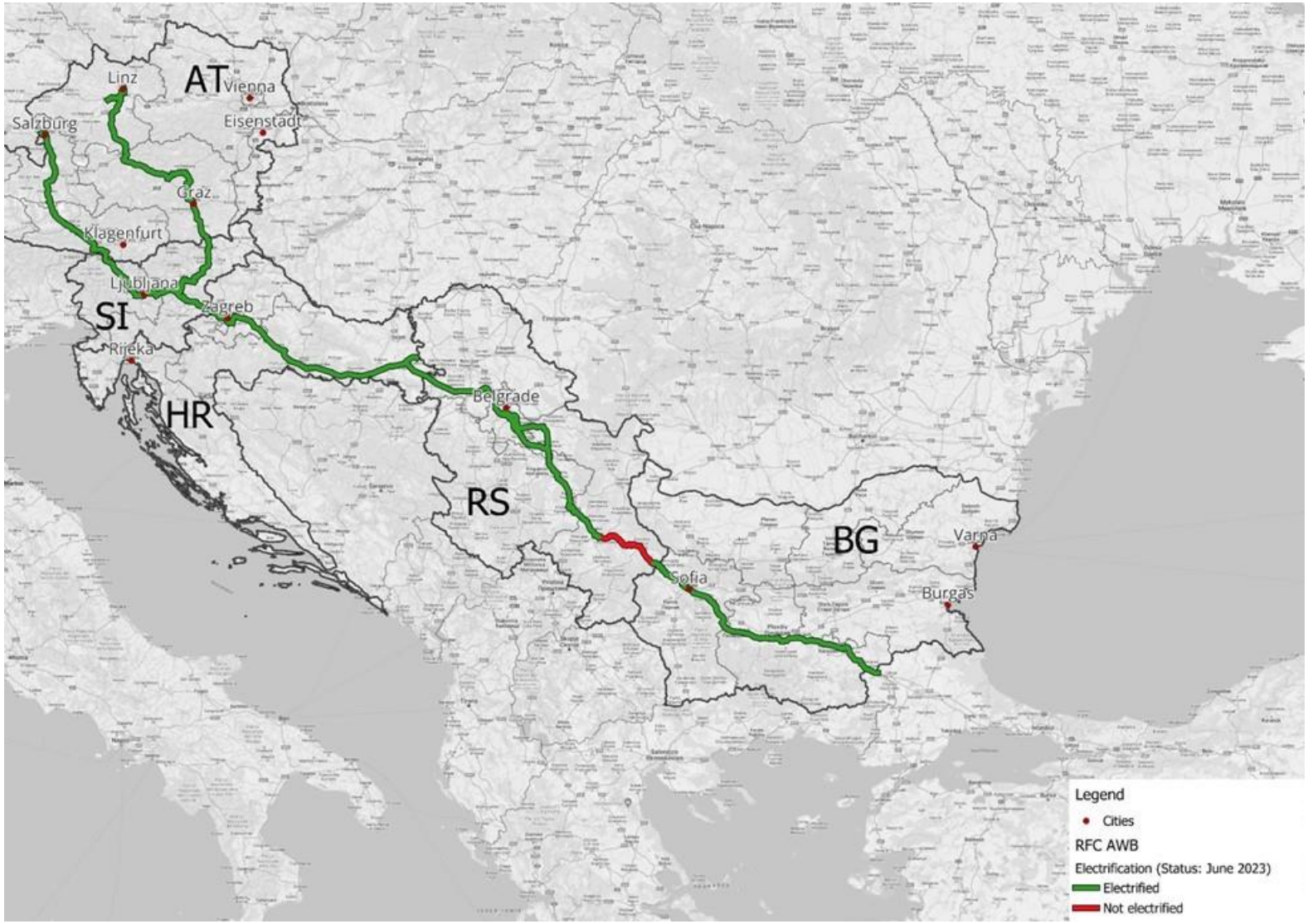
- The RFC AWB is already at standard concerning track gauge and axle load.
- The RFC AWB is also almost entirely electrified, although part of the network in Serbia, also affecting the cross-border itinerary towards Bulgaria, is not electrified.
- Speed limitations exist all over the RFC AWB, especially in Bulgaria, Croatia, Serbia and Slovenia.
- Along the RFC AWB the operation of 740 m long trains is not possible or possible subject to traffic conditions and permissions (operational compliance), except in Bulgaria towards Turkey.
- ERTMS is only available on some sections of the RFC AWB in Bulgaria, Croatia and Slovenia.

Figure 3 RFC AWB - Track gauge



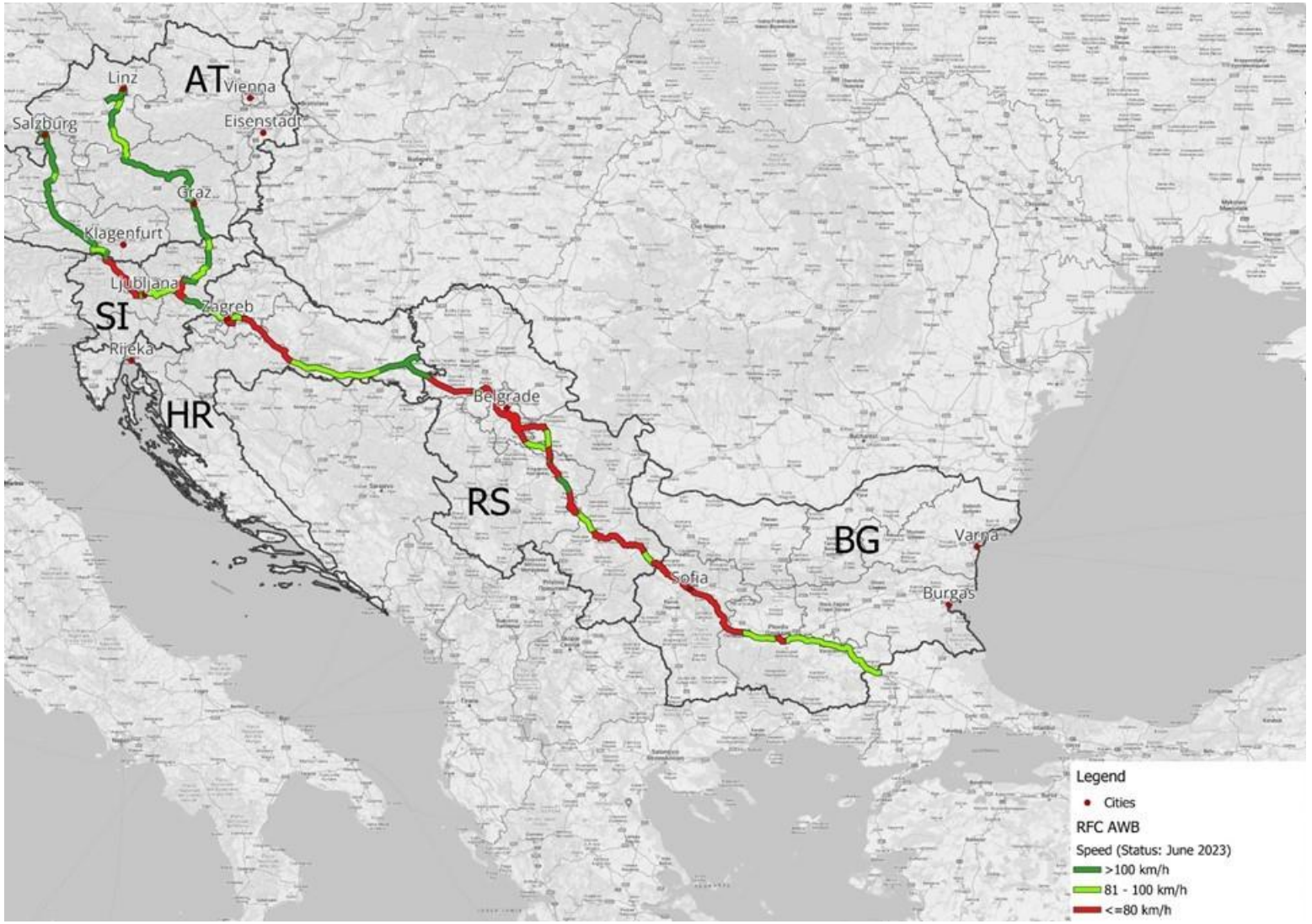
Source: Authors based on CIP

Figure 4 RFC AWB - Electrification



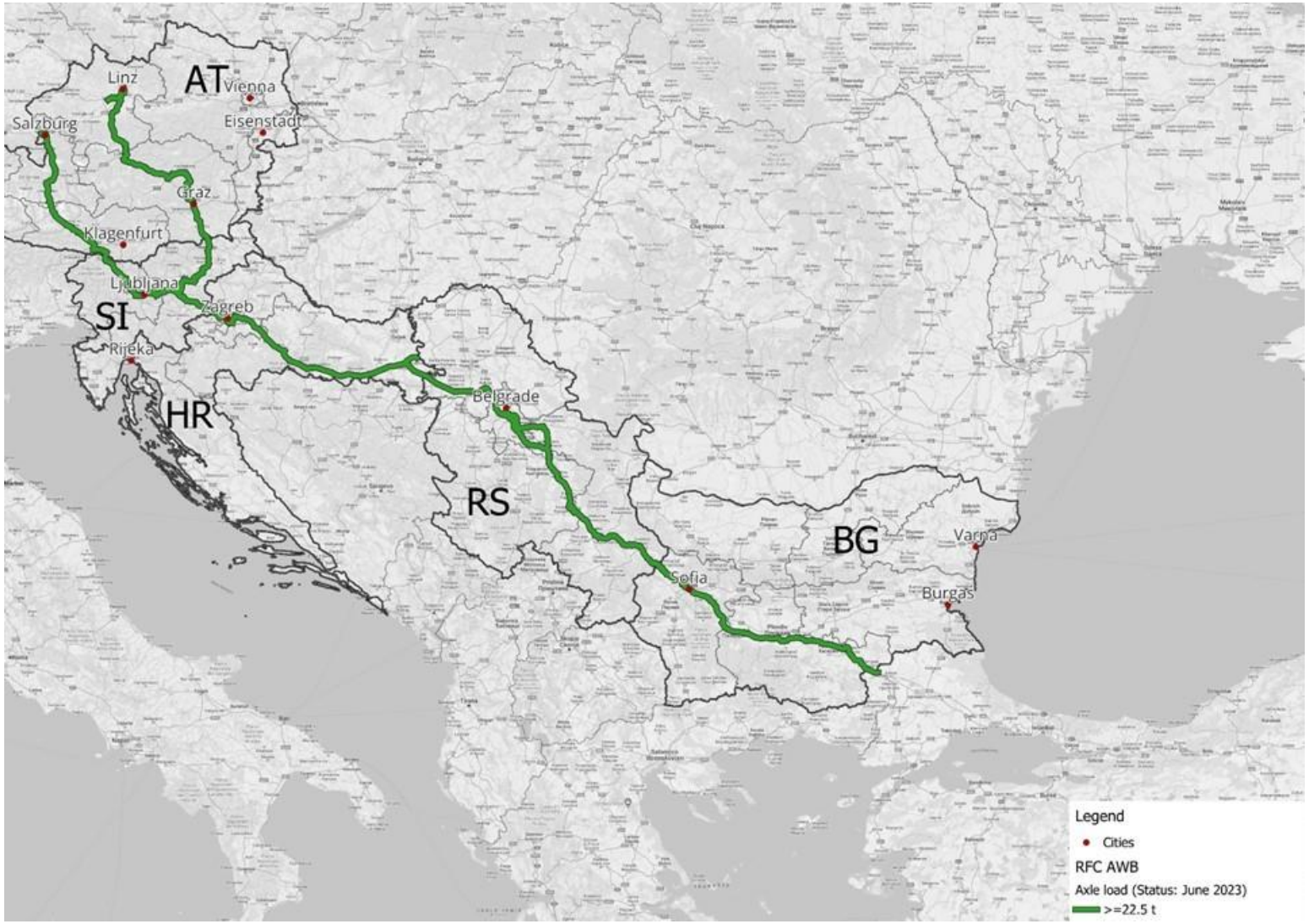
Source: Authors based on CIP

Figure 5 RFC AWB - Speed



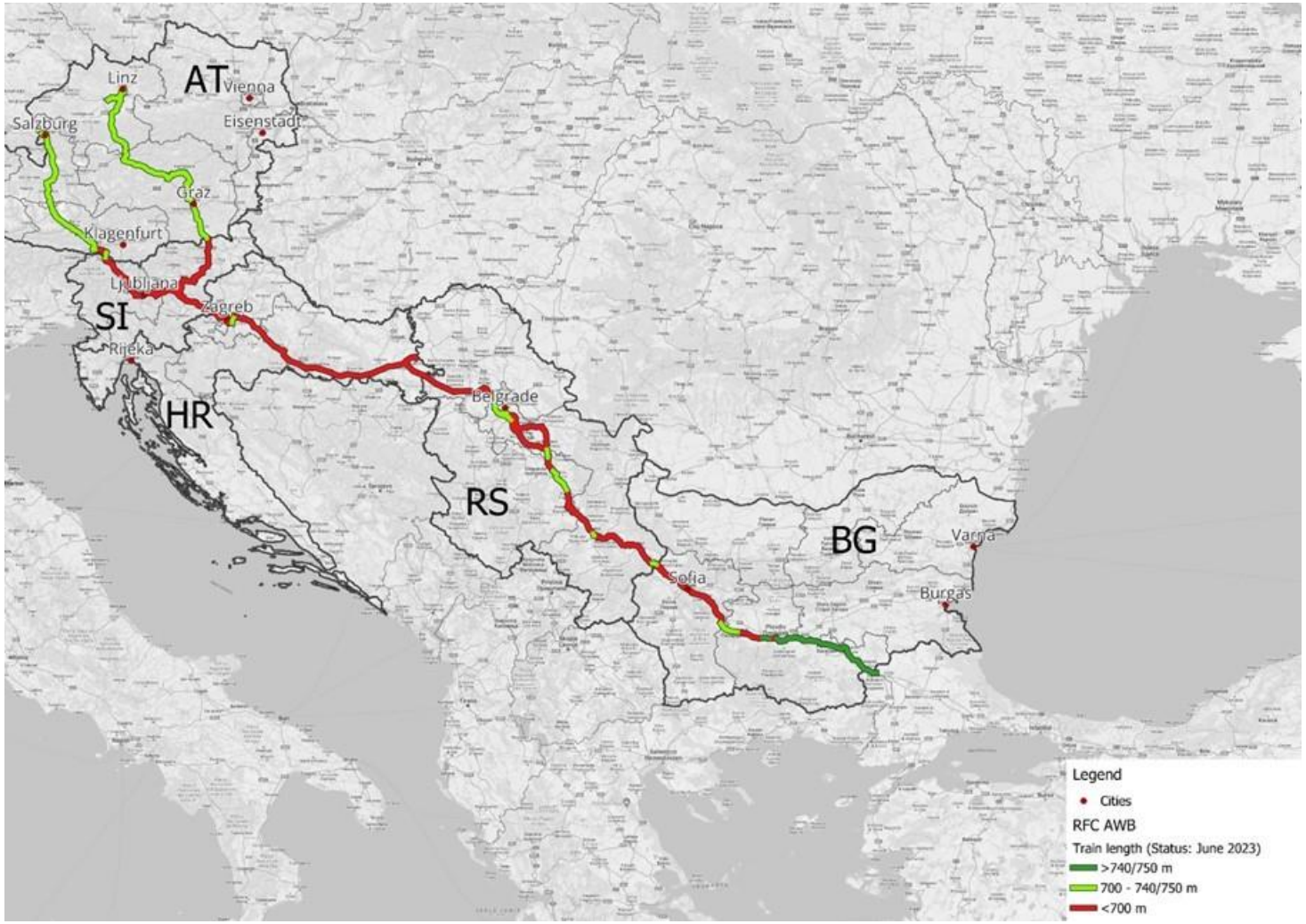
Source: Authors based on CIP

Figure 6 RFC AWB - Axle load



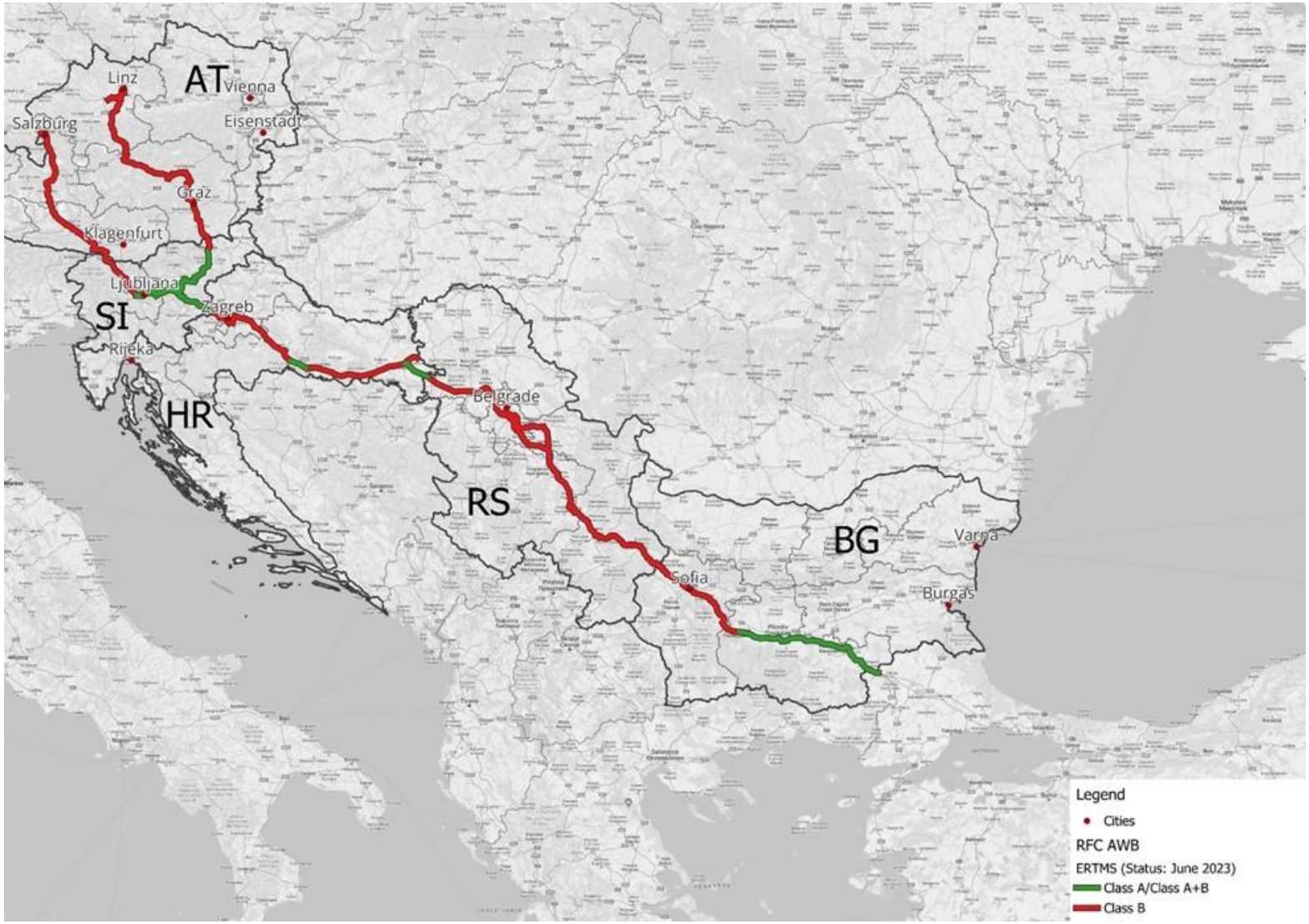
Source: Authors based on CIP

Figure 7 RFC AWB - Train length



*Source: Authors based on CIP; Note: * Sections displayed in light green, where 740 meter long trains are possible to be operated based on traffic conditions and upon request, i.e. "operational compliance", also include the network segments codified in CIP as "upon request". The operational compliance concept also applies to railway lines in Slovenia, though the map represents the infrastructure compliance*

Figure 8 RFC AWB - ERTMS



Source: Authors based on CIP

2.1.5 INFRASTRUCTURE BOTTLENECKS, ONGOING AND PLANNED PROJECTS

Infrastructure bottlenecks

The RFC AWB carried out in 2020 a "Capacity Improvement and Operational Bottleneck Study". All the analyses, assessments and classifications are made upon the definition of bottlenecks provided in point 15 of Article 2 of Regulation (EU) No 1316/2013. Bottleneck means a physical, technical or functional barrier which leads to a system break affecting the continuity of long-distance or cross-border flows and which can be solved by creating new infrastructure, or substantially upgrading existing infrastructure.

According to Article 39 of Regulation (EU) No 1315/2013, the following infrastructure requirements for the key technical parameters should be met by 2030 for the core network:

- Full electrification of the line tracks and, as far as necessary for electric train operations, sidings;
- At least 22.5 t axle load;
- 100 km/h line speed;
- Possibility of running trains with a length of 740 m;
- Full deployment of ERTMS;
- Nominal track gauge for new railway lines: 1,435 mm except for lines belonging to a network not directly interconnected with the main rail lines in the European Union;

The RFC AWB does not fully belong to the core network, but the Corridor's aim is to comply, as much as possible, with the core network requirements for the infrastructure parameters. According to the RFC AWB Transport Market Study special attention should be given to eliminate bottlenecks on the single track railway lines with capacity consumption over 100 %. However, it should be taken into account that a single railway line itself is not necessarily an indication of a capacity bottleneck.

The following paragraphs provide a description of the main bottlenecks identified along the RFC AWB by country. The list of identified bottlenecks is targeted at supporting governments, infrastructure managers and other stakeholders in the identification of key infrastructure and capacity improvement projects which would contribute to the possible removal of the identified bottlenecks.

AUSTRIA

All lines of the RFC AWB in Austria fulfilled the 22.5 t axle load standard already in 2019.

All lines of the RFC AWB in Austria fulfilled the 1,435mm track gauge standard already in 2019.

All lines of the RFC AWB in Austria fulfilled the 100km/h line speed standard (main lines of the corridor network) already in 2019. There are no further plans to increase the speed in other lines beside the projects mentioned below.

All lines of the RFC AWB in Austria fulfilled the 740m long train operating standard already in 2019. There are plans to increase the capacity for 740m long trains by implementing additional longer sidings by 2030 on the core corridors in Austria.

ÖBB-I will implement the following major projects on the RFC AWB before 2030:

- Line: Graz - Bruck a.d. Mur: Station reconfigurations Bruck a.d.M - Graz (Mixnitz-Bärenschützklamm – by 2026, Peggau-Deutschfeistritz – by 2023, Gratwein-Gratkorn – by 2030) incl. 740m sidings for capacity improvement; new 740m sidings;
- Line: Spielfeld-Straß – Graz: Graz – Weitendorf; 4. Track upgrade; Connection to Terminal and Airport link; Connection Koralm line for capacity improvement (4 track upgrade), Terminal connection; by 2025.

ÖBB-I together with the Ministry of transport elaborated a comprehensive traffic forecasts (passenger and freight traffic) and timetable/capacity calculations. With the prerequisite of implementing the above mentioned projects, there will be no capacity bottlenecks on the lines of RFC AWB in Austria before 2030 (>100% according to UIC method). (Remark: a single-track line itself is not an indication of a capacity bottleneck).

SLOVENIA

Lack of capacity in lines

The rising volume of traffic, with simultaneously increasing demands in terms of quality and quantity, requires a single, harmonized and generally valid understanding to be developed as regards available railway-infrastructure capacity.

According to UIC Leaflet 406 single-track is considered as 100% utilized if the percentage of capacity utilization approaches to 85%. For double tracks with mixed traffic this percentage is 75%.

Slovenia has capacity problems on the line section Kranj – Jesenice. Utilized capacity of trains in 24 hours is 76 -100 trains while occupancy rate is 92%. In some stations, a lack of capacity is also possible in a long-term perspective due to short tracks. On some of these sections, projects to upgrade these parameters are underway, and completion is expected in 2022.

Axle load and train weight limits

Category D3 (load per unit length 7.2 t/m and axle load 22.5 t) is considered as normal category for the Slovenian railway lines for international transit traffic.

Slovenia had restrictions on line sections Zidani Most – Rimske Toplice and Maribor – Pesnica where on some sections are classified C3 axle load (load per unit length 7.2 t/m and axle load 20.0 t). On both sections, projects to upgrade this parameter were completed in 2020. The goal for the development projects is to ensure axle load D4 (8,0 t/m and 22,5 t) on the entire RFC AWB lines in Slovenia.

Train length

The maximum permitted length of freight trains in Slovenia is 740 meters (traction included), depending on traffic conditions and subject to approval by the Infrastructure Manager (operational compliance). On some lines, the permitted length is extra limited due to short station tracks. There are currently restrictions on the following lines:

- Dobova border – Zidani Most - 570 m;
- Zidani Most – Ljubljana - 570 m;
- Ljubljana – Jesenice border - 515 m;

- Zidani Most – Pragersko - 597 m (ongoing project expected to be completed in 2024 – allowing for an increase of the permitted length of freight trains to 740 m);
- Pragersko – Maribor - 597 m (ongoing project expected to be completed in 2024 – allowing for an increase of the permitted length of freight trains to 740 m ;
- Maribor – Šentilj border - 560 m (ongoing project expected to be completed in 2024 – allowing for an increase of the permitted length of freight trains to 740 m).

The goal is to increase the train length on all RFC AWB line sections in Slovenia to 740 m.

CROATIA

Section Dugo Selo - Novska represents the main infrastructure bottleneck on the RFC AWB in Croatia. The section is single-track with speed range between 40 km/h and 70 km/h and with a number of stations with low track capacity in terms of number and length of tracks. Dugo Selo station and to a less extent Sesvete station represent the primary bottlenecks, especially in the peak hour due to the mixed use of the lines for both passenger and freight traffic. Investments to solve these bottlenecks and especially upgrading the line to two tracks are under development.

SERBIA

The two most problematic sections of the RFC AWB network in Serbia are:

- Batajnica - Surčin on line Batajnica - Beograd Ranžirna (throughput is 43 trains per day); and
- Čiflik - Staničenje on line Niš Ranžirna - Dimitrovgrad (throughput is 46 trains per day).

The two sections are single track and present low speed parameters, which affect their capacity.

The reconstruction of part of the line Niš Ranžirna - Dimitrovgrad, to be completed in 2026, will enable the gradual improvement of the infrastructure, thanks to the extension of tracks at stations, which will enable operating longer trains. Also, train speed will be improved on this line.

BULGARIA

The removal of the infrastructure bottlenecks affecting interoperability and capacity along the RFC AWB in Bulgaria is planned as follows:

- Sofia – Septemvri - until 2026;
- Voluyak - Sofia - until 2025;
- Dragoman - Voluyak - until 2030.

Ongoing and planned investments

The tables overleaf provide detailed information on the ongoing and planned investments that are expected to improve the RFC AWB infrastructure, contributing to the removal of the above identified bottlenecks.

Table 5 List of ongoing and planned infrastructure projects for Austria

N°	Railway section	Nature of Projects	Benefits for AWB	Start date of the works	End date of the works	Actual step	Estimation of the costs in M€	Funder 1	Funder 2	Funder 3	Funder 4	Comments
1	Graz - Bruck a.d. Mur	Station reconfigurations Bruck a.d.M - Graz (Mixnitz-Bärenschützklamm, Frohnleiten, Peggau-Deutschfeistritz, Gratwein-Gratkorn) incl. 740m sidings	Capacity improvement; new 740m sidings	2015	2030	Construction works ongoing	245	ÖBB-Rahmenplan				
2	Spielfed-Straß - Graz	Graz – Weitendorf; 4. Track upgrade; Connection to Terminal and Ariport link; Connection Koralm line	Capacity improvement (4 track upgrade), Terminal connection	2000	2025	Construction works ongoing	N/A	ÖBB-Rahmenplan				Part of overall "Koralm Line Project"
3	Werndorf – Border AT/SL	Upgrade of existing single/double track line, maximum speed up to 160 km/h, construction of 2nd track	Capacity improvement, higher speed	2027	2036	Planning	728	ÖBB-Rahmenplan				
4	Nettingsdorf - Rohr	Construction of 2nd track	Capacity improvement, higher speed	2028	2035	Planning	432	ÖBB-Rahmenplan				
5	Hinterstoder - Pießling-Vorderstoder	Construction of 2nd track	Capacity improvement, higher speed	2024	2031	Planning	248	ÖBB-Rahmenplan				
6	Linz - Selzthal	Station reconfigurations Linz - Selzthal (Klaus, Windischgarsten)	Capacity improvement; new sidings	2026	2029	Planning	34	ÖBB-Rahmenplan				
7	Spittal - Villach	Station reconfiguration Rothenthurn	Capacity improvement; new sidings	2024	2025	Planning	17	ÖBB-Rahmenplan				

Source: RFC AWB 2024 Implementation Plan

Table 6 List of ongoing and planned infrastructure projects for Slovenia

N°	Railway section	Nature of Projects	Benefits for AWB	Start date of the works	End date of the works	Actual step	Estimation of the costs in M€	Funder 1	Funder 2	Funder 3	Funder 4	Comments
1	Zidani Most - Ljubljana	Modernisation, upgrade of railway infrastructure, Signaling, longer station tracks, ... Zidani Most - Ljubljana	Capacity improvement		2027	planned	230	EU	State			
2	Dobova – Zidani Most	Modernisation, upgrade of railway infrastructure, Signaling, longer station tracks, ... Dobova - Zidani Most	Bottleneck relief Capacity improvement		2027	planned	210	EU	State			
3	Station Ljubljana	Modernisation, upgrade of railway station Ljubljana - Emonika	Interoperability		2026	in process	200	EU	State			
4	Zidani Most - Šentilj	Upgrading signalling safety devices	Interoperability		2024	in process	70	EU	State			
5	Pragersko - Šentilj	Implementation of ETCS on the section	Interoperability		2024	In process	5	EU	State			

Source: RFC AWB 2024 Implementation Plan

Table 7 List of ongoing and planned infrastructure projects for Croatia

N°	Railway section	Nature of Projects	Benefits for AWB	Start date of the works	End date of the works	Actual step	Estimation of the costs in M€	Funder 1	Funder 2	Funder 3	Funder 4	Comments
1	Dugo Selo - Novska	Upgrade and construction of second track/new double track line	Capacity improvement	2024	2029	Preparation of documentation and obtaining permits	670	EU	State			

N°	Railway section	Nature of Projects	Benefits for AWB	Start date of the works	End date of the works	Actual step	Estimation of the costs in M€	Funder 1	Funder 2	Funder 3	Funder 4	Comments
2	Okučani - Vinkovci	Upgrade the existing double track line, reconstruction of the stations to be able to accommodate 750 m long trains, construction of new platforms in stations and stops	Capacity improvement	2029	2034	Preparation of documentation	538	EU	State			

Source: RFC AWB 2024 Implementation Plan

Table 8 List of ongoing and planned infrastructure projects for Serbia

N°	Railway section	Nature of Projects	Benefits for AWB	Start date of the works	End date of the works	Actual step	Estimation of the costs in M EUR	Funder 1	Funder 2	Funder 3	Funder 4	Comments
1	Sićevo - Dimitrovgrad	Civil engineering reconstruction of the Niš – Dimitrovgrad railway line (including electrification)	Restoration line to projected parameters	11-Nov-2023	Q2 2026	Works in progress	169	EIB loan	WBIF grant	State		Traffic functioning and works execution agreed with the Contractor (72 hours- the execution of works and 96 hours- traffic functioning)
2	Railway bypass Nis	Civil works on construction of railway bypass Nis	Construction of new rail bypass will enable more reliable and faster rail transport through Serbia. By completion of rail bypass and electrification of	Q3 2022	Q3 2025	Preparation of Detailed deign with tender dossier	74,2	EIB loan	WBIF grant	State		There is no impact on traffic flows.

N°	Railway section	Nature of Projects	Benefits for AWB	Start date of the works	End date of the works	Actual step	Estimation of the costs in M EUR	Funder 1	Funder 2	Funder 3	Funder 4	Comments
			Sicevo-Dimitrovgrad the change of locomotive will not be necessary.									
3	Sićevo – Dimitrovgrad with railway bypass Nis	Electrification of the Niš – Dimitrovgrad railway line	Construction of new rail bypass will enable more reliable and faster rail transport through Serbia and no need for locomotive change by completion of rail electrification of Sicevo-Dimitrovgrad.	Q2 2022	Q2 2025	Preparation of Detailed deign tender dossier	93,5	EIB loan	WBIF loan	State		Traffic functioning and works execution will be performed alternately during time intervals that are going to be agreed with the Contractor.

Source: RFC AWB 2024 Implementation Plan

Table 9 List of ongoing and planned infrastructure projects for Bulgaria

N°	Railway section	Nature of Projects	Benefits for AWB	Start date of the works	End date of the works	Actual step	Estimation of the costs without VAT	Funder 1	Funder 2	Funder 3	Funder 4	Comments
2.1	Elin - Pelin – Kostenets Lot 1: km 22+554 km 42+200	Modernization of railway infrastructure in accordance with the requirements to the railway infrastructure	The project will contribute to eliminating the problem with the bottlenecks	05.2020	12.2025	In process construction works phase • 35.5% physical implementation • 34.49% financial implementation	The value of the contract with realized contingencies and concluded additional agreements is €312,238,182.51	Decision on the implementation of the European Commission (OPTTI 2014-2020)	Program transport connectivity			

N°	Railway section	Nature of Projects	Benefits for AWB	Start date of the works	End date of the works	Actual step	Estimation of the costs without VAT	Funder 1	Funder 2	Funder 3	Funder 4	Comments
		of the core TEN-T network as specified in Regulation 1315/2013										
2.2.	Elin - Pelin – Kostenets Lot 2: km 42+200 km 62+400	Modernization of railway infrastructure in accordance with the requirements to the railway infrastructure of the core TEN-T network as specified in Regulation 1315/2013	The project will contribute to eliminating the problem with the bottlenecks	10.2019	09.2024	In process construction works phase • 16% physical implementation • 29.97% financial implementation	The value of the contract with realized contingencies and concluded additional agreements is €59,528,399.73	Decision on the implementation of the European Commission (OPTTI 2014-2020)	Program transport connectivity			
2.3.	Elin - Pelin – Kostenets Lot 3: km 62+400 km73 +598	Modernization of railway infrastructure in accordance with the requirements to the railway infrastructure of the core TEN-T network as specified in Regulation 1315/2013	The project will contribute to eliminating the problem with the bottlenecks	08.2020	12.2025	In process construction works phase • 28% physical implementation • 31.48% financial implementation	The value of the contract with realized contingencies and concluded additional agreements is €213,357,117.98	Decision on the implementation of the European Commission (OPTTI 2014-2020)	Program transport connectivity			

N°	Railway section	Nature of Projects	Benefits for AWB	Start date of the works	End date of the works	Actual step	Estimation of the costs without VAT	Funder 1	Funder 2	Funder 3	Funder 4	Comments
3	Kostenets – Septemvri	Modernization of railway infrastructure in accordance with the requirements to the railway infrastructure of the core TEN-T network as specified in Regulation 1315/2013	The project will improve the competitiveness of the railway line and will remove the bottlenecks	07.2021	07.2027	In process construction works phase *27% physical implementation	201 325 780.37 euro +10% unforeseen work	Approved for funding under Connecting Europe Facility (CEF)	N/A			
4	Sofia – Voluyak	Modernization and upgrade of the existing double track railway section, in line with the requirements for Core Network Corridors as set by Regulation 1315/2013 and repealing Decision 661/2010/EU	The proposed Action is part of the Global project that aims to remove existing bottlenecks in the Sofia railway junction by upgrading the concerned sections of the railway	01.2016	12.2026	Construction and installation activities are currently being carried out at Sofia Central Station	104 211 047 euro	Approved for funding under Connecting Europe Facility (CEF)				Building and engineering works designed by the contractor

N°	Railway section	Nature of Projects	Benefits for AWB	Start date of the works	End date of the works	Actual step	Estimation of the costs without VAT	Funder 1	Funder 2	Funder 3	Funder 4	Comments
5	Voluyak-Dragoman	Modernization of Sofia – Dragoman – Serbian border Railway line: section Voluyak – Dragoman	The main objective is to provide the necessary capacity, optimization of existing infrastructure for better safety of the railway network	07.2021	12.2026	The project is in progress. Currently Phase I - Design preparation is ongoing with the applicable procedures	195 279 518,72 euro	OPTTI 2014-2020) TCP (2021-2027)				
6	Plovdiv – Svilengrad	Doubling the track of sections of the Krumovo-Svilengrad-Turkish border railway line	Increase the capacity of the railway line to handle the growing traffic, attract more international cargo and development of passenger transport by rail. Reducing operating costs and ensuring higher safety.	2030	2035	Contract No. 11401/22.04.2021 is executed. "Development of structural plans and technical design for the project "Doubling the track of sections of the Krumovo-Svilengrad railway line	315,025,523.03 euro as estimated as of December 2022.	It is being investigated	A bank loan			The project can be implemented in stages, depending on the financing secured

Source: RFC AWB 2024 Implementation Plan

ERTMS deployment plan

For the time being ETCS Level 1 is already deployed on some lines of the RFC AWB in Slovenia, Croatia and Bulgaria, as follows:

- Slovenia: section Ljubljana-Zidani Most-Pragersko;
- Croatia: sections Novska-Okučani and Vinkovci-Tovarnik HR/SRB border;
- Bulgaria: section Septemvri-BG/TR border.

To comply with the control command technical specifications for interoperability, RFC AWB continues to introduce the ECTS on its lines according to national deployment plans.

The following deployment plans related to future projects have been drafted by the IMs and include all ERTMS projects foreseen for development of infrastructure along RFC AWB. The following deployment plans could be the subject to changes and all information about planning and financing are without prejudice of each national deployment plan and European decision making.

Austria

ERTMS will be implemented on the RFC AWB in Austria according to the National Deployment Plan:

- Attnang Pucheim – Salzburg: ETCS L2 - 2028
- Linz – Wels – Attnang – Puchheim: ETCS L2 already in operation from 2023
- Spielfed-Straß – Graz: ETCS L2 - 2025
- Graz – Mixnitz: ETCS L2 - 2025
- Mixnitz – Bruck an der Mur: ETCS L2 - 2027
- Bruck a.d. Mur - St. Michael: ETCS L2 - 2028
- St. Michael – Wald am Schoberpass: ETCS L2 - 2028
- Wald am Schoberpass – Selzthal: ETCS L2 - 2034
- Traun – Linz: ETCS L2 - 2029
- Traun – Marchtrenk: ETCS L2 - 2029
- Selzthal – Traun: ETCS L2 - 2034
- Rosenbach – Villach: ETCS L2 - 2033
- Villach – Spittal-Milstättersee: ETCS L2 - 2037
- Spittal-Milstättersee – Schwarzach-St. Veit: ETCS L2 - 2037
- Schwarzach-St. Veit – Bischofshofen: ETCS L2 - 2033
- Bischofshofen – Salzburg: ETCS L2 - 2033.

Slovenia

The ERTMS deployment plan in Slovenia is as follows:

- ERTMS deployment on RFC AWB is part of former project »Deployment of ERTMS/ETCS on Corridor D«, which the European Commission with the Decision C (2008) 7888 of 10.12.2008 and in an annex to that Decision no. C (2014) 2858 of 24.4.2014 named as project no. 2007-EU-60120-P; with the Decision C (2010) 5873 of 20.8.2010 named as project no. 2009-EU-60122-P; with the Decision C (2014) 7670 of 17.10.2014 named as project no. 2013-EU-60017-P; and approved funding for the TEN-T co-financing in the Republic of Slovenia;

- The trackside deployment of the ETCS requested level 1 with version 2.3.0d, overlaid existing INDUSI I60 national signalling system;
- Current status of the projects on RFC AWB:
  - Section (Zidani Most – Pragersko) – all the works were completed in 2015 and ETCS is in operation from Q2 2017;
  - Section (Zidani Most – Ljubljana) – all the works were completed in 2015 and ETCS is in operation from Q2 2017.
- Ongoing investments:
  - Deployment of ERTMS/ETCS (level 1, baseline 3-set 2_ overlaid existing INDUSI I60 national signalling system), on line section (Zidani Most – Dobova – border HR) and on line section (Pragersko – Maribor – Šentilj – border AUT), for which the European Commission approved funding for the CEF co-financing in the Republic of Slovenia with the agreement no. INEA/CEF/TRAN/M2015/1125663 for action no. 2015-SI-TM-0111-W. According to the contract with the constructor, the deadline for the end of works is Q4 2023.
  - Section (st. border HR – Dobova – Zidani Most) – all the works were completed in 2019 and NSA issued operating permit in Q4 2020;
  - Section (Pragersko – Šentilj – st.border AUT) – is currently in the phase of system designing of ETCS (expected completion by end of 2024).
- Plans till the end of 2026:
  - Section Ljubljana – Jesenice – st. border AUT – expected deployment of ETCS is in 2026;
  - Bilateral meetings with HŽ-I, RFI and OBB. The main activities which to be carried out are a) coordination for establishing technical and traffic/operational rules on border section; b) preparation of Test cases from both parties which have to be put together in a single document; c) processing and entering ETCS on-board data; d) execution of test runs with locomotive equipped with appropriate on-board ETCS equipment.
- GSM-R: all sections of the RFC AWB are equipped with GSM-R. The system is in operation from Q4 2017.

Croatia

At the moment the ETCS Level 1 is deployed only on the following railway sections:

- Section Novska-Okučani;
- Section Vinkovci-Tovarnik HR/SRB border.

In 2016, HŽ Infrastruktura developed a Study on the Introduction of the European Rail Traffic Management System (ERTMS), which determined the gradual development of technical documentation and execution of works, taking into account the existing state of all railway infrastructure subsystems and projects that are under implementation as well as financial resources needed for the production of technical documentation, procurement of equipment and execution of works.

Within the framework of individual contracts, documentation for the installation of ETCS Level 1 is being drafted for the:

- Section Dugo Selo – Novska;
- Section Vinkovci – Vukovar.

The production of documentation within which ETCS Level 2 will be designed starting for the section Okučani – Vinkovci.

Preparation of documents for procurement process for drawing up a feasibility study for Zagreb node is underway. The feasibility study will provide conceptual solutions within which the conceptual decision of the ETCS will be given.

GSM-R is not implemented on any railway line section in Croatia. According to planned investments GSM_R will be installed on the RFC AWB by 2030.

Serbia

The ERTMS deployment plan in Serbia is as follows:

- Section Stara Pazova - Batajnica completed in 2022;
- Section Niš Ranžirna - Dimitrovgrad in the time frame 2023-2025;
- Section Velika Plana - Lapovo, Lapovo - Stalać and Stalać - Niš Ranžirna in the time frame 2025-2030.

Bulgaria

The ERTMS deployment plan in Bulgaria is as follows:

- Kalotina Zapad-Dragoman - The ERTMS (ETCS-1 and GSM-R) deployment project is set for implementation in the Operational Program "Transport and Transport Infrastructure" in the next programming period 2021-2027;
- Dragoman-Voluyak - The ERTMS (ETCS-1 and GSM-R) project is set for implementation in the Operational Program "Transport and Transport Infrastructure" in the next programming period 2021-2027;
- Voluyak-Sofia - For construction of ERTMS (ETCS-1 and GSM-R) has a selected contractor. It is expected that ERTMS will be built by 2026;
- Sofia-Septemvri - The GSM-R system is built. The ETCS-1 deployment project is set for implementation in the Operational Program "Transport and Transport Infrastructure" with a deadline of March 2027;
- Septemvri-Plovdiv - The ERTMS (ETCS-1 and GSM-R) is built;
- Plovdiv-Svilengrad - The ERTMS (ETCS-1 and GSM-R) is built.

2.2 CORRIDOR OPERATIONAL PERFORMANCE

2.2.1 KEY PERFORMANCE INDICATORS

According to article 19 (2) of Regulation (EU) 913/2010 the Management Boards of the Rail Freight Corridors are requested to monitor the performance of rail freight services on the freight corridor and publish the results of this monitoring once a year.

The RFCs are free to choose their own Key Performance Indicators (KPIs) to fulfil this requirement. However, in order to facilitate data provision for the calculation of the KPIs and the processing of such data, a common approach and set of KPIs applicable to all RFCs was developed and adopted under coordination of RNE .

The KPI framework includes capacity management, operations and market development indicators. The most relevant indicators are described below for the years 2020, 2021 and 2022.

Table 10 provides the number of trains per BCP along the RFC AWB (i.e. the number of commercial freight trains crossing selected border points), whereas Table 11 includes the number of trains crossing a BCP along the RFC (i.e. the number of trains crossing a corridor BCP, provided that trains crossing more than one BCP are only counted once).

Table 10 Number of trains per BCP along the RFC AWB

Border		BCP	2020	2021	2022	2023
AT	SI	Rosenbach/Jesenice	6,425	3,289	9,142	7,041
AT	SI	Spielfeld-Straß/Šentilj	8,891	11,429	9,154	7,923
SI	HR	Savski Marof/Dobova	7,300	7,161	7,058	7,245
HR	RS	Tovarnik/Šid	3,848	3,816	4,638	4,132
RS	BG	Kalotina Zapad/Dimitrovgrad	3,274	3,368	4,090	3,711

Source: RFC AWB KPIs

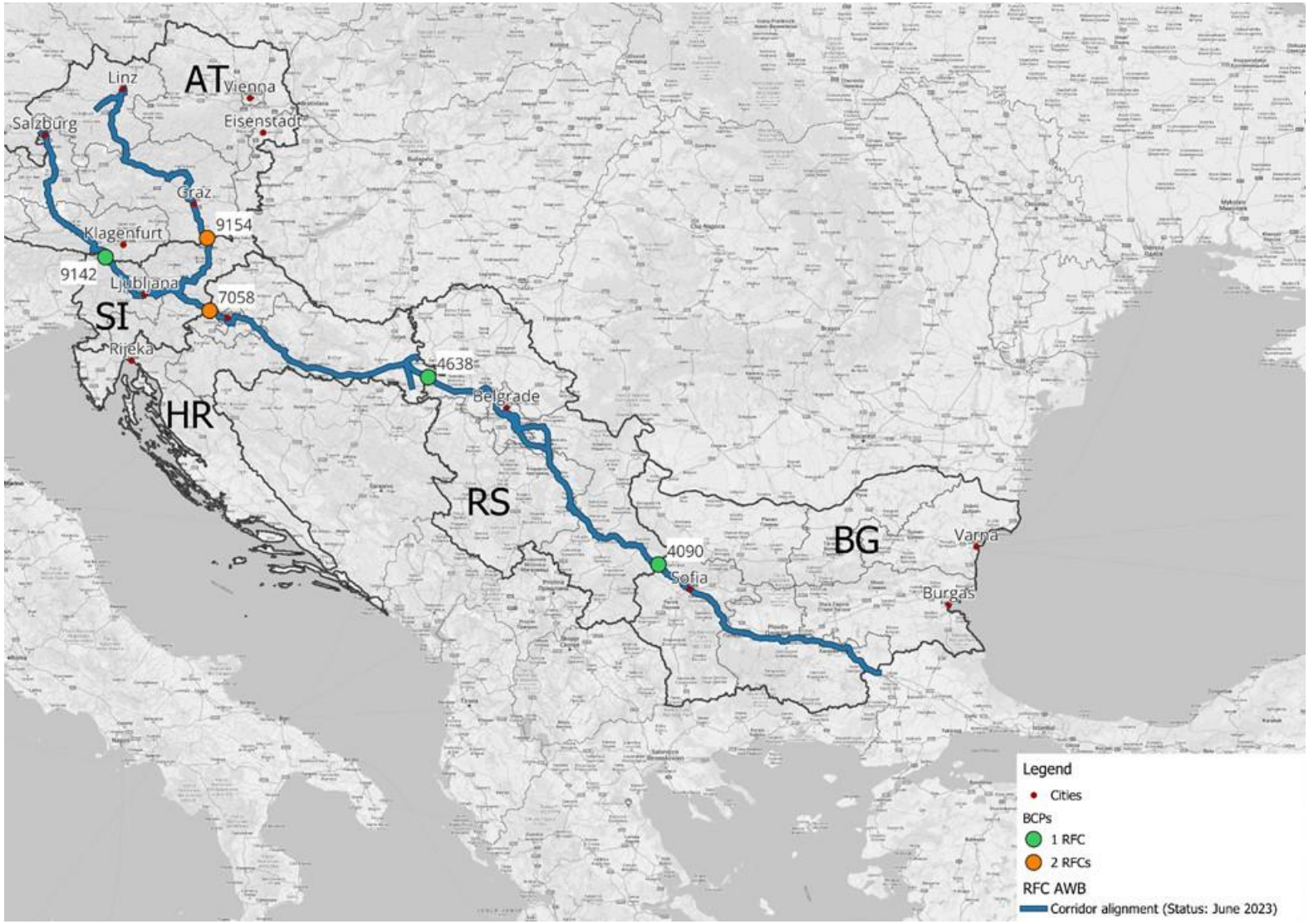
According to the available data, the highest traffic was registered during the last five years at Spielfeld-Straß/Šentilj, between Austria and Slovenia. Train traffic data/trends at BCPs include all RFCs trains and may vary according to traffic management solutions and traffic conditions on the accessing/interconnected lines, as well as traffic capacity restrictions on these lines, due to temporary/permanent maintenance and/or construction works. Furthermore, the COVID Pandemic first and Russian aggression to Ukraine later also affected traffic on the European network for competitive rail transport. Nonetheless, the number of corridor trains seems to be showing an increase in 2022 compared to 2021.

Table 11 Corridor trains crossing at least one RFC AWB BCP

	2021	2022	2023
Number of trains crossing a border along RFC AWB	16,404	28,830	30,052

Source: RFC AWB KPIs

Figure 9 RFC AWB – Trains at BCPs along the RFC AWB



Source: Authors based on CIP and RFC AWB KPIs

Further to the number of trains at BCPs, the set of common indicators also includes capacity management related parameters, for which data are collected and provided for all RFCs. Figures for the RFC AWB are provided in Table 12 below.

Table 12 Capacity Management KPIs

Parameter	TT 2022	TT 2023	TT 2024	TT 2025
	2021	2022	2023	2024
Volume of offered capacity – PaPs (at X-11), mio (path) km	1.5	1.6	1.6	1.6
Volume of requested capacity – PaPs (at X-8), mio (path) km	0.5	0.6	0.4	0.4
Number of requests – PaPs (at X-8)	6	8	6	8
Number of conflicts – PaPs (at X-8)	0	0	0	0
Volume of pre-booked capacity– PaPs (at X-7.5), mio (path) km	0.5	0.6	0.4	0.4
Ratio of pre-booked capacity (to the volume of capacity offered at x-11)	30.3%	35.2%	25.0%	25.9%
Volume of offered capacity – Reserve Capacity (at X-2), mio (path) km	0.7	0.7	0.9	0.8
Number of requests – Reserve Capacity (at X+12) (number of PCS dossiers)	0	0	0	
Volume of requested capacity – Reserve Capacity (at X+12), mio (path) km	0	0	0	

Source: RFC AWB KPIs

The commonly adopted KPI framework additionally includes indicators to measure the average planned speed of the offered Pre-arranged Paths (Figure 10) and punctuality of freight services along the RFCs (Table 13).

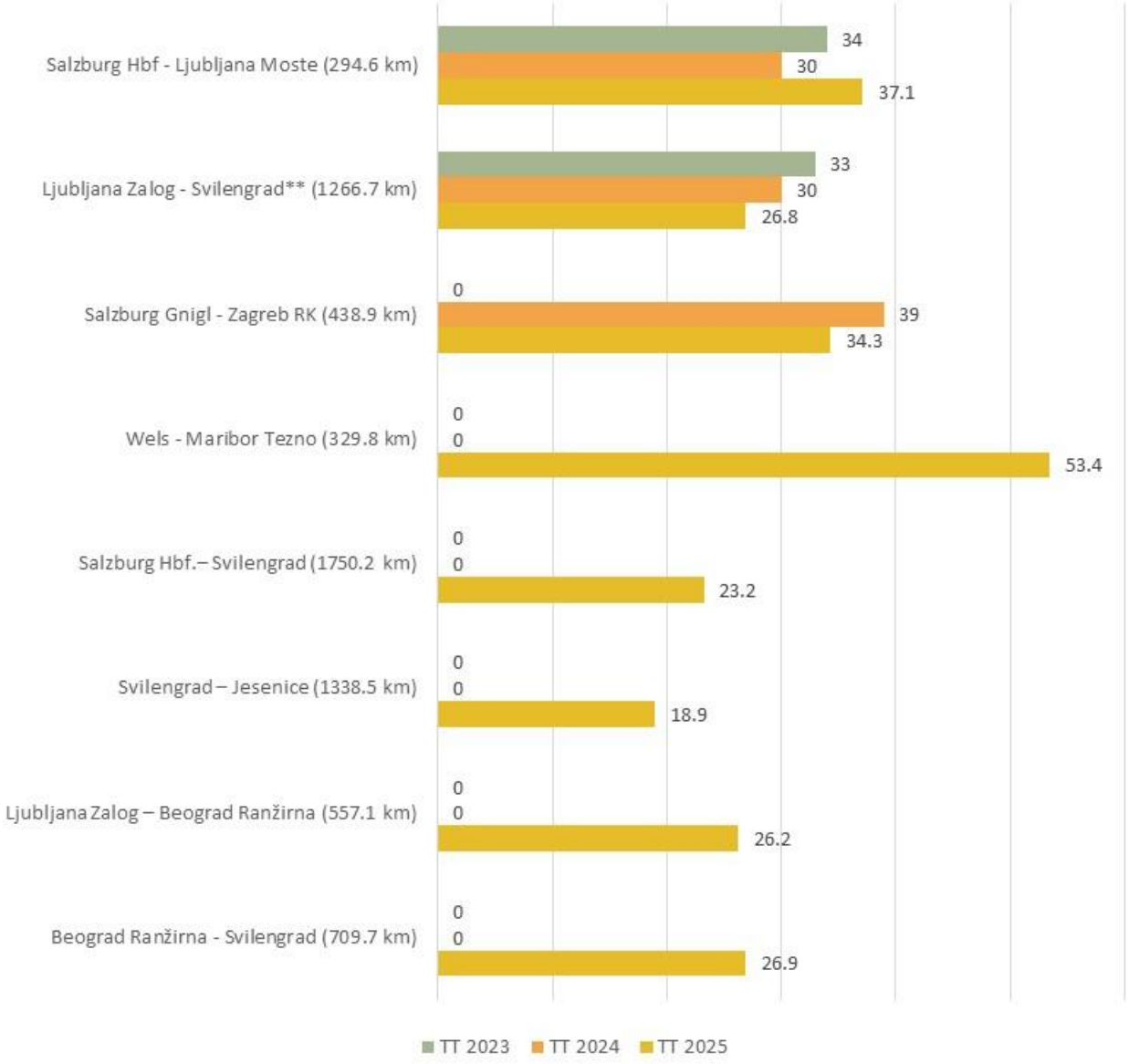
Table 13 Punctuality

			(delay ≤ 30 minutes)
	2021	2022	2023
Punctuality at origin (RFC entry)	52.0%	46.0%	48.0%
Punctuality at destination (RFC exit)	40.0%	36.0%	39.0%
			(delay ≤ 15 minutes)
Punctuality at origin (RFC entry)	44.0%	39.0%	42.0%
Punctuality at destination (RFC exit)	35.0%	32.0%	34.0%

Source: RFC AWB KPIs

The indicators for the past three years seem to show a steady trend in terms of capacity management and slight decreasing indicators for punctuality, which might be also related to capacity restrictions along several corridor sections. The COVID Pandemic, reducing traffic of passengers' trains, might also have had a positive impact in terms of punctuality, resulting in better performance of the RFC in 2021. Average planned speed of PaPs also shows a decrease in TT 2024 compared to TT 2023.

Figure 10 Average planned speed of PaPs, km/h



*Source: RFC AWB KPIs; ** PaP Ljubljana Zalog - Svilengrad* - does not exist as such in TT2025. It is average speed of 2 PaPs: Ljubljana Zalog - Beograd Ranžirna & Beograd Ranžirna - Svilengrad. The timetable of these PaPs is harmonized*

2.2.2 SPECIFIC PERFORMANCE OBJECTIVES AND TARGETS

Further to the monitoring activities associated with the common KPIs applicable to all RFCs, specific objectives have been also adopted by the RFC AWB, associated with quantified targets.

The following paragraphs provide a description of the identified objectives and related targets.

Similarly to other RFCs, RFC AWB also undertakes Train Performance Management tasks (producing annual reports on the performance of the corridor) and the user satisfaction survey.

Punctuality

Punctuality of a train will be measured on the basis of comparisons between the time planned in the timetable of a train identified by its train number and the actual running time at certain measuring points. A measuring point is a specific location on the route where the trains running data is captured. The comparison should always be done with an internationally agreed timetable for the whole train run.

Punctuality will be measured by setting a threshold up to which trains will be considered as punctual and building up a percentage. A basic punctuality goal of at least 60% of all monitored trains will be set.

Capacity

The objectives to offer capacity via the C-OSS is to have "one face to the customer" for international path requests along the RFC AWB and at the end harmonized path offers across at least one border. Furthermore, the decision on the PaP pre-allocation will be done by the C-OSS by the end of April for the entire international PaP segment on the basis of one harmonized allocation rule. As a result, the RUs will get earlier information about the PaP pre-allocation. Capacity related objectives are:

- Response time to questions of customers related to the information function of C-OSS shall be as soon as possible;
- Increasing the allocated pre-arranged paths and reserve capacity with aim of acquiring additional cargo;

Interoperability objectives

For more than a century the development of the railways has been managed nationally on the basis of national requirements rather than a common European approach. As a result international rail transport in Europe is still complex and costly to operate. This segmentation is still a barrier to a Europe-wide rail area even though substantial financial, political and human resources have been invested in integrating the railway systems.

The railway interoperability Directive 2008/57/EC of 17 June 2008 sets out the conditions to be met to achieve interoperability within the Union rail system. These conditions concern the design, construction, placing in service, upgrading, renewal, operation and maintenance of the parts of this system as well as the professional qualifications and health and safety conditions of the staff who contribute to its operation and maintenance. This Directive repeals Directive 96/48/EC on the interoperability of the European high-speed rail system and Directive 2001/16/EC on the interoperability of the European conventional rail system.

In a view of the provisions of EU Directives on the interoperability of the rail system within the European Union, the RFC AWB goal is:

- to contribute to the progressive creation of the internal market in equipment and services for the construction, renewal, upgrading and operation of the rail system within the RFC AWB;
- to contribute to the interoperability of the rail system within RFC AWB.

The system constituting the rail system may be broken down into the following subsystems, either:

- structural areas:
  - infrastructure (track, points, engineering structures - bridges, tunnels, etc., associated station infrastructure - platforms, zones of access, including the needs of persons with reduced mobility, etc., safety and protective equipment);

  - energy (electrification system, including overhead lines and the trackside of the electricity consumption measuring system);
  - trackside control-command and signalling (the trackside equipment required to ensure safety and to command and control movements of trains authorised to travel on the network);
  - on-board control-command and signalling (the on-board equipment required to ensure safety and to command and control movements of trains authorised to travel on the network);
  - rolling stock (vehicle dynamics and superstructure, command and control system for all train equipment, current-collection devices, traction and energy conversion units, braking, coupling and running gear and suspension, doors, man/machine interfaces, passive or active safety devices and requisites for the health of passengers and on-board staff);
- functional areas:
  - operation and traffic management (the procedures and related equipment enabling coherent operation of the various structural subsystems, during both normal and degraded operation, including in particular train composition and train driving, traffic planning and management. The professional qualifications which may be required for carrying out cross-border services);
  - maintenance (procedures, associated equipment, logistics centres for maintenance work);
  - telematics applications for passenger and freight services.

Railway interoperability is developed through the introduction of Technical Specifications of Interoperability (TSIs) concerning the specific subsystems; TSIs are also related to safety issues, even though security and interoperability are, at present, regulated by different normative initiatives. The European Railway Agency (ERA) is directly involved in the interoperability process with the role of advising and assisting the process. Moreover, ERA is in charge for the development of some TSIs.

The main obstacles to the railway interoperability concerns three main subsystems:

- Infrastructure: presence of different axle load, tunnel gauges, train length;
- Energy: presence of different power systems (A.C. systems and D.C. systems or without electrification) and different pantograph;
- Control-command and signalling: presence of different signalling and train control systems (in general, one or more system per national network).

The presence of several signalling and train control systems impacts negatively on:

- Costs: (brand-new) interoperable locomotive must be equipped with the specific signalling interface of every single national network where it is allowed to operate;
- Reliability: the presence of several systems and interfaces reduce the possibility of introducing redundancies, with consequent possible higher number of breakdowns;
- Safety, intended as "drivers' interoperability": drivers must get familiar with several systems and interfaces to be allowed driving trains on different national networks. This can lead to a reduction in the overall safety levels and higher human errors rate;
- Interoperability of existing rolling stock: existing rolling stock must be retrofitted with further system and interfaces; this has proven to be difficult in several cases. In fact, once locomotives have been designed it is extremely expensive and sometimes impossible to add more on board systems;

Other obstacles to interoperability reflect differences in the present national technical specifications, such as fire extinguisher on board, back lights and so on. The modification of these specifications in the view of better

interoperability is often refused or delayed by national authorities for different reasons, such as the safety reasons.

In the medium term such micro obstacles have to be eliminated to prevent a further obstacle to the full interoperability of the RFC AWB. According to Directive 2004/49/CE, some derogation to application of TSIs are possible; the derogation should be identified and explained.

Striving to fulfil the interoperability objectives as much as possible, the RFC AWB has developed the Capacity Improvement and Operational Bottleneck Study where the physical, technical and functional bottlenecks has been analysed and corrective measures has been proposed by the provider of the Study. The Study demonstrated the main obstacles for improving the rail freight traffic on the RFC AWB and could potentially serve as the basis for decision makers. The Study is available on Corridor's web site: Microsoft Word - Bottleneck-study_AWB-RFC_final.docx (rfc-awb.eu).

The national implementation plans of particular TSI shall be considered in order to monitor future development of interoperable infrastructure with capacity development concerned.

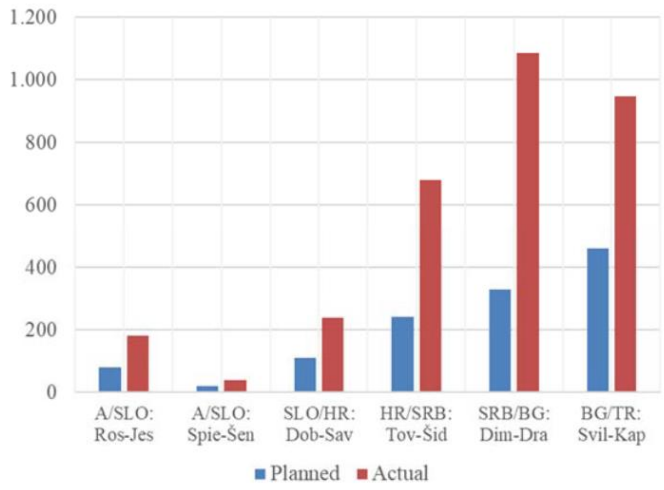
2.2.3 OPERATIONAL BOTTLENECKS AND PROPOSED SOLUTIONS

As mentioned in Section 2.1.5 above, the RFC AWB carried out in 2020 a "Capacity Improvement and Operational Bottleneck Study". Whereas infrastructure bottlenecks have been described in Section 2.1.5, in the following paragraphs operational bottlenecks are summarised from the mentioned report, focussing on cross-border operations.

At border crossing points several critical processes and procedures take place, such as transfer of wagons and goods between neighbouring railways, change of locomotive and crews, technical inspections and control of compliance with railway transport standards. Neighbouring railways often operate under different legal regimes and different standards.

Lack of railway interoperability, deficits in the operational coordination of border crossings and priority rules to the detriment of rail freight on a multi-purpose rail network are among the main reasons for non-competitive timetables and unreliable rail freight services.

Figure 11 Cross-border stopping times (min)



Source: RFC AWB Bottleneck Study 2020

Whereas the border stations between Austria, Slovenia and Croatia do not have police, customs, veterinarian and phyto pathological inspections, the border stations from Croatia to Serbia, Bulgaria and Turkey do have police and customs, as well as veterinarian and phyto pathological inspections. However, such inspections are not located at the railway stations, but usually at road border crossings with the staff arriving at the railway stations when needed. The total planned cross-border time may reach 20,77 hours (almost one day!) and the actual time is almost 53 hours (over two days!). The shortest stopping times are between Austria and Slovenia, the longest between Croatia, Serbia and Bulgaria.

The reasons for long stops and delays (over planned stops) at the border stations are reported in the following table, which are similar for all cross-border sections.

Table 14 General reasons for long stops and delays at the border stations

Reason for delay	Responsibility	Comments
Migrants	External	Detailed police inspections
Customs inspections	Authority	Duplicate procedure at both border states
Veterinarian and phyto pathological inspection	Authority	Not located at rail border stations
Lack of information systems	State, authority, RIM	A lot of paper documents for all participants at the rail border crossing
Maintenance works, closures	RIM, State	Maintenance and line upgrading with delays
Lack of mutual trust agreements	Rail carrier	Agreements between different rail carriers along the transport route
Lack of locomotives	Rail carrier	While changing the locomotive at the handover station
Lack of engine drivers	Rail carrier	Engine drivers are not always available
Broken wagon and load refused	Rail carrier	The following carrier refuses inadequate wagons at the handover station
Lack of capacity on lines and at railway stations	RIM, State	Bottlenecks on the railway infrastructure

Source: RFC AWB Bottleneck Study 2020

An analysis of conditions and procedures for rail freight at border crossings showed that huge improvements could be made inter alia by streamlining procedures at border crossings. The study revealed that average stopping times of freight trains at the RFC AWB border crossings are generally in the range of several hours. Many of the border crossings along the RFC AWB lag behind in this regard compared to the north or central EU RFCs. Many border procedures are duplicated at both border stations, the handover station and the station on the other side of the border. For example: at both stations customs and police procedures are carried out, thus doubling the time needed. There is significant potential for improvements to facilitate cross-border train operations on the RFC AWB, including measures such as mutual trust agreements or a closer cooperation in border and customs controls at border stations.

Simplification, standardisation and harmonisation of the legal, technical and operational requirements relevant for processes and procedures at railway border crossings is a very demanding and challenging endeavour that requires mandates given by the related governments for actions and cooperation at both national and cross-border levels. The relevant standards and recommendations address wide range of issues, including:

- Formalities at common border crossings, such as: correlation of business hours/competence; joint customs controls; juxtaposed customs offices;

- Coordinated and simultaneous controls of customs and other competent authorities;
- Lodging of the goods declaration/supporting documents by electronic means using recommended international standards;
- Limited requirements (only that deemed necessary) for data on the goods declaration/supporting documents;
- Limited requirements for translation of particulars in supporting documents;
- Pre-arrival lodgement/checking of goods declaration;
- Use of commercial/transport documents as a descriptive part of customs declarations or as customs declarations for transit;
- Providing simplified procedures for authorised operators;
- Simplified temporary admission formalities for means of transport.

The study includes several proposals for improvement of border-crossing practices in international railway transport include:

- Electronic information systems for sharing information;
- Railway-to-railway electronic data interchange (EDI);
- Information exchange between railways and control authorities;
- Reduced data and document requirements;
- Standardisation and harmonisation of data requirements;
- Rail Transport Single Window Facility/System;
- Government-to-government electronic information exchange;
- Pre-arrival information, risk assessment and selective controls;
- Use of new technologies and non-intrusive inspections;
- Simplification for customs transit procedures at railway border crossings; and
- Joint controls by border authorities at the railway border crossings.

Finally, the following soft measures are ultimately identified to improve competitiveness of rail freight transport along the RFC AWB, to reduce stopping times at borders:

- Border working groups for improvement of the conditions at border crossings, with permanent monitoring and different indicators (stopping time, transport volume…);
- RFC AWB office as a “Regional railways coordination centre” for better cooperation at the border crossings. Cooperation and connection with different involved parties from authorities (ministries, customs, police…) to rail carriers and RIMs;
- Better working conditions for border crossing staff (salaries, new offices and equipment,….);
- Introduction of ICT (TAF TSI) between rail carriers, RIMs and border authorities;
- Police procedures with new border equipment for faster train checks (scanners for undocumented immigrants on freight trains), especially at the Schengen borders;
- Customs procedures with new border equipment for faster train checks, electronically based procedures, without papers;
- Joint cross-border procedures of two states at handover stations, agreements between states;
- Modernisation and optimisation of the rolling stock at rail carriers, with interoperable locomotives and engine drivers. With the growth of the cargo the rail carriers should expand their fleets of locomotives and wagons;
- Usage of the mutual trust agreements between rail carriers for simplified border operations during the train handover process;

- Harmonised legislation along corridors (operating rules), based on TSI and operational legislation for interoperability.

2.2.4 RAILWAY UNDERTAKINGS OPERATING FREIGHT SERVICES ALONG THE 11 RFCS AND RFC AWB

The Train Information System (TIS) tool coordinated by RNE includes a detailed database of train operations. An analysis of the TIS dataset for the year 2022 has been made as part of this study aimed at producing statistical information on train operations along the RFCs. However, train operations encoded in TIS do not correspond to individual trains by Origin and Destination as more Railway Undertakings can be involved in the operation of international trains. A train along an RFC can be operated by more Railway Undertakings from origin to destination. For the analysis presented in this section, Railway Undertakings belonging to the same group of companies have been aggregated into a single unit of analysis. This specified, according to the TIS database, 166 railway undertakings/groups of railway undertakings have been identified which were involved in the operation of international rail freight services along the RFCs in 2022. About half operated more than 1,000 trains, whereas one-fourth operated more than 5,000 trains.

Table 15 Railway Undertakings operating international rail freight trains in 2022

N. trains	N. of RUs
> 15,000	18
> 10,000 < 14,999	11
> 5,000 < 9,999	12
> 2,000 < 4,999	27
> 1,000 < 1,999	16
> 500 and 999	24
> 200 < 499	31
> 100 < 199	14
< 100	13
Total	**166**

Source: RNE – TIS

The number of Railway Undertakings operating trains along the RFCs in 2022 varied from a minimum of 27 on the RFC Atlantic to 134 on the RFC Rhine-Danube. Overall, the number of RUs operating along each RFC and the number of trains they operate align with the market size and shares of rail transport in the countries crossed by the RFCs as illustrated in Sections 3.1 and 3.2 below. Not surprisingly, more operations, particularly by large Railway Undertakings/Groups of Railway Undertakings, are concentrated along the RFCs crossing Central and Eastern European countries.

Table 16 Railway Undertakings using RFCs in 2022 by class of number of operated trains

N. trains	RALP	NSM	SCANMED	ATL	BA	MED	OEM	NSB	RD	AWB	AMBER
> 5,000	7	5	6	1	8	2	9	10	9	**2**	4
> 1,000 < 4,999	18	5	6	6	13	9	24	19	19	**1**	6
< 1,000	61	23	49	20	96	40	99	79	106	**49**	66
Total	**86**	**33**	**61**	**27**	**117**	**51**	**132**	**108**	**134**	**52**	**76**

Source: RNE - TIS

Referring to the entire 11 RFCs Network, most RUs operate trains on more than one corridor: 55% of the RUs operate trains on 4 to 7 RFCs, whereas about 25% operate trains on up to 3 corridors and another 20%

operate trains on 8 or more corridors. Only 4 RUs operate trains on all RFCs, and 12 operate trains on only one RFC.

Table 17 Railway Undertakings using RFCs in 2022 by number of corridors where they operate

N. of RFCs where RUs operate	N. of operating RUs by RFC											
	RALP	NSM	SCANMED	ATL	BA	MED	OEM	NS-B	RD	AWB	AMBER	11 RFCs
1	1	1	1	2	1	1	2	0	3	0	0	**12**
2	6	0	0	1	2	1	3	7	3	1	0	**12**
3	3	2	2	4	6	2	12	7	11	1	4	**18**
4	5	2	3	1	13	4	17	8	17	3	11	**21**
5	9	5	6	2	21	4	23	18	24	4	14	**26**
6	19	4	11	4	28	10	30	25	30	8	17	**31**
7	10	1	11	0	13	4	13	12	13	6	8	**13**
8	14	4	9	3	14	8	14	13	14	11	8	**14**
9	10	7	9	3	10	8	9	9	10	9	6	**10**
10	5	3	5	3	5	5	5	5	5	5	4	**5**
11	4	4	4	4	4	4	4	4	4	4	4	**4**
Total	86	33	61	27	117	51	132	108	134	52	76	166

52 RUs operated trains on the RFC AWB in 2022. Most operated trains on more corridors and registered up to 1,000 operations. Still, 2 RUs operated more than 5,000 trains along the RFC AWB in 2022.

2.2.5 PASSENGERS TRAIN OPERATIONS ALONG THE RFC AWB

As part of the study, a high-level recognition of the passengers' train operations was performed based on the information available from the Train Information System (TIS) tool coordinated by RNE. Given that the database is not fully complete, the analysis is limited to identifying the main Origins and Destinations (O/Ds) of international passenger traffic along the 11 RFCs Network.

The international relation involving Graz (AT) and Maribor (SI) registers more than 1,000 trains per direction, All other registered relations present a number of international trains of about 1 train per day or less, specified that many O/D relations may be part of trips over longer O/D (e.g. train services between Graz and Maribor may originate in/extend to Wien and Ljubljana).

Detailed historical data are not available to assess the impact of the establishment of the RFCs on passenger operations and vice versa. Most of the above-listed O/Ds relate to cross-border regional mobility, and commuting traffic is likely to concentrate in peak hours, when limitations may affect freight operations, particularly long freight trains, rather than restricting passengers' train operations. There seems to be no evidence of the negative effects of the establishment and operations of the RFCs on passenger traffic.

3 2024 TMS UPDATE BACKGROUND INFORMATION

The first section of this chapter provides a statistical framework on the main socio-economic and transport developments on a European scale over the past decades. The second section reports on the main indicators monitored at the European level regarding the rail transport market and its liberalization process. The last section concerns the scenarios considered for elaborating future market estimates as part of the 2024 TMS Update, including the presentation of the main socio-economic assumptions and infrastructure developments.

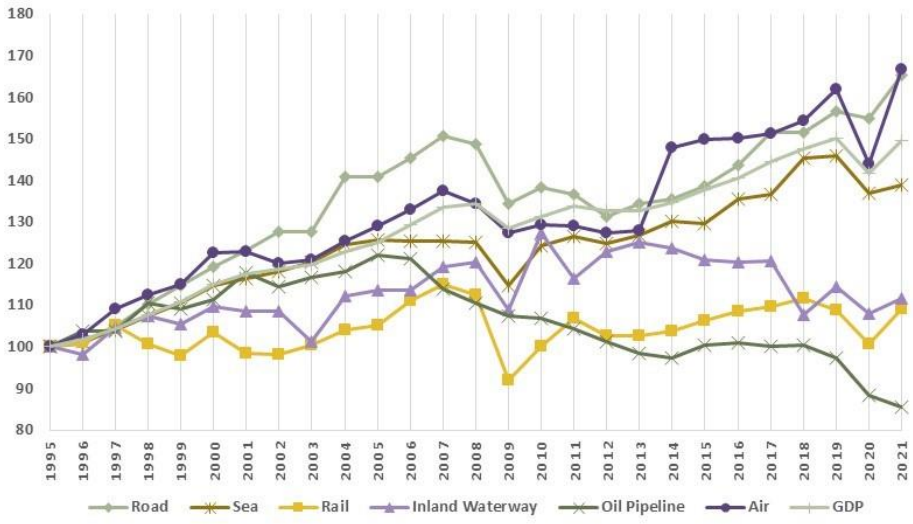
Given that the rail freight market and international freight train operations across EU Member States and between the EU and its neighbouring countries are shared among the different corridors, and considering that most statistics are available at the country level, and some of them only at the EU level, the analysis in this chapter is presented for the entire 11 RFCs Network, covering the entire EU and the relevant neighbouring countries for which data are collected and available from EU institutions. Whenever possible, data have been elaborated for the RFC concerned countries. Corridor countries have also been highlighted in the exhibits. Allowing for an understanding of the market trends along the RFCs within the wider EU context, such a solution is also more in line with the adopted approach of developing a market analysis using an EU-wide network model.

Specifically concerning the RFC AWB, it is worth noticing that the statistical analysis presented in this chapter omits data related to the rail network and market in the Republic of Serbia, as the sources considered for analysis do not include figures for this country.

3.1 TRANSPORT MARKET TRENDS IN EUROPE

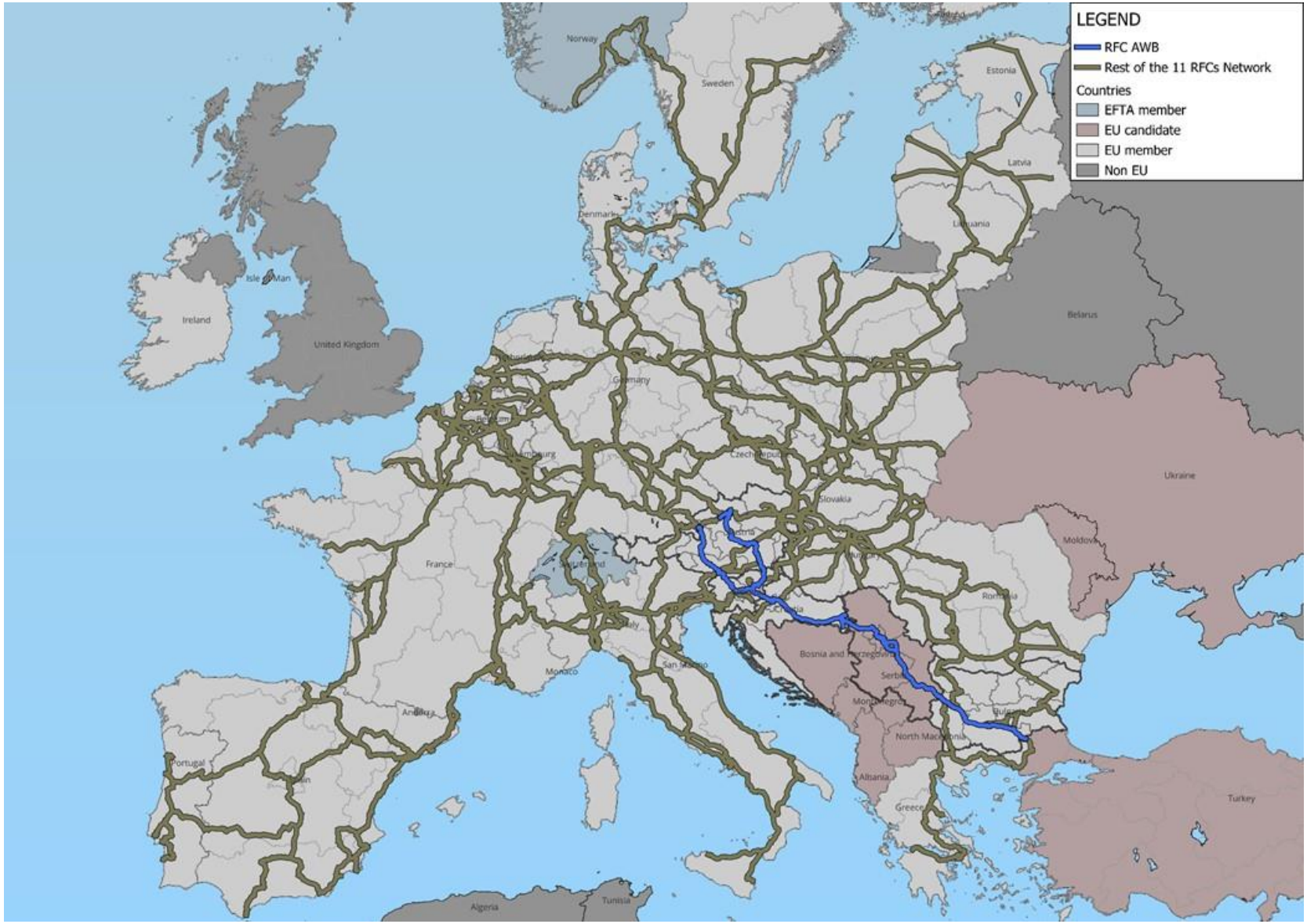
This section briefly reports the main transport statistics from the Statistical Pocketbook 2023, produced by the EC – DG MOVE and Eurostat. The analysis provides an overview of the development of the European rail freight sector since the middle of the 1990s when the rail freight market liberalization started, allowing monitoring trends before and after the 2008 credit crunch, which is considered the second major financial crisis after the 1930s Great Depression, and which was followed by additional adverse events during the past 10-15 years when the 11 RFCs were gradually established and entered into operation.

Figure 12 Transport trends in billion tkm EU27 (1995=100)



Source: EC – DG MOVE – Statistical Pocketbook 2023

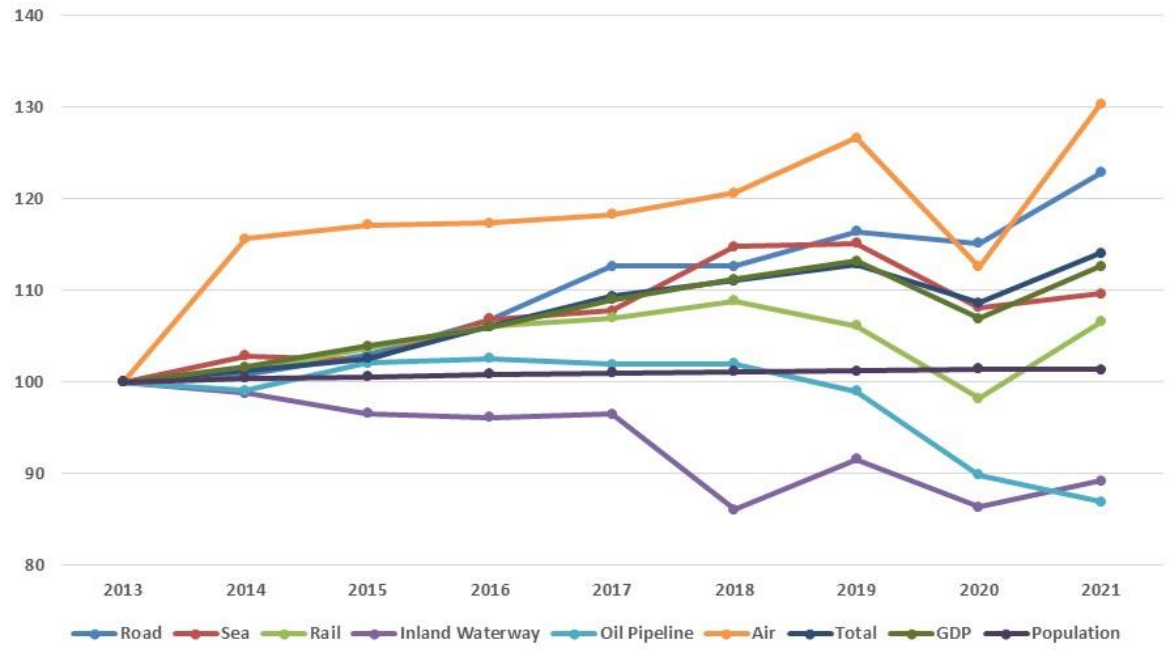
Figure 13 The RFC AWB within the 11 RFCs Network



Source: Authors based on CIP

The period since the entry into force of the Regulation (EU) 913/2010 has indeed been marked by a number of socio-economic, health and geopolitical events which negatively impacted trade and transport flows at the global and European scale. As visible from the available statistics, the above-mentioned 2008 financial crisis basically altered the economic and transport developments experienced by Europe over the previous decades. Long-term series over the past 30 years show that the effects of this crisis are persisting, which were more recently further impacted by the 2020-2021 COVID-19 pandemic and by the current geopolitical crisis that started in 2022 with the Russian-Ukrainian war and deteriorated with the Israel-Gaza conflict and Red Sea crisis. Notwithstanding the recurrent negative events and persisting economic uncertainties, most socio-economic and transport developments show overall positive trends, although the curves of the period after 2008 stand at lower growth rates. This is particularly true for the primary economic variable – Gross Domestic Product (GDP) – and freight traffic for all transport modes.

Figure 14 EU-27 performance by mode for freight transport 2013-2021 (billion tkm) (2013=100)



Source: EC – DG MOVE – Statistical Pocketbook 2023

Freight transport volumes in the EU have grown from about 2,400 billion tkm in 1995 to about 3,000 billion tkm in 2013 — when six of the first 9 RFCs in the Regulation 913/2010 were established — to over 3,400 billion tkm in 2021. Aviation is the only mode for which growth levels returned close to the previous pattern from 2014 until the COVID-19 pandemic, which negatively affected all transport modes' performance. Compared to 1995, all transport modes, except oil pipelines, showed higher levels of traffic volumes expressed in tkm in 2021. All transport modes except inland waterways and oil pipelines also show overall growing trends for the past decade – up until the COVID-19 pandemic – although they are lower for rail transport than for aviation, maritime and road transport.

About 425 million inhabitants lived in the EU27 in 1995, 441 million in 2013, and 447 million in 2021. Over 5,600 tkm of goods per inhabitant were transported in the EU27in 1995, growing to 6,800 tkm in 2013 and 7,700 tkm in 2021.

Table 18 EU-27 performance by mode for freight transport 2013-2019 and 2019-2021 (billion tkm)

	2013	2019	2021	CAGR '19-'13	CAGR '21-'13	Var. '21-'19
GDP	106.1	120.1	119.5	2.1%	1.5%	-0.5%
Population	441.3	446.4	447.2	0.2%	0.2%	0.2%
Air	1.8	2.3	2.4	4.0%	3.4%	2.9%
Inland Waterway	152.6	139.7	136.1	-1.5%	-1.4%	-2.6%
Rail	384.3	407.9	409.6	1.0%	0.8%	0.4%
Combined transport	40.7	83.5	100.2	12.7%	11.9%	19.9%
Oil Pipeline	102.1	101.0	88.7	-0.2%	-1.7%	-12.2%
Road	1,516.4	1,764.8	1,862.5	2.6%	2.6%	5.5%
Sea	851.0	979.5	932.7	2.4%	1.2%	-4.8%
Total	**3,008.1**	**3,395.3**	**3,431.9**	**2.0%**	**1.7%**	**1.1%**

Source: EC – DG MOVE – Statistical Pocketbook 2023

Looking at the differences between the 2013-2019 and 2019-2021 periods, the impact of the COVID-19 pandemic seems particularly damaging for maritime transport and oil pipelines. In contrast, as a result of the lockdowns, growth/decline rates were lower for all transport modes.

Notwithstanding the marginal increase of rail freight transport between 2013 and 2021, compared to other transport modes, particularly road (see Table 18 EU-27 performance by mode for freight transport 2013-2019 and 2019-2021 (billion tkm)), combined transport more than doubled from about 41 billion tkm to 100 billion tkm (Table 19).

Table 19 Combined transport traffic by UIRR companies

Year	Tkm				Traffic% of consignments		
	billion	% of which:			Semi-trailers	Rolling motorway	Swap bodies and containers
		below 300 km	between 300 and 900 km	more than 900 km			
1990	18.7	1%	68%	31%	20%	18%	61%
2000	35.2	2%	71%	27%	9%	23%	68%
2010	42.4	5%	58%	37%	10%	15%	75%
2015	55.0	1%	50%	49%	13%	5%	82%
2020	90.3	1%	49%	50%	15%	5%	80%
2021	100.2	1%	48%	51%	14%	5%	80%
2022	88.8	1%	52%	46%	16%	4%	80%

Source: EC – DG MOVE – Statistical Pocketbook 2023

Trends for the RFC AWB concerned countries are similar to the EU ones, specifying that the growth of rail freight transport registered higher rates.

Table 20 RFC AWB concerned countries performance by mode for freight transport 2013-2019 and 2019-2021 (billion tkm)

	2013	2019	2021	CAGR '19-'13	CAGR '21-'13	Var. '21-'19
Road	64.3	74.4	82.2	2.4%	3.1%	10.4%
Railways	31.4	36.7	37.5	2.6%	2.2%	2.1%
Inland waterways	9.2	9.1	10.0	-0.1%	1.1%	9.6%
Oil pipelines	10.5	11.6	10.5	1.7%	-0.1%	-10.1%
Total	**115.5**	**131.9**	**140.1**	**2.2%**	**2.4%**	**6.2%**

Source: EC – DG MOVE – Statistical Pocketbook 2023

The share of rail in total freight transport based on tkm varies significantly across the European Union. Data in Table 21 shows rail share is generally higher in Eastern and Central European countries and lower in

Western Europe. Austria and Switzerland are exceptions to this pattern, which is also due to the support these countries give to rail transport to reduce the impact of freight transport on the environment, with a focus on the alpine crossings.

Table 21 Share of rail in total freight transport in % (based on tkm)

	2008	2013	2015	2019	2022	Var. '19-'13	Var. '22-'13	Var. '22-'08
Lithuania	64.5	57.2	56.4	56.8	37.2	-0.4	-20	-27.3
Switzerland	35.3	36.0	37.2	34.1	33.4	-1.9	-2.6	-1.9
Slovakia	40.0	38.6	36.3	30.7	30.1	-7.9	-8.5	-9.9
Austria	**33.3**	**31.9**	**32.3**	**30.6**	**30.0**	**-1.3**	**-1.9**	**-3.3**
Slovenia	**26.7**	**30.5**	**30.9**	**31.4**	**28.8**	**0.9**	**-1.7**	**2.1**
Hungary	24.9	30.3	29.1	26	26.3	-4.3	-4.0	1.4
Latvia	47.9	43.1	42.3	37.4	26.0	-5.7	-17.1	-21.9
Czechia	31.9	28.0	26.1	25.9	22.0	-2.1	-6.0	-9.9
Romania	19.9	23.3	25.0	20.5	21.0	-2.8	-2.3	1.1
Poland	30.5	24.2	23.3	21.5	20.8	-2.7	-3.4	-9.7
Germany	14.6	13.9	14.1	13.7	14.9	-0.2	1.0	0.3
Bulgaria	**10.3**	**7.5**	**8.7**	**8.5**	**11.2**	**1.0**	**3.7**	**0.9**
Finland	13.1	12.7	10.9	11.8	10.8	-0.9	-1.9	-2.3
Sweden	10.3	9.6	8.6	9.4	10.5	-0.2	0.9	0.2
Belgium	8.2	6.8	6.9	7.2	7.3	0.4	0.5	-0.9
Luxembourg	9.8	7.2	7.0	6.8	6.1	-0.4	-1.1	-3.7
European Union - 27 countries (from 2020)	6.0	5.7	5.7	5.3	5.5	-0.4	-0.2	-0.5
Croatia	**4.5**	**3.1**	**3.2**	**3.5**	**4.1**	**0.4**	**1.0**	**-0.4**
France	4.2	3.6	4.1	3.5	3.7	-0.1	0.1	-0.5
Italy	2.6	2.4	2.6	2.3	2.7	-0.1	0.3	0.1
Estonia	10.4	7.6	4.5	3.3	2.4	-4.3	-5.2	-8.0
Norway	2.0	1.9	1.6	1.6	2.1	-0.3	0.2	0.1
Netherlands	2.0	1.7	1.8	1.8	1.9	0.1	0.2	-0.1
Denmark	1.4	1.8	1.9	1.7	1.6	-0.1	-0.2	0.2
Spain	0.8	0.8	0.9	0.8	0.8	0.0	0.0	0.0
Portugal	0.3	0.3	0.3	0.3	0.2	0.0	-0.1	-0.1
Ireland	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0
Greece	0.2	0.0	0.1	0.1	0.1	0.1	0.1	-0.1

Source: Eurostat [tran_hv_ms_frmod]

Compared to 2013, the share of rail in total freight transport based on tkm seems to have generally declined. The most significant drops can be seen in the Baltic States and Eastern Europe, whereas in the other countries, positive and negative variations are marginal. The rail share in so-to-say "isolated networks" like Portugal, Spain, and Ireland. Greece also shows a low modal share for rail transport.

The RFC AWB countries are among the ones registering relatively high rail modal share in the EU. Two out of four RFC AWB countries are indeed positioned within the ten first-ranking EU countries for rail modal share in 2022. However, Austria is also among the ones that are registering a high decline in rail modal share over time. A trend that is likely related to the change in the commodity basket trade.

Table 22 Goods transported by group of goods - from 2008 onwards based on NST 2007 (Tonnes '000) in the EU 27

Main group of commodities	Transported goods in Tonnes ('000)				Variations in Tonnes ('000)			Share in total in %			
	2008	2013	2019	2022	2019-2008	2019-2013	2022-2019	2008	2013	2019	2022
Unidentifiable goods: goods which for any reason cannot be identified and therefore cannot be assigned to groups 01-16	187,740	248,671	316,077	345,593	128,337	67,406	29,516	12.5%	16.3%	20.2%	23.5%
Metal ores and other mining and quarrying products; peat; uranium and thorium	241,294	254,245	254,355	217,994	13,061	110	-36,361	16.0%	16.7%	16.2%	14.8%
Products of agriculture, hunting, and forestry; fish and other fishing products	70,094	79,243	88,030	94,987	17,936	8,787	6,957	4.7%	5.2%	5.6%	6.5%
Chemicals, chemical products, and man-made fibers; rubber and plastic products ; nuclear fuel	99,803	102,438	108,291	85,334	8,488	5,853	-22,957	6.6%	6.7%	6.9%	5.8%
Basic metals; fabricated metal products, except machinery and equipment	169,705	146,343	135,089	127,790	-34,616	-11,254	-7,299	11.3%	9.6%	8.6%	8.7%
Coke and refined petroleum products	206,442	179,497	154,412	141,855	-52,030	-25,085	-12,557	13.7%	11.8%	9.9%	9.7%
Coal and lignite; crude petroleum and natural gas	267,461	266,949	213,421	182,566	-54,040	-53,528	-30,855	17.8%	17.5%	13.6%	12.4%
Other goods	262,695	248,962	297,904	272,329	35,209	48,942	-25,575	17.5%	16.3%	19.0%	18.5%
Total transported goods	**1,505,234**	**1,526,348**	**1,567,579**	**1,468,448**	**62,345**	**41,231**	**-99,131**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Source: Eurostat [rail_go_grpgood__custom_10416020]

Table 23 Goods transported by group of goods - from 2008 onwards based on NST 2007 (Tkm '000.000) in the EU 27

Main group of commodities	Transported goods in Tkm ('000.000)				Variations in Tkm ('000.000)			Share in total in %			
	2008	2013	2019	2022	2019-2008	2019-2013	2022-2019	2008	2013	2019	2022
Unidentifiable goods: goods which for any reason cannot be identified and therefore cannot be assigned to groups 01-16	72,621	81,257	101,632	113,203	29,011	20,375	11,571	19.0%	21.3%	25.0%	29.0%
Products of agriculture, hunting, and forestry; fish and other fishing products	19,100	21,513	23,723	25,601	4,623	2,210	1,878	5.0%	5.6%	5.8%	6.6%
Chemicals, chemical products, and man-made fibers; rubber and plastic products ; nuclear fuel	29,933	30,682	31,347	23,744	1,414	665	-7,603	7.8%	8.0%	7.7%	6.1%
Metal ores and other mining and quarrying products; peat; uranium and thorium	50,565	49,328	49,966	45,058	-599	638	-4,908	13.2%	12.9%	12.3%	11.6%
Coal and lignite; crude petroleum and natural gas	43,281	44,928	38,063	33,768	-5,218	-6,865	-4,295	11.3%	11.8%	9.4%	8.7%
Basic metals; fabricated metal products, except machinery and equipment	42,766	35,939	34,740	31,185	-8,026	-1,199	-3,555	11.2%	9.4%	8.6%	8.0%
Coke and refined petroleum products	51,691	47,259	41,087	38,087	-10,604	-6,172	-3,000	13.5%	12.4%	10.1%	9.8%
Other goods	73,243	70,606	85,507	79,055	12,264	14,901	-6,452	19.1%	18.5%	21.1%	20.3%
Total transported goods	**383,200**	**381,512**	**406,065**	**389,701**	**22,865**	**24,553**	**-16,364**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Source: Eurostat [rail_go_grpgood__custom_10416020]

Table 24 Goods transported by group of goods - from 2008 onwards based on NST 2007 (Tonnes '000) in the RFC AWB concerned countries

Main group of commodities	Transported goods in Tonnes ('000)				Variations in Tonnes ('000)			Share in total in %			
	2008	2013	2019	2022	2019-2008	2019-2013	2022-2019	2008	2013	2019	2022
Unidentifiable goods: goods which for any reason cannot be identified and therefore cannot be assigned to groups 01-16	5,462	35,367	47,642	51,088	42,180	12,275	3,446	10.6%	27.5%	32.0%	32.7%
Metal ores and other mining and quarrying products; peat; uranium and thorium	8,900	18,316	22,050	20,556	13,150	3,734	-1,494	17.3%	14.2%	14.8%	13.2%
Products of agriculture, hunting, and forestry; fish and other fishing products	3,224	11,451	11,549	12,657	8,325	98	1,108	6.3%	8.9%	7.7%	8.1%
Chemicals, chemical products, and man-made fibers; rubber and plastic products ; nuclear fuel	4,598	6,962	7,541	10,436	2,943	579	2,895	9.0%	5.4%	5.1%	6.7%
Basic metals; fabricated metal products, except machinery and equipment	6,524	10,424	10,340	10,646	3,816	-84	306	12.7%	8.1%	6.9%	6.8%
Coke and refined petroleum products	10,201	10,527	11,335	13,127	1,134	808	1,792	19.9%	8.2%	7.6%	8.4%
Coal and lignite; crude petroleum and natural gas	3,158	9,258	9,372	7,104	6,214	114	-2,268	6.1%	7.2%	6.3%	4.5%
Other goods	9,288	26,365	29,207	30,654	19,919	2,842	1,447	18.1%	20.5%	19.6%	19.6%
Total transported goods	**51,355**	**128,670**	**149,036**	**156,268**	**97,681**	**20,366**	**7,232**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Source: Eurostat [rail_go_grpgood__custom_10416020]

Table 25 Goods transported by group of goods - from 2008 onwards based on NST 2007 (Tkm '000.000) in the RFC AWB concerned countries

Main group of commodities	Transported goods in Tkm ('000.000)				Variations in Tkm ('000.000)			Share in total in %			
	2008	2013	2019	2022	2019-2008	2019-2013	2022-2019	2008	2013	2019	2022
Unidentifiable goods: goods which for any reason cannot be identified and therefore cannot be assigned to groups 01-16	1,144	6,413	10,155	10,899	9,011	3,742	744	9.9%	24.5%	31.2%	31.1%
Products of agriculture, hunting, and forestry; fish and other fishing products	2,029	3,182	4,128	4,188	2,099	946	60	17.6%	12.1%	12.7%	12.0%
Chemicals, chemical products, and man-made fibers; rubber and plastic products ; nuclear fuel	737	2,324	2,621	2,684	1,884	297	63	6.4%	8.9%	8.1%	7.7%
Metal ores and other mining and quarrying products; peat; uranium and thorium	1,316	1,817	1,990	2,438	674	173	448	11.4%	6.9%	6.1%	7.0%
Coal and lignite; crude petroleum and natural gas	1,653	2,325	2,409	2,506	756	84	97	14.4%	8.9%	7.4%	7.2%
Basic metals; fabricated metal products, except machinery and equipment	2,039	2,592	2,716	2,988	677	124	272	17.7%	9.9%	8.3%	8.5%
Coke and refined petroleum products	440	1,477	1,760	1,608	1,320	283	-152	3.8%	5.6%	5.4%	4.6%
Other goods	2,144	6,096	6,775	7,690	4,631	679	915	18.6%	23.2%	20.8%	22.0%
Total transported goods	**11,502**	**26,226**	**32,554**	**35,001**	**21,052**	**6,328**	**2,447**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Source: Eurostat [rail_go_grpgood__custom_10416020]

The above-described trends, including market and market share reduction in Eastern European countries and growth of combined transport, are indeed associated with changes in the type and quantities of goods transported across Europe (see Table 24 and Table 25). Products such as *chemicals, chemical products, and man-made fibers; rubber and plastic products; nuclear fuel, and particularly metal ores and other mining and quarrying products; peat; uranium and thorium; coal and lignite; crude petroleum and natural gas; basic metals; fabricated metal products, except machinery and equipment; and coke and refined petroleum products;* are gradually declining, whereas unidentifiable goods, i.e. goods which for any reason cannot be identified and therefore cannot be assigned to groups 01-16 of the NST 2007 (Standard goods classification for transport statistics abbreviated as NST), are growing, which are usually transported as unitised cargo and moved across intermodal logistics chains. Such trends are also visible in the RFC AWB concerned countries (see Table 24 and Table 25).

3.2 RAIL MARKET MONITORING INDICATORS

In line with Article 56 (paragraph 2) of Directive 2012/34/EU, foreseeing that regulatory bodies have the power to monitor the competitive situation in the railway market, national regulatory bodies started collecting and producing statistics on the rail market, delivering IRG-Rail's Market Monitoring Reports on an annual basis[7]. The first report was released in 2013, the latest one in 2023.

Since 2007, the EC (DG MOVE) has also started collecting data on rail market developments in Member States via the Rail Market Monitoring (RMMS) Questionnaires. The recast of the first Railway package (Directive 2014/34/EU) finally created a legal base for RMMS reporting and data harmonisation. Accordingly, in July 2015, after thorough consultation with Member States and stakeholders, the Commission adopted an implementing Regulation (EU) 2015/1100 on the reporting obligations of the Member States in the framework of rail market monitoring. Since 2016, EU Member States and Norway have been providing input to the Commission's rail market monitoring in line with the format and content defined in the Regulation. The latest RMMS report was released in 2023[8].

This section combines data from the above two market monitoring reports by IRG-Rail and the EC, providing data for 2013 and 2021, where available, to comment on the trends after the entry into force of Regulation (EU) 913/2010 and subsequent establishment of the RFCs. It shall be noted that data are not consistently available for all Member States and EU neighbouring countries and for considered years.

The first relevant information analysed in the above-mentioned market monitoring reports relates to market opening and liberalisation in the EU Member States. Table 26 provides information on the year of introduction of the legislation on the liberalisation of the rail freight market and the year of operation of the first new entrant. Additionally, the number of freight railway undertakings (RUs) is indicated for 2013 and 2021. Whereas the liberalisation of the rail market started in the EU well before 2013, the number of RUs operating in the EU further increased in many Member States and particularly in Poland (35), Germany (21), Austria (18), Croatia (13) and the Netherlands (11).

Focussing on the RFC AWB concerned countries, nearly 100 active RUs were registered in 2021, about 10% of the total number of active RUs registered in the monitored countries.

[7] https://irg-rail.eu/irg/documents/market-monitoring?page=0
[8] https://transport.ec.europa.eu/transport-modes/rail/market/rail-market-monitoring-rmms_en

Table 26 Market liberalisation and number of active railway undertakings

Country	Legal liberalisation freight	First new freight entrant	Number of freight RUs		
			2013	2021	var. 2021-2013
AT - Austria	**1998**	**2001**	**28**	**46**	**18**
BE - Belgium	-	-	13	10	-3
BG - Bulgaria	**2002**	**2005**	**10**	**15**	**5**
HR - Croatia	**2009**	**2014**	**1**	**14**	**13**
CZ - Czechia	-	-	-	97	-
DK - Denmark	1997	1997	5	8	3
EE - Estonia	2003	1999	-	2	-
FI - Finland	2007	2012	1	3	2
FR - France	2003	2005	20	23	3
DE - Germany	1994	1995	226	247	21
EL - Greece	2007	-	2	2	0
HU - Hungary	2006	2007	21	29	8
IE - Ireland	-	-	-	1	-
IT - Italy	2001	2001	-	25	-
XK - Kosovo*	2011	2015	1	2	1
LV - Latvia	1998	2003	-	4	-
LT - Lithuania	-	-	-	2	-
LU - Luxembourg	2010	-	-	1	-
MK - North Macedonia	-	-	-	1	-
NL - Netherlands	1995	1998	19	30	11
NO - Norway	2007	2007	8	12	4
PL - Poland	2003	2003	61	96	35
PT - Portugal	2007	2008	-	2	-
RO - Romania	2001	2001	-	24	-
RS - Serbia	**-**	**-**	**-**	**13**	**-**
SK - Slovakia	2006	2006	42	46	4
SI - Slovenia	**2007**	**2009**	**3**	**7**	**4**
ES - Spain	2003	2007	8	10	2
SE - Sweden	1996	1997	13	11	-2
CH - Switzerland	1999	1999	-	25	-
UK - United Kingdom	1994	1996	11	10	-1

*Source: EC – DG MOVE and IRG-Rail; Notes: * This designation is without prejudice to positions on status and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence*

Since the start of the liberalisation process, the market share of the domestic incumbent railway undertakings gradually declined in most EU Member States (Table 27), whereas the market share of non-incumbents increased together with the operations of foreign incumbents. As a general pattern, the trend of the market share by domestic incumbents continued to decline in the period 2013-2021.

In the RFC AWB concerned countries, the market share of the domestic incumbent in 2021 was nearly 65% on average.

Table 27 Market shares of freight railway undertakings (based on net tkm)

Country	Market share of domestic incumbent	Market share of foreign incumbent	Market share of non-incumbent	Market share of domestic incumbent		
	2021	2021	2021	2013	2021	var. 2021-2013
AT - Austria	**63.4%**	**7.7%**	**28.9%**	**81%**	**63%**	**-18%**
BE - Belgium	58.2%	24.4%	17.4%	81%	58%	-23%
BG - Bulgaria	**45.3%**	**0.0%**	**54.7%**	**55%**	**45%**	**-10%**
HR - Croatia	**54.1%**	**2.7%**	**43.2%**	**100%**	**54%**	**-46%**
CZ - Czechia	65.4%	7.6%	27.0%	-	65%	-
DK - Denmark	0.0%	0.0%	100.0%	77%	0%	-77%
EE - Estonia	0.0%	0.0%	100.0%	-	0%	-
FI - Finland	95.6%	0.0%	4.4%	100%	96%	-4%
FR - France	68.7%	18.8%	12.5%	64%	69%	5%
DE - Germany	42.4%	18.9%	38.8%	67%	42%	-25%
EL - Greece	0.0%	96.6%	3.4%	100%	0%	-100%
HU - Hungary	45.1%	1.8%	53.1%	67%	45%	-22%
IE - Ireland	100.0%	0.0%	0.0%	-	100%	-
IT - Italy	39.7%	26.6%	33.7%	-	40%	-
XK - Kosovo*	100.0%	0.0%	0.0%	100%	100%	0%
LV - Latvia	70.3%	0.0%	29.7%	77%	70%	-7%
LT - Lithuania	99.9%	0.0%	0.1%	-	100%	-
LU - Luxembourg	100.0%	0.0%	0.0%	-	100%	-
MK - North Macedonia	100.0%	0.0%	0.0%	-	100%	-
NL - Netherlands	0.0%	47.0%	53.0%	48%	0%	-48%
NO - Norway	44.9%	18.2%	36.9%	48%	45%	-3%
PL - Poland	46.4%	8.1%	45.5%	66%	46%	-20%
PT - Portugal	0.0%	0.0%	100.0%	86%	0%	86%
RO - Romania	19.9%	11.9%	68.2%	-	20%	-
RS - Serbia	**77.7%**	**0.0%**	**22.3%**	**-**	**78%**	**-**
SK - Slovakia	70.9%	0.0%	29.1%	87%	71%	-16%
SI - Slovenia	**77.8%**	**0.0%**	**22.2%**	**91%**	**78%**	**-13%**
ES - Spain	57.8%	24.0%	18.2%	77%	58%	-19%
SE - Sweden	48.1%	6.7%	45.2%	-	48%	-
CH - Switzerland	65.8%	0.0%	34.2%	-	66%	-
UK - United Kingdom	4.7%	34.5%	60.8%	45%	5%	-40%

*Source: EC – DG MOVE and IRG-Rail; Notes: * This designation is without prejudice to positions on status and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence*

Rail traffic expressed in million train-km, including passenger and freight services, remained stable or even increased in most EU Member States. However, some countries, such as France, Spain, and the United Kingdom, also experienced a decline (Table 28). The share of freight services is also stable overall, with either marginal increases or decreases in the production of million train-km. The most relevant variations in the period 2013-2021 were registered by Croatia (+11%) and Latvia (-26%). It is noticed that 12 countries register a share of freight services expressed in train-km of about or over 30%, including all RFC AWB concerned countries: **Austria**, **Bulgaria, Croatia**, Finland, Kosovo, Latvia, Lithuania, North Macedonia, Poland**, Serbia,** Slovakia, and **Slovenia**. Rail freight services account for over 50% of the total train-km produced in Lithuania and **Slovenia**.

Table 28 Rail traffic in million train-km

Country	Total rail traffic			Share of freight services		
Year	2013	2021	var. 2021-2013	2013	2021	var. 2021-2013
AT - Austria	**149**	**174**	**25**	**26.8%**	**29.1%**	**2.2%**
BE - Belgium	97	98	1	13.4%	12.3%	-1.1%
BG - Bulgaria	**28**	**31**	**3**	**25.0%**	**30.7%**	**5.7%**
HR - Croatia	**22**	**21**	**-1**	**22.7%**	**33.7%**	**11.0%**
CZ - Czechia	-	173	-	-	21.8%	-
DK - Denmark	85	92	7	4.7%	3.3%	-1.4%
EE - Estonia	-	7	7	-	18.8%	-
FI - Finland	50	47	-3	28.0%	31.0%	3.0%
FR - France	492	425	-67	15.0%	14.0%	-1.1%
DE - Germany	1055	1,140	85	24.5%	23.7%	-0.9%
EL - Greece	12	9	-3	8.3%	12.8%	4.4%
HU - Hungary	98	108	10	17.3%	17.7%	0.4%
IE - Ireland	-	16	16	-	1.7%	-
IT - Italy	-	358	-	-	15.4%	-
XK - Kosovo*	-	-	-	-	31.2%	-
LV - Latvia	19	10	-9	68.4%	41.8%	-26.6%
LT - Lithuania	-	15	-	-	61.1%	-
LU – Luxembourg	-	8	-	-	5.4%	-
MK - North Macedonia	-	2	-	-	41.2%	-
NL - Netherlands	154	163	9	6.5%	6.2%	-0.3%
NO - Norway	46	46	0	17.4%	18.6%	1.2%
PL - Poland	211	259	48	35.5%	31.6%	-4.0%
PT - Portugal	-	35	-	-	15.7%	-
RO - Romania	-	83	-	-	26.7%	-
RS - Serbia	**-**	**14**	**-**	**-**	**42.9%**	**-**
SK - Slovakia	46	50	4	30.4%	30.5%	0.1%
SI - Slovenia	**20**	**22**	**2**	**50.0%**	**51.8%**	**1.8%**
ES - Spain	187	156	-31	13.4%	15.4%	2.0%
SE - Sweden	151	156	5	25.2%	23.1%	-2.1%
CH - Switzerland	-	233	-	-	11.7%	-
UK - United Kingdom	541	494	-47	7.2%	6.7%	-0.5%

*Source: EC – DG MOVE and IRG-Rail; Notes: * This designation is without prejudice to positions on status and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence*

The analysis of rail freight traffic operations based on tkm (Table 29) aligns with the one concerning train-km. The COVID-19 pandemic seems to have had different impacts on rail freight traffic measured in net tkm, with

either increases or decreases in transport volumes between 2019 and 2021. The impact has been apparently significant in the Baltic States, Denmark, Luxembourg, and Portugal, whereas Bulgaria and Greece experienced about 20% growth in the same period.

Table 29 Rail freight traffic in billion net tkm

Country	Freight traffic			Evolution of tkm	
Year	2013	2021	var. 2021-2013	2019-2021	2020-2021
AT - Austria	21	23	2	1%	9%
BE - Belgium	7	7	-0.1	-7%	2%
BG - Bulgaria	3	5	2	20%	3%
HR - Croatia	2	3	1	9%	-3%
CZ - Czechia	-	16	-	1%	7%
DK - Denmark	2	2	0.0	-22%	-19%
EE - Estonia	-	1	-	-56%	-46%
FI - Finland	9	11	2	5%	6%
FR - France	32	36	4	5%	14%
DE - Germany	113	139	26	8%	13%
EL - Greece	<1	1	-	19%	5%
HU - Hungary	9	11	2	-2%	-5%
IE - Ireland	-	0.1	-	-2%	-5%
IT - Italy	-	27	-	8%	16%
XK - Kosovo*	<1	0.0	-	-9%	60%
LV - Latvia	20	7	-13	-50%	-6%
LT - Lithuania	-	15	-	-10%	-8%
LU - Luxembourg	-	0.2	-	-10%	9%
MK - North Macedonia	-	0.4	-	8%	10%
NL - Netherlands	6	7	1	2%	8%
NO - Norway	4	5	1	5%	3%
PL - Poland	51	56	5	0%	7%
PT - Portugal	-	2	-	-15%	-1%
RO - Romania	-	14	-	-2%	-14%
RS - Serbia	-	3	-	8%	13%
SK - Slovakia	9	9	0.3	4%	13%
SI - Slovenia	4	5	1	-2%	6%
ES - Spain	9	10	1	-2%	9%
SE - Sweden	21	23	2	3%	6%
CH - Switzerland	-	12	-	3%	9%
UK - United Kingdom	22	17	-5.3	-1%	10%

*Source: EC – DG MOVE and IRG-Rail; Notes: * This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence*

The share of international freight services in total freight services generally increased over the period 2010-2020, except in Estonia, Luxembourg, Latvia, Romania, Sweden and Slovakia (Table 30). The RFC AWB-concerned countries for which data is available, show stable/marginally positive growth.

Table 30 International freight services

Member state	2010	2020	var. 2020-2010
AT - Austria	**14%**	**17%**	**3%**
BE - Belgium	4%	5%	1%
BG - Bulgaria	**1%**	**2%**	**1%**
CZ - Czechia	-	11%	-
DE - Germany	53%	62%	9%
DK - Denmark	2%	2%	0%
EE - Estonia	6%	1%	-4%
EL - Greece	-	1%	-
ES - Spain	1%	2%	0%
FI - Finland	3%	3%	1%
FR - France	8%	13%	5%
HR - Croatia	**-**	**2%**	**-**
HU - Hungary	7%	10%	3%
IT - Italy	10%	10%	0%
LT - Lithuania	10%	12%	2%
LU - Luxembourg	1%	0%	-1%
LV - Latvia	17%	7%	-9%
NL - Netherlands	5%	10%	5%
NO - Norway	1%	1%	0%
PL - Poland	21%	23%	2%
PT - Portugal	0%	1%	0%
RO - Romania	2%	0%	-2%
SE - Sweden	9%	8%	-1%
SI - Slovenia	**4%**	**5%**	**1%**
SK - Slovakia	10%	8%	-2%

Source: EC – DG MOVE and IRG-Rail

The network usage intensity of freight trains remained overall stable, with either marginal positive, negative or null variations between 2013 and 2021, except for Austria (Table 31). More significant variations during the same period occurred for total traffic, meaning that passenger services increased equally and, in most cases, more than freight services. The parameter is calculated on the total network of the countries, and the data for the electrified sections of the network generally show higher usage intensity than the one related to the entire network.

Table 31 Network usage intensity (trains per day per route km))

Country	Network usage intensity for freight services			Network usage intensity for total services			Network usage intensity for total services on electrified routes (electrified train-km only)
Year	2013	2021	var. 2021-2013	2013	2021	var. 2021-2013	2021
AT - Austria	19	25	6	72	84	12	103
BE - Belgium	10	9	-1	74	75	1	81
BG - Bulgaria	5	6	1	19	21	2	25
HR - Croatia	5	7	2	22	22	0	35
CZ - Czechia	-	11	-	0	50	-	-
DK - Denmark	4	3	-1	88	103	15	-
EE - Estonia	-	3	-	0	13	-	24
FI - Finland	7	7	0	24	22	-2	34
FR - France	7	6	-1	45	42	-3	59
DE - Germany	18	19	1	74	79	5	112
EL - Greece	1	1	0	15	10	-5	25
HU - Hungary	7	7	0	37	39	2	70
IE - Ireland	-	0	-	0	26	-	-
IT - Italy	-	8	-	0	53	-	71
XK - Kosovo*	1	0	-1	3	1	-2	-
LV - Latvia	8	5	-3	24	13	-11	39
LT - Lithuania	-	13	-	0	22	-	24
LU - Luxembourg	-	4	-	0	79	-	80
MK - North Macedonia	-	3	-	0	6	-	-
NL - Netherlands	9	9	0	138	145	7	-
NO - Norway	6	6	0	33	32	-1	-
PL - Poland	10	12	2	29	37	8	48
PT - Portugal	-	6	-	0	37	-	45
RO - Romania	-	6	-	0	21	-	32
RS - Serbia	-	5	-	0	12	-	18
SK - Slovakia	11	12	1	35	38	3	-
SI - Slovenia	22	25	3	45	49	4	-
ES - Spain	5	4	-1	34	27	-7	36
SE - Sweden	9	9	0	37	39	2	51
CH - Switzerland	-	14	-	0	120	-	-
UK - United Kingdom	-	6	-	0	83	-	126

*Source: EC – DG MOVE and IRG-Rail; Notes: * This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence*

3.3 2030 FUTURE MARKET SCENARIOS

As part of the 2024 TMS Update, future market estimates were elaborated for different scenarios at the short term (2030) time horizon. A scenario represents a narrative or framework that outlines a set of assumptions regarding future developments affecting the rail freight corridors. These assumptions can cover a wide range of factors, including economic growth, technological advances, policy changes, environmental conditions, or infrastructure developments. The main purpose of using scenarios is to assess how different conditions or decisions may affect rail freight transport, which in turn impacts infrastructure requirements and rail system performance.

In general, a scenario consists of different components, each of which serves to detail the assumptions and parameters that define the future. These components include:

- *Economic conditions*: Assumptions about future economic conditions, such as GDP growth rates, trade volumes and industrial production. These conditions have an impact on freight demand by influencing production and consumption patterns.
- *Infrastructure developments*: Details of expected changes in transport infrastructure, such as expansion of rail networks, missing links in road and rail infrastructure, development of new ports or logistics hubs, and improvements in rail and intermodal facilities. Infrastructure developments are important in determining the capacity and efficiency of freight transport systems.
- *Policies and regulations*: Specific changes in policies and regulations that affect freight transport, such as environmental regulations, transport policies, tariffs, and trade agreements. These factors can change transport costs, modal choices, and operational practices.
- *Technological innovations*: Assumptions regarding the adoption and impact of new technologies within the freight transport sector. This includes advances in vehicle technologies, automation, digitalisation of supply chains and energy-efficient practices. Technological innovations can improve efficiency, lower costs, and reduce environmental impacts.
- *Environmental conditions and sustainability goals*: Assumptions regarding environmental conditions and sustainability goals, including climate change impacts and emission reduction targets. These components are becoming increasingly important in planning resilient and sustainable freight transport systems.
- *Social and demographic trends*: Reflections on social and demographic changes that may affect freight transport demand, such as urbanisation patterns, population growth and shifts in consumer behaviour.

By integrating these components, scenarios provide a comprehensive and multifaceted framework for exploring the future of transport. They enable examining the possible effects of various assumptions and support decision making regarding infrastructure investments, policy interventions, or strategic planning. Scenarios serve as an important tool in the management of transport systems and facilitate the development of strategies that are robust and flexible to future uncertainties.

For the purposes of the 2024 Joint TMS Update, future scenarios have been built only considering socio-economic and infrastructure developments. This solution reflects the decision to develop only short-term forecasts up to 2030 and adopt a pragmatic and as far as possible, concrete approach, thus omitting the simulation of the possible effects associated with policy developments such as:

- The proposed weights and dimensions directive and electrification of Heavy Goods Vehicles;
- The internalization of external costs of road transport (road pricing);

- Incentives to rail/combined transport operations;
- Technological/operational improvements of intermodal transport solutions and logistics chains;
- Market sensitivity to climate and energy transition.

In line with this approach, the following scenarios have been defined, all of them at the 2030 time horizon:

- *Reference or background scenario*: It describes the economic developments (in terms of GDP changes), that have the most important impact on the future of rail transport. The base for this is the EU Reference Scenario 2020-2050 and the World Economic Outlook 2023. The economic projections are described in more detail in Section 3.3.1.
- *Projects scenario*: It provides an overview of the impact resulting from the expected developments in the rail transport system. These concern projects related to , ERTMS deployment, missing links, upgrades, and improvements of the rail network belonging to the 11 RFCs, expected to be implemented by 2030, according to the project completion dates defined in the available project lists by December 2023. In Section 3.3.2 an overview of the projects that are being considered is given, which is a subset of the most relevant projects that are ongoing or planned to be implemented and completed by 2030 on the 11 RFCs Network.
- *Sensitivity scenario: an 11 RFCs network at TEN-T standard*: It provides an overview of what would happen if – in addition to the investments included in the projects scenario - ERTMS is fully introduced, 740 meter long trains are allowed to operate anywhere on the whole network, 22.5 t axle load is achieved on the entire network, intermodal loading gauge is also possible along the RFCs and if the rail gauge in Spain and Portugal meets the European track gauge standards (the Rail Baltica initiative, providing interconnectivity of the three Baltic States to Europe is already considered in the *Projects scenario*). This scenario can be regarded as a hypothetical exercise as the projects needed to achieve these standards are not fully defined. Additionally, the TEN-T legislation allows Member States to apply for derogation to achieve compliance without achieving the TEN-T requirements in those cases where the cost of the investment may not be supported by sufficient economic benefits. Section 3.3.3 further describes the assumptions underlying this scenario.

All the above scenarios were analysed using the NEAC model (see Annex 1 to this report) to assess the impact of economic developments, infrastructural improvements, and further general changes for the sensitivity analysis.

3.3.1 ECONOMIC PROJECTIONS TOWARDS 2030

To create the projections for international rail transport, the EU Reference Scenario 2020-2050 (EC, 2021) and the World Economic Outlook (IMF, 2023) were considered. The EU Reference Scenario is used for projections in Europe, while the World Economic Outlook provides input for the rest of the world. This section focuses first on the EU Reference Scenario 2020-2050 and then on the World Economic Outlook.

EU Reference Scenario 2020-2050

This scenario has been used as a common ground, because it covers the EU and makes it a consistent background framework for each of the individual 11 RFCs and their combined network.

The EU Reference Scenario 2020-2050 projects the impact of macro-economic developments, fuel prices, technology trends, and policies on the evolution of EU transport. It provides a model-based simulation of a possible future outlook until 2050, given the insights and policy context, based on certain framework conditions, assumptions, and historical trends, notably in the light of the most recent statistical data.

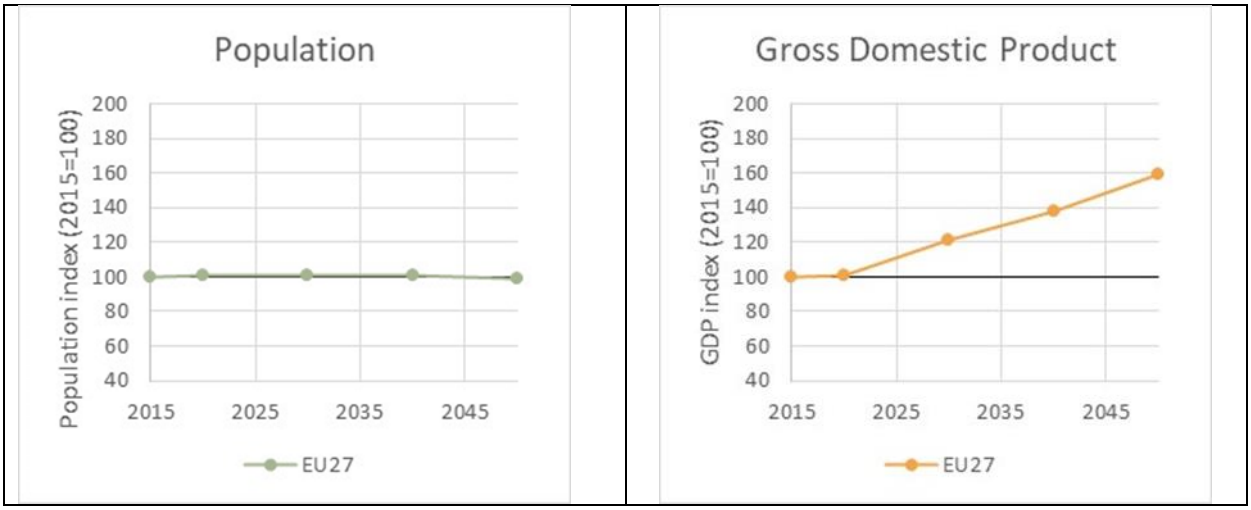
For a complete list of included transport and energy policies, we refer to the report on the EU Reference Scenario published by the European Commission[9]. The central model behind the EU Reference Scenario is the PRIMES model, an energy system model that produces projections for energy, transport and CO_2 emissions.

Figure 15 shows the indexed trends for population, GDP, and road and rail freight transport according to the EU Reference Scenario (*The impacts of the COVID-19 pandemic are considered in the EU Reference Scenario. However, the pandemic effects seem to be negligible for the long-term trends*).

The growth of the EU27 population is expected to stagnate between 2030 and 2050. After 2040, it even goes into negatives. GDP levels, however, are projected to keep increasing until 2050.

Figure 16 shows the indexed trends for transport by road and rail, based on performance (tkm), relating to both international and domestic transport. The impact of the COVID-19 pandemic is visible in the transport levels for 2020. However, as of 2025 the transport forecasts seem to be following the pre-COVID trend. Hence, the pandemic effects seem to be negligible for the longer term. The growth rates for rail freight are, in general, higher than those for road transport, although this can differ per country. For freight transport by rail, the largest increases are projected between 2025 and 2040. The growth of transport is not evenly distributed across Europe. Some areas or countries show a moderate growth rate.

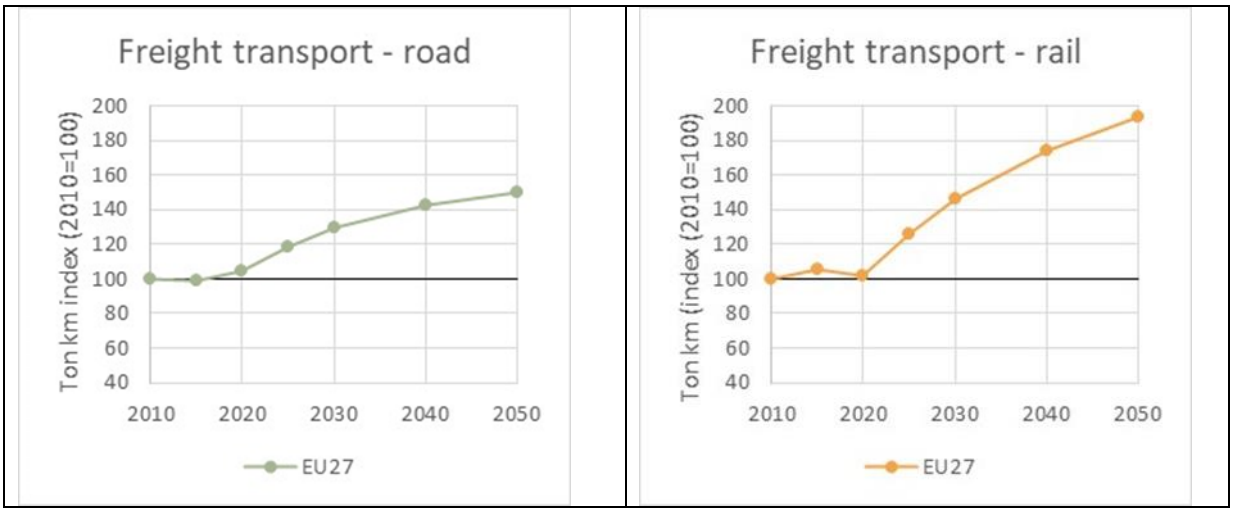
Figure 15 Forecasts population and GDP development in the EU27 between 2015 and 2045



Source: EC (2021)

[9] European Commission, Directorate-General for Climate Action, Directorate-General for Energy, Directorate-General for Mobility and Transport, De Vita, A., Capros, P., Paroussos, L., et al., EU Reference Scenario 2020 : energy, transport and GHG emissions : trends to 2050, Publications Office, 2021, https://data.europa.eu/doi/10.2833/35750

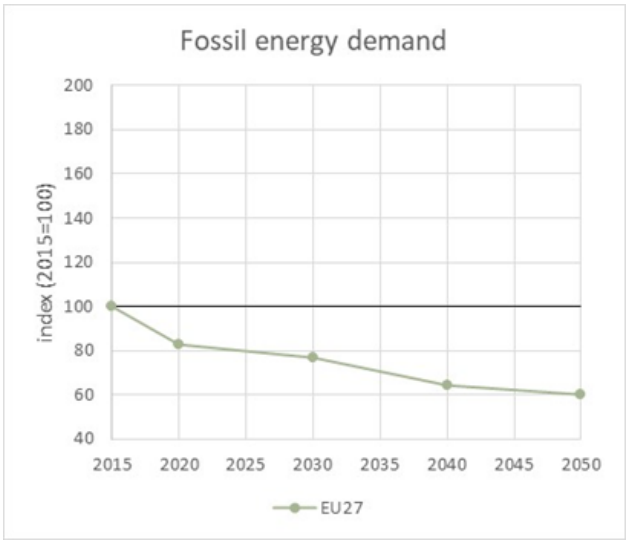
Figure 16 Forecasts on freight transport by road and rail (tkm, index 2010=100) for the EU27



Source: EC (2021)

Figure 17 shows the energy demand for fossil fuels (solid, petroleum products and natural gas) according to the EU Reference Scenario. The scenario predicts for the EU a decrease of 40% in 2050. This has an impact on the development of transport of dry and liquid bulk in the EU. Growth might be less or even negative.

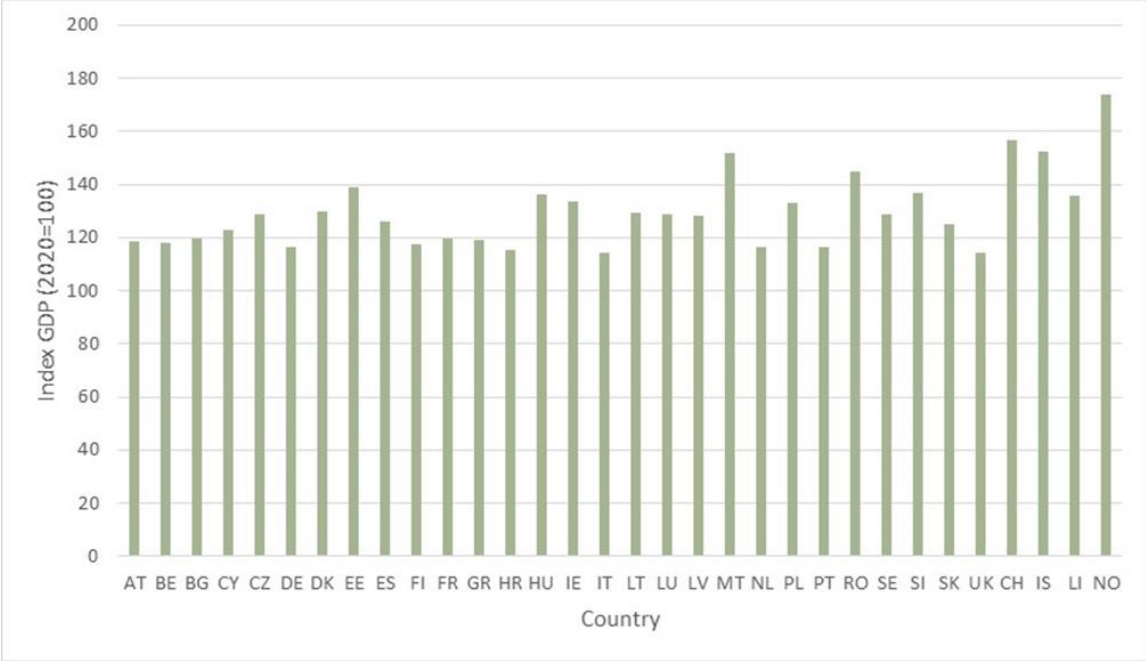
Figure 17 Forecasts on fossil energy demand for the EU27



Source: EC (2021)

The GDP figures from the EU Reference Scenario are used to make projections for 2030 for international rail transport in Europe. Figure 18 shows the economic development in GDP as an index (2020=100) by country, as provided by the EU Reference Scenario. The index ranges from 114 (Italy and the United Kingdom) to 174 (Norway). On average, the weighted growth index for the EU27 is about 117.

Figure 18 Development of GDP (Index 2020=100) for European countries according to the EU Reference Scenario



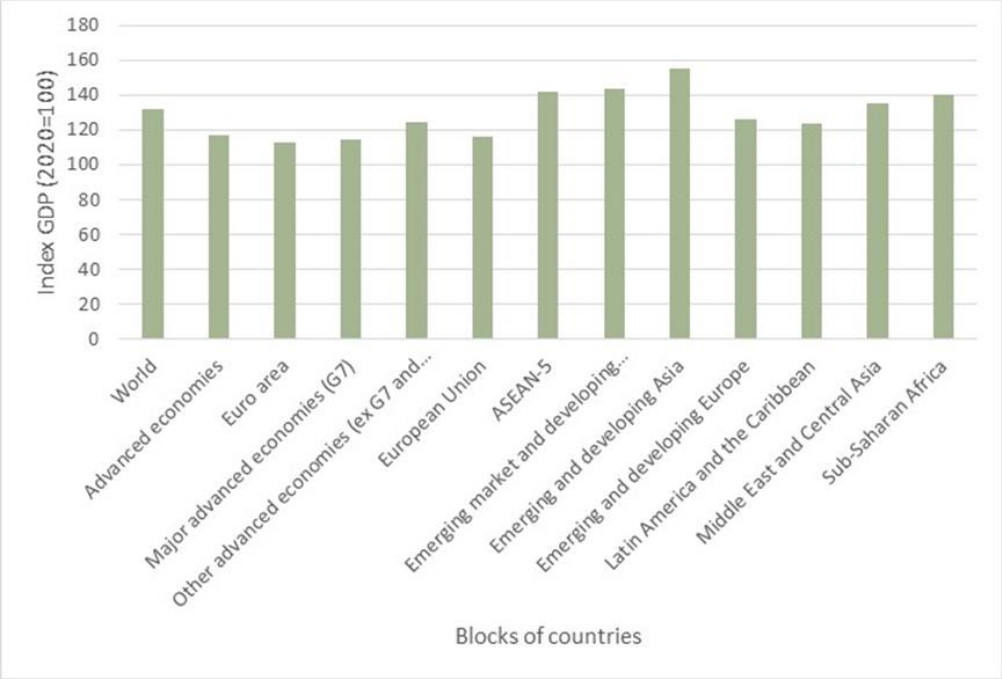
Source: EC (2021)

World Economic Outlook

Concerning the World Economic Outlook[10], the outlook for the GDP in constant prices for the period 2023-2028 was used in this study. Some historical figures are provided as well. Based on the 5-year period 2023-2028, an extrapolation was made for the remaining years until 2030. Figure 19 shows the GDP developments for blocks of countries. Worldwide, the GDP development between 2020 and 2030 is estimated at 32%. For the period 2022-2030, this is approximately 24%. The different blocks of countries show different growth patterns. Growth in the Euro area is, according to the IMF, the lowest at about 13% between 2020 and 2030, while the growth in the emerging and developing countries in Asia is the highest at about 54% between 2020 and 2030.

[10] IMF (2023). *World Economic Outlook. Navigating Global Divergences. October 2023*. Washington DC: International Monetary Fund.

Figure 19 Development of GDP between 2020 and 2030 in IMF economic blocks of countries



Source: IMF (2023), additional calculations Panteia

Road projects

Different road projects across Europe which are planned to be ready by 2030 are included in the Reference Scenario. This includes projects such as the Antwerp Western ring road, the Rotterdam Blankenburgtunnel or the A281 missing link in Bremen. These projects have an impact on road freight transport demand, which will increase.

3.3.2 RAIL PROJECTS FINISHED BY 2030

The Projects scenario is used to assess the impact of the different rail projects expected to be completed by 2030 along the 11 RFCs Network. Time, distance and costs are important bases for calculating the changes in transport demand until 2030. These variables are also important for determining where shifts between modes will occur. The NEAC model was used to assess the impact of the Projects scenario (see Annex 1 to this report).

Currently, a number of projects are ongoing and/or are planned for the improvement of the railway infrastructure belonging to the 11 RFCs Network. Such projects were first identified in the 11 RFCs Implementation Plans, which were further confirmed by the 11 RFCs. Furthermore, the list of the investments planned for the development of the 9 TEN-T Core Network Corridors was consulted to complement the information available from the RFCs. The ongoing and planned investments differ in size. Some are big projects such as Rail Baltica or the Fehmarnbelt. Other projects are much smaller such as the upgrading or modernisation of railway lines. A selection of projects was considered for forecasting purposes according to the following criteria:

- The projects need to be implemented before or in 2030;
- Projects should be able to 'translate' into a time gain or cost reduction.

Table 32 below shows the projects that are considered in the Projects scenario. The selected projects reflect the purpose of the study and nature of the model, limited to the freight market analysis and thus modal share estimation, excluding network capacity simulation and assessment, and looking at the 2030 time-horizon. It is worth noticing that given the uncertainties related to the completion by 2030 of the European standard gauge network along the whole 11 RFCs network, as well as the full deployment of ERTMS and the possibility of operating 740 meter trains and the achievement of the 22.5 t axle load and P400 loading gauge standards, a Sensitivity scenario has been developed as part of this study for the simulation of the completion of the 11 RFCs Network in line with the TEN-T standards (see 3.3.3). This network-wide solution was deemed more appropriate than implementing individual projects within the Projects scenario 2030 as the presence of gaps in the completion of the 11 RFCs Network at TEN-T standard makes the impact of those investments negligible, especially for the European track gauge, axle load, P400 loading gauge, ERTMS and 740 meter long trains standards.

Table 32 Rail projects considered in the Projects scenario 2030

Project	End date	RFC
Follobanen	03/2023	SCANMED
Rehabilitation and upgrade of Corridor Section Aveiro - Vilar Formoso	12/2024	ATL
ABS Hoyerswerda–Horka–Border DE/PL	12/2024	NS-B
Rehabilitation of the railway line Border – Curtici, Section Gurasda – Simeria	12/2025	OEM
Upgrade Stadlau-Marchegg (Marchegger Ast)	12/2025	BA, OEM
Graz-Klagenfurt; Koralm line	12/2025	BA
Second Track Divaça-Koper	10/2025	BA, MED, AMBER
Future Development of Railway Infrastructure: increase of capacity: Biasca, Chiasso, Arth-Goldau, Brig-Iselle, Basle PB, Basle-Luzern, Rothrist, noise protection Gotthard and Lötschberg axes	12/2025	RALP
EuroCap-Rail: modernization of the Brussels-Luxembourg axis	12/2026	NSM
ABS/NBS Karlsruhe - Basel Phase 2, No 1	12/2026	RALP, RD
Construction of double-track railway from Sandbukta to Såstad.	08/2026	SCANMED
Modernisation of Vidin - Medkovets railway section	12/2026	OEM
ABS Angermünde - Border DE/PL	12/2026	NS-B
ABS Berlin – Frankfurt (Oder) – Border (DE/PL)	12/2027	NS-B
Works on main passenger lines (E 30 and E 65) in Śląsk area, phase I: line E 65, section Będzin – Katowice – Tychy – Czechowice Dziedzice – Zebrzydowice, lots A, A1	06/2027	BA
Works on railway line E 75, section Białystok – Suwałki – Trakiszki (state border), Stage I, sub-section Białystok - Ełk, phase II	12/2027	NS-B
Rehabilitation of the railway line Cluj – Episcopia - Border	12/2027	OEM, RD
Upgrading of Alexandroupoli-Ormenio/BG border railway line	12/2027	OEM
Rehabilitation of the railway line Brasov - Simeria	12/2027	OEM
Upgrading Gallarate-Rho line 0294	11/2028	RALP
Upgrade of Brno - Breclav line as a High-speed Rail line	12/2029	OEM
Modernisation of the railway line Bucharest - Giurgiu	12/2029	OEM
Upgrade of the railway access line to the Fehmarn Belt Fixed Link - Section Ringsted - Rødby	06/2029	SCANMED
Southern access line to Brenner; Lotto/lot 1: Fortezza/Franzenfeste - Ponte Gardena/Waidbruck 0292A	12/2029	SCANMED

Project	End date	RFC
ABS/NBS Hamburg - Lübeck - Puttgarden (Hinterland connection to Fehmarn Belt Fixed Link)	12/2029	SCANMED
Rail Baltica	12/2030	NS-B
New Rail Line Dresden - Praha (Section Heidenau - State Border DE/CZ)	12/2030	NS-B, OEM
ABS/NBS München - Rosenheim - Kiefersfelden - Grenze D/A (--> Kufstein)	12/2030	SCANMED, RD
Upgraded line (ABS) (Amsterdam) - DE/NL border - Emmerich - Oberhausen (1. + 2. Phase)	12/2030	RALP, NS-B
Y Basque High-speed Rail (freight and passenger traffic): all sections + access to cities Bilbao and Vitoria + implementation of UIC between Astigarraga-border + ERTMS + electrification + systems	12/2030	ATL
ABS Kehl–Appenweier (POS-Süd)	12/2030	RD
ABS München-Mühldorf-Freilassing	12/2030	RD
ABS Nürnberg – Passau	12/2030	RD
ABS Hof - Marktredwitz - Regensburg - Obertraubling (Ostkorridor Süd)	12/2030	RD
Semmering base tunnel	12/2030	BA
Modernisation/ Rehabilitation and Electrification of Craiova-Calafat railway section (107 km)	12/2030	OEM
Upgrade Nordbahn Wien Süßenbrunn - Bernhardsthal	12/2030	BA, OEM
Modernization of the Radomir - Gyueshevo railway section	12/2030	OEM
ABS Nürnberg – Marktredwitz – Reichenbach/BGr DE/CZ (–Prag)	12/2030	RD
ABS Nürnberg - Schwandorf/München - Regensburg - Furth im Wald - Grenze D/CZ	12/2030	RD
Modernization of the line Plzeň - Česká Kubice, section Stod (excl.) - State border D	12/2030	RD
Rehabilitation of the railway line Caransebes – Craiova	12/2030	OEM
Kanin – Hradec Kralove – Chocen, second track increase speed	12/2030	OEM

3.3.3 SENSITIVITY ANALYSIS: AN 11 RFCS NETWORK IN LINE WITH TEN-T STANDARDS

The Sensitivity scenario helps to understand the impact of completing the 11 RFCs Network according to TEN-T standards[11]. This scenario concerns the availability of European standard rail gauge in Spain and Portugal, the introduction of ERTMS on the entire rail network, and the introduction of 740-meter trains along the 11 RFCs. This scenario can be regarded as a hypothetical exercise as the projects needed to achieve these standards are by no means all ready to be implemented in 2030. Additionally, the TEN-T legislation allows Member States to apply for derogation to achieve compliance without achieving the TEN-T requirements in those cases where the cost of the investment may not be supported by sufficient economic benefits. Despite being theoretical, this scenario provides insights into what would happen with rail transport demand if the TEN-T standards would be achieved in full scale along the 11 RFCs Network. The scenario has been implemented as follows:

- ***ERTMS***. The European Rail Traffic Management System (ERTMS) is important to enhance the interoperability of rail transport through a single European signalling system. ERTMS is designed to replace the multitude of incompatible safety systems currently in use across European railways,

[11] According to Article 39 of Regulation (EU) 1315/2013 on Union guidelines for the development of the trans-European transport network

thereby facilitating cross-border rail traffic and improving the competitiveness of the rail sector. It is expected that the implementation of ERTMS will lead to safety enhancements, operational efficiency, and environmental benefits. Despite the investments and the challenges faced during its deployment, the long-term benefits of ERTMS can be substantial. To simulate the improvements in safety and efficiency, the **speed on the entire network is increased by 3%**.

- ***Introduction of 740-meter trains***. The introduction of longer freight trains (740 meters) will further enhance the efficiency and capacity of rail freight transport. The 740-meter adjustments represent a significant increase over the standard length of freight trains, which traditionally varies by country often ranging around 400 to 600 meters. The transition to 740-meter trains is part of broader efforts to make rail freight a more competitive and sustainable alternative to road transport. The impact of deploying such long trains within the rail freight sector is multifaceted, encompassing operational, economic, and environmental perspectives. However, realizing these benefits fully necessitates significant investments in infrastructure and operational adjustments. The strategic move towards longer trains reflects a commitment to enhancing the competitiveness of rail freight and its role in a sustainable transport system, despite the challenges involved. From a study carried out for the Ministries of Transport in The Netherlands, Belgium, and Germany[12], it was found that, on average, **the average train volume will increase by 15%,** leading to a reduction in rail freight transport costs of approximately 5%. It is assumed that the 15% increase will take place **between *all* origins and destinations in Europe**. The increase will not always be possible, but as this scenario is hypothetical, we neglect these details for reasons of efficiency.
- ***European standard gauge along the 11 RFCs network.*** The Projects scenario already includes the development of the Rail Baltica Project, which among others integrate the rail system of the Baltic Member States into the EU one, with reference to the European standard track gauge. The sensitivity scenario complement the Projects scenario in simulating the impact of the transition to European gauge of all the RFC lines crossing Spain and Portugal, thus assuming the whole 11 RFCs Network would be in line with the TEN-T standards in terms of track gauge. Whereas the effects of such a scenario on the international traffic between the two Iberian countries might be marginal, international traffic between these two countries and other EU countries across the Pyrenees would be smoother and more efficient. Whereas the implementation of the EU track gauge network in the Iberian peninsula (and similarly in the Baltic States) may be challenging under the socio-economic point of view, as costs may exceed possible benefits especially upon accurate consideration of investments, resources and time needed to change not just the rail infrastructure, but also the rolling stock, and the terminals equipment and facilities along the whole logistics chain, the availability of an EU track gauge network reduces in principle logistical complexities, times and costs associated with gauge changeovers between different gauge systems. Taking into consideration the difficulties in assessing the impact of the migration of the Iberian network belonging to the RFCs to the EU standard track gauge, to the purposes of this study the transition has been simulated by a reduction of the waiting time by **4 hours**. We acknowledge that this approach is simple and that not all details or costs associated with the transition are considered. Nevertheless, some positive effects on demand are expected.
- ***22.5 t axle load and P400 intermodal loading gauge***. The above-quantified effects are assumed to generally capture also the benefits potentially attributable to the TEN-T axle load requirement and P400 intermodal gauge as conditions for an 11 RFCs Network in line with TEN-T standards, specifying

[12] TML, Panteia, ViaCon (2023). Cost-benefit analysis 3RX. Leuven: TML.

that both elements are crucial for the competitiveness of rail freight transport in Europe, although their direct effects on transport costs and travel times are difficult to be quantified on the entire network.

The simulated measures provide insight into the potential impact that rail freight transport may have on transport demand. A shift from road and inland shipping to rail transport is expected.

4 ANALYSIS OF THE CURRENT RFC AWB TRANSPORT MARKET

This chapter provides an overview of the analysis of the current freight transport market along the RFC-AWB in 2022. The analysis of both the current and future market has been done using an EU-wide NEAC model, combining transport and economic statistics from Eurostat with train traffic data available from the RNE TIS database. The analysis focusses on the international trains, i.e. those trains crossing at least one BCP. In this respect, it is noticed that in national train databases and in the TIS dataset, trains logged as national ones might actually operate along international itineraries. The use of the NEAC model made it possible to partially overcome the limitations of the current structure of the datasets. Nonetheless, the results presented in this report might be conservative in the estimation of the international flows along the RFCs.

For a correct assessment and understanding of the current RFC AWB market, a top-down approach has been adopted. Before exploring the specifics of the RFC AWB, an overview of the European international (rail) freight market is given. This is appropriate as on the one hand the RFC AWB is used by trains with origins and destinations outside the RFC concerned countries; on the other hand, the RFC AWB overlaps with other RFCs.

The analysis of the current market is presented as follows:

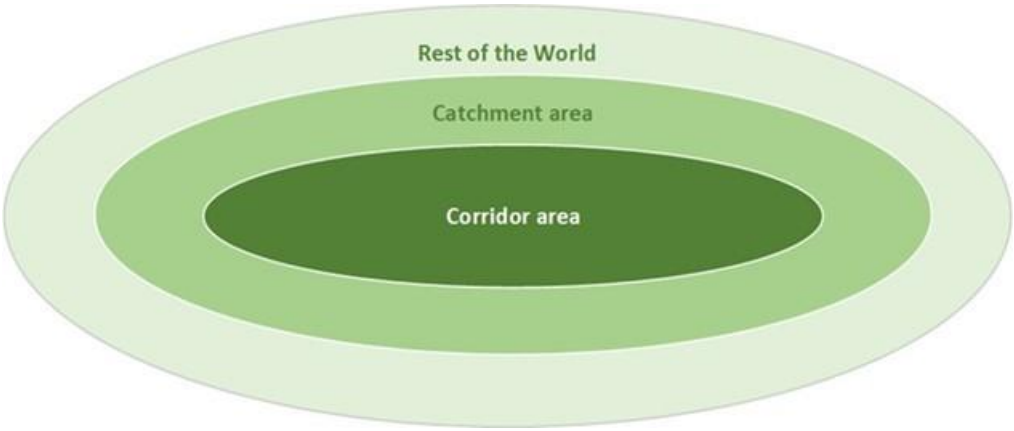
- Section 4.1 presents the **Definition of catchment area and corridor area.** It shows the importance of both definitions and lays a basis for the rest of the chapter.
- Section 4.2 presents the **International freight transport in the 11 RFCs Network**:
  - Section 4.2.1 gives an overview of the **Corridor and catchment areas of the joint RFCs.**
  - Section 4.2.2 provides a general overview of **ALL International freight transport for the 11 RFCs Network catchment AREA**. This includes total volumes by mode and cargo type. Furthermore, we present the volumes by main origin and destination countries, as well as the main relations for all freight transport. Finally, a volume-distance distribution by mode is presented.
  - Section 4.2.3 describes the **International rail freight transport in the combined 11 RFCs Network catchment area**. This provides a general overview of the origins and destinations of rail freight in Europe.
  - Section 4.2.4 presents the **International rail freight transport flows in the CATCHMENT AREA OF THE 11 RFCs Network**.
- Section 4.3 provides the **International freight transport in the RFC AWB**:
  - Section 4.3.1 gives an overview of the **Corridor and catchment area of RFC AWB**.
  - Section 4.3.2 provides **a general overview of ALL international freight transport for the RFC AWB catchment area**. This includes total volumes by mode and cargo type. Furthermore, the volumes by main origin and destination countries are described, as well as the main relations for all freight transport. Finally, a volume-distance distribution by mode is presented.
  - Section 4.3.3 illustrates the **International rail freight transport in the RFC AWB catchment area**. This provides a general overview of the origins and destinations of rail freight for the RFC AWB.
  - Section 4.3.4 describes the **International rail freight transport flows in the RFC AWB**.

4.1 DEFINITION OF CATCHMENT AREA AND CORRIDOR AREA

The presentation of the results for an RFC necessitates a brief definition of the corridor area and of the corridor catchment area. The definition of both can be approached from two perspectives: the supply perspective, focusing on the railway network within a corridor, and the demand perspective, centred on the volume of goods transported via an RFC. The **corridor area** refers to the geographic area that is crossed by the railway freight lines. The **catchment area** encompasses regions that use the RFC for international goods transportation by rail, often extending beyond the boundaries of the corridor area. The corridor area is (by definition) part of the catchment area.

The difference between these two types of areas is important, as numerous origins and destinations within a corridor area of an RFC may currently not receive or use rail services. However, they may be served by rail transport in the future. Furthermore, understanding the current origins and destinations served by an RFC is essential. This is where the catchment area comes in. It comprises all NUTS2[13] regions that are being served by a specific RFC. Figure 20 shows the differences between the corridor area and the catchment area, as well as the rest of the world. As can be seen, the corridor area has the smallest coverage of all areas.

Figure 20 Schematic concept of the geographic coverage of the market analysis



The **corridor area** of an RFC is defined as NUTS 2 zones which are being crossed by the freight railway lines of this RFC. Regarding the **catchment area**, a more precise definition is applied. To qualify, rail transport between an origin and destination must cross *at least* one border crossing point (BCP) associated with the respective RFC.

4.2 INTERNATIONAL FREIGHT TRANSPORT IN THE 11 RFCS NETWORK

The rail freight market for the individual RFCs can only be appropriately understood within the rail freight market across the whole European rail network. Each RFC has connections or overlaps with other RFCs. Also, trains using an RFC often have an origin or destination outside of a corridor area. Furthermore, by looking at the entire network, the 'double counting' risk is mitigated. Therefore, a good knowledge of the European rail freight market forms the basis for the analysis of the individual RFCs' markets.

[13] A NUTS 2 zone refers to a level within the Nomenclature of Territorial Units for Statistics (NUTS), a hierarchical system developed by the European Union to divide the economic territory of the EU into territorial units for the purpose of collecting, developing, and harmonising statistical information. NUTS 2 forms basic regions for the application of regional policies, often used for regional development and structural funding. These zones are generally composed of regions with a population between 800,000 and 3 million people, although there can be exceptions. The precise structure and the number of NUTS 2 zones can vary between countries, depending on national administrative structures and the size and population of the country.

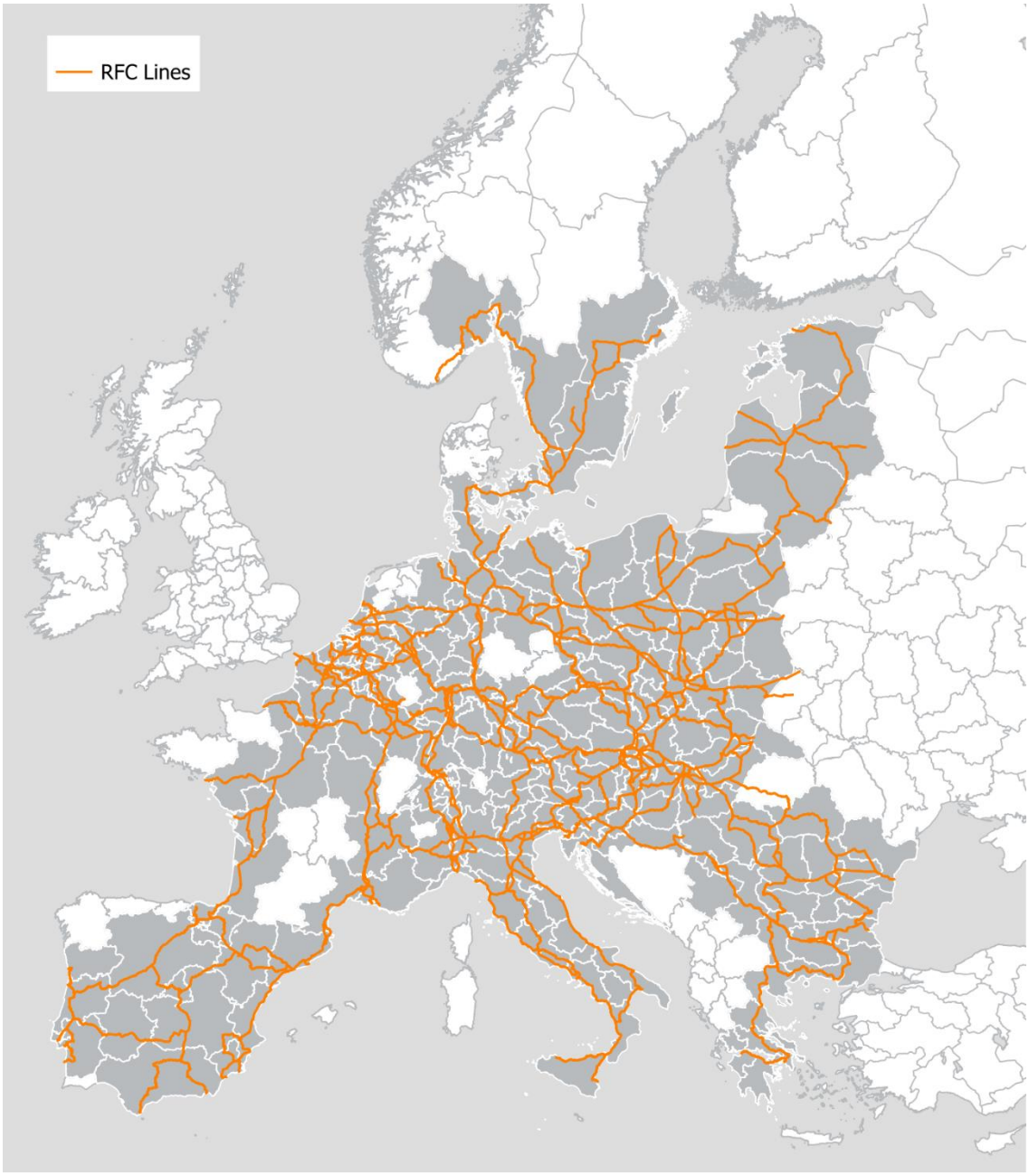
This section (4.2.1) starts with a description of the corridor and catchment areas of the 11 RFCs Network. It then first focuses on all international freight transport of the catchment area of the 11 RFCs Network. After that it presents (4.2.2) the results at an aggregate level, before describing the volumes for origin and destination countries and the top 10 relations for the land transport modes, i.e. road, rail, and inland shipping (IWW).

4.2.1 CORRIDOR AND CATCHMENT AREAS OF THE JOINT RFCS

Figure 21 provides an overview of the *corridor area* of the 11 RFCs Network. It covers a vast part of Europe, but excludes countries such as UK, Ireland, Finland, Northern Scandinavia, and parts of the Balkan. Those countries or parts of countries have no railway lines that belong to and RFC. The 11 RFCs Network *catchment area*[14] covers a much wider area. It includes countries and regions such as Ukraine, Moldova, Kazakhstan, UK, Northern Scandinavia and China. For rail transport the catchment area seems vast, but the number of rail relations is limited when compared to road transport. This is due to the character of road transport which can reach any location in Europe, while rail transport only serves areas with a rail connection.

[14] Not shown here, it will be shown later when presenting the international rail freight transport results.

Figure 21 Corridor area and rail network of the joint RFCs

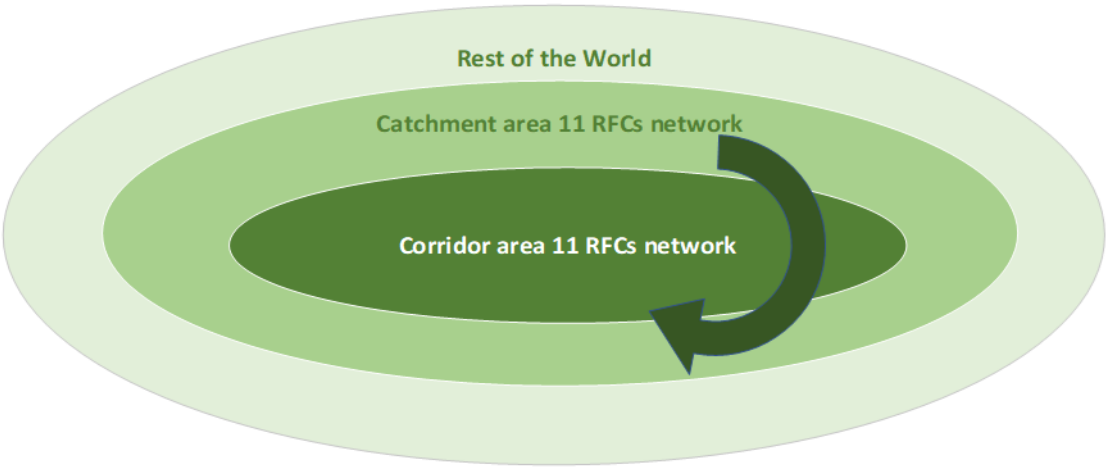


Source: NEAC.

Figure 22 shows which results for the international freight transport for the 11 RFCs Network are presented in this section. It includes *all* international freight transport within the corridor area of the 11 RFCs Network and the 11 RFCs Network catchment area. The latter includes all international freight transport to and from locations such as China, Ukraine, Moldova, Kazakhstan, the UK, or Northern Scandinavia as these countries and regions are part of the 11 RFCs Network catchment area. However, it excludes international freight transport from Africa, the US, or South America, as these are not part of the catchment area of the 11 RFCs Network. The analysis focuses on land modes that compete within the catchment area, i.e. road, rail, and inland shipping[15]. For the RFC specific part, also sea transport receives attention.

[15] Maritime transport is left out, as it makes the interpretation of the results challenging. As we only consider the rail catchment area, several other maritime relations are not considered, which might easily lead to misinterpretations. Therefore, we only consider land modes in the rail transport market study, also because these are the main sources for modal shift.

Figure 22 Schematic concept of the geographic coverage of the results presented in this section.



4.2.2 ALL INTERNATIONAL FREIGHT TRANSPORT FOR THE 11 RFCS NETWORK CATCHMENT AREA[16]

The total volume of international freight transport over land for the 11 RFCs Network catchment area is 1,439 million tonnes. The volume of international rail freight transport is 265 million tonnes (about 440.000 international trains[17]), which is 18% of the total amount of transport to, from, and within the catchment area of the 11 RFCs Network. The share and volume of IWW is 17% (240 million tonnes), and the share of road transport is 65% (934 million tonnes).

Concerning the cargo types[18], the category *Other* (general cargo, including intermodal transport and container) dominates the international freight transport for the 11 RFCs Network, by 845 million tonnes. This is about 59% of all international freight transport. This cargo type is mostly transported by road (about 69%). *Dry bulk* is the second largest cargo type at 32% (465 million tonnes). *Liquid bulk* has as share of 9% (128 million tonnes) in the total volume of international freight transport over all modes.

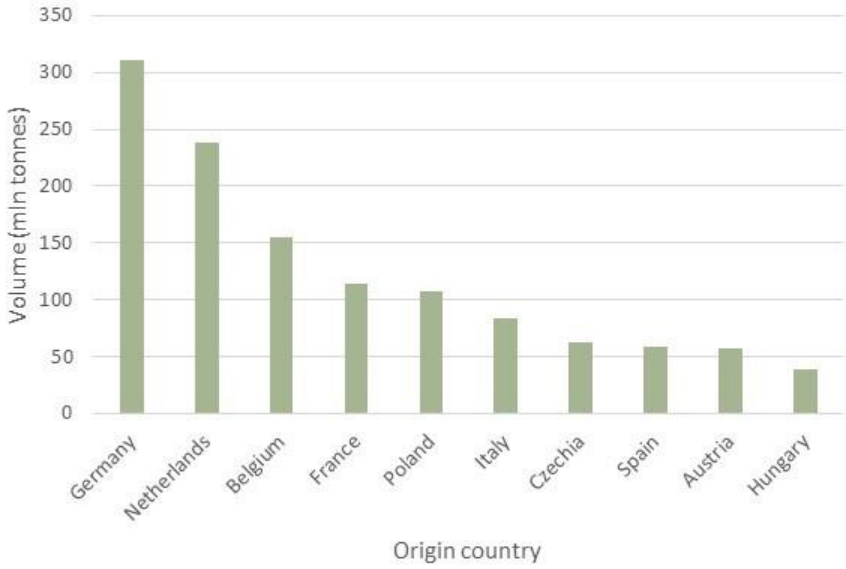
Figure 23 Estimated volume (million tonnes)[19] of international freight transport over land by mode and cargo type within the catchment area of the 11 RFCs Network in 2022

[16] This chapter is a copy of section 4.2.2 of the RFCs joint transport market study.
[17] Using an average of 600 tonnes per train
[18] We distinguish dry bulk, liquid bulk, and other (general cargo and container). Dry bulk comprises commodities such as sand, ores and coal. Liquid bulk comprises mainly oil(products) and liquid chemicals. General cargo concerns a broad range of products such as cars, machinery, and electronics. Containers concern intermodal transport. The content is often unknown.
[19] The volumes for 2022 are based on a combination of observed values from Eurostat, RNE (TIS) and estimated values from NEAC at a detailed NUTS2 level. Therefore, the results are called estimation. Detailed observed values are not available.

Source: NEAC estimations

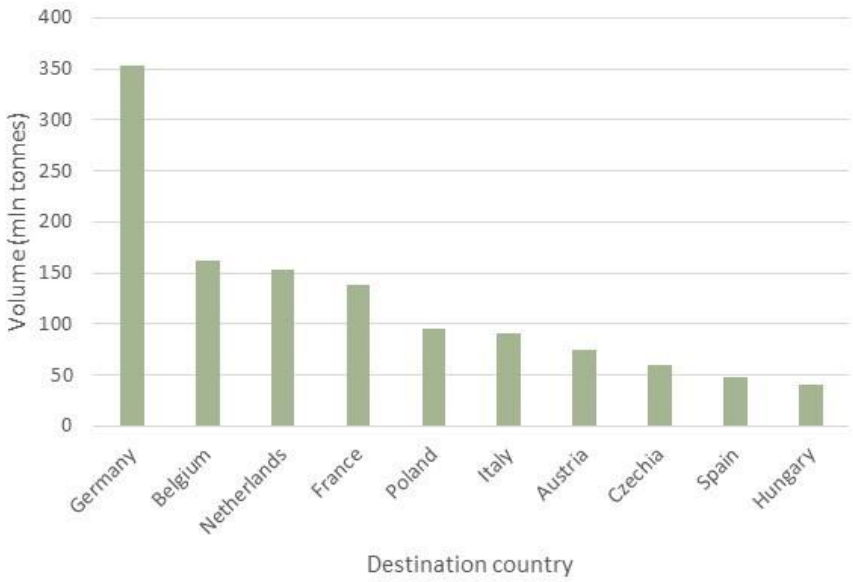
Figure 24 and Figure 25 show the top 10 origin and destination countries of *all* international freight transport within the 11 RFCs Network catchment area. The top 3 origin and destination countries for international freight transport over land in the 11 RFCs Network are Germany, the Netherlands and Belgium. This concerns transport by road, rail, and inland shipping. A volume of 311 million tonnes of international freight transport has its origin in Germany, while 352 million tonnes have Germany as a destination in 2022. Due to the ports in the Rhine-Scheldt delta (such as Port of Rotterdam, Port of Amsterdam, and Port of Antwerp-Bruges), both the Netherlands and Belgium are important origin and destination countries as well for international freight transport. The top 10 countries for origin cover 85% of all international freight transport for the catchment area of the 11 RFCs Network, while the top 10 destination countries cover 84% of all international freight transport.

Figure 24 Estimated volume (million tonnes) of *all* international freight transport over land by *origin* in 2022 for the top 10 origin countries.



Source: NEAC estimations

Figure 25 Estimated volume (million tonnes) of *all* international freight transport over land by *destination* in 2022 for the top 10 destination countries



Source: NEAC estimations

Table 33 shows the international freight volumes transported between the 15 most important origin countries and the 15 most important destination countries within the catchment area of the 11 RFCs Network. The total freight volume for these countries is 1,266 million tonnes, which is 85% of all international freight transport in the 11 RFCs Network catchment area. The most important freight transport relation is between the Netherlands and Germany at 123 million tonnes of freight transport by all land modes. Other big relations concern Netherlands-Belgium (79 million tonnes) Germany-Netherlands (67 million tonnes), Belgium-Netherlands (58 million tonnes), and Belgium-Germany (42 million tonnes). Together the freight transport relations between these 3 countries show once more the importance of the ports in the Rhine-Scheldt delta for their hinterland. Some 27% of all international freight transport in the 11 RFCs Network corridor area concerns the relationship between these 3 countries.

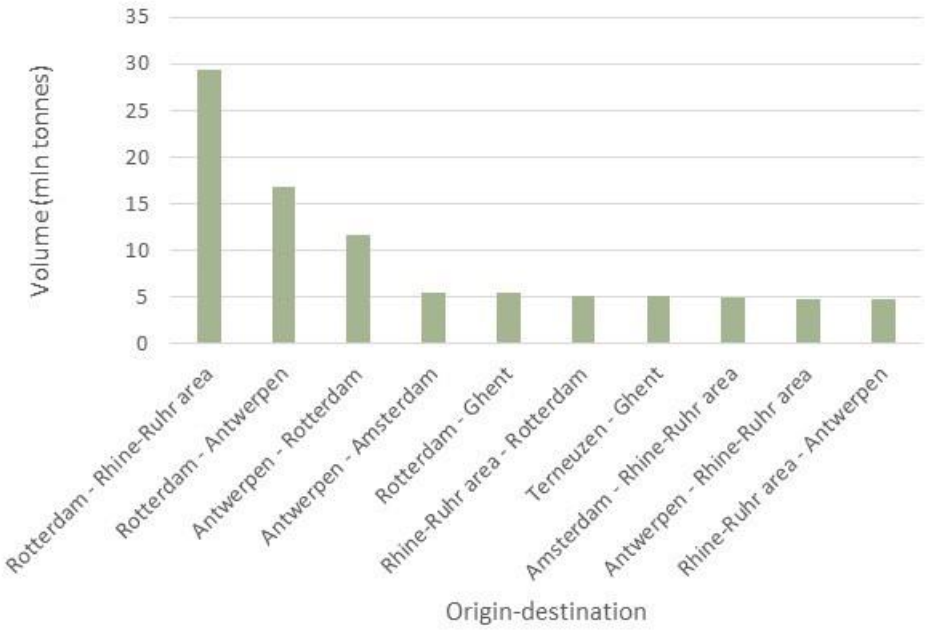
Table 33 Freight volume (million tonnes) between the 15 most important origin and the 15 most important destination countries in 2022.

From/To	AT	BE	CH	CZ	DE	ES	FR	HU	IT	NL	PL	PT	RO	SI	SK	Total
AT		1	2	3	25	0	1	4	9	1	2	0	1	5	2	**56**
BE	1		1	2	42	2	35	1	3	58	5	0	0	0	0	**150**
CH	1	0		0	7	1	4	0	4	1	0	0		0	0	**18**
CZ	5	1	0		23	0	2	3	3	2	12		0	1	8	**61**
DE	33	38	17	18		8	31	7	28	67	36	1	2	2	5	**292**
ES	0	2	1	1	8		26	0	4	2	2	12	0	0		**58**
FR	1	30	7	1	25	20		0	11	10	3	1	0	0	0	**110**
HU	6	1	0	2	7	0	1		5	1	3	0	3	2	4	**34**
IT	8	2	7	2	25	4	12	3		3	5	0	1	4	1	**79**
NL	2	79	3	2	123	2	13	1	4		5	0	0	0	0	**235**
PL	3	3	1	17	41	1	4	3	5	4			3	1	6	**93**
PT	0		0		1	9	1	0	0	0	0			0		**12**
RO	1	0		0	2	0	1	3	2	1	2			0	1	**13**
SI	8	0	0	1	2	0	0	3	5	0	1	0	0		1	**21**
SK	4	0	0	9	6	0	0	7	2	0	5		1	1		**35**
Total	**73**	**158**	**39**	**58**	**336**	**48**	**133**	**35**	**86**	**150**	**81**	**14**	**11**	**15**	**29**	**1,266**

Source: NEAC estimations

The main origins and destinations for all modes in international freight transport are depicted in Figure 26 below. As can be seen, these concern relations between the Netherlands, Belgium, and Germany mainly (with ports such as Rotterdam, Amsterdam, Ghent (North Sea Port) and Antwerp (Port of Antwerp-Bruges), and inland locations such as the Rhein-Ruhr area).

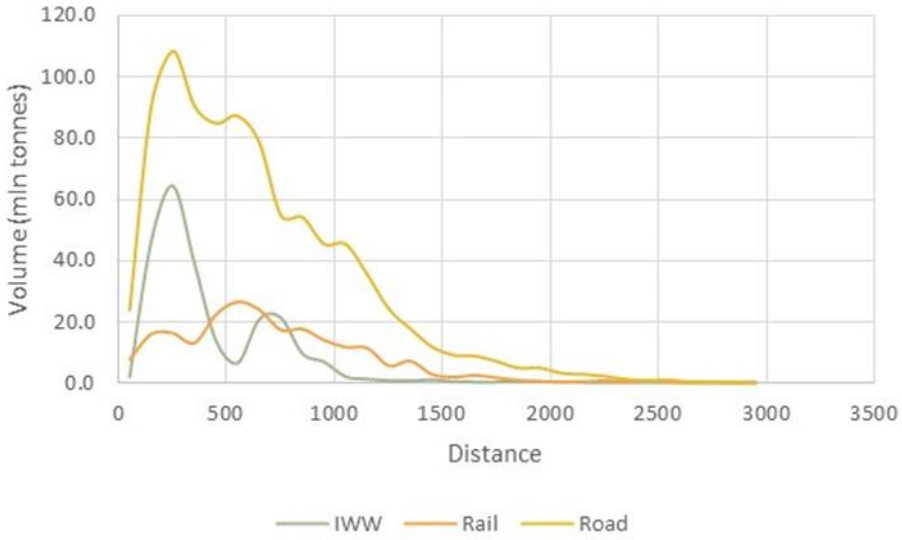
Figure 26 Estimated volume (million tonnes) for the 10 relations (at NUTS2 level) of all international freight transport over land in 2022 within the catchment area of the 11 RFCs Network area.



Source: NEAC estimations

The 'trip' length distribution for international freight transport in Europe in the catchment of the 11 RFCs Network is shown in Figure 27. This graph shows the volume (in million tonnes) by distance (in km). The peak for road (107 million tonnes) and inland shipping (64 million tonnes) is in both cases around 250 km. For international rail transport this is around 550 and 750 km at 27 million tonnes.

Figure 27 Volume distribution (million tonnes) by distance (km) *within* the catchment area of the 11 RFCs Network in 2022



Source: NEAC estimations

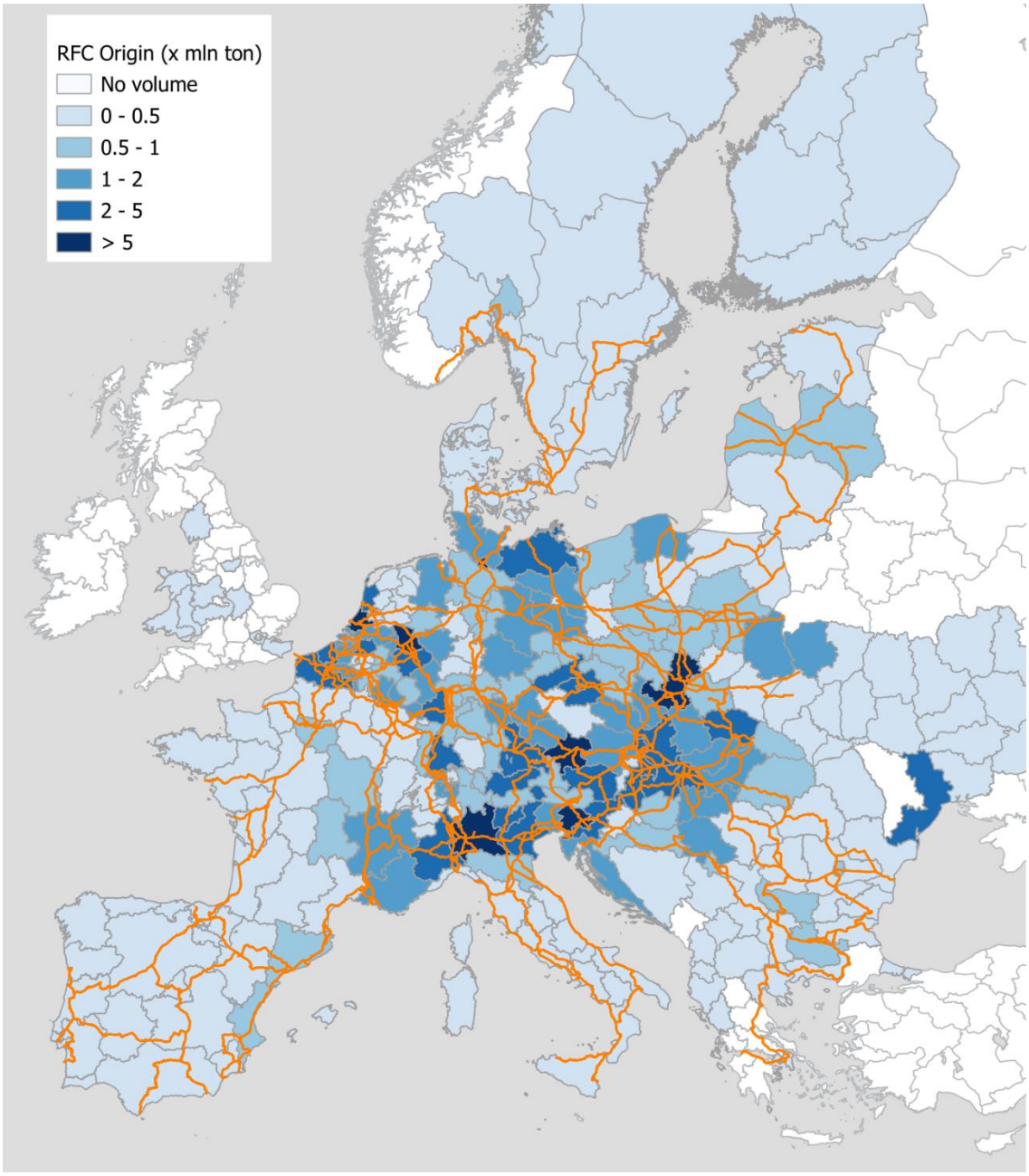
4.2.3 INTERNATIONAL RAIL FREIGHT TRANSPORT IN THE COMBINED 11 RFCS NETWORK CATCHMENT AREA

Figure 21 provides an overview of the corridor area of the 11 RFCs Network. The corridor area of the 11 RFCs Network covers a vast part of Europe but excludes countries such as the UK, Ireland, Finland, Northern Scandinavia, and parts of the Balkan. The 11 RFCs Network catchment area covers a much wider area. It includes the previously mentioned countries, as well as countries east of Europe such as Ukraine, Moldova, Kazakhstan, and China. The rail freight transport catchment area of the 11 RFCs Network is shown in Figure 28 and Figure 29. Figure 28 provides an overview of the volumes by origin, while Figure 29 shows the volumes by destinations. As can be seen, international rail freight transport is clearly generated or destinated outside the corridor area of the 11 RFCs Network (in countries such as Ukraine, Finland and UK). The 11 RFCs Network catchment area for international rail freight transport is thus wider than the corridor area of the 11 RFCs Network. Note that some areas are white. These do not generate or receive international rail transport.

Important NUTS2 origins[20] for rail freight transport are Rotterdam, Hamburg, the Rhein-Ruhr area, Linz, Ostrava, Katowice, Trieste, and Milan. On the destination side, we see similar locations such as Rotterdam, Hamburg, Rhein-Ruhr area, Saarland, Ostrava, Katowice, Linz, Turin, Milan, and Budapest. Typically, land-locked regions in countries such as Austria, Czechia, Hungary, Poland and Slovakia rely upon rail transport for larger quantities of transport volumes. This is expressed in the maps presented below.

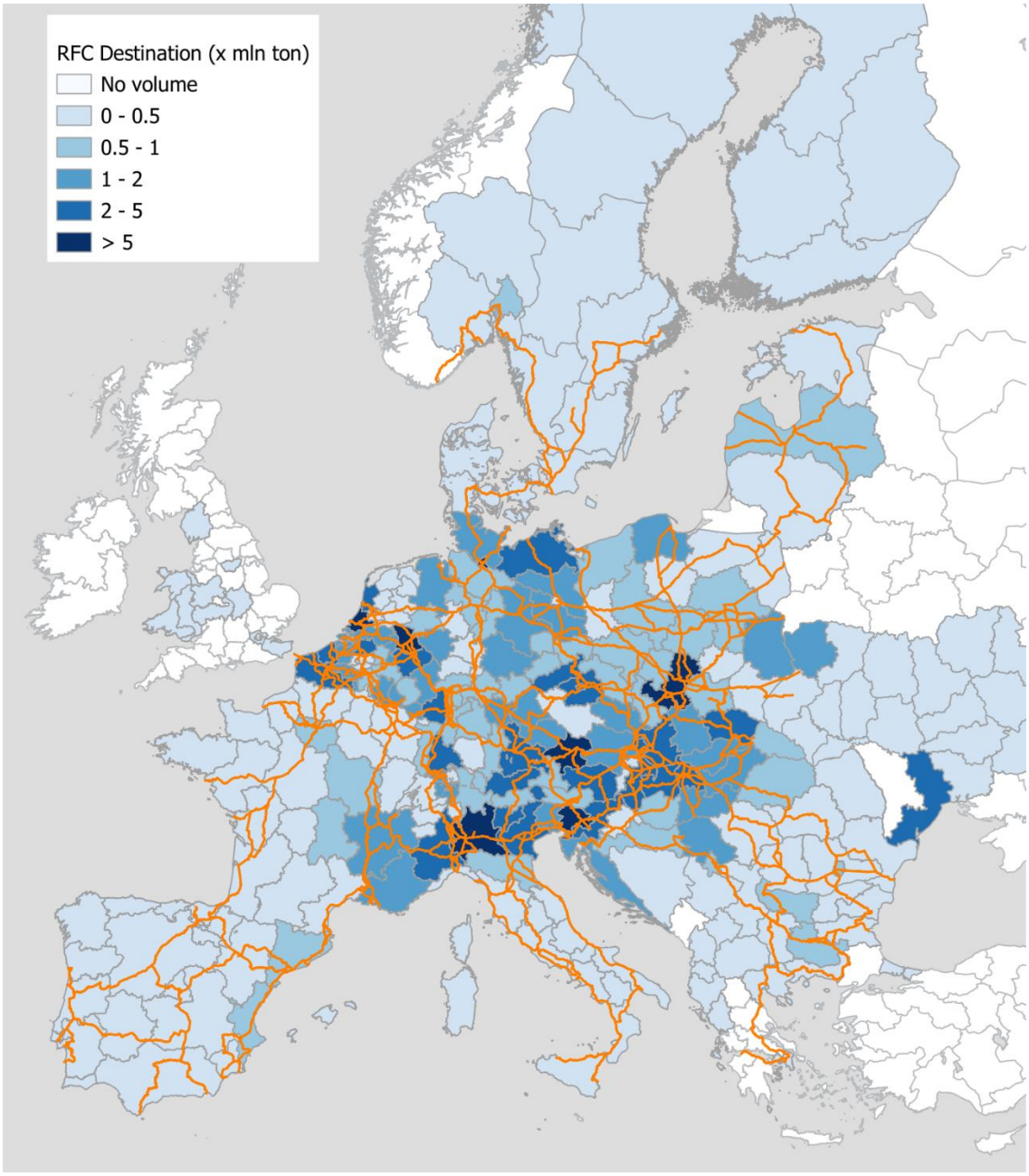
[20] We present the NUTS2 regions by mentioning the main cities in these regions, to make it easier to understand the results.

Figure 28 Origins of international rail freight transport (in million tonnes) for the 11 RFCs Network catchment area in 2022



Source: NEAC estimations

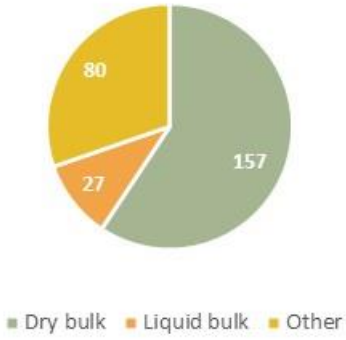
Figure 29 Destinations of international rail freight transport (in million tonnes) for the 11 RFCs Network catchment area in 2022.



Source: NEAC estimations

Figure 30 shows the volumes of international rail freight transport by cargo type in the 11 RFCs Network catchment area. Dry bulk is the most important cargo type for international rail freight transport. It has a share of 59%, which is equivalent to 157 million tonnes. The cargo type *Other* (general cargo, including intermodal transport and container) has a share of 30% (80 million tonnes), and liquid bulk of 10% (27 million tonnes) in the total volumes of international rail freight transport.

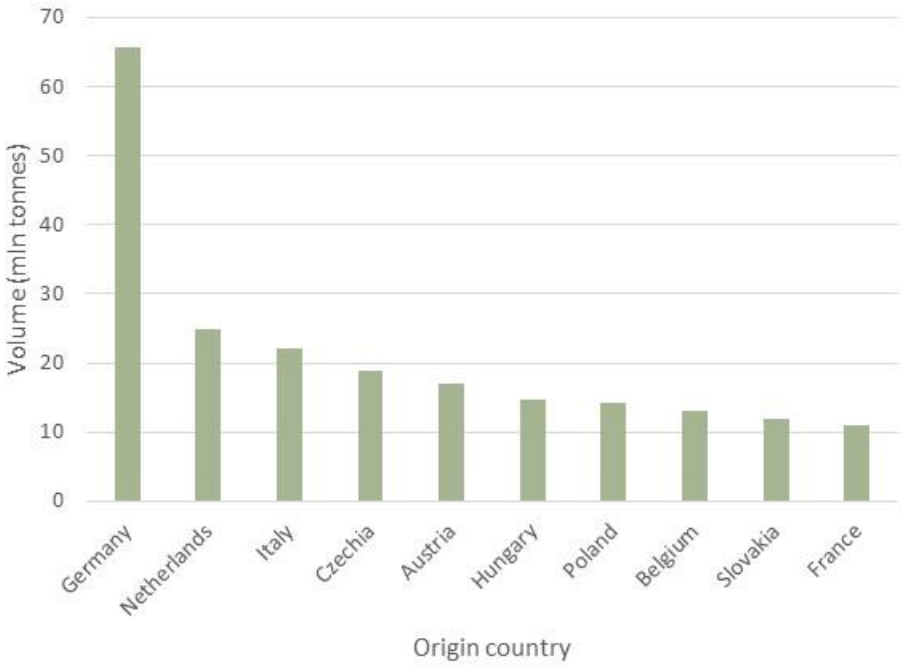
Figure 30 Estimated volume of international rail freight transport (million tonnes) by cargo type in 2022, in the 11 RFCs Network catchment area



Source: NEAC estimations

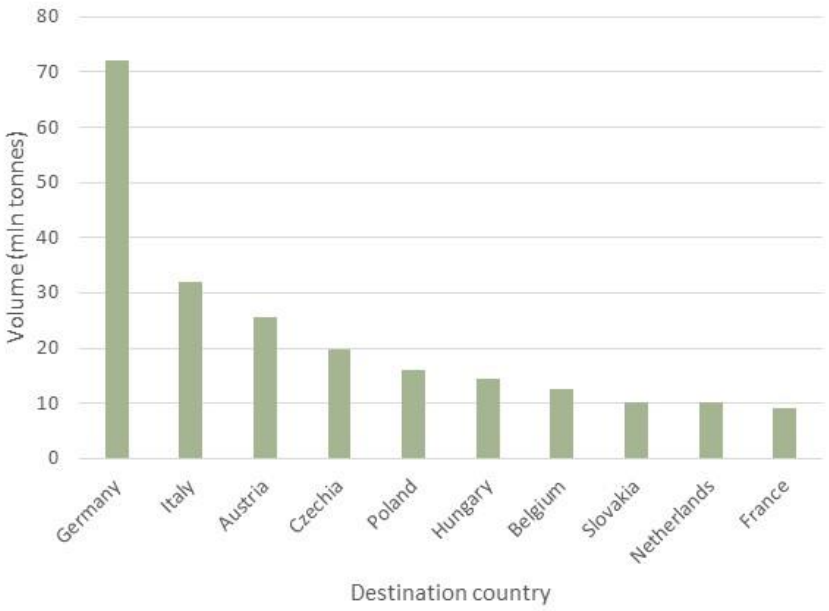
The most important origin and destination countries for rail transport are provided in the Figures 35 and 36 below. Concerning both origin and destination, Germany is the country with the highest international rail freight transport volumes. As an origin country it ships 66 million tonnes, while as a destination it receives 72 million tonnes of international rail freight transport. Other important origin countries are the Netherlands and Italy (25 and 22 million tonnes). Concerning destination, Italy and Austria are number 2 and 3 with respectively 32 and 26 million tonnes of international rail freight transport.

Figure 31 Estimated volume of international rail freight transport (million tonnes) by *origin* country in 2022 in the 11 RFCs Network catchment area



Source: NEAC estimations

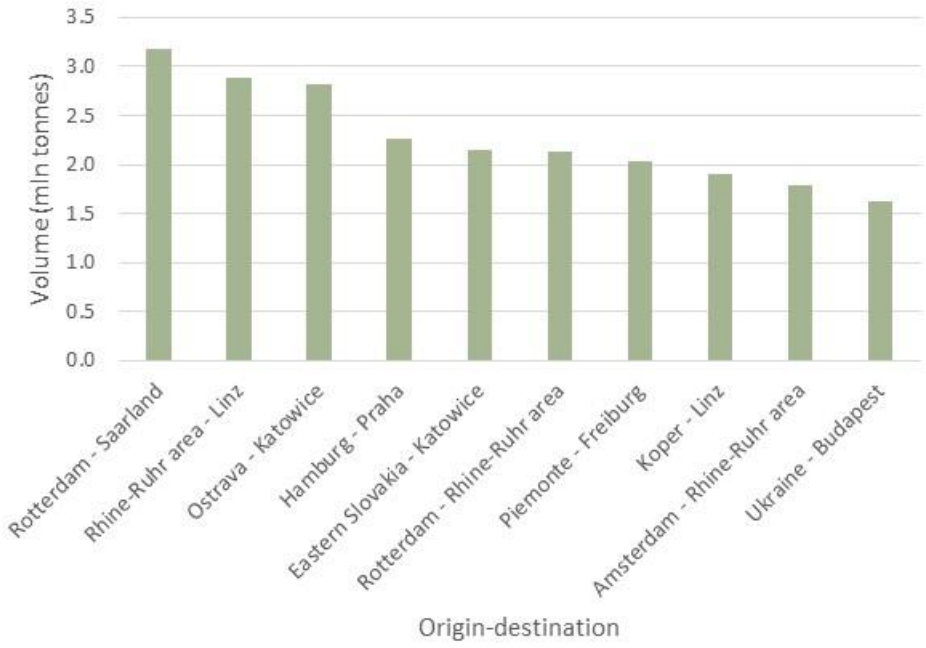
Figure 32 Estimated volume of international rail freight transport (million tonnes) by *destination* country in 2022 in the 11 RFCs Network catchment area



Source: NEAC estimations

Figure 33 shows the 2022 top 10 international rail freight transport relations in the 11 RFCs Network catchment area. The relation between Rotterdam and Saarland is the most important one, with a volume of 3.2 million tonnes. This concerns the transport of dry bulk (coal). In second place comes the relation between the Rhein-Ruhr area and Linz, at 2.9 million tonnes. This concerns mostly liquid bulk transport. In third place we see the relation between Ostrava and Katowice, which is mostly dry bulk (coal) for the steel plants in Ostrava. The relation between Hamburg and Prague (Praha) comes in fourth place. This rail transport relation is mostly about the transport of general cargo. There is not a single relation that dominates the international rail freight transport market.

Figure 33 Estimated volume of international rail freight transport (million tonnes) on the top 10 most important relations in 2022 in the 11 RFCs Network catchment area



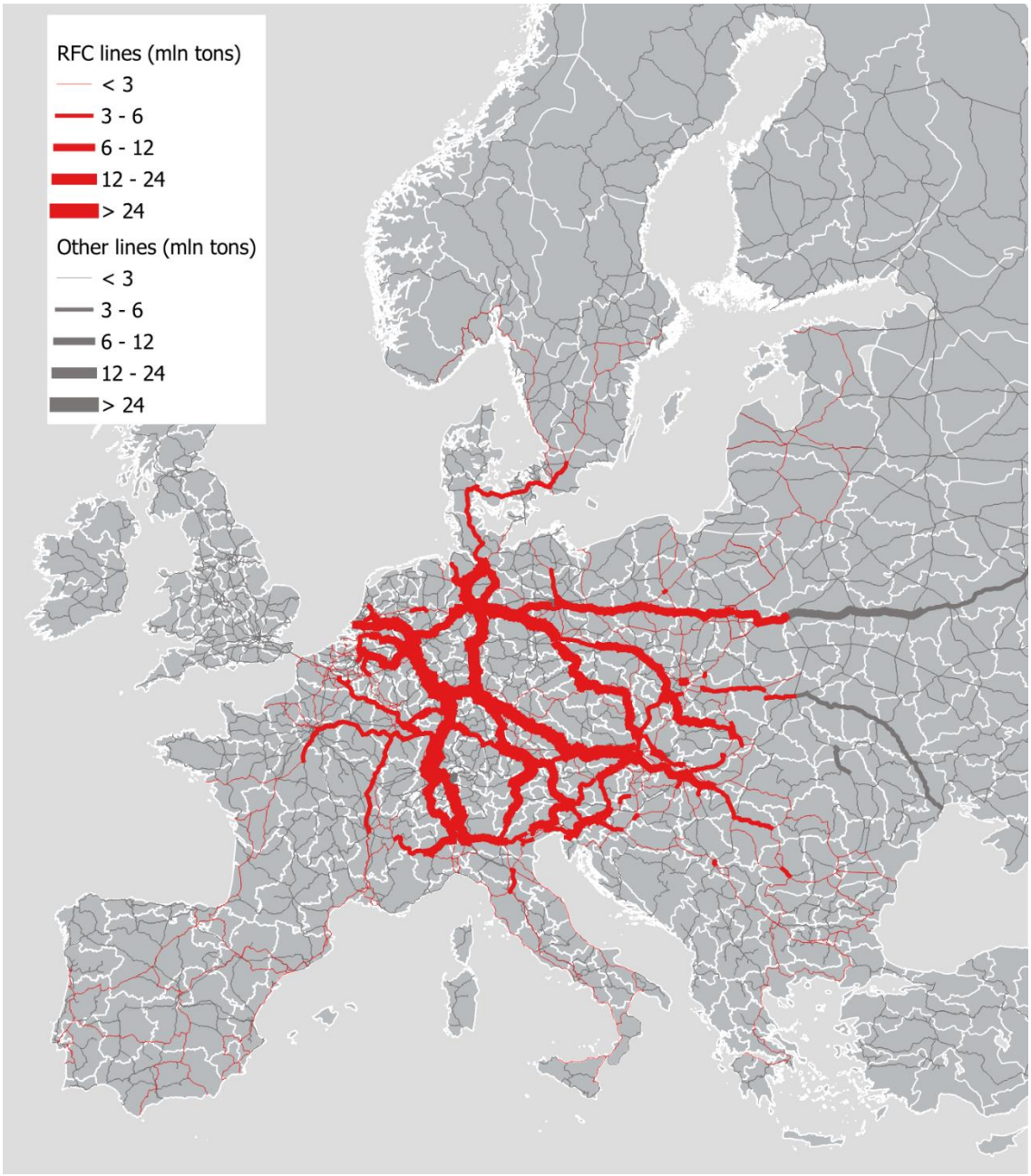
Source: NEAC estimations

4.2.4 INTERNATIONAL RAIL FREIGHT TRANSPORT FLOWS IN THE CATCHMENT AREA OF THE 11 RFCS NETWORK

Figure 34 shows the estimated international rail freight flows (in tonnes) for the corridor area of the 11 RFCs Network. This provides a general overview of the main railway lines in Europe. As can be seen, Germany comprises the most used railway lines for international rail freight transport. Important relations between Germany and its neighbouring countries are also clearly depicted. Furthermore, a large amount of rail transport can be seen between Poland and Czechia. At the different border crossing points the volumes are consistent with the number of trains observed. Also important to note is the transport to/from Ukraine and China.

Another thing to notice is the relatively small amount of international rail freight transport in Spain, Portugal, the Balkans, mid and South Italy, Greece, South of France, Sweden, Norway and the Baltic States. The international rail freight volumes in those areas are limited compared to the larger volumes in the centre of Europe.

Figure 34 Estimated volume of international rail freight transport (million tonnes) in 2022



Source: NEAC estimations

4.3 INTERNATIONAL FREIGHT TRANSPORT IN THE RFC AWB

After the presentation of the European international freight transport market, this section provides further details on international freight transport for the RFC AWB. The structure of this section is as follows:

- Presentation of the catchment and corridor area of the RFC AWB.
- Description of the results for all international freight transport for the RFC AWB catchment area.
- Results of the international rail freight transport in the RFC AWB catchment area.
- Flows of rail freight on the RFC AWB.

4.3.1 CORRIDOR AND CATCHMENT AREA OF RFC AWB

In section 4.1, a definition of corridor and catchment areas is given. This section details the corridor area for the RFC AWB. Figure 35 provides an overview of the RFC AWB network within its corridor area, in relation to the rest of the European rail network. The RFC AWB network and corridor area serves as a basis for the estimation of the international rail freight volumes transported between the different origins and destinations. It is worth noticing that international rail transport within the RFC AWB is also dependent upon rail transport to and from locations outside the corridor area of the RFC AWB, as further elaborated in later sections.

Figure 35 Corridor area and rail network of the RFC AWB

4.3.2 ALL international freight transport for the RFC AWB catchment area

The total volume of international freight transport in the *catchment* area of the RFC AWB is estimated at 78 million tonnes in 2022, transported by road, rail, inland shipping and sea shipping. The international rail freight transport volume in this area is estimated at 29 million tonnes (about 48.000 trains). This is 37% of the total amount of transport for the RFC AWB. The share of inland shipping is 7%, the share of road transport 37%. Sea shipping has a share of 18%.

Concerning the cargo types, *Other* (General cargo, including intermodal transport and container) and *Dry bulk* both dominate the international freight transport within the catchment area of the RFC AWB, both with a volume of 33 million tonnes. In both cases this is 43% of all international freight transport for the RFC AWB. Liquid bulk has a share of 15% in the total volume of international freight transport over all modes in the corridor area of the RFC AWB.

Figure 36 Estimated volume (million tonnes) and share of *all* international freight transport over land by mode and cargo type in the *catchment* area of RFC AWB

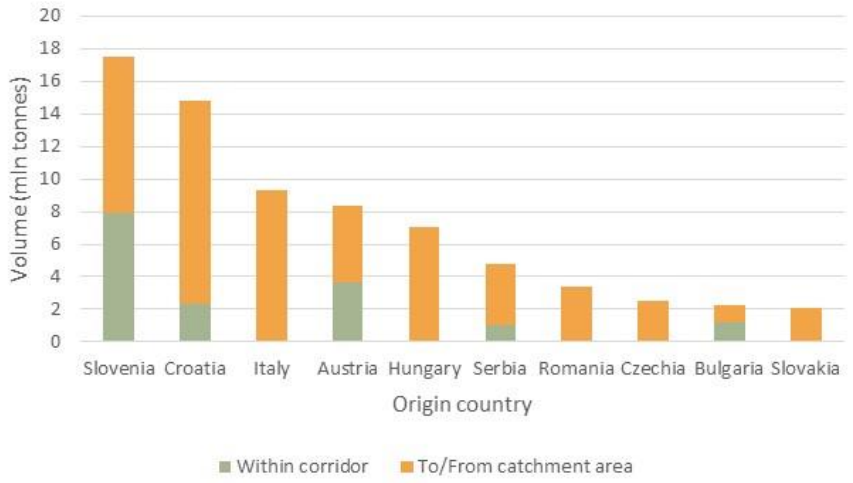
Source: NEAC estimations

Figure 37 and Figure 38 show the origin and destination countries for all international freight transport within the catchment area (which includes the corridor area) of the RFC AWB. The green colour shows the origin and destination *within* the corridor area of the RFC AWB. The orange colour shows the international freight transport to and from the rest of the catchment area. As can be seen, only the RFC AWB countries (SI, HR, AT, RS, and BG) have green-coloured bars beside the orange ones, as these are the corridor countries.

The main countries with origin locations for international freight transport in the RFC AWB are Slovenia, Croatia, and Italy. This concerns all transport by road, rail, and inland shipping. A volume of 18 million tonnes of international freight transport has its origin in Slovenia. Of this volume, 45% (8 million tonnes) is transported to other countries within the RFC, such as Croatia or Serbia. Croatia comes in second place with 15 million tonnes originating from locations in this country. In this case, 2 million tonnes (16%) go to other countries within the RFC. Italy is the third most important origin country with 9 million tonnes. Note that this country is not part of the RFC AWB. Also, countries such as Hungary, Romania, and Czechia are origin countries located outside of the RFC AWB.

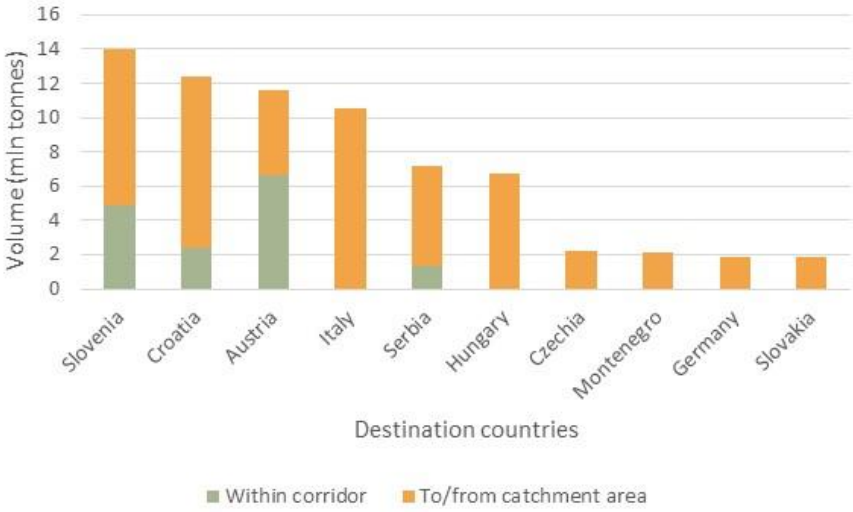
The main countries with destination locations are Slovenia, Croatia, and Austria. Slovenia receives 14 million tonnes, of which 5 million tonnes stem from other RFC AWB countries. Croatia is second, with a volume of 12 million tonnes, of which 2 million tonnes have their origin in other RFC AWB countries. Austria receives 12 million tonnes, with 7 million tonnes coming from other RFC AWB countries.

Figure 37 Estimated volume (million tonnes) of *all* international freight transport over land by *origin* in 2022 within the catchment and corridor area of RFC AWB



Source: NEAC estimations

Figure 38 Estimated volume (million tonnes) of *all* international freight transport over land by *destination* in 2022 within the catchment and corridor area of RFC AWB



Source: NEAC estimations

The following table shows all international freight volume between the countries *within the corridor area* of RFC AWB for the *land* modes. The total amount of international freight volume is 16 million tonnes within the corridor area. The most important freight transport relation is between locations in the Slovenia and Austria at 6.2 million tonnes of freight transport by all land modes. The reverse direction has 3.0 million tonnes. Also, the volume on the relation Croatia-Slovenia (vv) is relatively high. NB, the zero's indicate a small amount of volume.

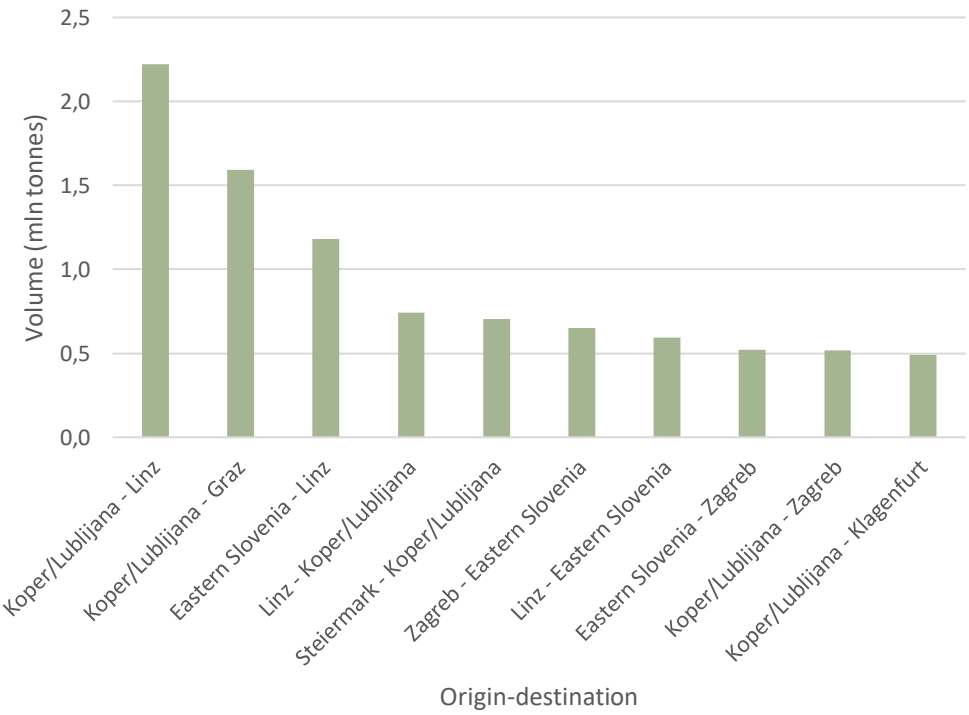
Table 34 Total freight volume (million tonnes) between the countries for land modes within the corridor area of the RFC AWB

From/To	AT	BG	GR	HR	RS	SI	Total
AT		0.1		0.3	0.1	3.0	3.6
BG	0.1		0.6		0.6		1.2
GR		0.3					0.3
HR	0.3				0.5	1.6	2.3
RS	0.1	0.2		0.6		0.2	1.1
SI	6.2			1.5	0.2		7.9
Total	6.7	0.6	0.6	2.4	1.3	4.8	16.4

Source: NEAC estimations

The chart below depicts the main origins and destinations for all *land* modes. The most important relation is Koper/Ljubljana - Linz, at 2.2 million tonnes. The relation Koper/Ljubljana – Graz is in second place, at 1.6 million tonnes, followed by Eastern Slovenia – Linz (at 1.2 million tonnes). The most important locations seem to be the inland locations Linz and Eastern-Slovenia, while on the port side, Koper is important for serving the hinterland of the RFC AWB.

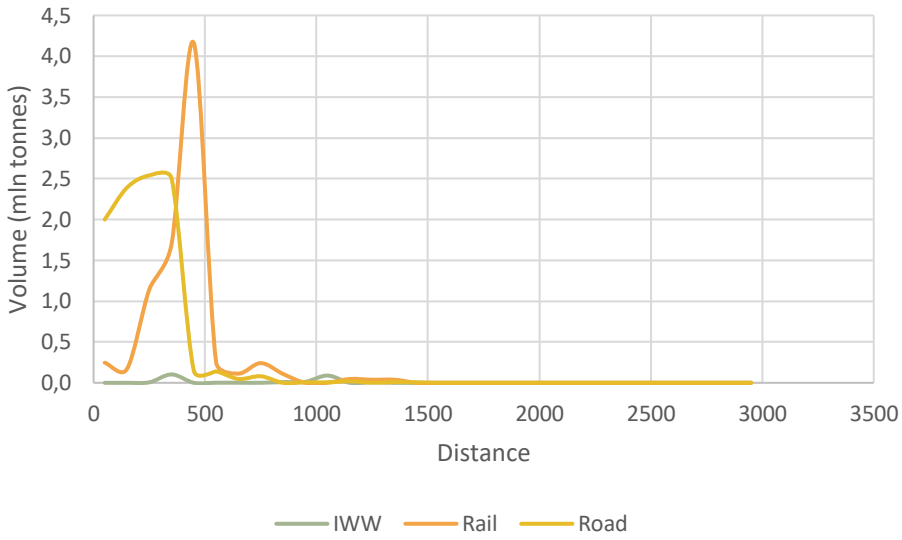
Figure 39 Estimated volume (million tonnes) for the 10 relations (at NUTS2 level) of *all* international freight transport over land in 2022 within the corridor area of RFC AWB



Source: NEAC estimations

The 'volume' distance distribution for international freight transport *within the corridor area* of RFC AWB is shown in the Figure 40 below (in million tonnes) by distance (in km). For international rail transport the peak is around 450 km at 4.7 million tonnes. The peak for road (2.5 million tonnes) is around 300 km. Inland shipping does not play a role withing the corridor. As can be seen, after 1,000 km the volume of rail and road transport is small. This notion is important as it shows there might be a potential for a shift from road to rail on longer distances.

Figure 40 Volume distribution (million tonnes) by distance (km) within corridor area of RFC AWB in 2022

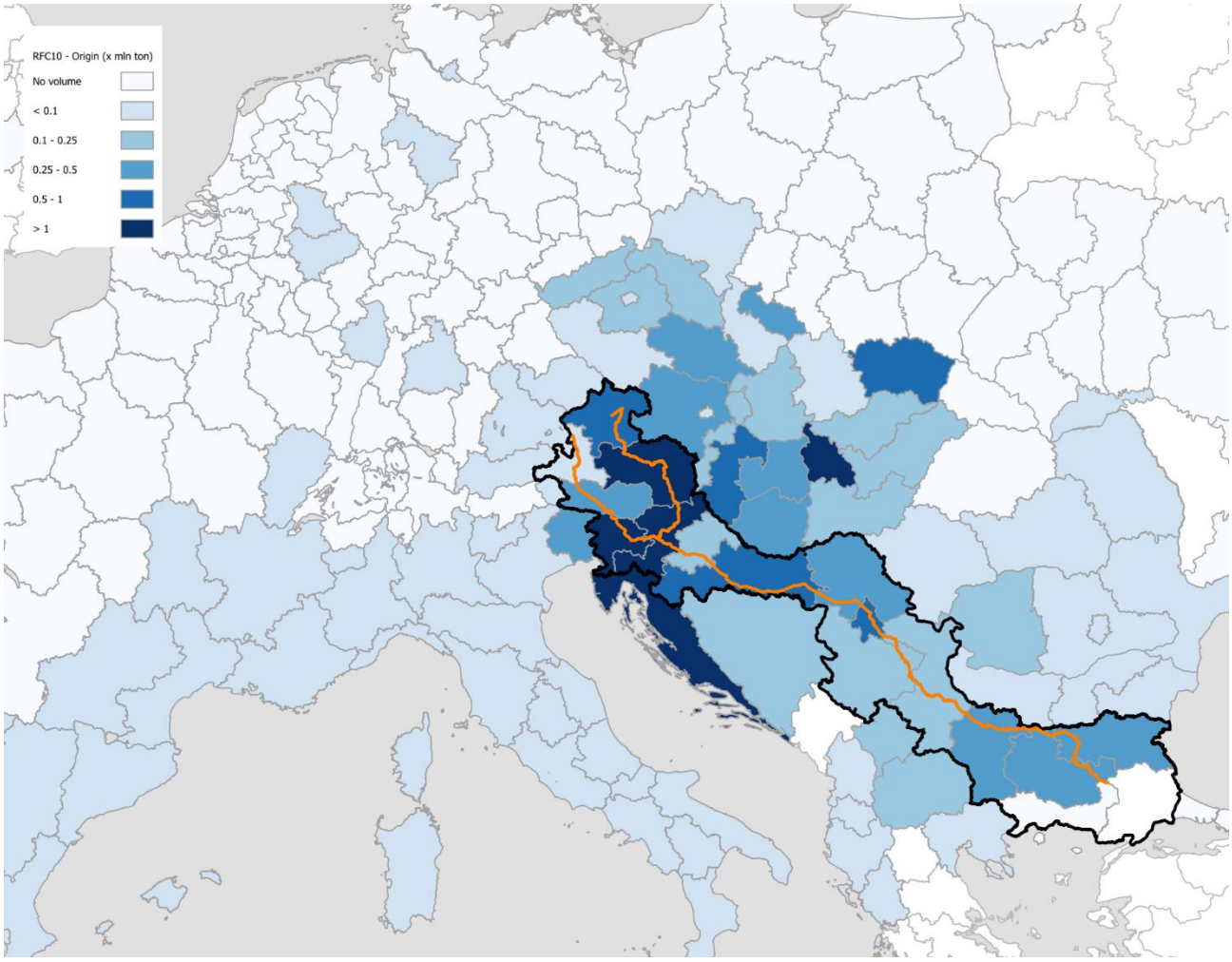


Source: NEAC estimations

4.3.3 INTERNATIONAL RAIL FREIGHT TRANSPORT IN THE RFC AWB CATCHMENT AREA

The catchment area for international rail freight transport of the RFC AWB exceeds the corridor area. It captures large parts of Austria, Slovenia, Croatia, Serbia, and Bulgaria. A large proportion of the rail freight transport uses the RFC AWB, and its border crossing points, to ship freight by rail from different origins to different destinations (see overview in the next figures). The picture below shows the origins of the RFC AWB, with important origins such as Koper/Ljubljana, Eastern Slovenia, Linz, and Zagreb. Also, outside the corridor area different zones can be seen that contribute to the RFC AWB, such as Budapest or Adriatic Croatia. Note that outside the corridor it often concerns small amounts of volume.

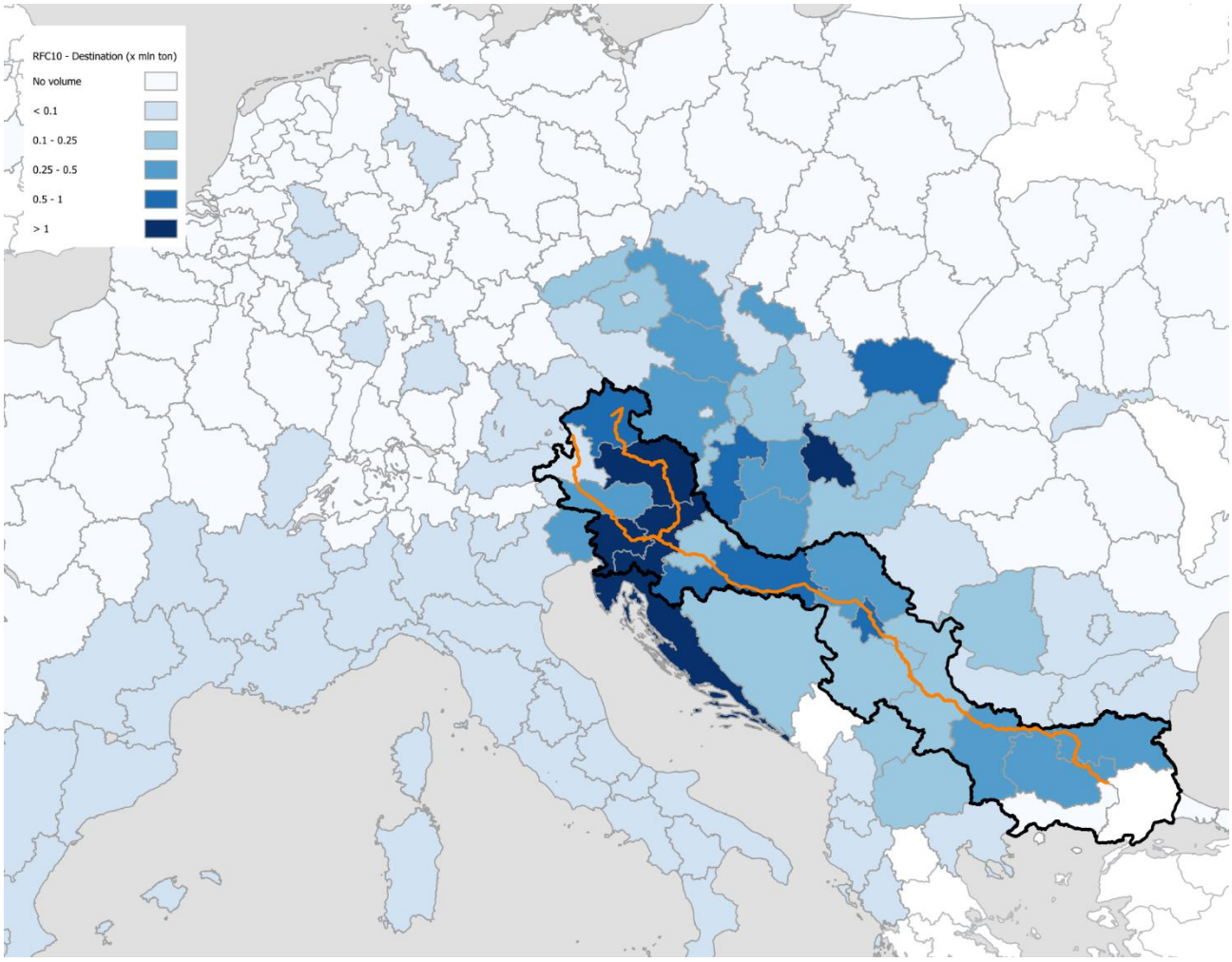
Figure 41 Origins of international rail freight volume (in million tonnes) that use the RFC AWB rail network and the delineation of the potential RFC AWB catchment area



Legend: Orange = rail tracks of RFC AWB. Blue = Volume by origin. Black = Delineation of potential catchment area

The next figure presents the destinations within the RFC AWB catchment area. The figure highlights similar zones as the origins that exhibit the high freight volumes dispatched from these destinations. It is evident from the figure that numerous zones benefiting from RFC AWB's services fall outside the corridor area, such as areas in the rest of Italy, France, and Romania. Within the corridor area, there are also a few zones with limited rail volumes for international transport such as in Greece.

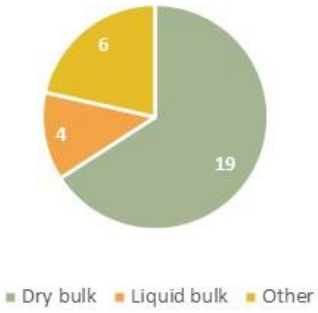
Figure 42 Destinations of international rail freight volume (in million tonnes) that use the RFC AWB rail network and the delineation of the potential RFC AWB catchment area



Legend: Orange = rail tracks of RFC AWB. Blue = Volume by origin. Black = Delineation of potential catchment area

Looking at the volumes of international rail freight transport by cargo type within the catchment (and corridor) area of the RFC AWB, *Dry bulk* is the most important cargo type. It has a share of 66%, with 19 million tonnes of rail freight. The category *Other* has a share of 21% and liquid bulk of 13% in the total volumes of international rail freight transport in the RFC AWB.

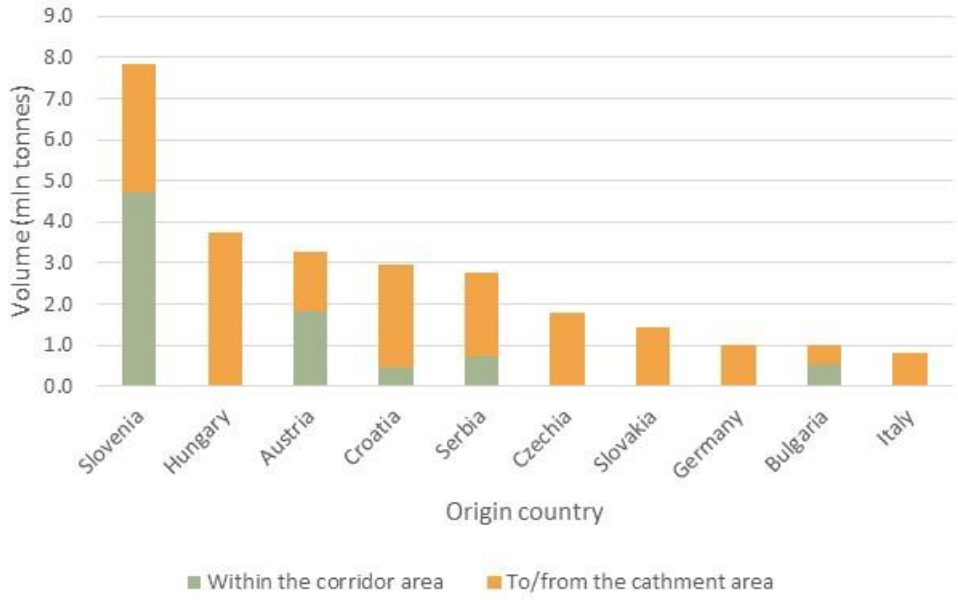
Figure 43 Estimated Volume of international rail freight transport (million tonnes) by cargo type in 2022 within the catchment (and corridor) area of the RFC AWB



Source: NEAC estimations

The origin and destination countries for international rail freight transport in the catchment and corridor area are provided in the graphs below. Concerning origin, Slovenia is the country with the highest international rail freight transport volume. As an origin country, it ships 8 million tonnes. This country is an important origin for countries *inside* of the RFC AWB, 60% of the rail freight is transported to locations in outside of the RFC AWB countries, using the RFC AWB network. In second place comes the Hungary at 4 million tonnes. Third comes Austria at 3 million tonnes of international rail freight transport volume. Note that the share of rail freight transport *within* the corridor area of the RFC AWB is 31% (which relates to the green bars in the graph). Also note flows from non-RFC AWB countries such as Hungary, Czechia, Slovakia, Germany, and Italy. Although sometimes moderate compared to other RFC AWB countries, the flows are still important.

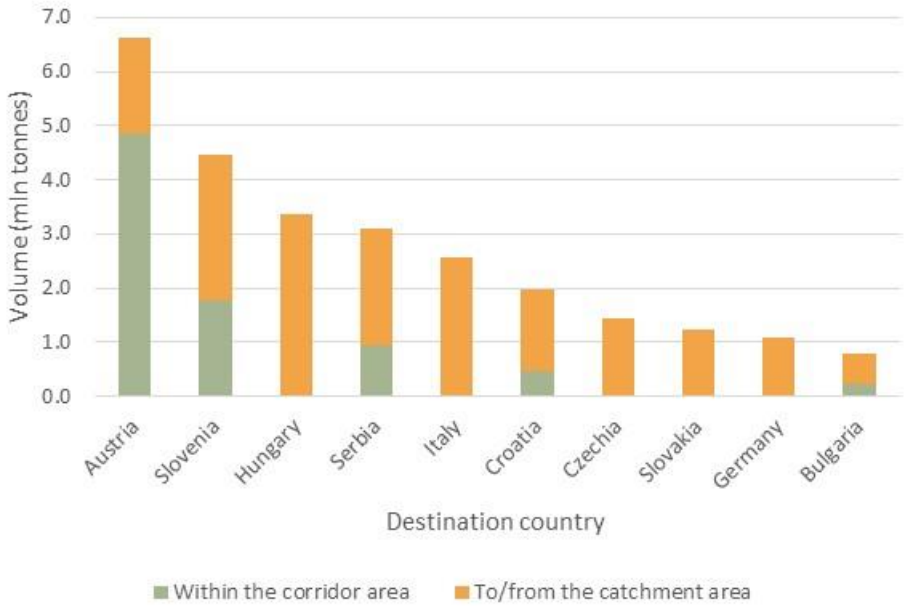
Figure 44 Estimated volume of international rail freight transport (million tonnes) by *origin* country in 2022 in the catchment and corridor area of the RFC AWB



Source: NEAC estimations

The most important destination country is Austria. It receives almost 7 million tonnes of rail transport. Other important destination countries are Slovenia (5 million tonnes), and Hungary (3 million tonnes). The volume stemming from other countries in the RFC AWB is 31%. It shows that the RFC AWB is a rail freight corridor with an important international position as 69% of the relations outside the RFC AWB uses the rail network of the RFC AWB.

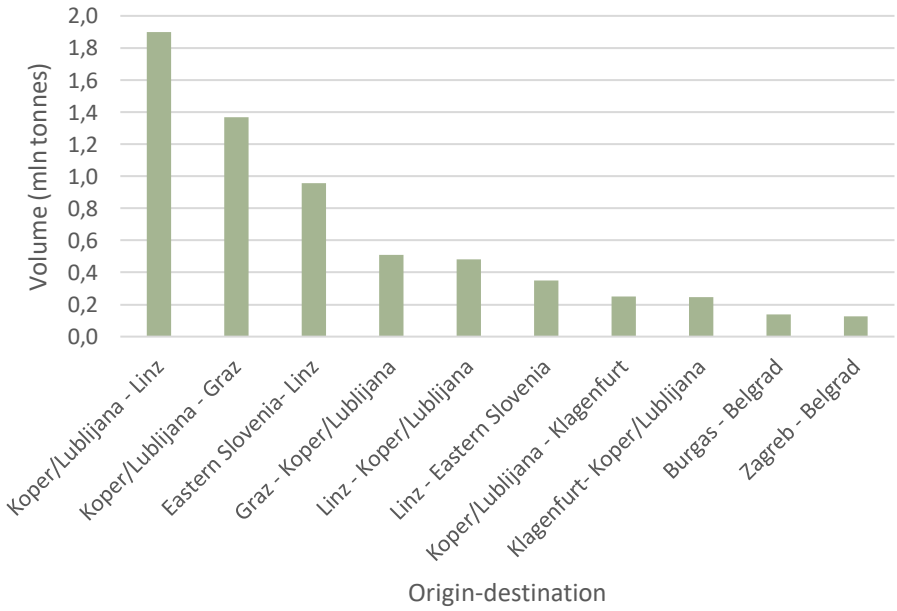
Figure 45 Estimated volume of international rail freight transport (million tonnes) by *destination* country in 2022 in the catchment and corridor area of the RFC AWB



Source: NEAC estimations

The figure below shows the top 10 most important international rail freight transport relations within corridor area of the RFC AWB. The relation between Koper/Ljubljana and Linz is the most important one, at 1.9 million tonnes. This concerns mostly dry bulk transport. The Koper/Ljubljana-Graz comes in second place, which is also mostly general cargo (1.4 million tonnes). Eastern Slovenia - Linz comes in third place at 1.0 million tonnes of international rail freight transport. Note the relations to and from Koper/Ljubljana. This is an important region for transport to and from Austria.

Figure 46 Estimated volume of international rail freight transport (million tonnes) on the top 10 most important relations in 2022 in the corridor area of the RFC AWB

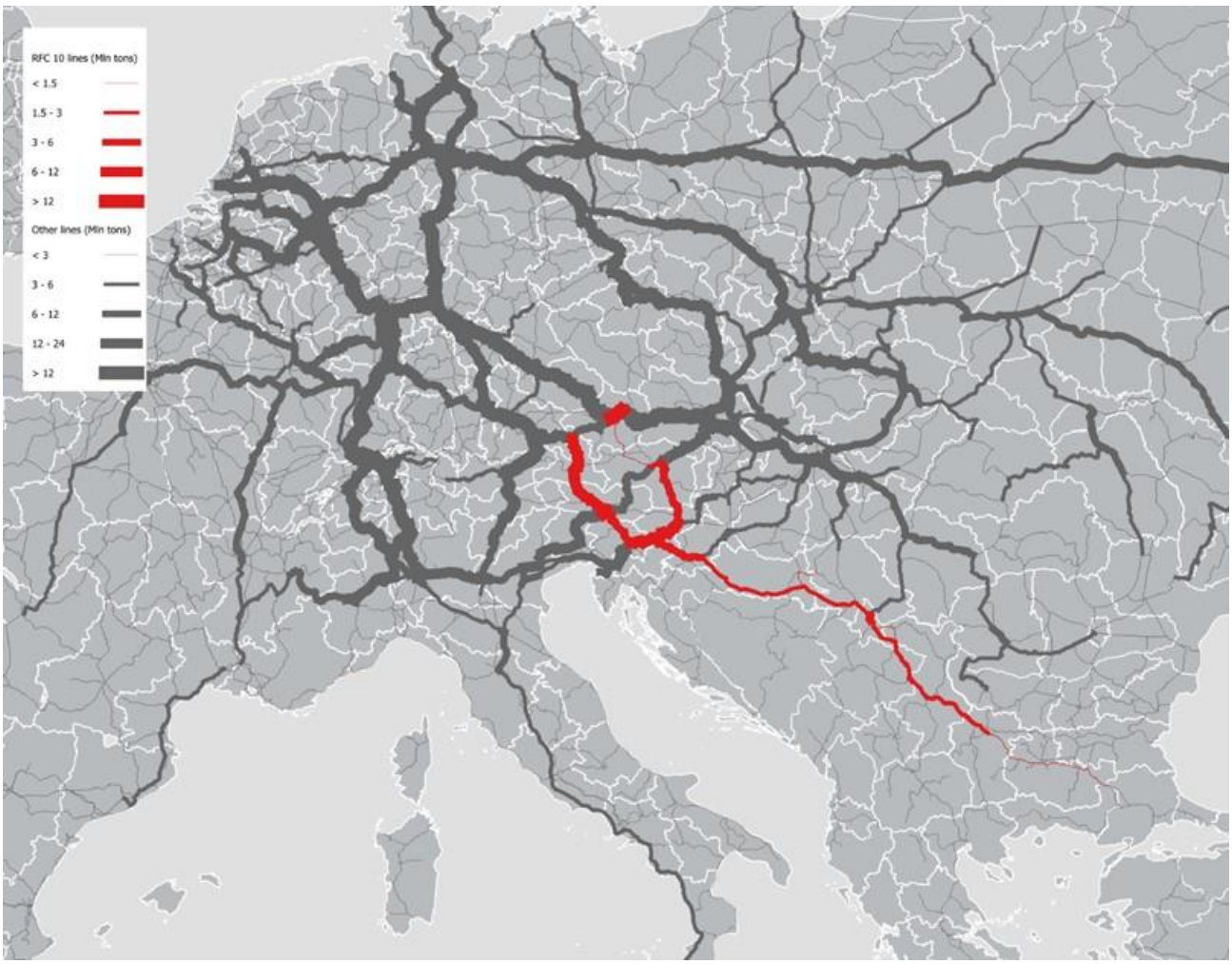


Source: NEAC estimations

4.3.4 INTERNATIONAL RAIL FREIGHT TRANSPORT FLOWS IN THE RFC AWB

The figure below shows the estimated international rail freight flows (in tonnes) for the RFC AWB. This provides a general overview of the use of the main rail lines in the corridor area. The volumes on the RFC AWB cannot be understood if we present them isolated. The rail volumes on the different tracks of the RFC AWB often have an origin or destination elsewhere in Europe. Looking at the map, we see the 1 flow with high volumes in the RFC AWB from Slovenia to Austria. Towards the south (between Slovenia and Bulgaria), the flows decrease gradually.

Figure 47 Estimated Volume of international rail freight transport (million tonnes) by cargo type in 2022



Source: NEAC estimations

5 ANALYSIS OF THE FUTURE RFC AWB TRANSPORT MARKET

The future market analysis has been performed for the three scenarios for 2030 described in 3.3 above and compared to the Base year 2022 (BAS), i.e. the Reference scenario (REF), the Projects scenario (PRO) and the Sensitivity scenario (SEN). The results for these three scenarios have been produced for 2030. The future freight transport market is presented in steps to help understand the importance of international freight transport in general and rail freight transport in particular. First, results for the 11 RFCs Network catchment area are presented, then we zoom in on results for the RFC AWB catchment area.

- Section 5.1 presents **Future transport market in the 11 RFCs Network catchment area**:
  - Section 5.1.1 provides the **Future of *all* international FREIGHT transport for the 11 RFCs Network catchment area**. This includes the total volumes by mode and cargo type. Furthermore, the volumes by main origin and destination countries are illustrated, as well as the main relations for all freight transport. Finally, a volume-distance distribution by mode is given.
  - Section 5.1.2 presents the **Future of international RAIL FREIGHT transport for the JOINT RFCs**, with the volume by cargo type, the flows on the rail network, the rail volumes by origin and destination countries and the top 10 relations for international rail freight transport.
- Section 5.2 provide the **Future of the international FREIGHT transport for RFC AWB**.
  - Section 5.2.1 describes the **Future of all international FREIGHT transport for RFC AWB**. This includes total volumes by mode and cargo type. Furthermore, we present the volumes by main origin and destination countries, as well as the main relations for all freight transport. Finally, a volume-distance distribution by mode is presented.
  - Section 5.2.2 describes the **Future of international RAIL FREIGHT transport for RFC AWB**. This provides a general overview of the origins and destinations of rail freight for the RFC AWB. We present the volume by cargo type, the flows on the rail network, the rail volumes by origin and destination countries and the top 10 relations for international rail freight transport.
  - Section 5.2.3 presents the **Development of the most important BCPs in the RFC AWB**.

In the following paragraphs the results of the future market analysis are presented comparing the 2022 Base year estimates (**BAS**), with the outcome of the model simulations for the EU Reference scenario (**REF**), Projects scenario 2030 (**PRO**) and Sensitivity scenario (**SEN**).

5.1 FUTURE TRANSPORT MARKET IN THE 11 RFCS NETWORK CATCHMENT AREA

This section describes the results of the future market analysis in the 11 RFCs Network catchment area. As explained in the previous chapter on the current market analysis, the market analysis of the individual RFCs is more appropriately assessed in the framework of the 11 RFCs Network, as the RFCs do not function in isolation.

5.1.1 FUTURE OF *ALL* INTERNATIONAL FREIGHT TRANSPORT FOR THE 11 RFCS NETWORK CATCHMENT AREA

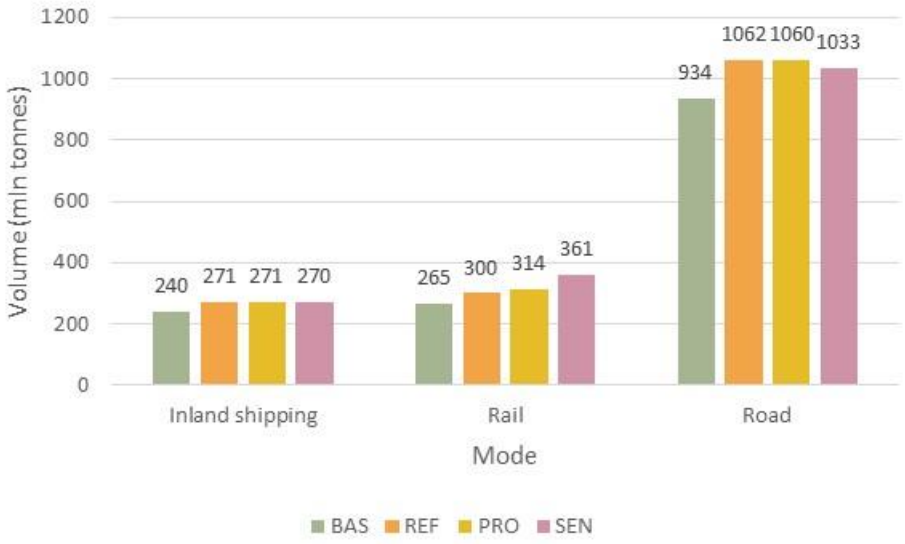
Due to the economic developments, all modes grow in the Reference scenario between 2022 and 2030. Inland shipping and rail grow by 13%, road by 14%. In absolute terms, international road freight transport

grows most, by 126 million tonnes (from 934 to 1,062 million tonnes). Inland shipping grows by 31 million tonnes (from 240 to 271 million tonnes) and rail transport by 35 million tonnes (from 265 to 300 million tonnes). Figure 48 shows the overall developments by mode and scenario within the 11 RFCs Network catchment area.

The implementation of different rail projects across Europe (Projects scenario) leads to an extra growth of 5% for rail transport compared to the Reference scenario, which is 14 million tonnes. Large rail projects across Europe, such as Rail Baltica, the Koralm railway line and tunnel, the Semmering tunnel, the second track Koper-Divača, or Rijeka-Zagreb-Koprivnica account for this growth. Inland shipping remains the same and road transport decreases a bit. Although not shown in the graph, a small shift in sea transport also causes extra growth.

The third scenario (Sensitivity) shows a hypothetical development for rail transport, assuming the completion of infrastructure with reference to the TEN-T requirements and the loading gauge. Compared to the base year situation, a growth of 36% is calculated for rail (+23% compared to the Reference scenario). The introduction of longer trains (740 meter) has an important effect on this result. This scenario can be regarded as a maximum potential for rail transport. Both inland shipping and road transport would decrease by 1 million tonnes for inland shipping and 27 million tonnes for road transport.

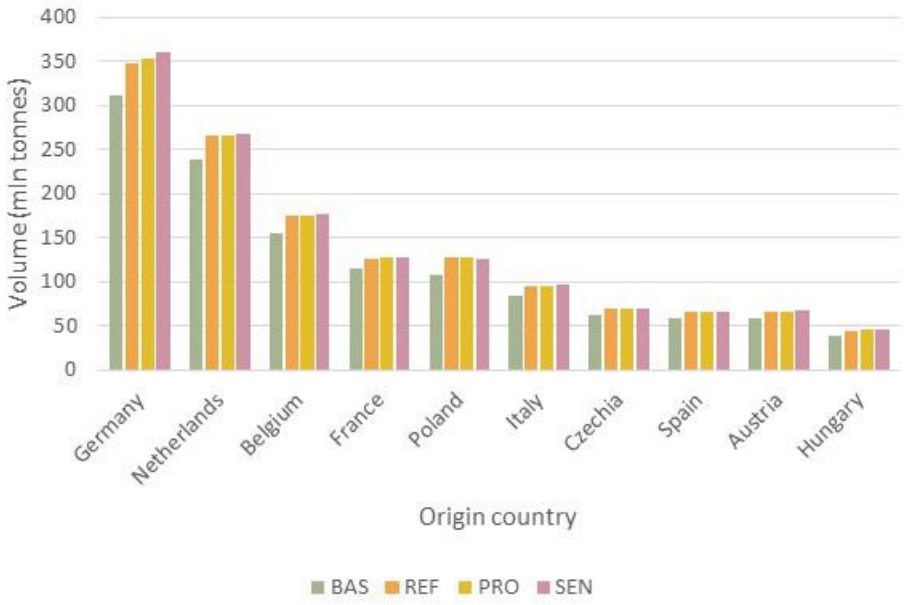
Figure 48 Development of volume (in million tonnes) by mode and scenario for the 11 RFCs Network catchment area



Source: NEAC estimations

Figure 49 and Figure 50 show the development of the volume of international freight transport for all modes for the top 10 countries per scenario. The most prominent growth stems from the Reference scenario for both origins and destinations. The Projects scenario and the Sensitivity scenario show only small differences compared to the Reference scenario; the largest differences can be seen in Germany. The top 10 origin countries remain the same as presented earlier for 2022. Germany, the Netherlands, and Belgium constitute the 3 largest origin countries for international freight transport. The total amount of volume for Germany increases by 12% between the 2022 Base year and 2030 Reference scenario, from 311 to 348 million tonnes. Similar growth can be found in the Netherlands (+12% from 238 to 265 million tonnes) and Belgium (+13% from 155 to 175 million tonnes). The largest growth between the 2022 Base year and the 2030 Reference scenario can be found in Poland (+20% from 107 to 128 million tonnes) and Hungary (+18% from 38 to 45 million tonnes).

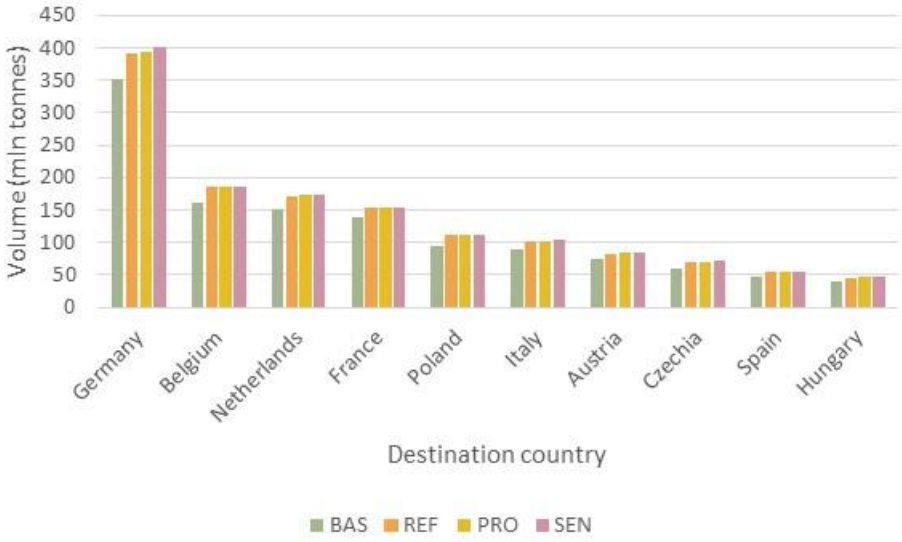
Figure 49 Development of volume (in million tonnes) of all international freight transport by the top 10 origin countries within the 11 RFCs Network catchment area



Source: NEAC estimations

Similar growth rates can be found for the destination countries. Also, the top three countries for international freight transport consist of Germany (+11% from 352 to 392 million tonnes), Belgium (+14% from 163 to 185 million tonnes and the Netherlands (+13% from 152 to 172 million tonnes. As with the origin countries, the ranking of the destination countries does not change in 2030 compared to 2022.

Figure 50 Development of volume (in million tonnes) of all international freight transport by the top 10 destination countries within the combined 11 RFCs Network



Source: NEAC estimations

5.1.2 FUTURE OF INTERNATIONAL RAIL FREIGHT TRANSPORT FOR THE JOINT RFCS

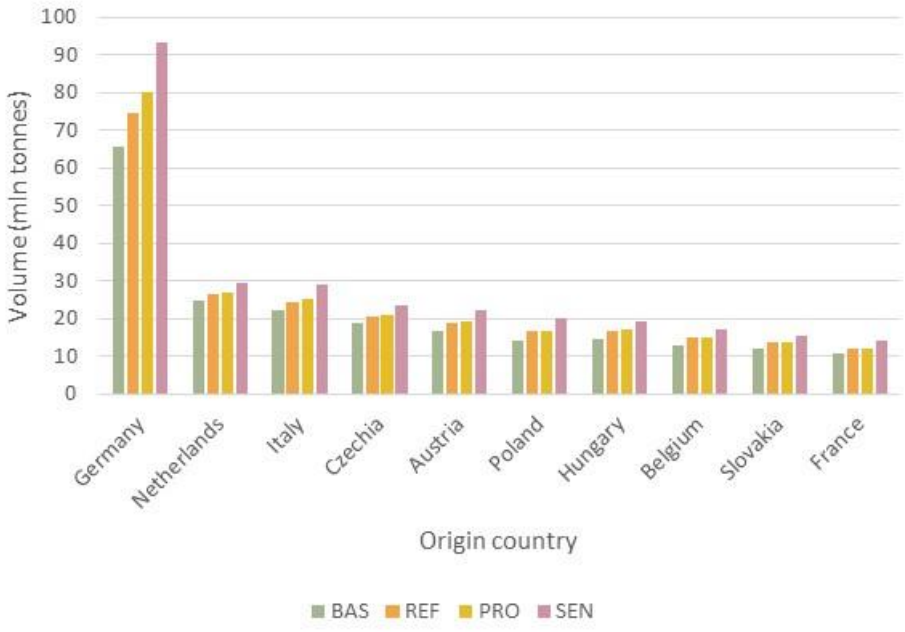
Figures 51 and 52 show the development of the volume in international rail freight transport for the origins and destinations of the top 10 countries of the 11 RFCs Network. The changes are more prominent for international rail transport than for *all* international rail freight transport as shown in the previous section.

In the Reference scenario, international rail freight transport is the highest in Germany for both origin (+14% from 65 to 75 million tonnes) and destination (+11% from 72 to 80 million tonnes). In the top 10 origin countries, the overall growth varies per country from 7% (The Netherlands from 25 to 27 million tonnes)) to 19% (Poland from 14 to 17 million tonnes). For the destination countries, similar growth patterns are forecasted.

The *Projects scenario* shows a limited impact on international rail freight transport volume, except for Germany. On average, the growth in international rail volume for the top 10 countries is 4%, compared to the Reference scenario. The lowest extra growth for the Projects scenario compared to the Reference scenario is reported for Poland at 0%, the highest growth for Germany at 6% (from 75 to 80 million tonnes). For the destination top 10 countries the growth is 3%. The smallest growth is found in Czechia (+1% from 22 to 23 million tonnes), the largest growth can be found in Slovakia (+15%, from 12 to 14 million tonnes).

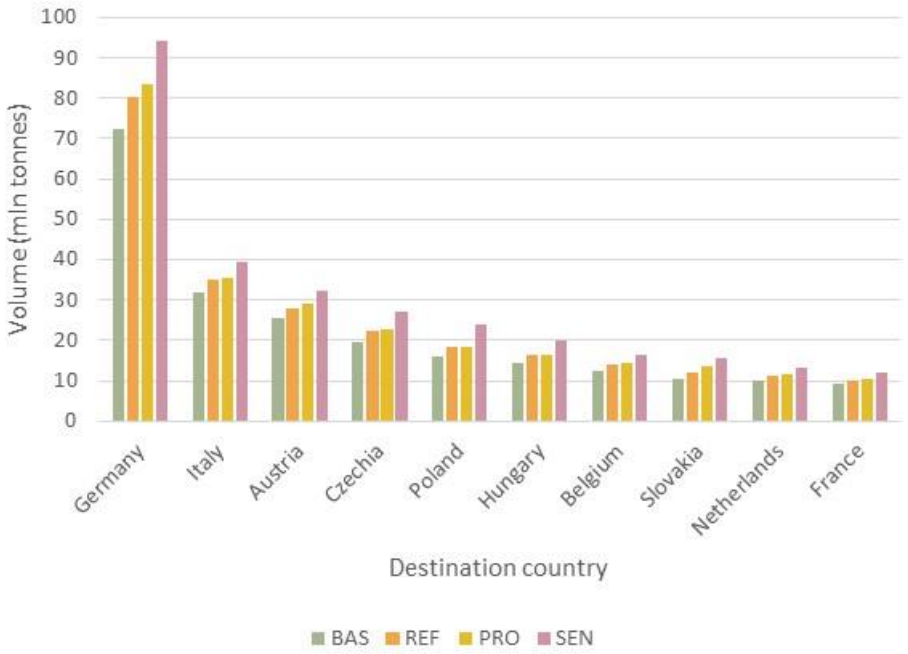
The potential extra volume in the top 10 origin countries, as shown by the *Sensitivity scenario*, is overall 18% (from 239 to 283 million tonnes), compared to the Reference scenario. The lowest growth compared to the Reference scenario can be seen for the Netherlands (+10% from 27 to 29 million tonnes), the highest growth for Germany (+25% from 75 to 93 million tonnes). For the destination countries the growth is 19% (from 247 to 293 million tonnes) compared to the Reference scenario. Italy has the lowest growth at +12% (from 35 to 39 million tonnes) and Poland shows the largest growth at +33% (from 18 to 24 million tonnes).

Figure 51 Development of volume (in million tonnes) of all international rail freight transport by the top 10 origin countries within the 11 RFCs Network catchment area



Source: NEAC estimations

Figure 52 Development of volume (in million tonnes) of all international rail freight transport by the top 10 destination countries within the 11 RFCs Network catchment area



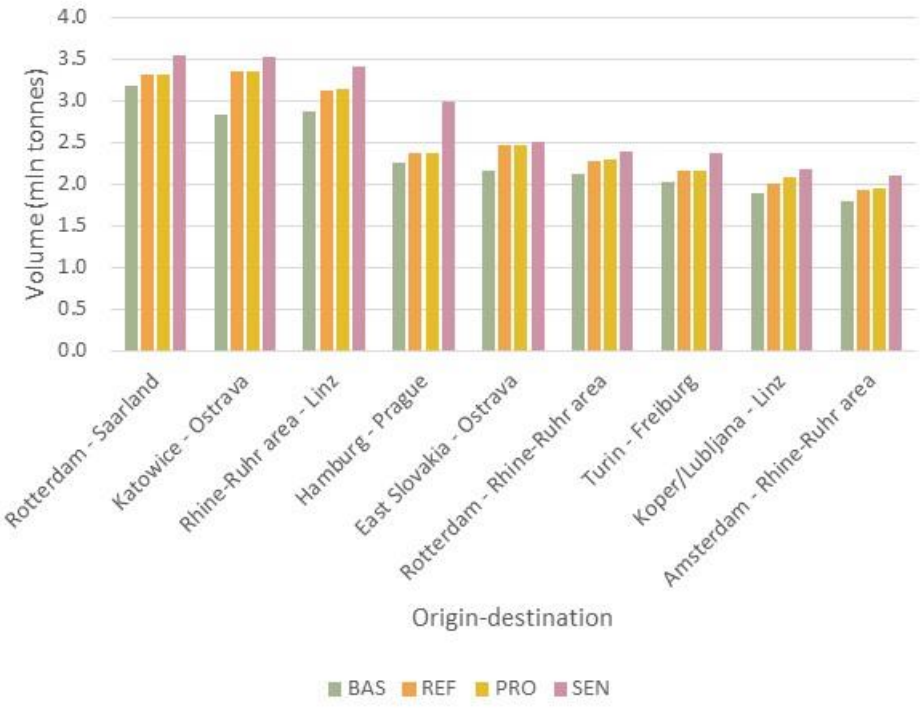
Source: NEAC estimations

Looking at the top 10 relations within the the 11 RFCs Network, the main one is between Rotterdam (NL) and Saarland (DE), the second most important relation is between Katowice (PL) and Ostrava (CZ). Both relations are important for the steel production in Saarland and Ostrava and for the transport of dry bulk. Another important relation concerns the Rhein-Ruhr area to Linz. In this case, the type of cargo is more varied, but the transport of liquid bulk (oil products and chemicals) is important in this relation. Between Hamburg and Prague, the cargo comprises mainly general cargo.

Interesting to see is the impact of the Projects scenario between Western Slovenia (Koper) and Graz. It shows that the Semmering base tunnel and Koralm tunnel seem to have a significant impact on international rail freight transport also on this relation.

The Sensitivity scenario shows, compared to the Reference scenario most growth between Hamburg and Prague (+25% from 2.3 to 3.0 million tonnes) and between Koper and Graz (+41% from 1.4 to 2.0 million tonnes). The general measures function as a multiplier and add extra growth of the Project scenario.

Figure 53 Development of volume (in million tonnes) of all international rail freight transport by the top 10 relations within the combined 11 RFCs Network



Source: NEAC estimations

5.2 FUTURE OF THE INTERNATIONAL FREIGHT TRANSPORT FOR RFC AWB

5.2.1 FUTURE OF ALL INTERNATIONAL FREIGHT TRANSPORT FOR RFC AWB

This section shows the results of the future market analysis for the RFC AWB. Figure 54 shows the overall developments by mode and scenario in the catchment and corridor area of RFC AWB.

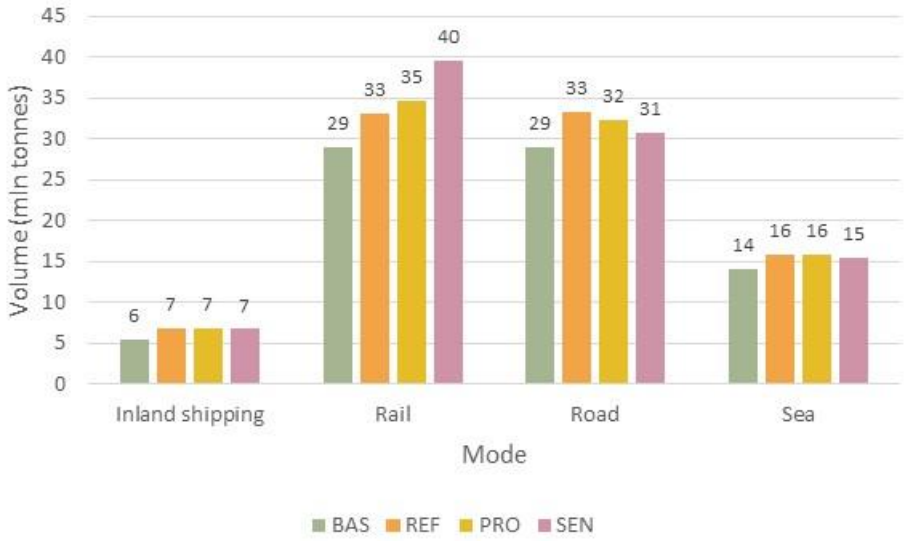
Between the 2022 Base year and 2030 Reference scenarios, all modes grow due to economic developments. Rail transport grows by 14% (4 million tonnes) from 29 to 33 million tonnes. Inland shipping grows by 24%, road by 15%, and sea shipping by 12%. In absolute terms, both international road and rail freight transport grows equally most, by 4 million tonnes (from 29 to 33 million tonnes). Inland shipping increases in volume from 6 to 7 million tonnes.

The implementation of different rail projects across Europe, does not lead to a significant growth of rail transport in the RFC AWB. There is some modal shift between road and rail. In the RFC AWB large and smaller projects across the rail network account for this shift. Also, infrastructure projects outside the RFC AWB contribute leading to mode shift or rerouting. Road transport decreases a bit, while rail transport grows by 2 million tonnes.

The third scenario shows a hypothetical development for rail transport. Compared to the base year situation, a growth of 19% in volume (million tonnes) is estimated. The introduction of longer trains (740 meters) has an important impact on this result. This scenario can be regarded as a maximum potential for rail transport in 2030. The growth has different causes, such as rerouting, mode shift, or splitting freight transport from

one mode into transport by two modes (for example, splitting road transport into road and rail transport). In the third scenario, rail transport in the RFC AWB grows by 36% compared to the base situation. This is a substantial achievement compared to the 14% forecasted for the Reference scenario.

Figure 54 Development of volume (in million tonnes) by mode and scenario for the corridor area of RFC AWB

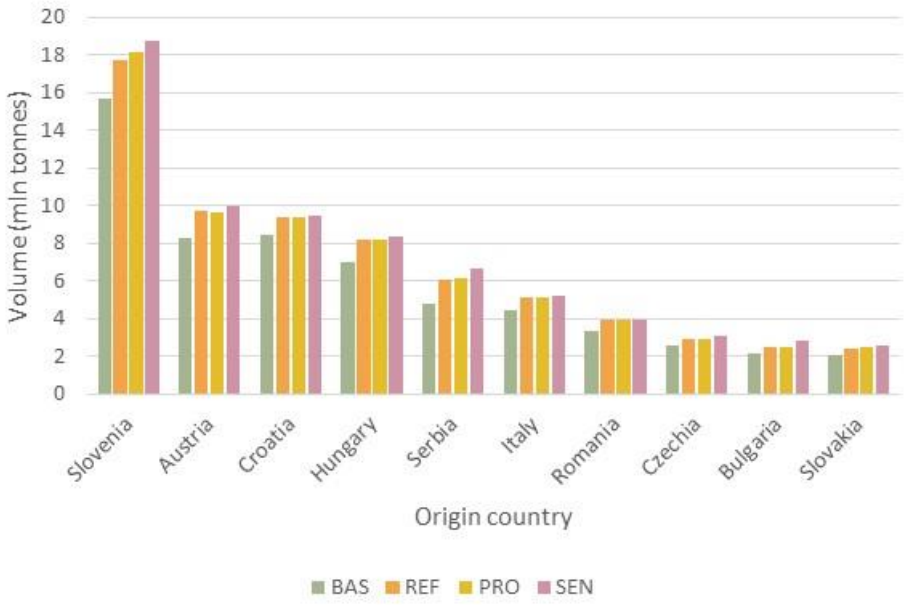


Source: NEAC estimations

The next two figures show the development of the volume of international in freight transport by *land modes* for the origin and destination countries in the catchment area and the corridor area of the RFC AWB for their respective scenarios. In general, the most prominent growth stems from the economic development (REF). The Projects (PRO) scenario and the Sensitivity (SEN) scenario show small differences. Concerning the Projects scenario variations are primarily due to mode shifts, where the total volume does not really change. The Sensitivity scenario for all land modes shows a bit more volume compared to the Reference and Projects scenarios. The totals are almost equal between the different scenarios. The reason is mainly due to a shift between the land modes.

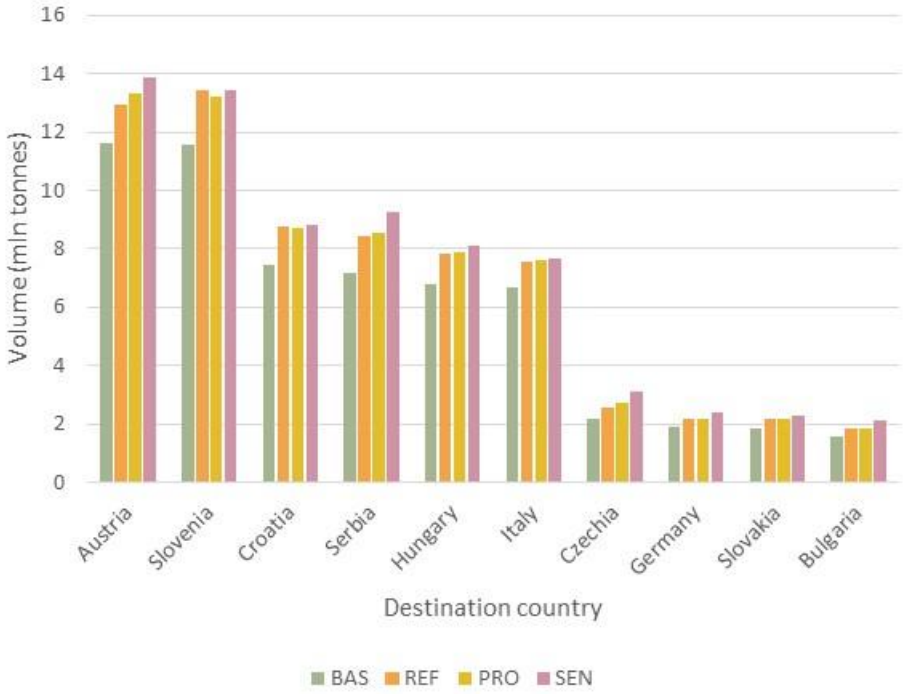
Concerning the top 10 origins, these are the same as for the base year. The overall growth for the top-10 origins in the Reference scenario is 15% and varies from 11% (Croatia) to 27% (Serbia). Slovenia, Austria, and Croatia are the top 3 origin countries in the RFC AWB. Concerning the Projects scenario, in general the average growth rate does not deviate from the Reference scenario. Concerning the Sensitivity scenario, a slightly higher volume is registered. The growth per countries varies from 12% (Croatia) to 40% (Serbia).

Figure 55 Development of volume (in million tonnes) of all international freight transport by origin countries in the catchment area of the RFC AWB



Source: NEAC estimations

Figure 56 Development of volume (in million tonnes) of all international freight transport by the destination countries in the RFC AWB



Source: NEAC estimations

The picture for the destination countries is like the one for the origin countries, but the ranking is somewhat different. The overall growth in the top 10 countries is approximately 15% for both the Reference and Projects scenarios. The growth between the 2022 Base year and the Reference scenario varies from 11% (Austria) to 19% (Bulgaria). The growth for the Sensitivity scenario ranges from 14% (Italy) to 41% (Czechia).

5.2.2 FUTURE OF INTERNATIONAL RAIL FREIGHT TRANSPORT FOR RFC AWB

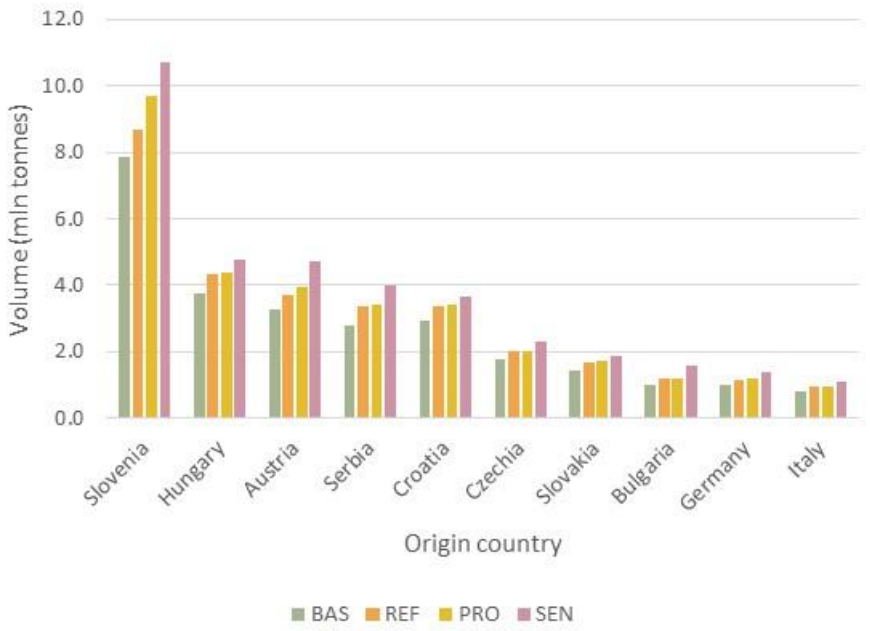
As concerns the RFC AWB, we see a growth from 29 million tonnes to 33 million tonnes in the Reference situation. Expressed in trains, this would mean a growth from about 29,000 international trains to about 33,000 trains. The Projects scenario adds another 2 million tonnes to the total volume leading to a total number of trains of 35,000. The sensitivity scenario will finally lead to a volume of 40 million tonnes, which is about 35,000 trains. The same number of trains compared to the project scenario is because the volume is transported by longer trains.

The next two graphs show the development of volume in international *rail* freight transport for origin countries for the RFC AWB. International rail freight transport is highest in Slovenia (9 million tonnes in the Reference scenario). Hungary and Austria come in second and third place (both at 4 million tonnes).

The Projects scenario shows the impact on the volume of international rail freight transport. Overall, the growth in international rail volume for the top-10 countries is about 6% compared to the Reference scenario. The potential extra volume as shown by the TEN-T standards interoperability scenario is overall 22% higher on the total volume compared to the Reference scenario. In Austria, Serbia, and Bulgaria we see a relatively high growth. The Sensitivity scenario shows more growth of international rail freight transport. This is mainly due to the increase of train length up to 740 m and the transition to the standard gauge in Spain and Portugal.

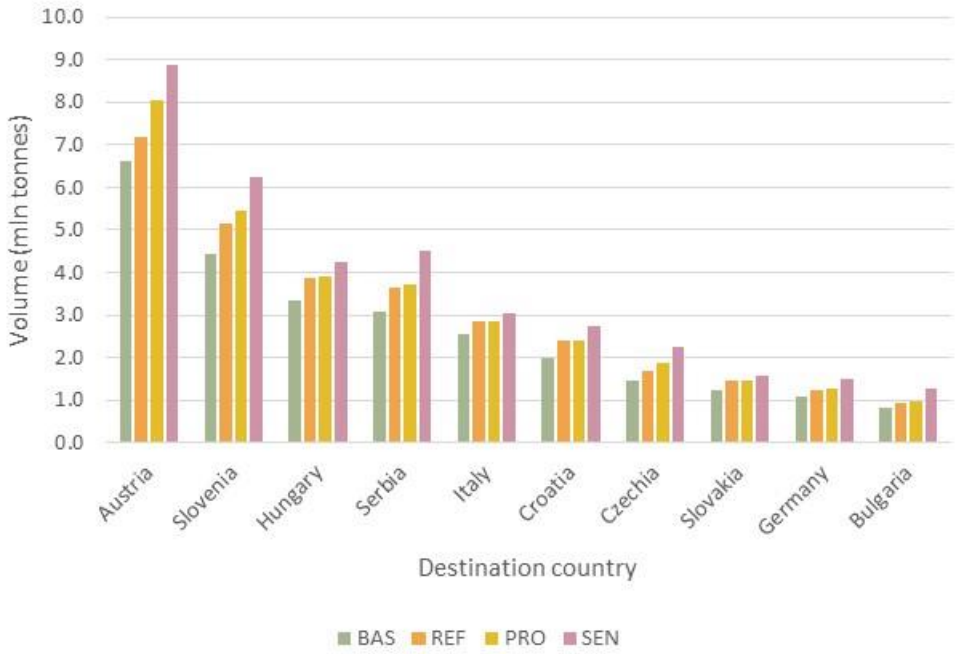
For destinations, a similar picture can be noticed. In this case, Austria has a number 1 position in the RFC AWB concerning international rail freight transport. Slovenia and Hungary are ranked 2 and 3 for international rail freight transport. The impact of the Projects scenario is limited, whereas the Sensitivity scenario shows higher effects. Compared to the 2022 Base year situation, the growth varies from 18% (Italy) to 55% (Czechia).

Figure 57 Development of volume (in million tonnes) of all international rail freight transport by the origin countries in the RFC AWB



Source: NEAC estimations

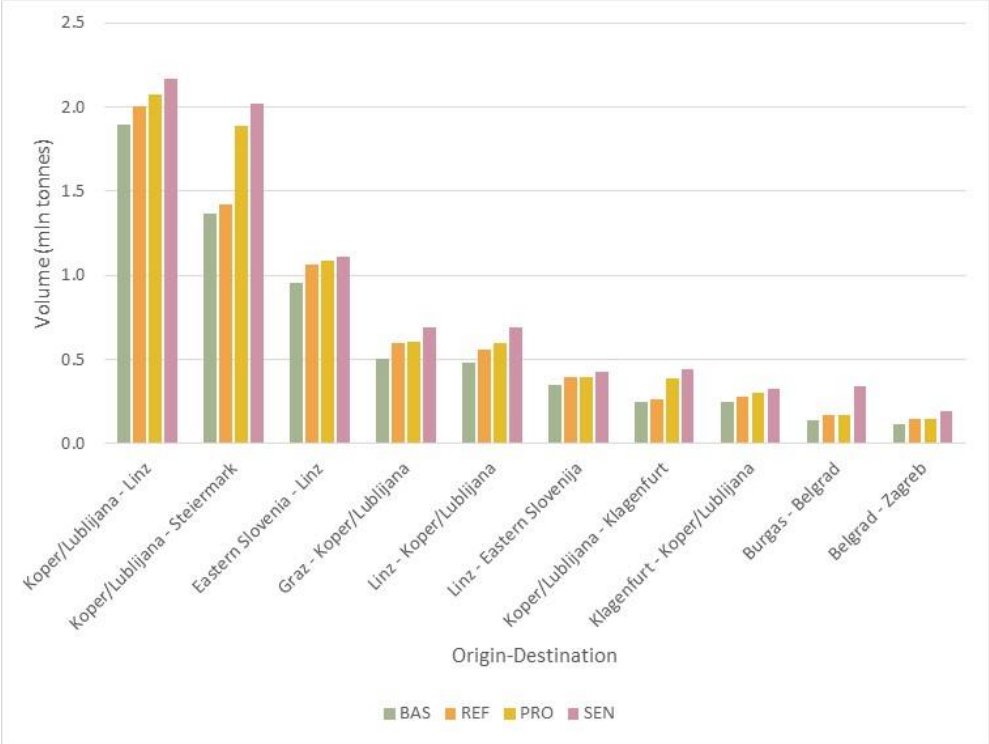
Figure 58 Development of volume (in million tonnes) of all international rail freight transport by destination countries in the RFC AWB



Source: NEAC estimations

Looking at the top 10 relations within the RFC AWB, the main relation is between Koper/Ljubljana and Linz at 2 million tonnes. This relation is important for dry bulk. In second place comes Koper/Ljubljana - Graz, also with dry bulk as main cargo type. Another important relation concerns Eastern Slovenia to Graz. The other relations show similar volumes of around 0.5 million tonnes of volume. As can be seen Koper is an important port for this RFC, Linz is an important inland location in the RFC AWB.

Figure 59 Development of volume (in million tonnes) of all international rail freight transport by the top 10 relations within the corridor area of RFC AWB



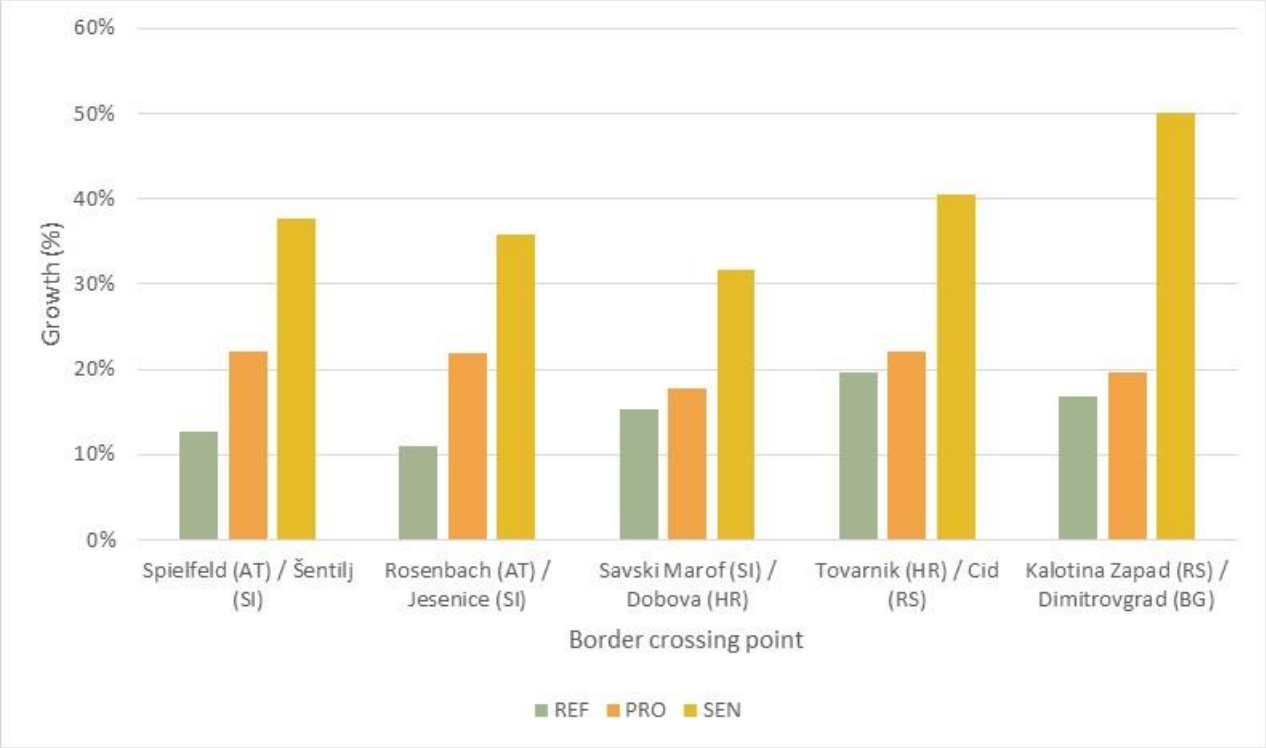
Source: NEAC estimations

5.2.3 DEVELOPMENT OF THE MOST IMPORTANT BCPS IN THE RFC AWB

The different border crossing points in the RFC AWB each show different growth between the 2022 Base year and 2030 Reference, Projects and Sensitivity scenarios. Overall, the Reference shows growth in volume of 14% on the BCPs. This is in line with the general growth for rail transport between the 2022 Base year and 2030 Reference scenarios. The completion of different projects by 2030 leads to different growth patterns; on average, the growth in relation to the base is 21% more volume, which translates into 21% more trains on average. The sensitivity scenario leads to 37% more volume, which is 37% more trains compared to 2022. Due to the extra train length, there is less growth in number of trains. Furthermore, interesting is the fact that the growth differentiates by BCP. Interesting to see is that the sensitivity has most impact on the BCPs between Bulgaria and Greece. Keep in mind that the volumes on these BCPs are relatively low. But there seems to be potential for growth.

The total amount of unique trains on some BCPs in 2022 in the graph below is estimated at 29.000 trains. In the Reference situation this would be approximately 33,000. In the Projects scenario, this is 35,000 trains, while in the Sensitivity scenario, this is 35,000 trains (due to extra volume per train, the same as the Projects scenario). Keep in mind that the number of reported trains is higher, but this is due to double counts (some trains pass more than 1 BCP).

Figure 60 Development of volume (in million tonnes) of international rail freight transport on important border crossing points of the RFC AWB

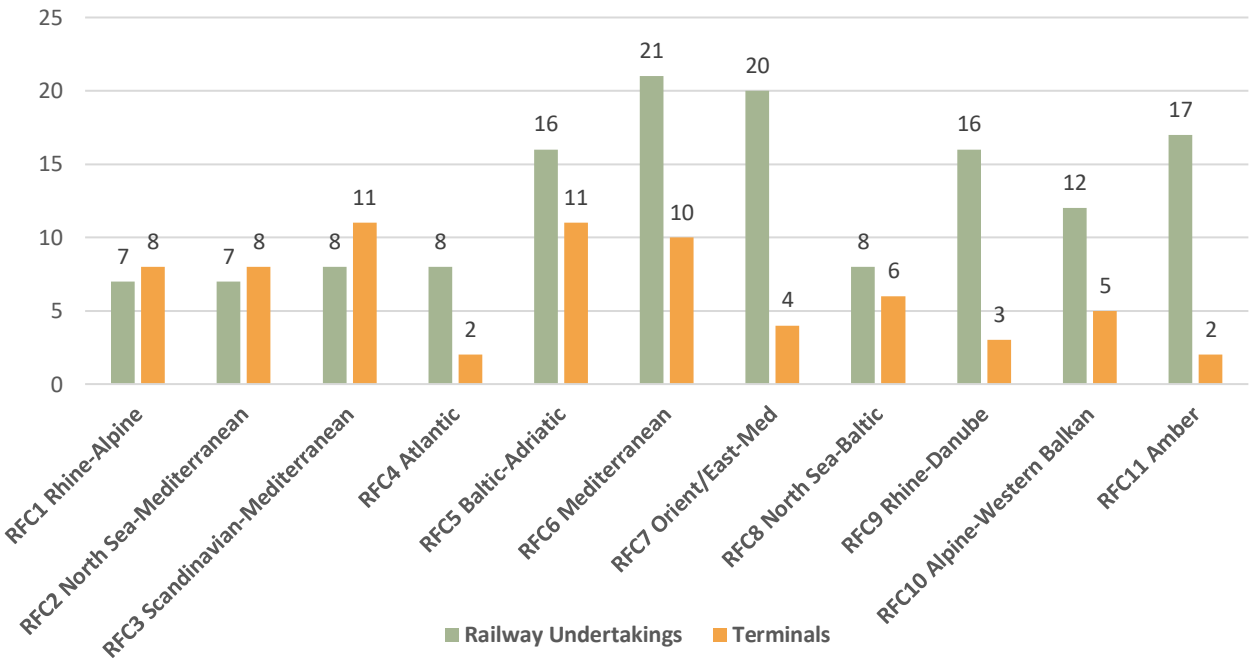


Legend: REF=Reference, PRO=Projects, SEN=Sensitivity (Interoperability)

6 OCCURRED AND EXPECTED CHANGES ASSOCIATED WITH THE ESTABLISHMENT OF THE RAIL FREIGHT CORRIDORS: 2023 11 RFCS JOINT TMS SURVEY

No relevant time series data are available supporting a consistent appraisal of the occurred and expected changes associated with the establishment of the 11 RFCs. It's worth adding that the current 11 RFCs started operating in different years, 5 in 2013, 3 in 2015 and 3 after 2018, and their alignment was adjusted over time to market needs. To assess the occurred and expected changes associated with their establishment, an e-survey (2023 11 RFCs Joint TMS Update Survey) has been conducted, submitting a questionnaire to the members of the Railway Undertaking Advisory Groups (RAGs) and the Terminal Advisory Groups (TAGs) of the 11 RFCs. Questionnaires were collected via the EUSurvey platform of the European Commission (DG DIGIT) between September 2023 and January 2024. Forty-two members of the RAGs and thirty members of the TAGs participated in the survey, for a total of seventy-two respondents, operating services/terminals along the alignment of all 11 RFCs (Figure 61).

Figure 61 RFCs usage by respondents operating or serving trains at terminals crossing at least one border crossing point(s) in any RFCs



Source: 2023 11 RFCs Joint TMS Update; Notes: Questions C) 3.R and 3.T

The survey was conducted to collect the opinion of the 11 RFCs market players on three main areas:

1. Occurred and expected changes due to the establishment of the RFCs;
2. Occurred and expected market developments along the RFCs; and
3. Market drivers.

This chapter summarises the main outcome of the survey with reference to these three areas. The full set of responses is provided in Annex 2 of this report.

Whereas the total number of responses for all RFCs makes the outcome of the survey meaningful from the 11 RFCs Network perspective, a presentation of the results by individual RFC would lose significance due to the limited number of answers. As a result, the outcome of the survey is presented in this report for all RFCs together /for the RFC Network as a whole.

Especially regarding the opinion of the 11 RFCs RAGs and TAGs members on the occurred and expected market developments, it is worth noticing that it reflects their views at the time of submission of the questionnaire (Autumn 2023/January 2024). Additionally, survey responses represent a partial view of the market as the sample of the respondents is not representative of the market universe. Furthermore, differences may exist between RFCs as they were established and entered into operation in different years. Finally, the survey outcome may partially diverge from the findings from the statistical review presented in the previous section above, as the opinions relate to the RFCs and international trains, whereas national statistics refer to the whole country network and national as well as international traffic.

6.1 CHANGES OCCURRED SINCE THE ESTABLISHMENT OF THE RFCS AND EXPECTED CHANGES CONCERNING THE FACILITATION OF INTERNATIONAL RAIL FREIGHT TRANSPORT

Occurred and expected changes have been investigated as part of the survey around three main areas of activity of the Rail Freight Corridors, which are of relevance for the facilitation of international rail freight transport, and namely: governance, operational efficiency and capacity management. For each area, questions have been made to assess:

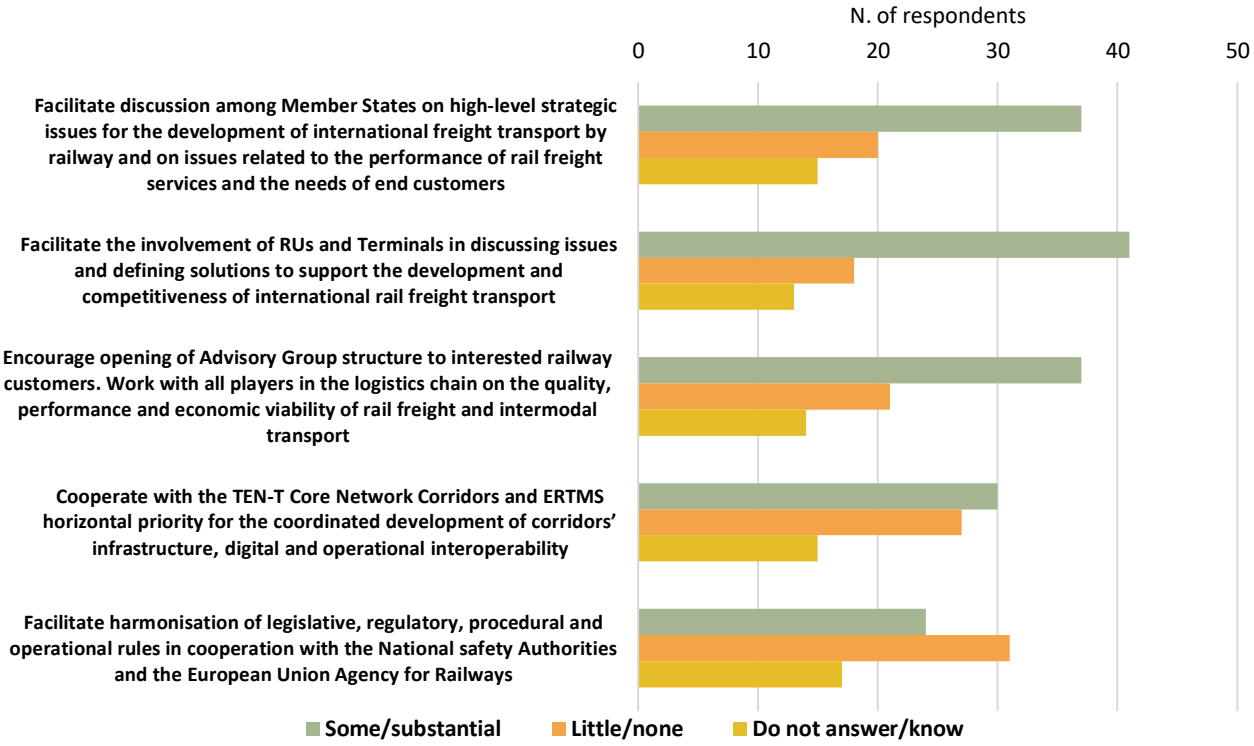
- Changes occurred since the establishment of the RFCs;
- Expected changes assuming continuation of the activities by the RFCs; and
- The best fitting governance to address the issues identified for each of the three investigated areas, also considering the proposed termination of the RFCs activities in the Proposal for a Regulation of the European Parliament and of the Council on the use of railway infrastructure capacity in the single European railway area, amending Directive 2012/34/EU and repealing Regulation (EU) No 913/2010[21]

6.1.1 GOVERNANCE ISSUES

The respondents' opinion about the changes within the governance area is positive, especially in terms of cooperation with the market, including but not limited to RUs and terminal operators, as well as concerning facilitation of discussion among Member States about the issues affecting the competitiveness of international rail freight transport (Figure 62). The opinion about the progress made regarding cooperation between RFCs and Core Network Corridors (CNCs)/ERTMS horizontal priority is less favourable. The market opinion is negative about the progress made on harmonising international freight rail services' legislative, regulatory, procedural and operational aspects.

[21] https://ec.europa.eu/transparency/documents-register/detail?ref=SEC(2023)443&lang=en

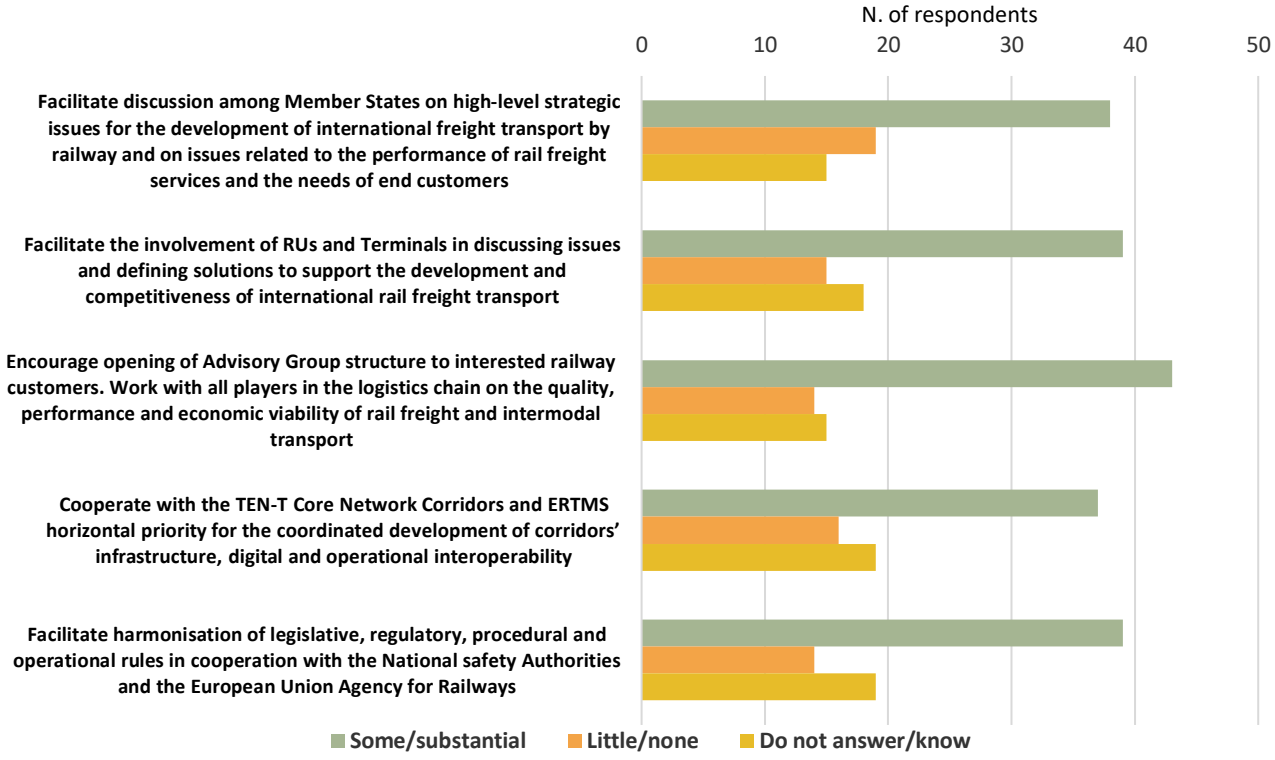
Figure 62 Progress made to date since the establishment of the RFCs - Governance Issues



Source: 2023 11 RFCs Joint TMS Update; Notes: Question B) 1.RT

The expectations of the market players concerning the future impact of the programmes and activities of the RFCs are relatively positive concerning all issues (Figure 63).

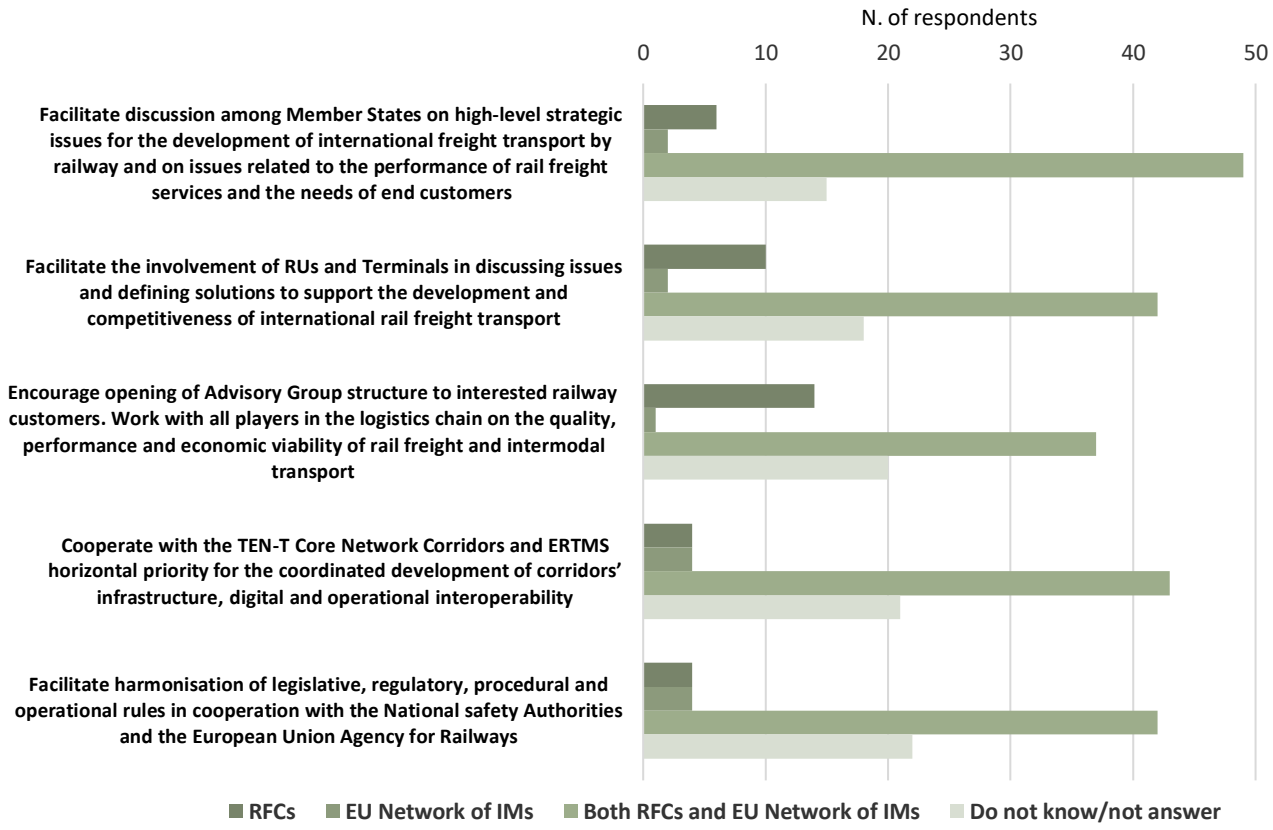
Figure 63 Expected changes based on current programmes/initiatives - Governance Issues



Source: 2023 11 RFCs Joint TMS Update; Notes: Question B) 1.RT

Respondents consider the cooperation between RFCs and an EU Network of Infrastructure Managers (IMs) to be the best governance solution for bringing issues forward (Figure 64)

Figure 64 Best fitting governance to bring the issue forward - Governance Issues

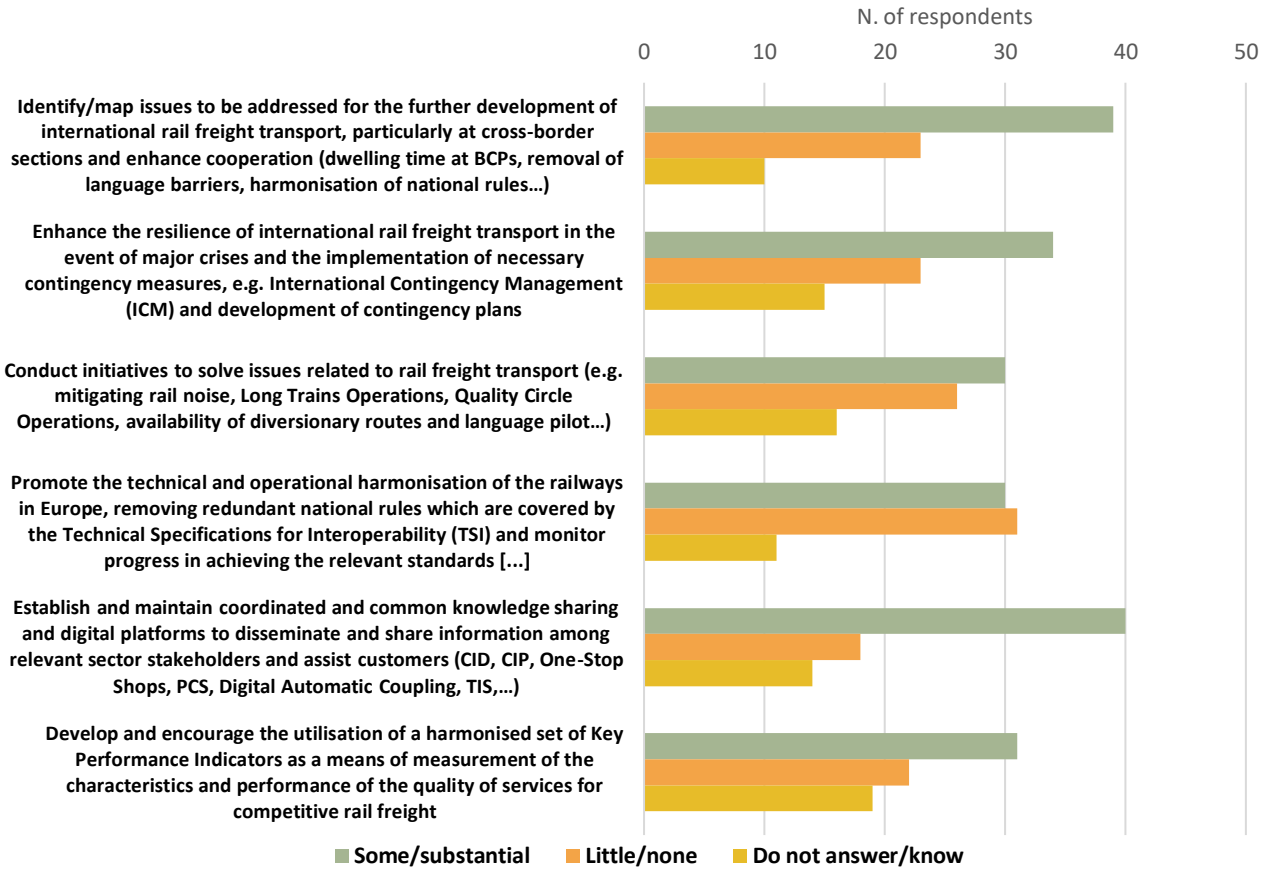


Source: 2023 11 RFCs Joint TMS Update; Notes: Question B) 1.RT

6.1.2 OPERATIONAL EFFICIENCY ISSUES

The market opinion about the changes that occurred within the operational efficiency area is also generally positive, except for the progress made in the promotion of technical and operational harmonisation of the European railway transport system towards its interoperability (Figure 65).

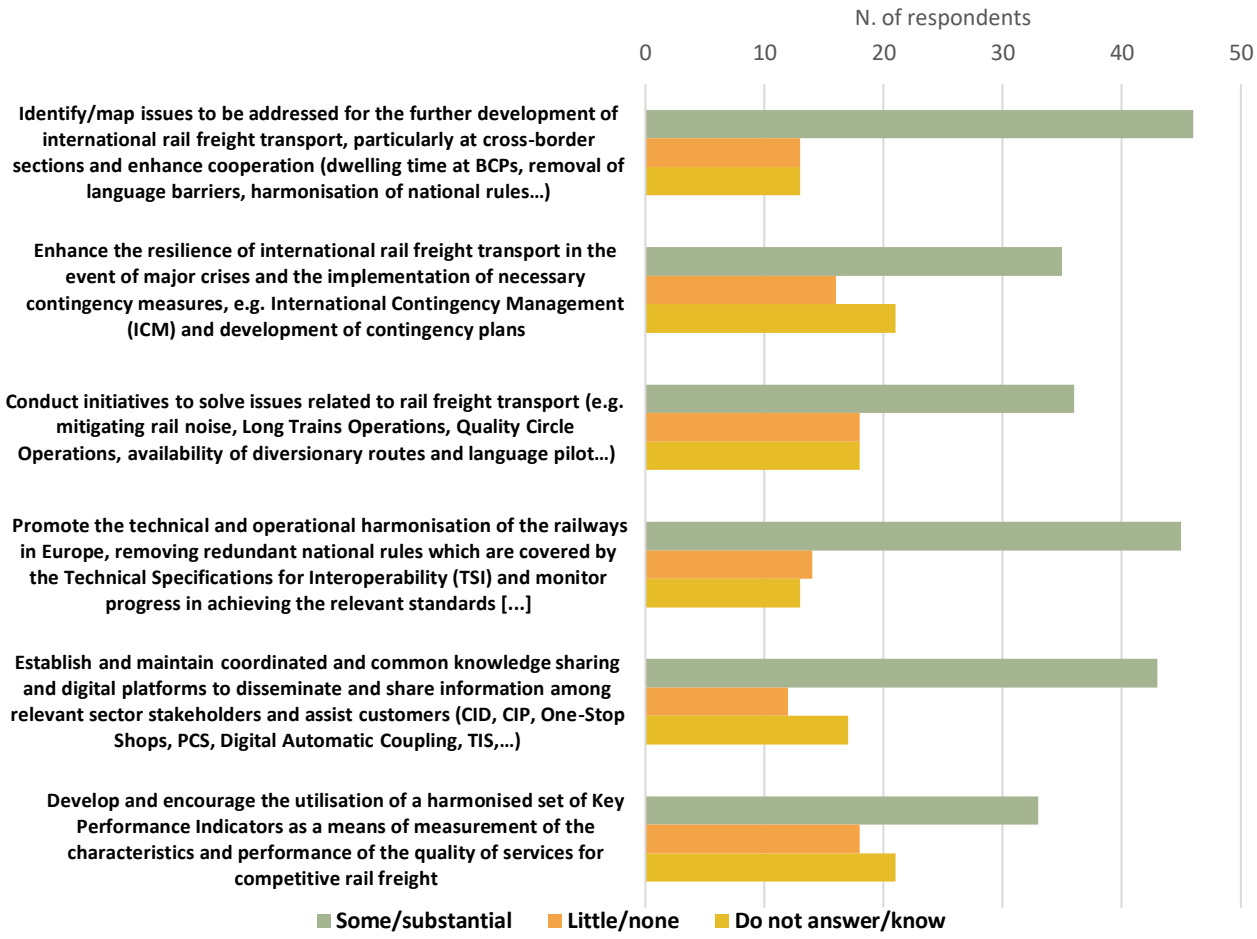
Figure 65 Progress made to date since the establishment of the RFCs - Operational Efficiency Issues



Source: 2023 11 RFCs Joint TMS Update; Notes: Question B) 2.RT

The respondents' expectations concerning the future impact of the programmes and activities of the RFCs are relatively positive concerning all issues (Figure 66).

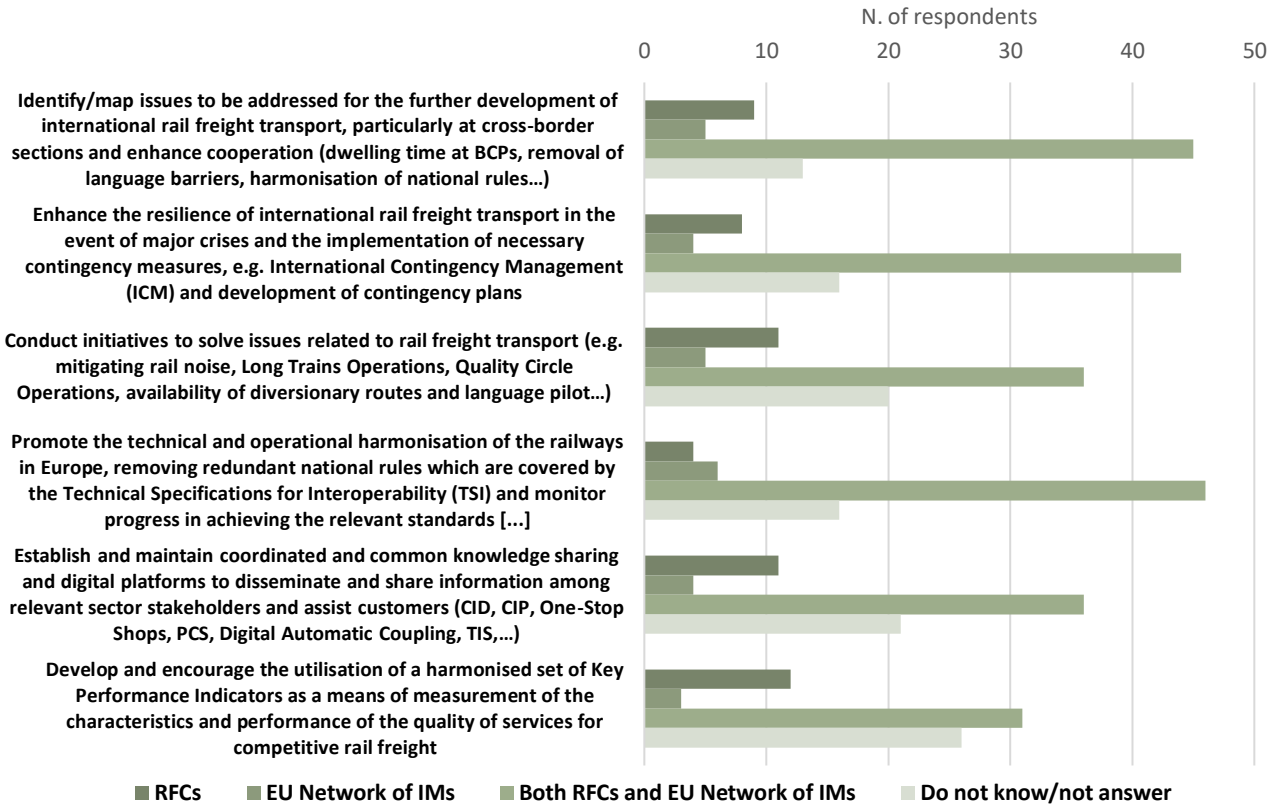
Figure 66 Expected changes based on current programmes/initiatives by RFCs - Operational Efficiency Issues



Source: 2023 11 RFCs Joint TMS Update; Notes: Question B) 2.RT

Cooperation between RFCs and an EU Network of Infrastructure Managers (IMs) is also considered the best-fitting governance solution to bring operational efficiency issues forward (Figure 67).

Figure 67 Best fitting governance to bring the issue forward - Operational Efficiency Issues

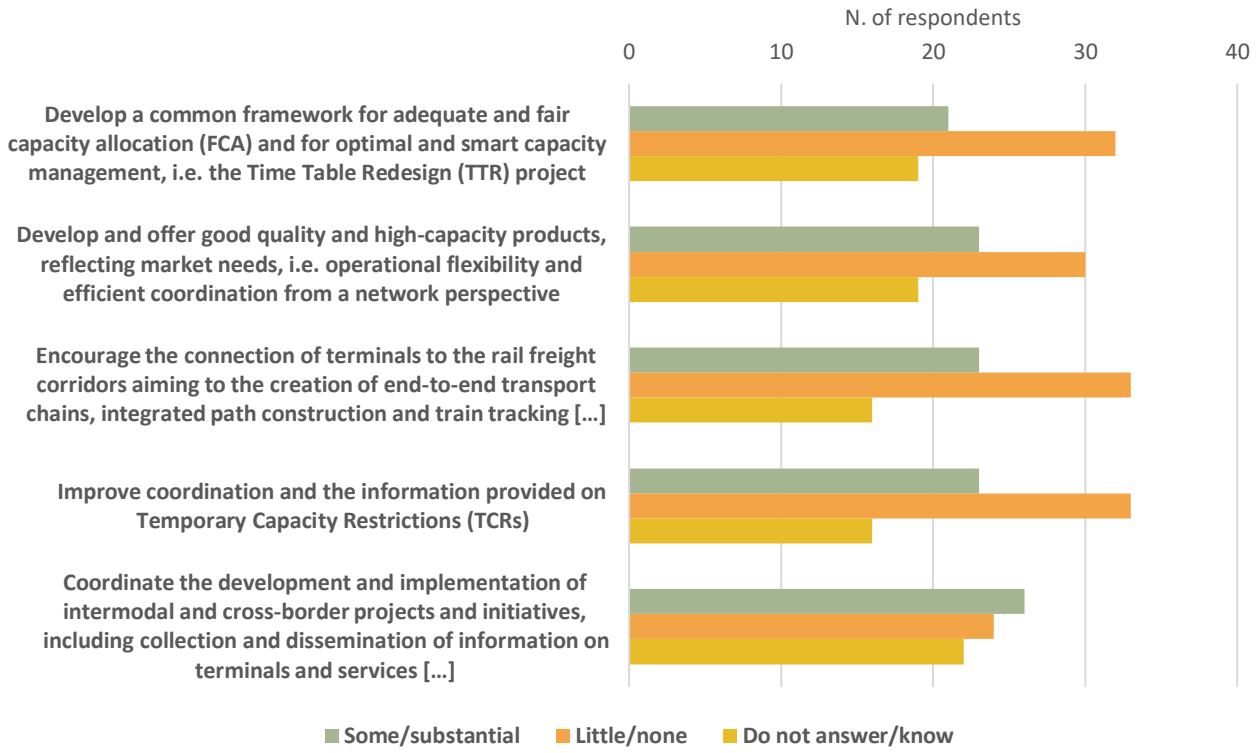


Source: 2023 11 RFCs Joint TMS Update; Notes: Question B) 2.RT

6.1.3 CAPACITY PLANNING ISSUES

The respondents' opinions about the changes that occurred within the capacity management area are predominantly negative, except for the coordination of the development and implementation of cross-border projects and initiatives (Figure 68).

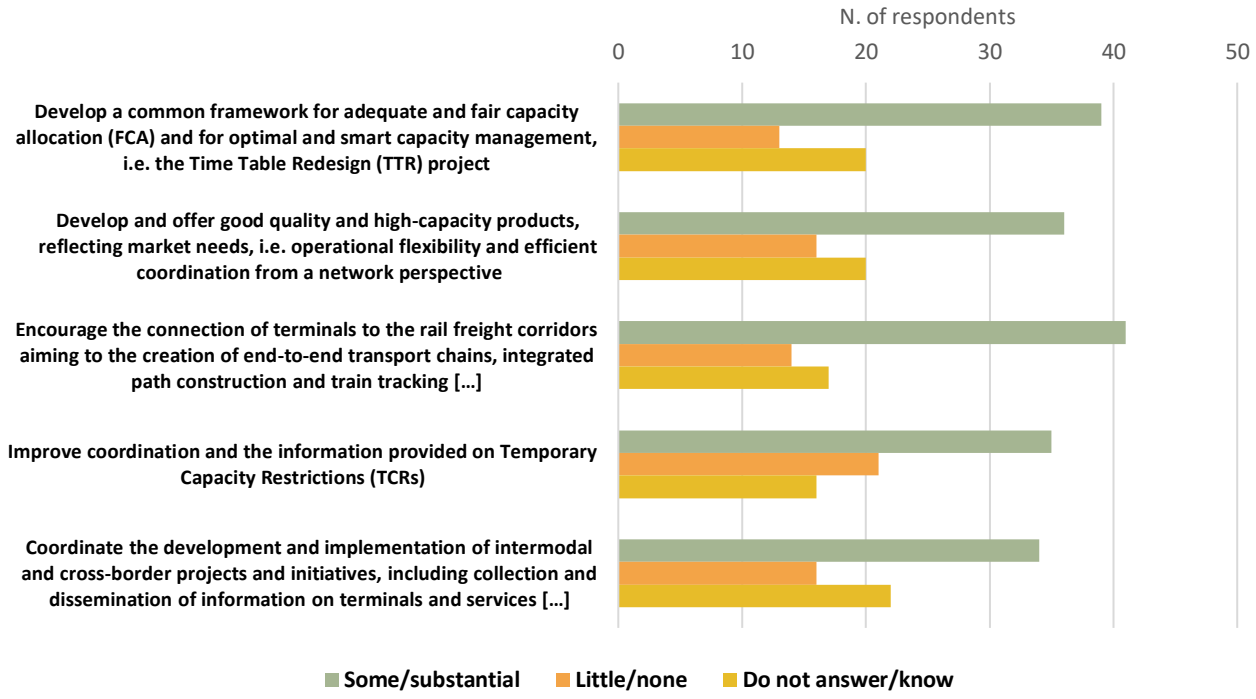
Figure 68 Progress made to date since the establishment of the RFCs - Capacity Planning Issues



Source: 2023 11 RFCs Joint TMS Update; Notes: Question B) 3.RT

Notwithstanding the market's opinion that little or no progress made since the establishment of the RFCs, the expectations on the future impact of the programmes and activities by the RFCs are rather positive with regard to all issues (Figure 69).

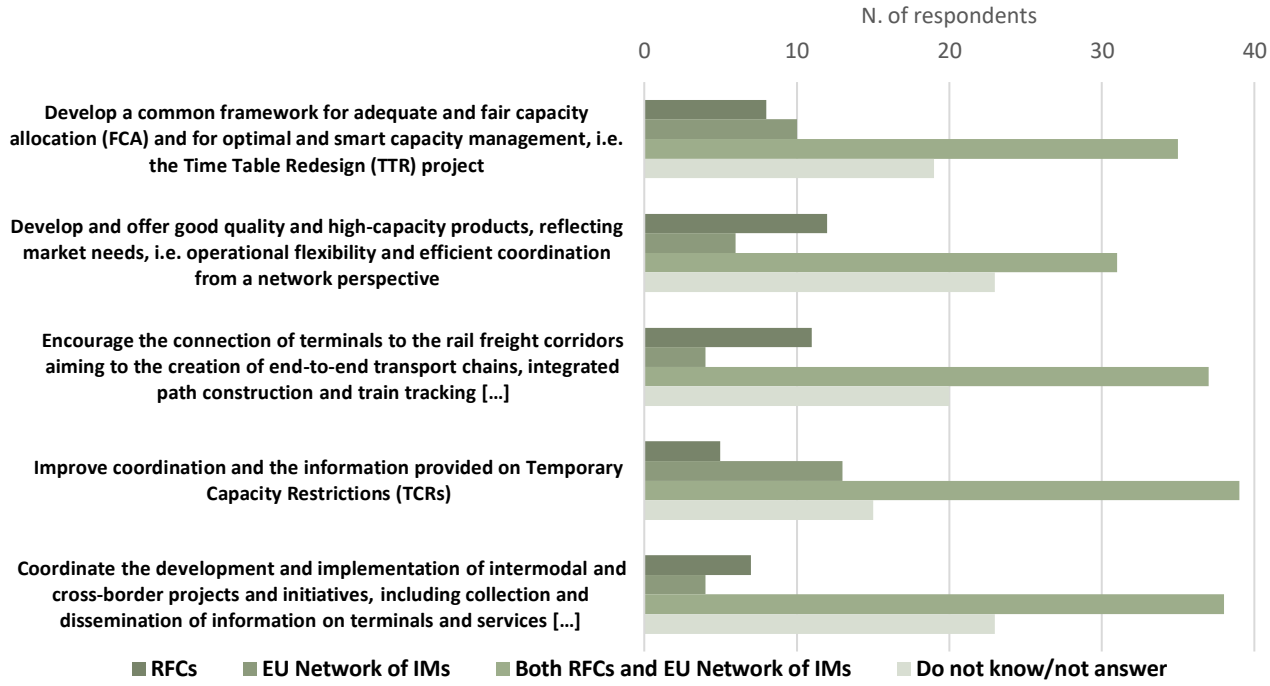
Figure 69 Expected changes based on current programmes/initiatives - Capacity Planning Issues



Source: 2023 11 RFCs Joint TMS Update; Notes: Question B) 3.RT

Also, for the improvement of capacity management-related issues, the best governance solution is deemed to be the cooperation between RFCs and an EU Network of Infrastructure Managers (IMs) (Figure 70).

Figure 70 Best fitting governance to bring the issue forward - Capacity Planning Issues

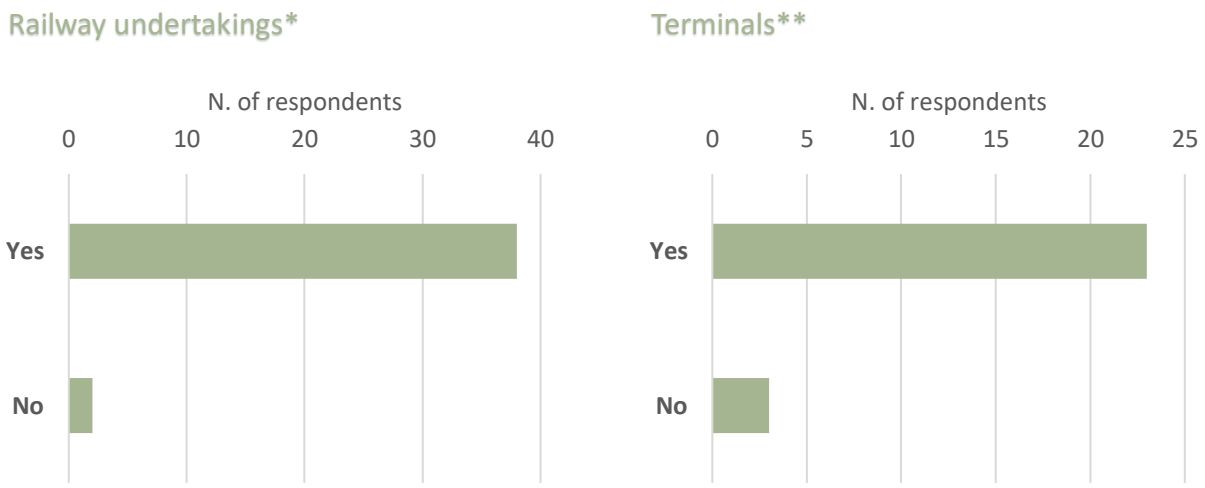


Source: 2023 11 RFCs Joint TMS Update; Notes: Question B) 3.RT

6.2 EXPERIENCED AND EXPECTED MARKET DEVELOPMENTS

Experienced and expected variations in the market have also been investigated as part of the 2023 11 RFCs Joint TMS Survey, which is further described in this section.

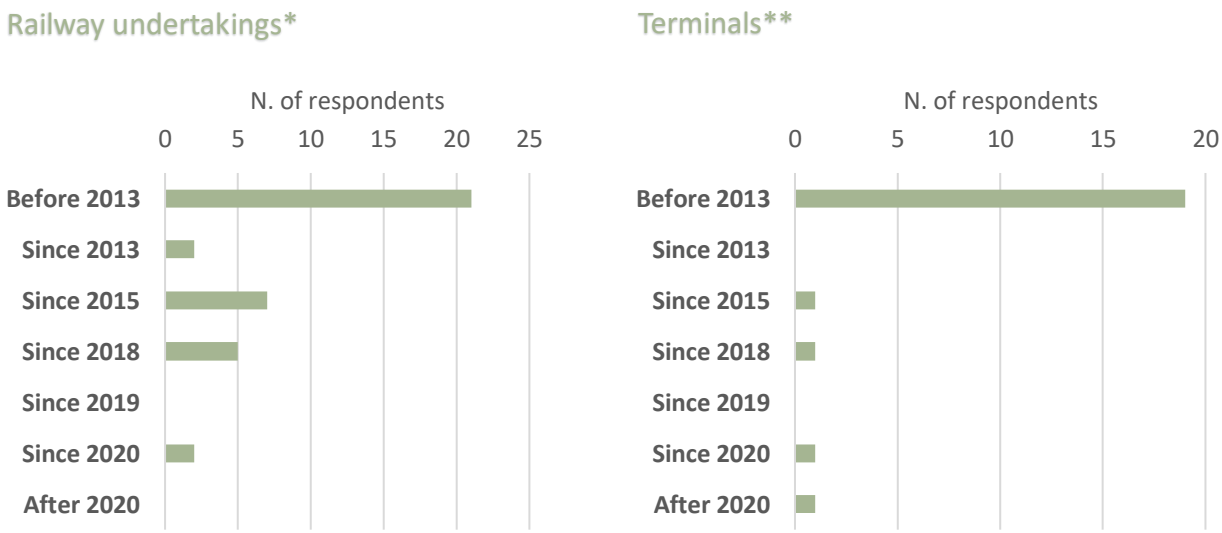
Figure 71 Respondent has operated/operates rail services or manages/operates terminals serving trains across at least one border crossing point(s) on any RFC



Source: 2023 11 RFCs Joint TMS Update; Notes: Questions C) 1.R and 1.T,
**40 out of 42 respondents, **26 out of 30 respondents*

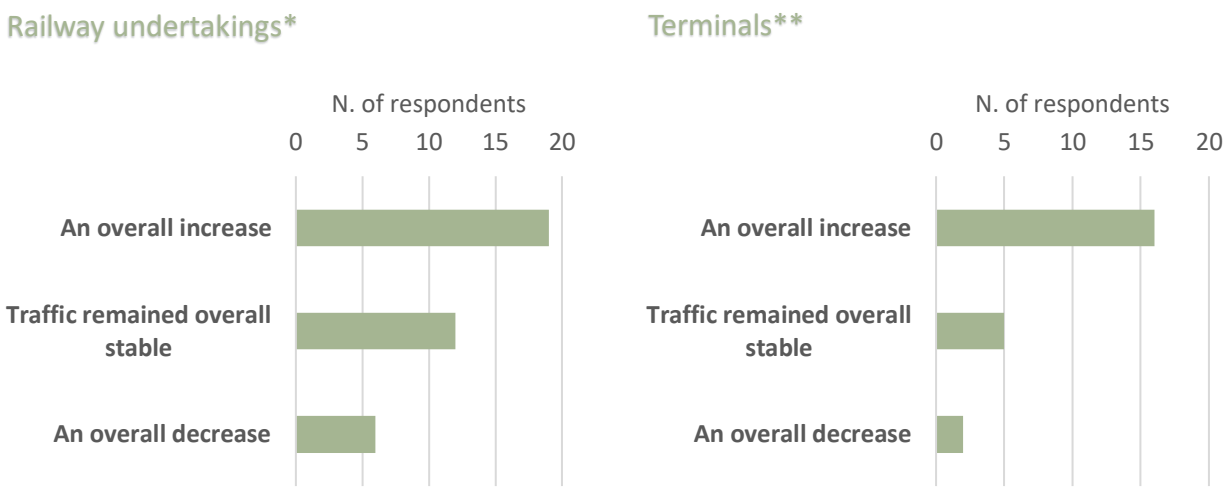
The vast majority of the respondents who participated in the survey operated or still operates rail services or manage/operate terminals serving trains across at least one border crossing point(s) on any RFC. Most of them also operated or served international rail freight transport before the establishment of the RFCs.

Figure 72 Respondent has operated/operates rail services or manages/operates terminals serving trains across at least one border crossing point(s) on any RFC



Source: 2023 11 RFCs Joint TMS Update; Notes: Questions C) 1.1R and 1.1T,
**37 out of 42 respondents, ** 23 out of 30 respondents*

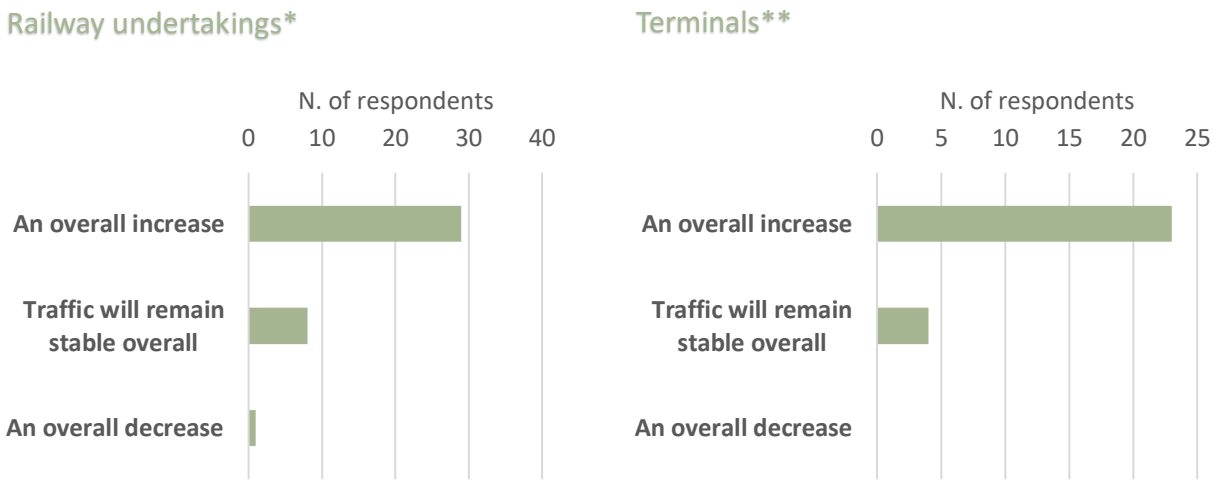
Figure 73 Variation in the operation of trains and in serving trains crossing at least one border crossing point(s) on any RFC since 2013



*Source: 2023 11 RFCs Joint TMS Update; Notes: Questions C) 1.2R and 1.2T, *37 out of 42 respondents, ** 23 out of 30 respondents*

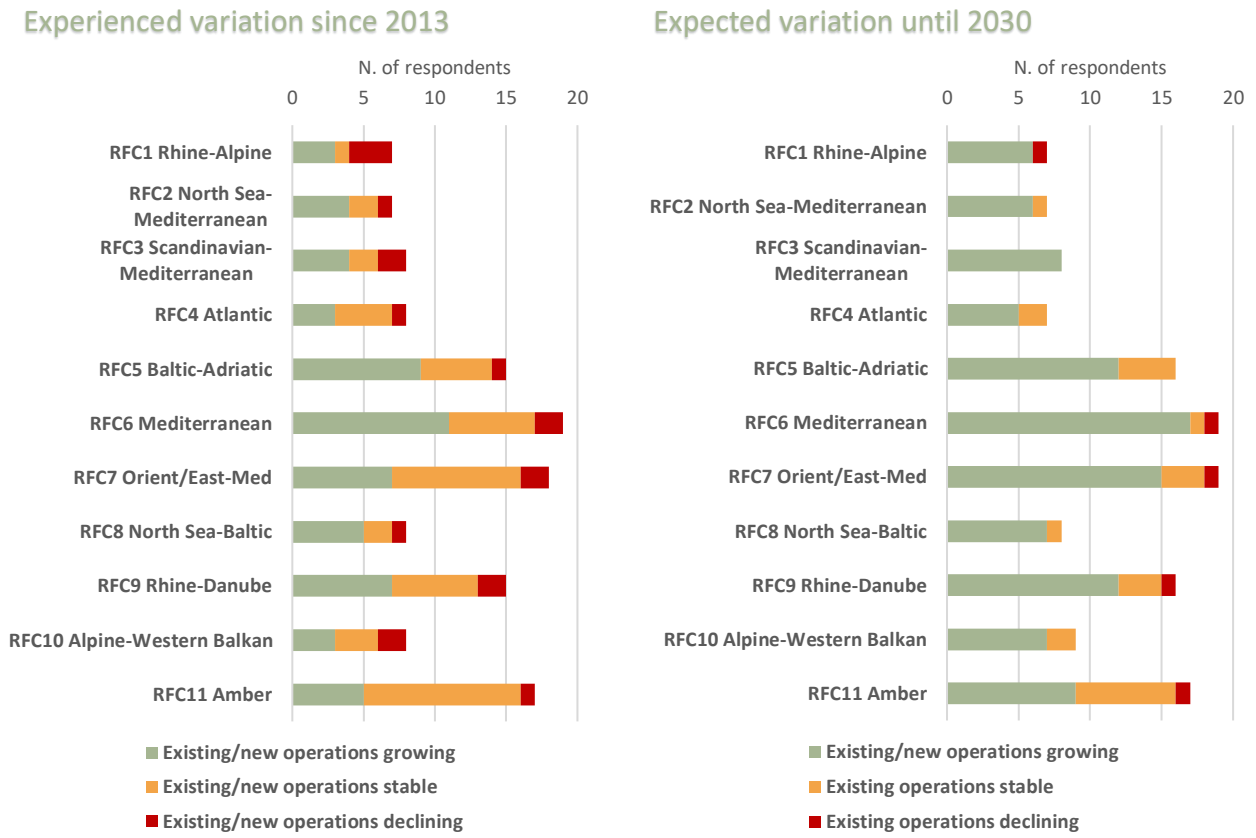
The majority of the respondents declare they experienced an increase in their operations since 2013 (Figure 73), and most of them also have a positive expectation about the future, expecting overall market growth (Figure 74).

Figure 74 Variation in the operation of trains and in serving trains crossing at least one border crossing point(s) on any RFC in the short term until 2030



*Source: 2023 11 RFCs Joint TMS Update; Notes: Questions C) 2.R and 2.T, *38 out of 42 respondents, ** 23 out of 30 respondents*

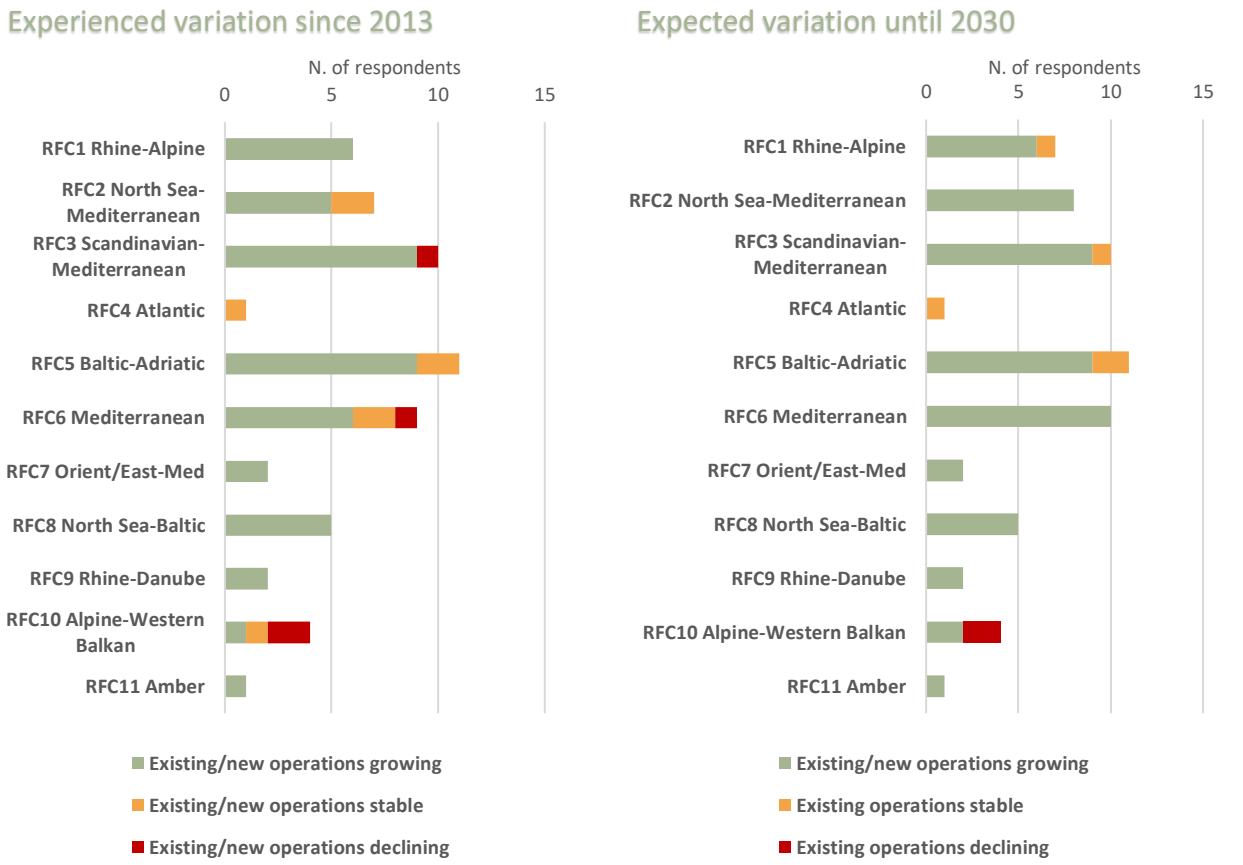
Figure 75 Experienced and expected traffic trends according to the trains operated by RUs, crossing at least one border crossing point(s) on any RFC



Source: 2023 11 RFCs Joint TMS Update; Notes: Question C) 3.R

The variation in traffic experienced by RUs since 2013 differs from RFC (Figure 75). The majority of the respondents declare they experienced market growth along the NSM, SCAN-MED, BA, MED, NSB, and RD RFCs, whereas a prevailing stable trend is registered for the ATL, OEM, AWB, and Amber RFCs. For RALP, the number of growing and declining registered trends are similar. The expectation for the future (2030) is generally positive for all RFCs.

Figure 76 Experienced and expected traffic trends on corridors according to the trains served at terminals, crossing at least one border crossing point(s) in any RFCs



Source: 2023 11 RFCs Joint TMS Update; Notes: Question C) 3.T

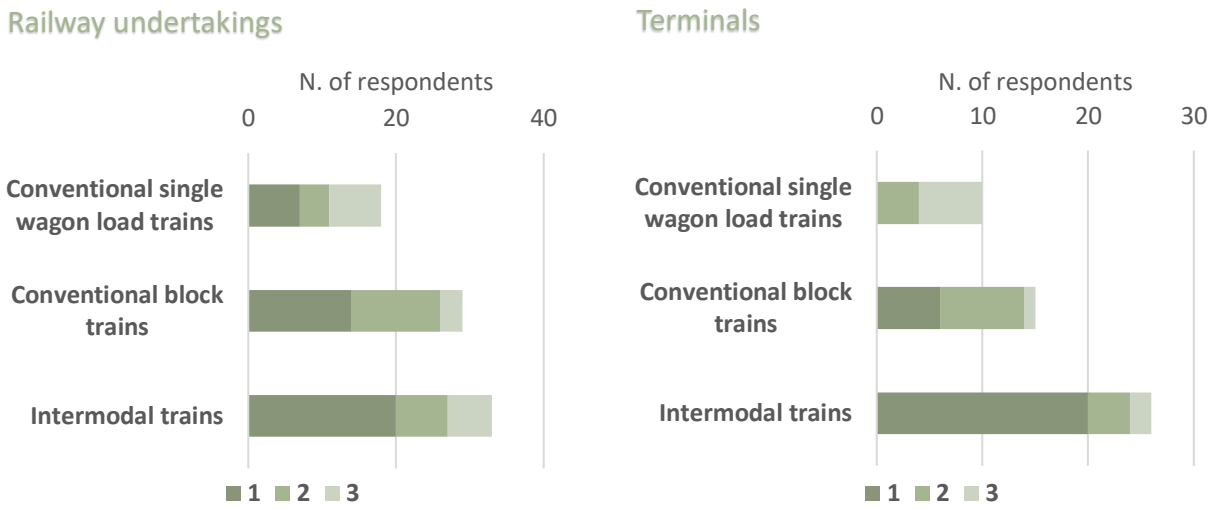
The variation in traffic experienced by terminal operators since 2013 and the expected growth are generally positive, except for the ATL and AWB RFCs (Figure 76). The prevailing response is pessimistic about the experienced variation, whereas the number of growing and declining registered trends is similar regarding future expectations.

Figure 77 Type of trains operated by railway undertakings or served at terminals crossing at least one border crossing point(s) in any RFCs

Source: 2023 11 RFCs Joint TMS Update; Notes: Questions C) 4.R and 4.T

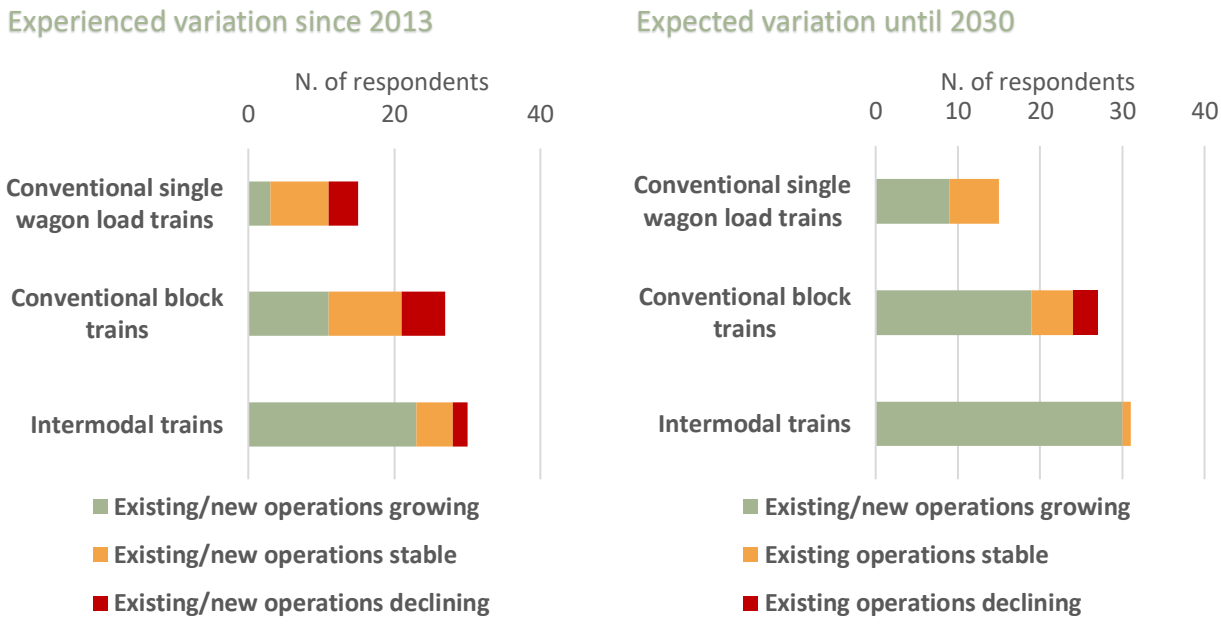
The prevailing type of international trains operated on the 11 RFCs Network consists of intermodal trains, followed by conventional block trains and single wagonload trains (Figure 77 and Figure 78).

Figure 78 Ranking of type of trains operated by railway undertakings or served at terminals crossing at least one border crossing point(s) on any RFC



Source: 2023 11 RFCs Joint TMS Update; Notes: Questions C) 4.R and 4.T; Note: 1= first, 2=second, 3= third

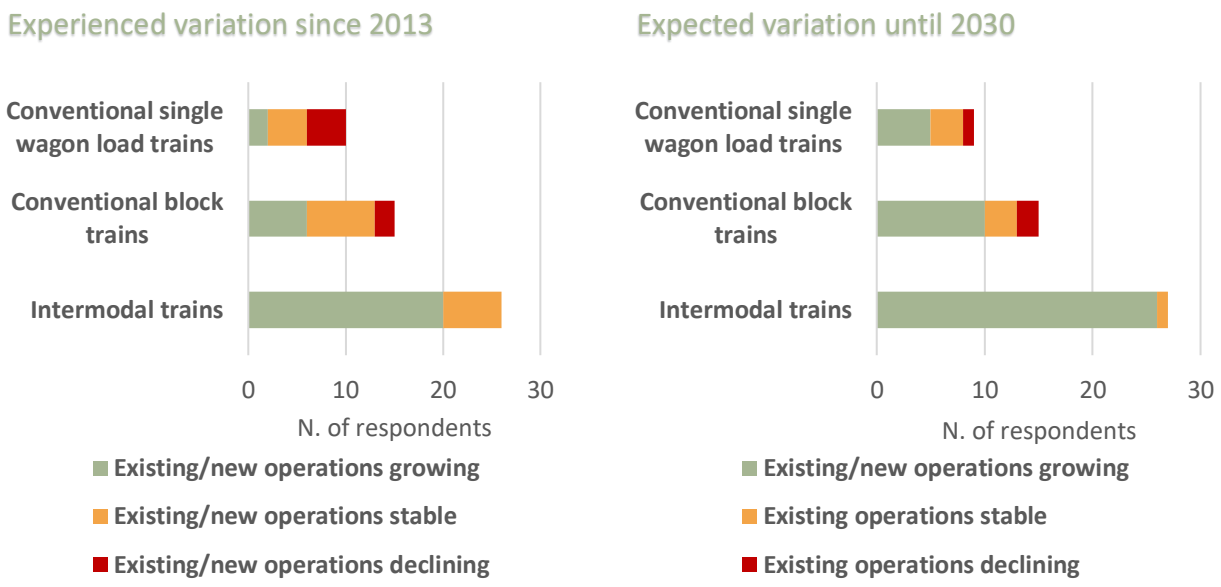
Figure 79 Experienced and expected traffic trend on the type of trains operated by RUs crossing at least one border crossing point(s) in any RFCs



Source: 2023 11 RFCs Joint TMS Update; Notes: Question C) 4.R

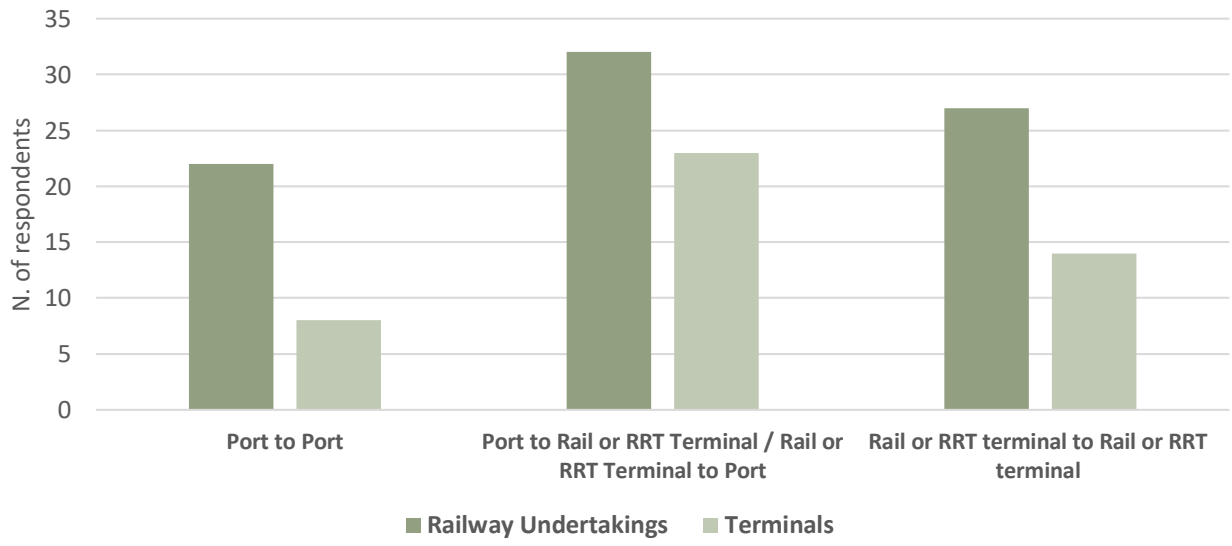
Most RUs and terminal operators experienced growth in intermodal train operations in the past years (Figure 79 and Figure 80), whereas the trend for conventional block and single wagonload trains is predominantly stable. Most respondents have a positive expectation for the future in terms of traffic growth for all market segments.

Figure 80 Experienced and expected traffic trend on the type of trains served at terminals crossing at least one border crossing point(s) in any RFCs



Source: 2023 11 RFCs Joint TMS Update; Notes: Question C) 4.T

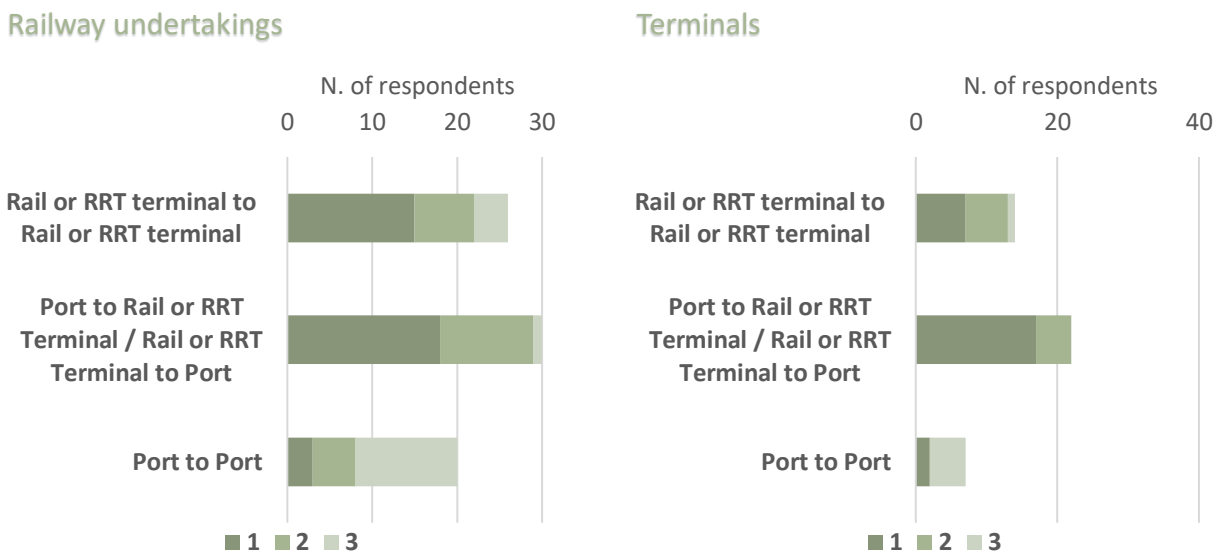
Figure 81 The type of O/Ds of the trains operated by railway undertakings or served at terminals crossing at least one border crossing point(s) on any RFC



Source: 2023 11 RFCs Joint TMS Update; Notes: Questions C) 5.R and 5.T

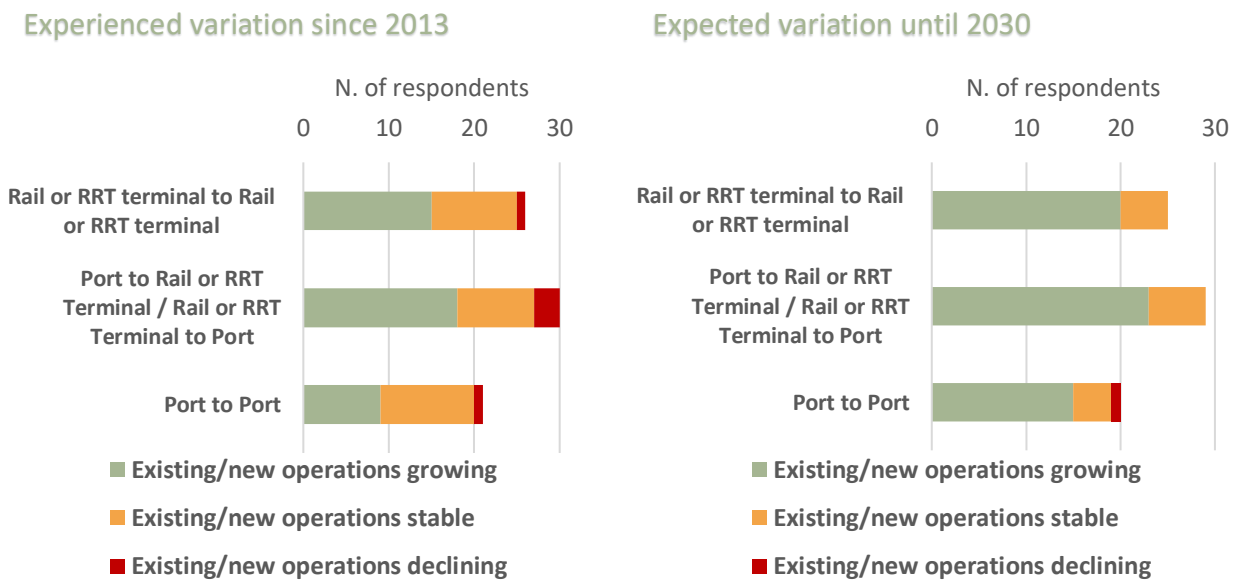
Most operations relate to Port to Rail-Road Terminal (RRT) transport, followed by RRT to RRT services and Port to Port operations (Figure 81 and Figure 82).

Figure 82 Ranking of the types of O/Ds of the trains operated by RUs or served at terminals crossing at least one border crossing point(s) on any RFCs



Source: 2023 11 RFCs Joint TMS Update; Notes: Questions C) 5.R and 5.T; Note: 1= first, 2=second, 3= third

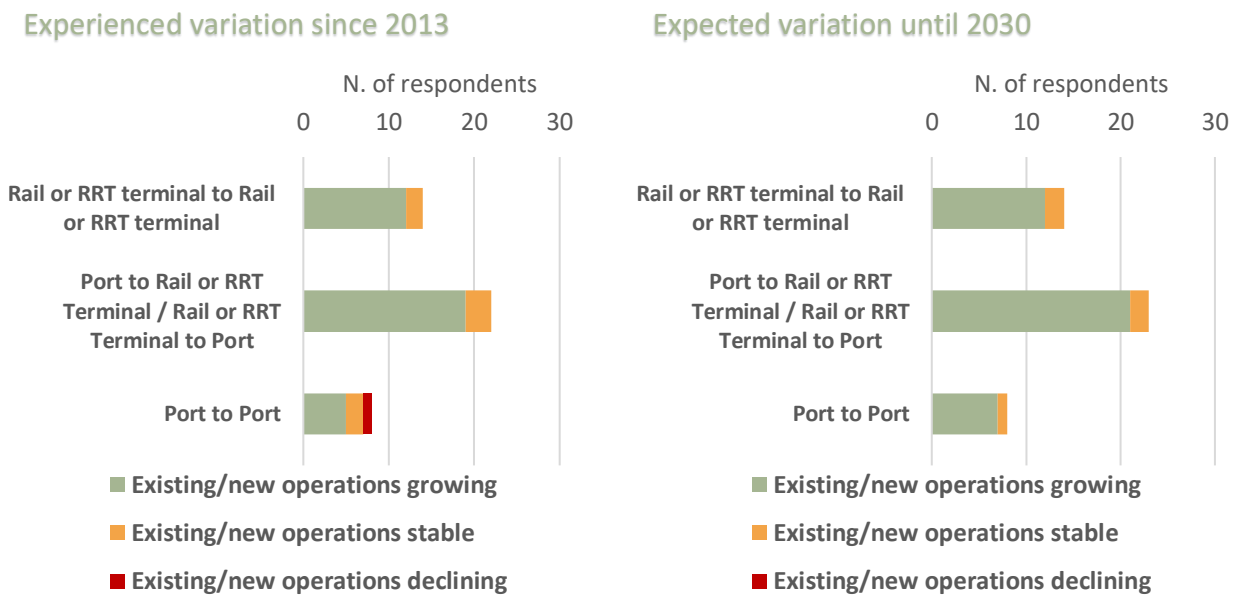
Figure 83 Experienced and expected traffic trend on the type of O/Ds of the trains operated by RUs crossing at least one border crossing point(s) in any RFCs



Source: 2023 11 RFCs Joint TMS Update; Notes: Question C) 5.R

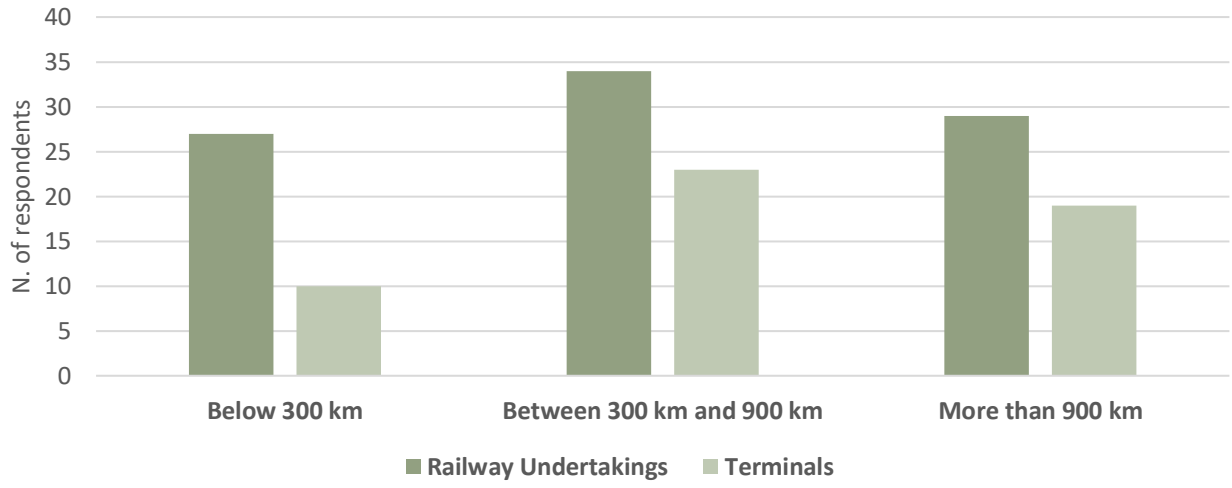
Experienced variations by RUs were mostly positive for the Port to RRT or RRT to RRT segments and stable for the Port to Port one (Figure 83). Terminal operators have predominantly experienced growing trends in all market segments in the past years (Figure 84). The vast majority of RUs and terminal operators are expecting positive future trends for the three market segments (Figure 83 and Figure 84).

Figure 84 Experienced and expected traffic trend on the type of O/Ds of the trains served at terminals crossing at least one border crossing point(s) in any RFCs



Source: 2023 11 RFCs Joint TMS Update; Notes: Question C) 5.T

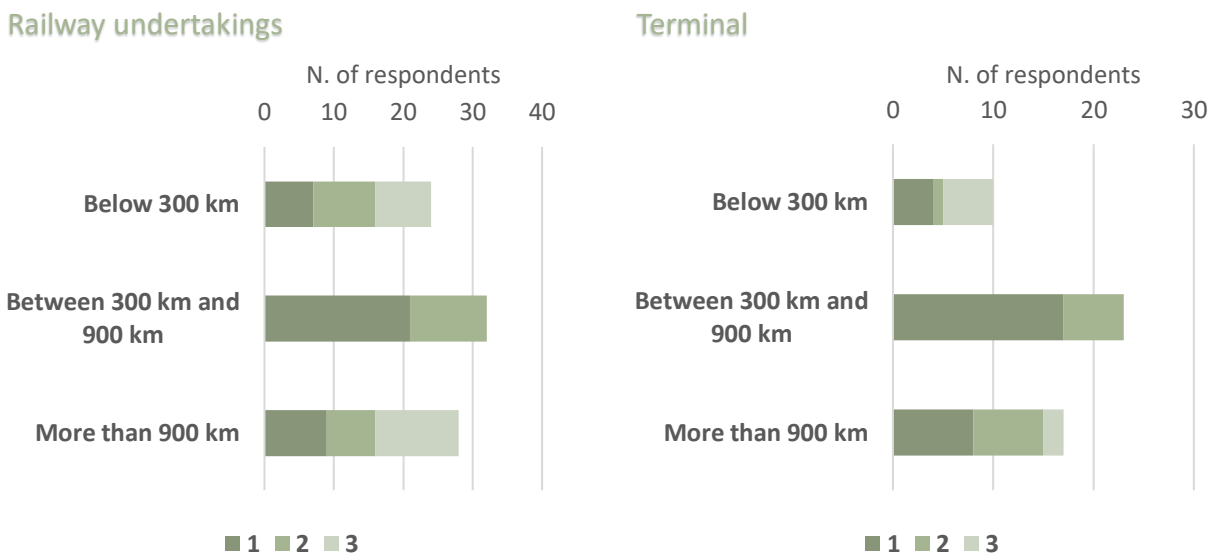
Figure 85 Type of distances of the trains operated by railway undertakings or served at terminals crossing at least one border crossing point(s) in any RFCs



Source: 2023 11 RFCs Joint TMS Update; Notes: Questions C) 6.R and 6.T

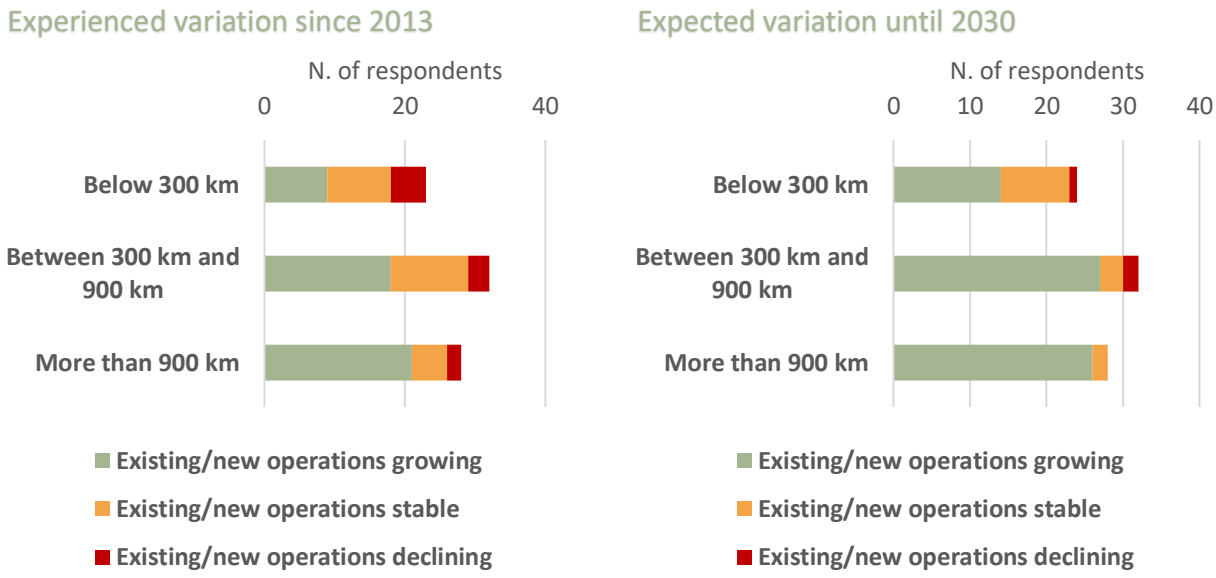
Most international train operations cover distances between 300 km and 900 km, followed by services covering distances longer than 900 km and below 300 km (Figure 85 and Figure 86).

Figure 86 Ranking of types of distances of the trains operated by railway undertakings or served at terminals crossing at least one border crossing point(s) in any RFCs



Source: 2023 11 RFCs Joint TMS Update; Notes: Questions C) 6.R and 6.T; Note: 1= first, 2=second, 3= third

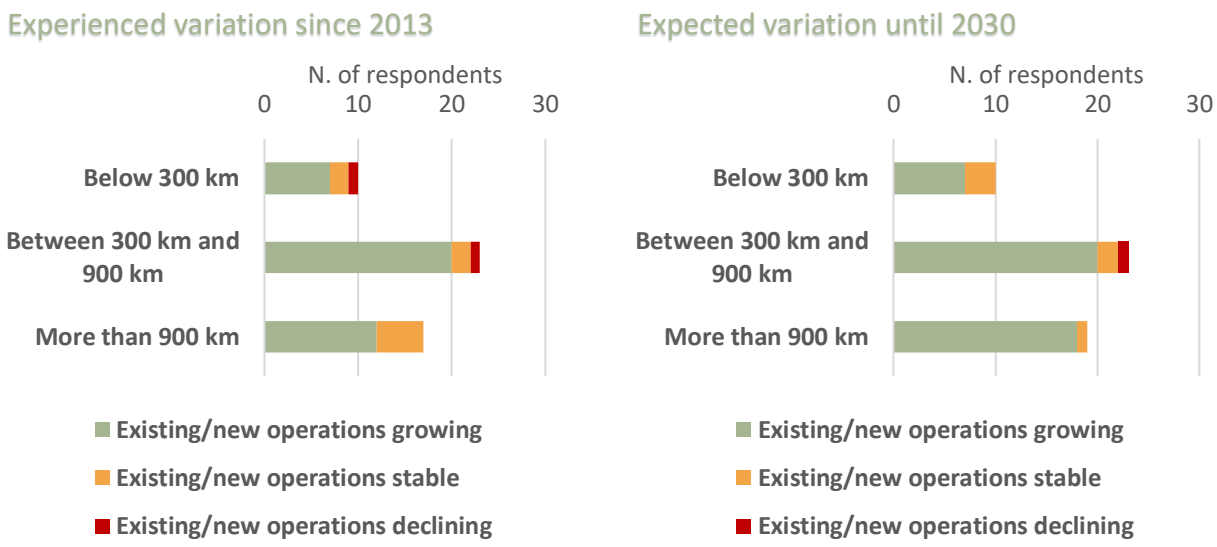
Figure 87 Experienced and expected traffic trend on type of distances of the trains operated by RUs crossing at least one border crossing point(s) in any RFCs



Source: 2023 11 RFCs Joint TMS Update; Notes: Questions C) 6.R

RUs experienced mostly positive variations for services covering distances longer than 300 km and declared the market is stable for operations below 300 km (Figure 87). Terminal operators have predominantly experienced growing trends in all market segments in the past years (Figure 88). The vast majority of RUs and terminal operators are expecting positive future trends for the three market segments.

Figure 88 Experienced and expected traffic trend on type of distances of the trains or served at terminals crossing at least one border crossing point(s) in any RFCs

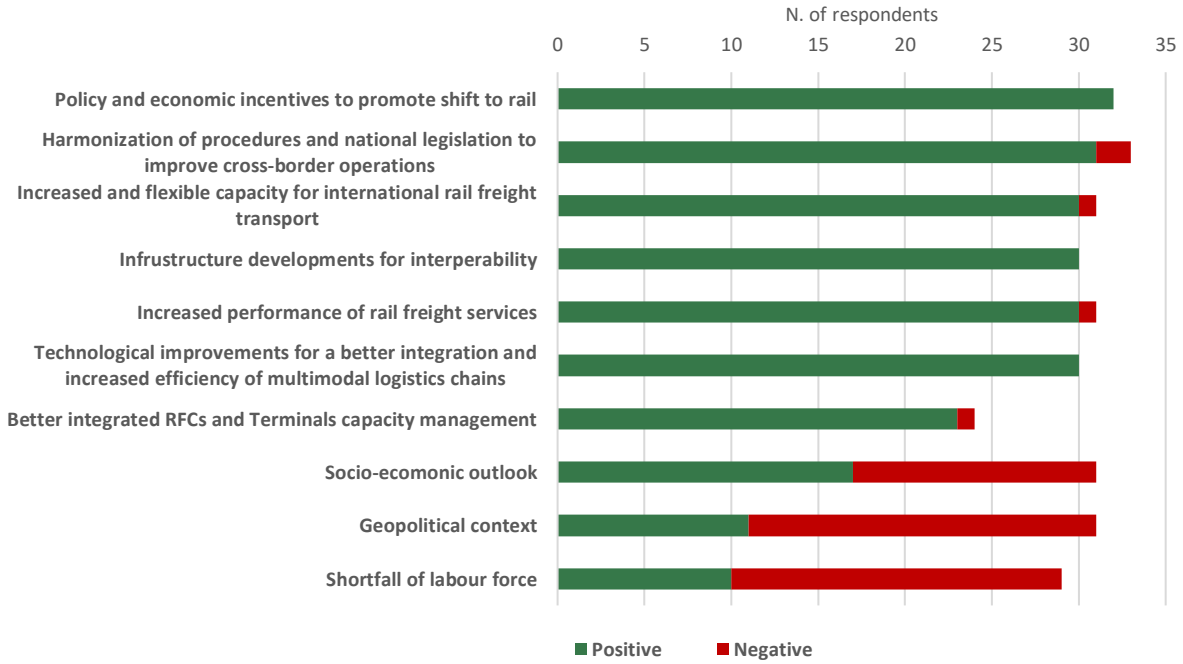


Source: 2023 11 RFCs Joint TMS Update; Notes: Questions C) 6.T

6.3 MARKET DRIVERS

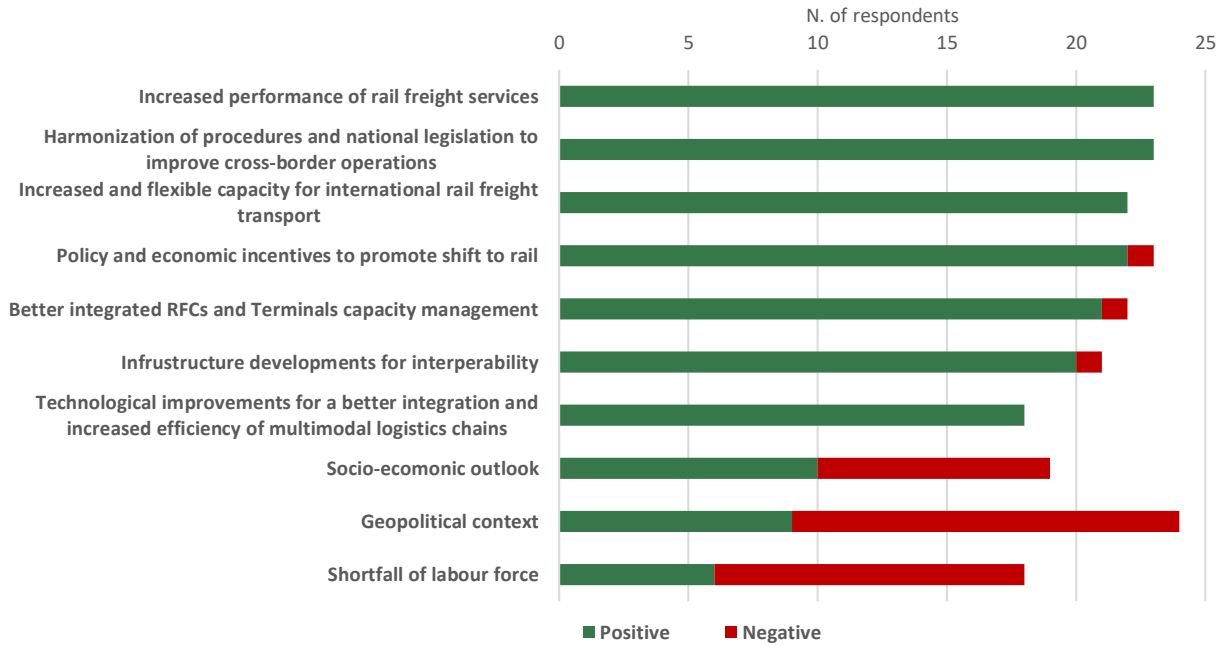
RUs and terminal operators have very similar views about the effects of the main market drivers on the growth of international rail freight transport in the short term, i.e., up until 2030 (Figure 89 and Figure 90). Most identified drivers are expected to have positive effects as they are assumed to improve rail transport's competitiveness. At the same time, the geopolitical context, the socio-economic outlook as well as the shortfall of the labour force are perceived as threats.

Figure 89 Potential effect of market drivers on the evolution of international rail freight transport operated by RUs until 2030



Source: 2023 11 RFCs Joint TMS Update; Notes: Question C) 7.RT

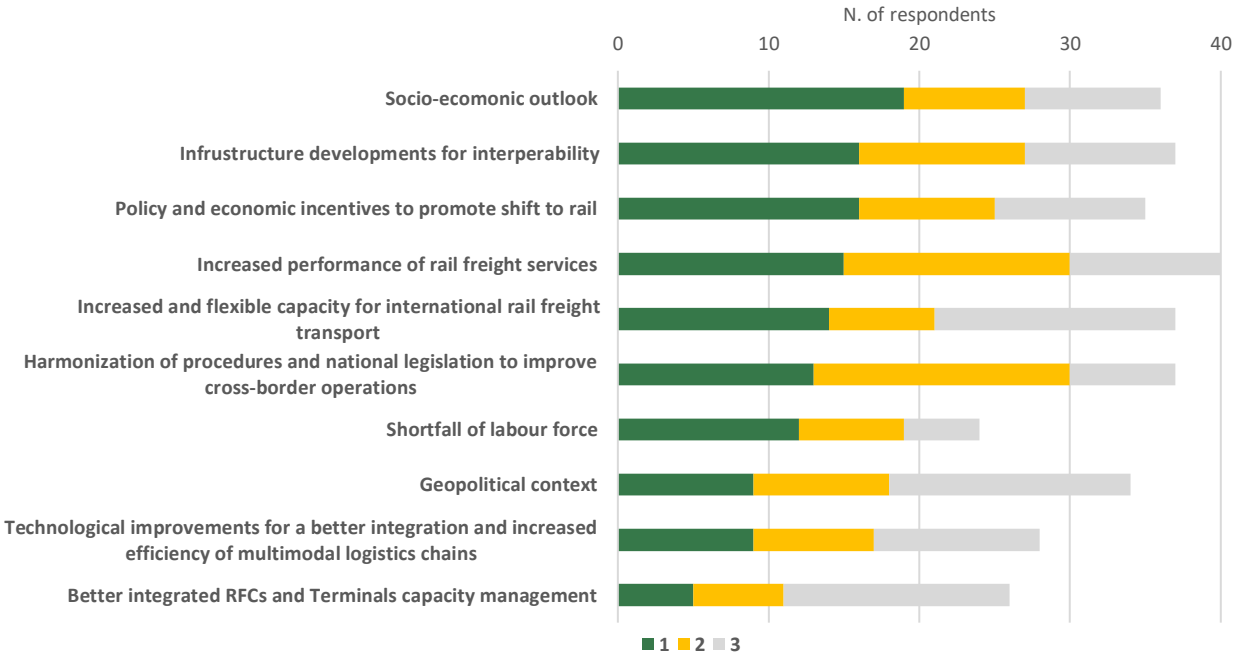
Figure 90 Potential effect of market drivers on the evolution of international rail freight transport served at terminals until 2030



Source: 2023 11 RFCs Joint TMS Update; Notes: Question C) 7.RT

Market players rank as most relevant market driver the socio-economic outlook (Figure 91). This is followed by "infrastructure developments for interoperability", "policy and economic incentives to promote shift to rail". "increased performance of rail freight services" and "harmonisation of procedures and national legislation to improve cross-border operations" are the two most relevant market drivers, according to the respondents, if considering both first- and second-ranking options.

Figure 91 Ranking of the most relevant short-term market drivers for RUs and Terminals



Source: 2023 11 RFCs Joint TMS Update; Notes: Question C) 7.RT

Although indicated as having a potential negative impact on the market, labour shortages and geopolitical context are not among the most critical market drivers. Finally, “technological improvements towards better integration and increased efficiency of multimodal logistics chains” and “better-integrated RFCs and terminal capacity management” do not seem to be considered priority issues by the RUs and terminal operators.

7 KEY FINDINGS AND RECOMMENDATIONS ON FACILITATING AND STRENGTHENING RAIL FREIGHT MARKET ALONG THE 11 RFCS NETWORK AND THE RFC AWB

The European Commission introduced the European Green Deal at the end of 2019, representing Europe's long-term comprehensive strategy to make the European continent carbon-neutral by 2050. To implement the European Green Deal and support the achievement of its ambitious goals, the European Commission updated between 2020 and 2021 all main economic sector policies, including for transport and mobility. About one year after the adoption of the European Green Deal, the European Commission published its Smart and Sustainable Mobility Strategy, replacing the 2011 White Paper. To support the achievement of the ambitious target of the European Green Deal, of reducing transport emissions by 90% by 2050 (compared to 1990 levels), the Sustainable and Smart Mobility Strategy sets specific milestones for the rail sector, i.e., doubling passenger high-speed rail traffic by 2030 and tripling it by 2050, while increasing rail freight by 50% by 2030 and doubling it by 2050 (compared to 2015 levels).

To make the above vision and targets a reality, the strategy identifies a total of 82 initiatives in 10 key areas for action, including one dedicated to the greening of freight transport, proposing measures to make freight transport more efficient and more sustainable, by improving rail infrastructure management, offering stronger incentives for low-emission lorries, and better information on freight transport greenhouse gas emissions. The Greening Freight Transport flagship action of the Smart and Sustainable Mobility Strategy involves three main measures:

- A new regulation on the use of railway infrastructure capacity in the single European railway area, amending Directive 2012/34/EU and repealing Regulation (EU) No 913/2010[22] aimed at optimising use of the railway infrastructure, improving cross-border coordination, increasing punctuality and reliability, and ultimately attracting more freight to rail. Current rules on capacity management are decided annually, nationally and manually. This does not favour cross-border traffic (around 50% of rail freight crosses borders); the fractured approach leads to delays at borders. This, in turn, hinders the functioning of the Single Market. Delays due to congestion caused by uncoordinated maintenance work are also common. The proposal for a regulation on the use of railway infrastructure capacity in the single European railway area builds on the industry-led Timetable Redesign Project. The aim is to better respond to the different needs of the rail sector: stable timetables and early booking of tickets for passenger services, and flexible train runs adapted to just-in-time supply chains for freight shippers.
- A new directive 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[23]. More than 50% of freight is carried by road in the EU (2020 figures), and this transport is a major contributor to greenhouse gas emissions. The current Weights and Dimensions Directive sets the maximum weight length, width and height for heavy-duty vehicles. The proposed directive revises these rules to allow additional weight for vehicles using zero-emission technologies, as they tend to increase a vehicle's weight. This is expected to incentivise the take-up of cleaner vehicles and technologies.

[22] https://transport.ec.europa.eu/document/download/9393e22e-72ee-440d-a983-e2ee116e11ba_en?filename=COM_2023_443_0.pdf
[23] https://transport.ec.europa.eu/document/download/6d96dca5-11f2-4499-81cd-b3d44b67a73d_en?filename=COM_2023_445_0.pdf

The uptake of more aerodynamic cabins and other energy-saving devices will also be encouraged increasing the efficiency of zero-emission powertrains (further to improving driver comfort and safety). The proposal also provides clarity on the use in cross-border traffic, in certain conditions, of heavier and longer vehicles, which are allowed today in some Member States. This includes clarifying that Member states who allow European Modular Systems (EMS) in their territories will also be able to use them in international operations among these neighbouring Member States, without a need for a bilateral agreement and without a restriction of crossing only one border. As a results, the same amount of cargo can be carried in fewer trips. Finally, to encourage intermodal transport, whereby goods are moved using more transport modes but with a standardised cargo unit (like a container trailer or other), lorries, trailers and semitrailers will be allowed to carry extra weight. Extra height will also facilitate the transport of high-cube containers by standard vehicles.

- A new regulation on the accounting of greenhouse gas emissions of transport services[24], defining a new methodology for companies to calculate their greenhouse gas emissions if they choose to publish this information, or if they are asked to share it for contractual reasons. The method is based on the recently adopted ISO/CEN standard for the quantification and reporting of greenhouse gas emissions arising from the operation of transport chains of passengers and freight. Reliable data on door-to-door emissions will enable operators to benchmark their services and allow consumers to make informed choices on transport and delivery options.

The Greening Freight Transport package is part of a broader effort to make mobility and transport more sustainable. It follows on from the key components of the Fit for 55 package, such as its targets for recharging and refuelling stations, and for the deployment of sustainable fuels in aviation and maritime transport. To complement these proposals, the European Commission is also revising the Combined Transport Directive, as part of which it will consider a range of regulatory, operational and economic measures to make intermodal transport more competitive.

Finally, the Green Freight Transport package of proposals also complements the revised Trans-European Transport Network (TEN-T) policy through incentives and requirements for infrastructure development, and by better integrating the different modes within a multimodal transport system. Digital technologies are also helping to increase efficiency, including the European Rail Traffic Management System and Digital Automatic Coupling for rail, the Electronic freight transport information Regulation and the European Maritime Single Window environment.

With reference to the 50% rail target growth set in the EU policies for the period 2015-2030, Table 35 transport volume figures in million tkm for the EU27 in 2015, and 2022. Data show that the gap to be filled between 2023 and 2030 is significant, especially for the international segment.

Table 35 Freight volume (million tkm) in 2015 and 2022

	2015	2022	Var. % '15-22
International rail freight transport	155,289	149,032	-4%
National rail freight transport	181,811	199,830	10%
Total rail freight transport	337,100	348,862	3%

Source: Eurostat [rail_go_typepas]; Notes: (1) Data for Belgium are excluded from the total as they are not available for 2015 and 2022. (2) Data are limited to main undertakings

[24] https://transport.ec.europa.eu/document/download/6fd194f0-1618-45c8-822e-1b13e808eb23_en?filename=COM_2023_441.pdf

7.1 SUMMARY OF KEY FINDINGS OF THE STUDY

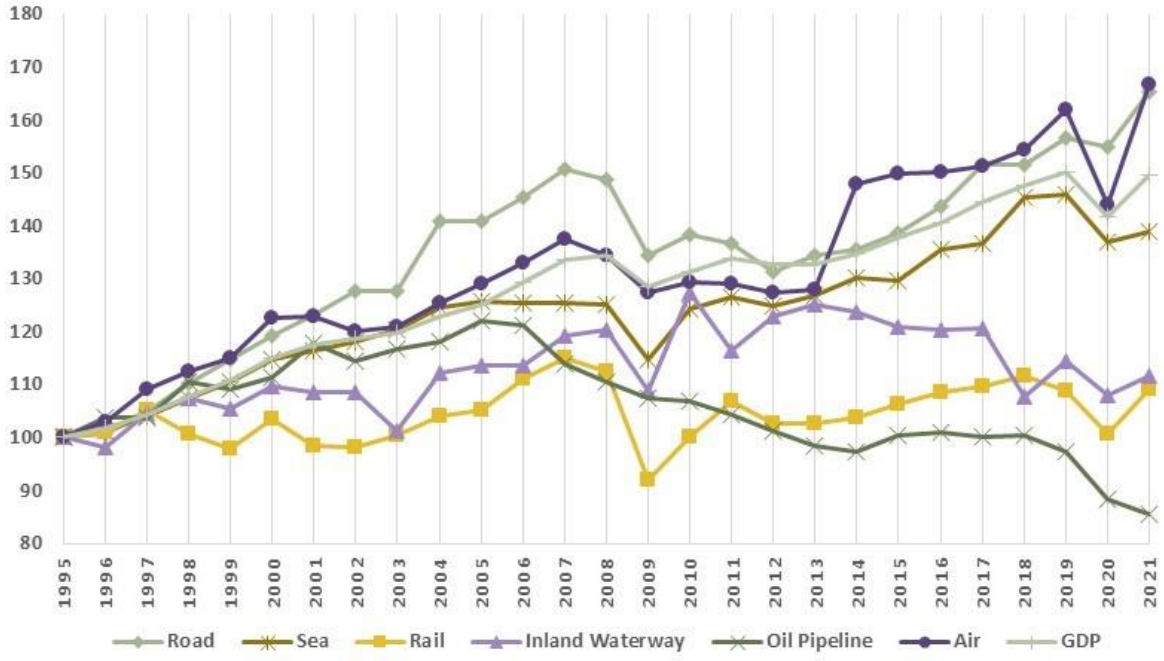
7.1.1 THE RAIL FREIGHT MARKET IN EUROPE AND ON THE RFC AWB

Overall market trends and sector developments

An analysis of the available statistics was performed as part of the study based on the data available from the EC DG MOVE/Eurostat (Statistical Pocketbook 2023 and RMMS Rail Market Monitoring Report) and from the Independent Regulators Group (IRG) (Rail Market Monitoring Reports). The analysis provides an overview of the development of the European rail freight sector since mid of the 1990s when the rail freight market liberalization started, allowing monitoring trends before and after the 2008 credit crunch, which is considered the second major financial crisis after the 1930s Great Depression, and which was followed by additional adverse events during the past 10-15 years when the 11 RFCs were gradually established and entered into operation. Key findings from the statistical analysis are as follows:

- The period between the entry into force of Regulation (EU) 913/2010 has indeed been marked by a number of socio-economic, health and geopolitical events which negatively impacted trade and transport flows at the global and European scale. The statistical review shows that the 2008 financial crisis basically altered the economic and transport developments experienced by Europe over the previous decades. EU27 long-term series over the past 30 years show that the effects of this crisis are persisting: albeit positive, the trend of GDP and most transport modes of the following period stands indeed at lower growth rates. Overall, the European rail freight market grew modestly over the last decade, contrasting with the strong development experienced between 2001 and 2008. The EU economy and transport markets were more recently further impacted by the 2020-2021 COVID-19 pandemic and by the current geopolitical crisis that started in 2022 with the Russian-Ukrainian war and deteriorated with the Israel-Gaza conflict and Red Sea crisis.

Transport trends in billion tkm EU27 (1995=100)



Source: EC – DG MOVE – Statistical Pocketbook 2023

- Rail freight transport between 2013 and 2021 marginally grew in the EU27 from about 385 billion tkm to 410 billion tkm, i.e. 7%, which is only half the rate of growth of total transport volumes and GDP. However, over the same period combined transport more than doubled from about 41 billion tkm to 100 billion tkm. Trends for the RFC AWB concerned countries are similar to the EU ones, specifying that the growth of rail freight transport registered higher rates. In the RFC AWB concerned countries rail freight transport grew indeed from about 31 to 38 billion tkm, i.e. 19%.
- The RFC AWB countries are among the ones registering relatively high rail modal share in the EU. Two out of four RFC AWB countries (Austria and Slovenia) are indeed positioned within the ten first-ranking EU countries for rail modal share in 2022. However, Austria is also among the ones that are registering a high decline in rail modal share over time. A trend that is likely related to the change in the commodity basket trade.
  At both EU 27 and RFC AWB concerned country levels, there is an underlying stagnation or decline of dry and liquid bulk commodities (originating even from before the mid of the 1990s), associated with a growth of intermodal transport, a market segment that is apparently growing with the gradual opening of the rail freight market and greening of logistics chains. The market share of rail transport is slightly declining in Austria, and stable or slightly growing in the other countries.
- At the EU27 scale, the COVID-19 pandemic seems to have had different impacts on rail freight traffic measured in net tkm, with either increases or decreases in transport volumes between 2019 and 2021. The impact has been apparently significant in the Baltic States, Denmark, Luxembourg and Portugal, whereas Bulgaria and Greece experienced about 20% growth. Except Belgum and Luxembourg, the RFC AWB concerned countries seem to have registered positive variations during the pandemic period.
- Since the start of the rail freight liberalisation process late 1990's and 2000's, the market share of the domestic incumbent railway undertakings gradually declined in most EU Member States, whereas the market share of non-incumbents increased together with the operations of foreign incumbents. As a general pattern, common to the EU27 and RFC AWB concerned countries, the trend of the market share by domestic incumbents continued to decline in the period 2013-2021. In the RFC AWB concerned countries, the market share of the domestic incumbent in 2021 was about 65%.

Analysis of the current and future freight transport market along the 11 RFCs Network

As part of the 2024 Joint TMS Update, an analysis of the current and future market has been done using an EU-wide NEAC model, combining transport and economic statistics at the EU scale with train traffic data available from RNE databases, TIS.

Within the 11 RFCs network areas, rail freight transport in 2022 accounts for 18% of the total international freight transport volume, which is approximately 265 million tonnes. This relates to approximately 442,000 trains[25].

For the analysis of the future short-term market trends, at the 2030-time horizon, three scenarios have been simulated. The first one only simulates economic growth (EU Reference); another one simulates the effects of the completion of major transport investments currently ongoing or expected to be finished by 2030 (Projects); and an additional one simulates the impact of the completion of the 11 RFCs Network in line with TEN-T standards, regardless the possibility to implement the required projects (Sensitivity). The three

[25] An average volume per train of 600 tonnes is assumed.

scenarios show an increase in international freight transport in general. Within the 11 RFCs Network catchment area, due to economic growth (EU Reference), the increase in general is about 13%. This is in line with the GDP growth for the EU27, which is 17%. IWW shows a growth of 13%, road has a growth of 14% and rail transport of 13%. In the absence of further developments, the rail freight market is expected to grow at a slower pace compared to GDP and to the overall transport sector, therefore losing market share. This is due to the changing trends in the basket of transported commodities and differentiated geographic demand growth distribution. For all land freight transport, the projects scenario and the sensitivity scenario have a limited impact on the overall growth of international freight transport.

Focusing on international rail freight transport, the reference scenario expects a growth of 13%, which is approximately 35 million tonnes extra compared to the 2022 situation. Both the Projects scenario and the Sensitivity scenario show the impact of the different rail projects and rail measures. In the Projects scenario, rail transport grows an extra 2% compared to the reference scenario (300 million tonnes to 313 million tonnes) due to projects. In total it is estimated that this is approximately 13 million tonnes of extra international rail freight transport.

The hypothetical sensitivity scenario shows that compared to the reference, there is a potential of 58 million tonnes extra rail freight transport due to longer trains, ERTMS, and standard gauge in Spain. The total expected rail freight transport volumes in this scenario reaches 361 million tonnes, corresponding to a 20% growth compared to the reference.

Considering both economic and infrastructure developments, the sensitivity scenario can be regarded as a potential maximum growth for rail transport across the 11 RFCs Network. Compared to the 2022 base year, transport volumes would increase from 265 to 361 million tonnes i.e. by 36%, out of which around 1/3 is due to economic development and 2/3 to infrastructure investments.

As a result of the analysis performed, it is possible to conclude that the major planned projects along the 11 RFCs Network assumed to be completed by 2030 (see Section 3.3.2), and the modernisation of railway lines and cross-border sections in the Eastern European corridor countries, are fundamental to removing infrastructure bottlenecks and reducing travel times and transport costs. Such initiatives are expected to increase competitivity of rail transport on the 11 RFCs Network, and thus on each RFC, including the RFC AWB. Further to these projects, completing the 11 RFCs Network in line with the TEN-T requirements is key to increase the rail market share.

With reference to the 50% rail growth set in the EU policies for the period 2015-2030, the combined observed growth for the period 2015-2022 (-4%, see Table 35) and expected for the time frame 2023-2030 (+36%) still lags below the target. Therefore, the development of a high-quality 11 RFCs Network in line with TEN-T standards does not seem to be sufficient to achieve the ambitious targets set in the relevant European transport policies.

Such targets remain challenging to meet in the absence of a significant change in the structure of the costs of road and rail transport. Internalising external costs of road transport, and or incentives to reduce the costs of rail transport might be needed. The potentially negative impacts on rail market share of measures such as improving the efficiency of road transport shall also be considered, as also reported in a recent study by the Community of European Railway and Infrastructure Companies (CER) – *Study on Weights and Dimensions: Impacts of the Proposed Amendments to the Weights and Dimensions Directive on Combined Transport and*

Rail Freight Transport[26]. Market opening appears also to be relevant in increasing the competitiveness of rail transport. A recent study by the European Rail Freight Association (ERFA) – *The European Rail Freight Market; Competitive Analysis and Recommendations*[27] – considers how non-incumbent operators, focussing on the fast-growing intermodal and logistics train segments, are likely to experience further growth in market share in the 2020s. According to the study, competition amongst railway undertakings has made rail more attractive compared with road, which can be partially explained by the business model of non-incumbents, more focused (i.e., intermodal and logistics, block trains, and international traffic), lean and agile, and cost competitive, able to offer better service levels consistently.

Analysis of the current and future freight transport market along the RFC AWB

International freight transport across all modes in the catchment area of the RFC AWB amounts to 78 million tonnes. Overall, most transport concerns both cargo type *Other* (43%), and dry bulk (43%). The cargo type *Other* is mostly transported by road, while rail has a large share in the international transport of dry bulk (58%).

On relations within the catchment area of RFC AWB, rail freight transport has a share of 37% in the total amount of international freight transport. This is a volume of 29 million tonnes. The total amount of international rail freight transport of 29 million tonnes relates to approximately 29,000 trains within the corridor area of RFC AWB.

Looking within the corridor area, rail transport amounts to 8 million tonnes. This is equivalent to approximately 8.000 trains from and to locations within the corridor area of the RFC AWB.

The most important rail transport origins and destinations can be found in Slovenia and Austria, in locations such as Koper and Linz. The port of Koper serves as a gateway to the hinterland (mainly Austria) in the RFC AWB. The most important relation is between Koper/Ljubljana and Linz.

For the analysis of the future short-term market trends, at the 2030 time horizon, three scenarios have been simulated. The first one only simulates economic growth (EU Reference); another one simulates the effects of the completion of major transport investments currently ongoing or expected to be finished by 2030 (Projects); and an additional one simulates the impact of the completion of the 11 RFCs network in line with TEN-T standards, regardless the possibility to implement the required projects (Sensitivity).

The three future scenarios (Reference, Projects and Sensitivity) show an increase in international freight transport in the RFC AWB in line with what expected at the European level. Mainly due to autonomous economic growth, the increase in general is about 13%, in the RFC AWB slightly more at 15%. This is in line with the GDP growth for the EU27 which is 17%. In the RFC AWB, rail has a growth of 14%, inland shipping shows a growth of 23%, road has a growth of 15%, and sea shipping 12%. In the absence of further developments, the rail freight market is expected to grow at the same pace compared to GDP and to the overall transport sector, therefore slightly losing market share. For all land freight transport, the Projects scenario and the sensitivity scenario have an impact on the overall growth of international freight transport, especially in the RFC AWB.

In the RFC AWB, for the Reference scenario, a growth of international rail transport is expected at 14%, which is approximately 4 million tonnes extra compared to the 2022 situation. This would be (rounded) 4,000 extra

[26] https://www.cer.be/cer-reports/study-on-weights-and-dimensions
[27] https://erfarail.eu/news/the-european-rail-freight-market-competitive-analysis-and-recommendations

international freight trains in the RFC AWB. In the RFC AWB in 2022 the total amount of unique international freight trains is estimated at about 29,000. The total number of international trains would then be some 33,000 trains in the Reference situation in 2030.

The Projects scenario shows the impact of the different rail projects and rail measures. Rail transport grows an extra 6% compared to the reference scenario. In total it is estimated that this is approximately 2 million tonnes of extra international rail freight transport. This gives (rounded) 2,000 extra trains in the RFC AWB. Together with the Reference scenario results, this would be approximately 35,000 trains for the RFC AWB.

The Sensitivity scenario shows that there is another potential of 5 million tonnes extra rail freight transport due to longer trains, ERTMS, and standard gauge in Spain and Portugal. With an average volume of 690 tonnes per train (15% extra), the total number of unique international freight trains would then be around 35,000. Compared to the 48,000 unique trains in 2022, this is a growth of around 21%. This figure can be regarded as a potential maximum growth.

Overall, the sensitivity scenario can be regarded as a potential maximum growth for rail, considering both economic and infrastructure developments. Compared to the 2022 base year, transport volumes would increase from 29 to 40 million tonnes i.e. by 38%.

7.1.2 OCCURRED AND EXPECTED CHANGES DUE TO THE ESTABLISHMENT OF THE RFCS

In the absence of a consistent historical series of data and information on the operations along the 11 RFCs – worth also considering that the RFCs were established and entered into operation in different years between 2013 and 2020 and their alignment was adjusted over time to market needs – an e-survey was conducted as part of the 2024 Joint TMS Update – *2023 11 RFCs Joint TMS Update Survey* – to assess the occurred and expected changes associated with their establishment. The survey involved the Railway Undertakings Advisory Groups (RAGs) and Terminal Advisory Groups (TAGs) of the 11 RFCs. In total, 42 representatives of the RAGs and 30 members of the TAGs submitted valid questionnaires between September 2023 and January 2024.

The survey was conducted to collect the opinion of the 11 RFCs market on three main areas: occurred and expected impact of the RFCs, occurred and expected market developments along the RFCs, and market drivers. The main findings from the survey are summarised in the following bullet points for each of the three areas. Especially regarding the opinion of the 11 RFCs RAGs and TAGs members on the occurred and expected market developments, it is worth noticing that it reflects their views at the time of submission of the questionnaire (Autumn 2023/January 2024). The responses given by the 11 RFCs RAGs and TAGs members represent furthermore a partial view of the market as the sample of the respondents is not representative of the market universe. Finally, the outcome of the survey may contrast with the findings from the statistical review presented in the previous section above, as the opinions relate to the corridors and international trains, whereas national statistics refer to the whole country network and national as well as international traffic.

Occurred and expected impact of RFCs, in the areas of governance, operational efficiency and capacity management

- The respondents' opinion about the changes within the governance area is positive, especially in terms of cooperation with the market, including but not limited to RUs and terminal operators, as well as concerning facilitation of discussion among Member States about the issues affecting the

competitiveness of international rail freight transport. The opinion about the progress made regarding cooperation between RFCs and Core Network Corridors (CNCs)/ERTMS horizontal priority is less favourable. The market opinion is unfavourable about the progress made on harmonising international freight rail services' legislative, regulatory, procedural and operational aspects. The expectations of the market players concerning the future impact of the programmes and activities of the RFCs are relatively positive concerning all issues. Respondents consider the cooperation between RFCs and an EU Network of Infrastructure Managers (ENIM) as assumed in the proposal for the new capacity regulation, to be the best governance solution for bringing issues forward.

- The stakeholders' opinion about the changes that occurred within the operational efficiency area is also generally positive, except for the progress made in the promotion of technical and operational harmonisation of the European railway transport system towards its interoperability. The respondents' expectations concerning the future impact of the programmes and activities of the RFCs are relatively positive concerning all the assessed aspects related to operational efficiency. Cooperation between RFCs and an EU Network of Infrastructure Managers (ENIM) is also considered the best-fitting governance solution to bring operational efficiency issues forward.
- The respondents' opinions about the changes that occurred within the capacity management area are predominantly negative. Notwithstanding the market's unfavourable opinion of the progress made since the establishment of the RFCs in this area, the expectations on the future impact of the programmes and activities by the RFCs are rather positive with regard to all the investigated aspects related to capacity management. The best governance solution for capacity management improvements is deemed to be the cooperation between the RFCs and an EU network of Infrastructure Managers (IMs).

Occurred and expected market developments

- The vast majority of the respondents operated or still operate rail services or manage/operate terminals serving trains across at least one border crossing point on any of the RFCs. Most of them also operated or served international rail freight transport before the establishment of the RFCs. The majority of the respondents declare they experienced an increase in their operations since 2013, and most of them also have a positive expectation about the future, expecting overall market growth.
- Most RUs declare the market trend is stable since 2013 on the AWB but have positive expectations about the future. The variation in traffic experienced by terminal operators since 2013 and the expected growth tends to be slightly pessimistic.
- The prevailing type of international trains operated on the RFCs Network consists of intermodal trains, followed by conventional block trains and single-wagon load trains. Most RUs and terminal operators experienced growth in intermodal train operations in the past years, whereas the trend for conventional block and single-wagon load trains is predominantly stable. Most respondents have a positive expectation for the future in terms of traffic growth for all market segments.
- Concerning traffic between logistics nodes, most operations relate to Port to Rail-Road Terminal (RRT) transport, followed by RRT to RRT services and Port to Port operations. Experienced variations by RUs were mostly positive for the Port to RRT or RRT to RRT segments and stable for the Port to Port one. Terminal operators have predominantly experienced growing trends in all market segments in the past years. The vast majority of RUs and terminal operators are expecting positive future trends for the three market segments.
- Regarding service distances, most operations cover distances between 300 km and 900 km, followed by services covering distances longer than 900 km and below 300 km. RUs experienced

mostly positive variations for services covering distances longer than 300 km and declared the market is stable for operations below 300 km. Terminal operators have predominantly experienced growing trends in all market segments in the past years. The vast majority of RUs and terminal operators are expecting positive future trends for the three market segments.

Market drivers

- RUs and terminal operators have very similar views about the effects of the main market drivers on the growth of international rail freight transport in the short term, i.e., up until 2030. Most identified drivers are expected to have positive effects as they are assumed to improve rail transport's competitiveness. At the same time, the geopolitical context and socio-economic outlook, as well as the shortfall of the labour force, are perceived as threats.
- The socio-economic outlook is ranked first by the market, followed by infrastructure development and interoperability, policy and economic incentives to promote shift to rail. Increased performance of rail freight services and harmonisation of procedures and national legislation to improve cross-border operations are the two most relevant market drivers, according to the respondents, if considering both first- and second-ranking options.
- Although indicated as having a potential negative impact on the market, labour shortages and geopolitical context are not ranked among the most critical market drivers. Finally, technological improvements towards better integration and increased efficiency of multimodal logistics chains, better-integrated corridors and terminal capacity management do not seem to be considered priority issues by the RUs and terminal operators.

7.2 STUDY RECOMMENDATIONS

Building on the study's key findings, recommendations have been formulated around two main areas: market developments and targets and institutional and operational developments.

Market developments and targets

The simulations made in the study demonstrate that major projects, and particularly the completion of the TEN-T network at standard, would significantly increase the competitiveness of rail freight transport. The post-COVID recovery and the recent geopolitical crisis caused delays in the implementation and completion of the projects needed to complete and high quality and interoperable TEN-T network. Price increases and shortages of construction materials particularly affected the advancement of ongoing and planned projects. A high-quality and interoperable network might, furthermore, not be sufficient to achieve the ambitious targets set in the relevant European transport policies, in the absence of a significant change in the structure of the costs of road and rail transport. The following recommendations are proposed to support market development towards the achievement of the EU policy targets:

- *Timely complete the development of a high-quality 11 RFCs Network in line with TEN-T standards:*
  - *Building missing links and removing infrastructure bottlenecks* increasing infrastructure capacity by adding new tracks and lines where needed, increasing their speed and improving their gradient, can solve congestion problems, save energy and reduce transport costs as well as improve travel times. Such developments are relevant at the network level, but produce effects also at the individual corridor scale;
  - *Achieving the requirements set in the TEN-T Regulation towards a Single European Railway Area*, i.e. 740 meter long trains, ERTMS, 22.5 tonnes axle load, intermodal loading gauge,

UIC gauge, electrification, is fundamental to support the development of a Single European Railway Area;

- *Support intermodal and combined transport*. The intermodal market is the most promising international rail freight market segment, requiring improvement of interconnectivity between main railway lines and terminals, increasing the capacity of the existing terminal infrastructure, investing in technologies to facilitate and speed up transport and transhipment operations, and tracking and making more reliable the transport of intermodal units along logistics chains and within logistics clusters.
- *Stronger cooperation between all involved parties for better effectiveness in the availability and use of funds and the definition of investment implementation strategies focussed on those sections of the network with higher market potential*. For over a decade, the sector has benefited from a stronger TEN-T policy with a dedicated Connecting Europe Facility Fund. Among the different transport modes involved in the TEN-T network, rail and rail cross-border initiatives are treated as a priority. However, the available financial resources are limited overall compared to the financial needs that would be necessary to complete all projects. Investing in infrastructure might not be sufficient, e.g. to be operational, ERTMS also requires rolling stock to be equipped with onboard units.
- *Introduce market regulatory and policy measures to increase the competitiveness of rail freight transport*. Although not a specific subject of this study, regulatory and policy measures might be necessary to facilitate and foster the rail freight market in Europe towards the achievement of higher market shares and EU policy targets. Rail freight transport is generally more expensive and less flexible compared to road transport. Internalising external costs of road transport, and/or creating incentives to reduce the costs of rail transport would increase its competitiveness and support the achievement of the ambitious EU policy targets. In this respect, policymakers shall also consider the potential effects on the modal share of measures improving the efficiency of road transport. As emphasised in the above-mentioned study by ERFA[28] regulatory measures facilitating market opening appear also to be relevant in increasing the competitiveness of rail transport (e.g. enforcement of antitrust regulations; unbundling of subsidised public service operations from open market business; and ending direct subsidies to or recapitalization of state-owned freight railway undertakings).

Institutional and operational developments

Recommendations on institutional and operational developments are formulated as follows, according to the findings from the market consultation (2023 11 RFCs Joint TMS Update Survey), conducted as part of this study and the use of the available infrastructure and market dataset to produce the current and future market analysis for the 11 RFCs:

- *Improve capacity management*. Capacity management is considered by the market and also by the analyses and studies at the basis of the proposal for the new capacity regulation, a key area for improvement. Progress was made in the management of Temporary Capacity Restrictions, however, capacity planning remains an issue. Digital Capacity Management as an integral part of the European program “Timetable Redesign (TTR) for Smart Capacity Management” is at the core of

[28] https://erfarail.eu/news/the-european-rail-freight-market-competitive-analysis-and-recommendations

the proposal for the new capacity regulation, and it is paramount to reaching Green Deal targets for the transport sector and the rail freight segment within it.

- *Monitor operational performance*. The revised TEN-T regulation identifies new operational requirements, related to punctuality and dwell times at borders. Furthermore, some infrastructure requirements also depend on operations, such as 740 meter long trains. Investing in infrastructure, albeit needed, is long-lasting and capital-intensive. The competitiveness of international rail freight transport also depends on the improvement of cross-border operations and integrated/coordinated planning and management of the rail network at the European scale. An RFCs common KPI framework is already in place, and RNE is also already monitoring infrastructure KPIs. Such activities might be continued in light of the new set of requirements foreseen in the revised TEN-T Regulation (EU) 1679/2024 and RFC governance structure, also defined in the Art. 67 of this regulation.
- *Balance network and corridor governance approach*. The analysis of the RFC catchment areas shows that international trains using at least one corridor BCP may actually use more than one RFC. A network approach is more fitting to the planning and management of the network capacity. Geographical specificities and logistics clusters and chains exist that still make the corridor concept useful, especially to support discussion and coordination among IMs and Member States and for a customer-oriented approach aimed at involving RUs and Terminal Operators. This consideration also seems to be in line with the opinions expressed by the RAG and TAG members in the survey conducted as part of this study.
-

ANNEX 1 – OVERVIEW OF THE NEAC MODEL

NEAC is a freight transport forecast model, which helps to identify the best policy options and infrastructure alternatives at European level. The model is able to produce forecasts of transport flows (both volume and vehicles) for different modes (road, rail, inland shipping, maritime, and other). The model results can be used in transport studies, but also for studying emissions or for use in social cost-benefit analysis.

Over the past decades, NEAC freight transport forecast system has frequently helped to assess and evaluate different policy options at European and national level. The system was used successfully in several projects such as corridor studies (such as North Sea-Med or Rotterdam-Alpine), Iron Rhine cost-benefit analysis, French international freight transport, Alpine crossings, North-South freight transport markets and safe truck parking. The system helped to get insights to pick the best policy options to make the European transport system more sustainable, resilient and robust.

For the near future, the model is able to assist in studies such as corridor studies, infrastructure projects for rail, road and inland waterways, port studies, safe and secure truck parking, impact of COVID, Ukraine war or pricing at both European and national level. These are typically topics that play an important role in shaping the future of Europe. Scenarios for Green Deal or the Reference scenario are used to look at the impacts.

The system comprises of a database and a forecast model. Together they are very helpful:

- The database contains freight transport chains to, from and within Europe. It is based on reliable data such as Comext by mode and commodity, Port-to-Port statistics and socioeconomic data on population and GDP. Furthermore, the database contains mode specific networks for road, rail, inland waterways and sea. Terminals and ports form connection points in the networks. An extra asset in the database are the transport costs for the different modes which help to get insights in policies on modal shift;
- The forecast model is based on reliable methods and have been used in many other transport models in Europe and abroad. Think of ETIS+, Transtools, Worldnet or HIGH-TOOL. The forecast model comprises an economic model, a distribution/mode choice model and assignment models for different modes. The model is able to use different scenarios such as the European Reference or Green Deal package. These help to show the impacts on freight transport in general or on modes more specifically.

ANNEX 2 – 2023 11 RFCS JOINT TMS SURVEY COMPLETE RESULTS

This annex is enclosed as a separate file.

ANNEX 3 – SUMMARY OF PREVIOUS TRANSPORT MARKET STUDY

A first Transport Market Study (TMS) was elaborated for the RFC AWB in 2019. The following sections provide an abstract of the 2019 TMS Update, focussing on the key findings from the current market analysis and the main recommendations for rail freight market development along the RFC AWB.

The following table and figure presents the volume of gross tonnes and freight trains in 2017 on cross border sections.

Table 36 Trains and tonnes at RFC AWB BCPs 2017

From Station	To Station	Freight trains	Mill. gross tons
Rosenbach (A)	Jesenice (SLO)	11.500	13,4
Spielfeld-Straß (A)	(Šentilj) Maribor (SLO)	8.200	8,2
Dobova (SLO)	Savski Marof (HR)	7.000	6,8
Tovarnik (HR)	Šid (SRB)	4.550	3,9
Dimitrovgrad (SRB)	Dragoman (BG)	5.100	5,2
Svilengrad (BG)	Kapikule-Edirne (TR)	2.900	2,6

Source: RFC AWB 2019 TMS

The figure overleaf represents the volume of trains along the RFC AWB in 2017. At that time, the RFC AWB sections with over 50.000 trains per year were:

Austria

- Salzburg-Schwarzach-St. Veit;
- Wels-Marchtrenk;
- St. Michael-Graz;

Slovenia

- Ljubljana-Zidani Most;

Croatia

- Zaprešić-Zagreb-Dugo Selo;

Serbia

- Batajnica-Beograd.

Figure 92 Volume of all trains along the RFC AWB in 2017

Source: RFC AWB 2019 TMS

Gross tonnes km for the RFC AWB are presented in the following table.

Table 37 Volume of gross tonnes km along the RFC AWB in the period 2014 – 2017

State	RFC AWB: Million Gross tonnes km			
	2014	2015	2016	2017
Austria	9,972	9,525	9,356	10,157
Slovenia	3,631	3,552	3,839	4,205
Croatia	1,511	1,430	1,512	1,720
Serbia	3,661	3,811	3,345	4,204
Bulgaria	1,264	1,329	1,374	1,344
Total	**20,039**	**19,647**	**19,426**	**21,630**

Source: RFC AWB 2019 TMS

A total of 47 % of the gross tonnes km on the RFC AWB in 2017 was made in Austria, 20 % in Slovenia, 19 % in Serbia and less than 10 % in Croatia and Bulgaria.

The following table presents the freight train kilometres along RFC AWB.

Table 38 Volume of gross tonnes km along the RFC AWB in the period 2014 – 2017

State	RFC AWB: Freight train km			
	2014	2015	2016	2017
Austria	8,038,148	7,725,358	7,556,102	8,922,094
Slovenia	3,940,631	3,789,766	4,103,074	4,328,424
Croatia	1,478,695	1,391,359	1,552,706	2,215,423
Serbia	4,338,150	4,471,073	3,866,123	4,906,976
Bulgaria	1,891,443	1,971,021	2,065,301	1,905,808
Total	**19,687,067**	**19,348,578**	**19,143,306**	**22,278,726**

Source: RFC AWB 2019 TMS

A total of 40 % of freight train km from the RFC AWB in 2017 was in Austria, 22 % in Serbia, 19 % in Slovenia, and 10 % or less in Croatia and Bulgaria.

The following main considerations are reported in the study concerning market demand, and specifically the views and opinions from the rail freight carriers and their clients concerning improvement of rail transport along the RFC AWB, which need to be met in order to further raise the competitiveness of rail transport compared to the other modes (road, sea,…):

- **Travel time:** at the moment travel times via railway cannot be competitive to road transport, because of many obstacles on the rail. The travel times depend on the different authorities' procedures (customs procedures, inspections,…) and infrastructure conditions (speed restrictions…). The travel times must thus be reduced through different measures (investments or/and organisation).
- **Traction system:** the many traction systems along RFC AWB should be harmonised with the use of multisystem locomotives. Some railway sections are not electrified yet but should be. On electrified lines electric traction is provided. This leads to more efficient train operations because of the better

technical characteristics of electric locomotives, such as a lack of the gas exhausts seen with diesel locomotives.

- **Axle load category:** different track categories with various allowed axle loads along the RFC AWB have an influence on operating the rolling stock of the rail carriers. Because of insufficient axle load, freight wagons are not loaded optimally, and the locomotives used should also be suitable for the related infrastructure conditions. All lines should be for the category 22,5 t/axle.
- **Punctuality:** delays in freight transport are a huge problem and can be over 100 minutes for a 100 km route. It is necessary to reduce delays in freight transport by using with different measures – the first measures without any investment should be organisational ones, particularly among the infrastructure managers and between the infrastructure managers and rail carriers.
- **Safety:** critical points in railway safety are the level crossings between rails and roads. Many rail-road crossings have automatic barriers, but some of the crossings still have only Saint Andrews Cross systems. Because of this many collisions between road vehicles and trains occur, leading to injuries and even deaths.
- **Border crossing:** every border crossing takes times because of different border procedures: locomotive exchange, customs procedures, train inspection, brake test, etc. Freight trains thus spend a lot of time at borders. This time could be reduced to the minimum with organisational changes.
- **Speed restrictions:** such restrictions can be temporary or for a long time. Speed restrictions are usually introduced because of the railway infrastructure conditions, such as a lack of maintenance or maintenance works on the tracks, thus leading to delays. When the maintenance is foreseen in the timetable then the delays should be minimized.
- **Bottlenecks:** some railway lines are serious bottlenecks because of restricted capacity and the high volume of trains. Bottlenecks are usually located on single track railway lines, where freight trains have additional stops to wait for a free path. Their elimination can only be achieved with investment in a second track or additional railway stations.
- **Train path allocation:** railway infrastructure managers allocate train paths to carriers and other applicants in two ways:
    - orders for a new timetable period: through the regular procedure; or through a late procedure;
    - orders for ad hoc train paths: through the regular procedure; or through a shortened procedure.

  There is now a lack of the One-Stop Shops (OSS), and path allocation should be centralised for the RFC AWB to simplify the procedures for carriers. OSS could solve some of the administrative barriers that now exist between carriers and infrastructure managers.
- **Intermodal terminals:** freight transport uses intermodal terminals to supply industrial and residential areas. In some terminals there is a lack of modern transhipment equipment (portal cranes, reach stackers…). The rail tracks at terminals are often too short for longer trains, and the access of the different rail carriers to private terminals (i.e. under private ownership) is sometimes disturbed.
- **Just-in-time delivery:** many clients that use the railway services require deliveries of cargo that are “just-in-time”. Additional storage of cargo incurs additional costs for clients. However, delays in

railway freight transport can lead to dissatisfied clients. This can be overcome with better timetable planning and greater punctuality.

- **Railway infrastructure charges:** each RFC AWB member state has a different method for its railway infrastructure charges, which thus vary from state to state.
- **Train's length:** in freight railway transport the length of a train is very important in order to ensure competitiveness with other modes and reduce the operational costs per unit. Many freight trains (container trains, empty trains, car trains, mixed trains…) could be extended with additional wagons, but the usable track length at many railway stations is not long enough.
- **Information and communication technologies (ICT):** the efficiency of international rail freight transport could be increased with ICT, such as with better exchanges of information and the use of a path allocation system. The Path Coordination System (PCS) is an international path request coordination system for path applicants (railway undertakings, infrastructure managers and allocation bodies). This internet-based application optimises international path coordination by ensuring that path requests and path offers are harmonised by all involved parties.

An analysis of the capacity of the RFC AWB railway lines was also performed as part of the 2019 TMS, based on the approach and criteria suggested in the UIC 406 leaflet (2nd edition, June 2013), which provides an international standard for evaluating capacity, to be used in developing common values for international corridors sharing different railway networks in different countries. According to the applied methodology capacity consumption exceeded 100 % on the following line sections:

- Austria: section Wels-Marchtrenk;
- Croatia: section Dugo Selo-Novska.

Capacity consumption between 80 % and 99 % was also found on the following line sections:

- Austria: section Salzburg-Schwarzach-St. Veit o section Bruck a.d. Mur;
- Slovenia:section Jesenice-Ljubljana;
- Croatia: section Savski Marof-Zagreb.

Concerning the main considerations and findings from the study, it is noticed that rail freight is considered to be the most environmentally friendly mode of transport of goods, with an important role in the freight transport market. It contributes to the development of human society and combines economic and social progress while respecting the environment.

None of the measures taken so far to improve rail freight have dealt with common organisation, regulation and optimisation of the network in order to eliminate the shortcomings in continuity and reliability in international rail freight transport along the RFC AWB (see also Section 2.2.3). Strengthening the cooperation among infrastructure managers should be primarily focused on the allocation of train paths for freight trains for the purpose of mutual coordination and acceleration of international rail freight transport. The result of coordination with regard to border waiting times is their reduction and the optimal use of the available network for sustainable development of rail transport.

The RFC AWB has high potential to increase its competitiveness due to its location, tradition and good infrastructure connectivity between Central Europe and South-East Europe and Turkey and thus it can increase transport performances as well as its share of total transport volume within the related countries.

The significant potential of the RFC AWB is underlined by the fact that prior to the dissolution of Yugoslavia – which ended the functioning of the corridor as a seamless transport axis – the volume of transit goods transported along this route was about double the current figures: In 1989, approximately 18 million gross tonnes were shipped by rail along the corridor. One of the key reasons for the decrease in volumes has been a shift of transit traffic to routes further north.

In terms of markets, the RFC AWB has the potential to serve two geographically distinct submarkets:

- Transport related to the regions served by the RFC AWB, including:
  - transport between the regions directly served by the corridor and
  - transport between the regions served by the corridor and other parts of Europe;
- Long-distance transport transiting RFC AWB along its entire length.

In each of these markets there is significant potential to develop rail freight transport, either by shifting transport to rail from other modes (modal shift effect) or by developing overall transport volumes via the positive impact of transport improvements on regional economic development and trade (development and trade effect).

Historic and current trade data suggest that trade flows and goods traffic between Slovenia, Croatia and Serbia are at a comparatively high level. The establishment of the RFC AWB can help to increase the market share of rail in this significant market. At the same time, there is significant growth potential for freight transport to and from Bulgaria to the other countries along the corridor.

Regarding trade and transport between the states of the RFC AWB and the rest of Europe, it is important to note that the EU is the dominant trading partner of the Western Balkan states. Roughly three quarters of the trade volume of these countries, both in terms of exports and imports, is directed to EU countries, in particular to the core of the EU.

Significant growth potential could result from a convergence of the Western Balkan region towards the income and productivity levels seen in Central and Western Europe. The level of economic activity in the countries involved in the RFC AWB is generally well below the average of the 27 EU Member States. Convergence towards EU levels would imply above-average GDP growth rates over the long term. Due to its close relation to economic activity, economic growth would be accompanied by significant growth of freight transport.

The RFC AWB represents the shortest route between Central Europe and Turkey. The economic cooperation (trade, goods exchange) between Germany and Turkey is at a high level (Germany is the most important economic partner for Turkey). The RFC AWB route between Munchen and Istanbul is about 350 km shorter than the parallel competitive route via RFC 7 (Bulgaria-Romania-Hungary-Austria).

The railway users' demands should be taken into consideration to improve services and infrastructure along the RFC AWB. The most important demands are reduction of travel times, elimination of diesel traction, achieving the axle load standard, improving punctuality and safety, speeding up border crossing procedures, eliminating speed restrictions and bottlenecks, and extension of freight trains.

Many infrastructure projects are in progress with an aim to upgrade the existing railway infrastructure (see also Section 2.1.5). The focus on future upgrading projects should be on implementation of the ERTMS,

extension of station tracks to 740 meters and upgrading of the line speeds. The maintenance of the railway lines and stations should also be sped up.

Another important part of railway transport is the rolling stock – and here the locomotives and wagons are outdated and should gradually be modernised. Locomotives that do not enable interoperability must be changed at the border crossings – thus lengthening the travel time. Modernisation of the rolling stock has to be done by the railway carriers.

As already mentioned in this study, the average external costs for road transport are more than four times higher than rail for freight. In this direction the EU and RFC AWB member states should support green rail freight transport and propose that the negative external costs of transport be paid by the end users.

A good pilot project from 2009 using an intermodal train running from Ljubljana to Istanbul showed that the travel time could be greatly reduced without any investments in the railway infrastructure. The use of good communications and technological procedures alone could thus reduce the travel time and improve the competitiveness of railway transport.

The optimisation of cross-border procedures to reduce travel times must include the railway sector (represented by infrastructure managers, rail carriers….) and public sector (represented by customs, police, etc….). Only common work on this issue could have positive impacts on railway transport.

The cargo potential seen in the countries around the RFC AWB could be the basis for the further extension of the RFC AWB route to other countries, such as Turkey, Germany, Hungary, Bosnia and Herzegovina, North Macedonia and Greece.