IMPLEMENTATION PLAN

Update 2023

Rail Freight Corridor Rhine – Alpine

Co-funded by
the European Union

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1. Introduction

The Rail Freight Corridors (RFCs) have been established to strengthen Europe-wide rail freight transport by lowering barriers at borders, improving performance quality and cooperation in the rail sector as well as the development of a network, that offers sufficient capacity and harmonised processes. All this shall support the modal shift from road to rail to meet the targets of the transport and environmental policy, like e. g. decarbonization.

The Rail Freight Corridor Rhine-Alpine is committed to develop the Corridor in line with the Implementation Plan. In a broader context, both, the Executive Board and Management Board, will continue the cooperation with external partners. Cooperation with Rail Freight Corridor North-Sea-Mediterranean is of critical importance. In addition, the Rail Freight Corridor will continue to invest in cooperation at the European network level, e.g., to foster digitalisation (the ETA projects) and improve reliability (i.a. Rail CDM). All these international cooperation issues are in line with the Berlin declaration of ministers from 2020.

Legally the RFCs are based on the Regulation (EU) 913/2010 which entered into force on 9 November 2010. RFC Rhine-Alpine was officially established on 10 November 2013, when the initial Implementation Plan (IP) was published.

According to Art. 9(2) of Regulation (EU) 913/2010, the Management Board (MB) shall periodically review the Implementation Plan, taking into account progress made in its implementation, the rail freight market on the freight corridor and the performance measured in accordance with the objectives referred to in point c) of Art. 9 (1).

The last update dates back to 2 December 2021 and will be replaced by this update, which is a regular update, not related to any change in routing.

The structure of this update of the Implementation Plan is in line with the RNE guidelines "Corridor Information Document Common Texts and Structure ([link](#)).

The focus of this update is mainly on:
- New strategic targets for the RFC
- Update of the investment plan and capacity bottleneck analysis
- Update of the ERTMS deployment.

This update was elaborated by the Management Board, consulted with Railway undertaking Advisory Group (see Annex F) and approved by the Executive Board of RFC Rhine-Alpine on 7th of December 2023.

This update includes all information available up to 30 October 2023. In some cases, more recent or older information is included and highlighted. On CIP more recent information can be found, according to the update routine of the respective document.

2. Corridor Description

The corridor routing is based on the annex of the Regulation (EU) 913/2010 as amended. In 2019 the RFC was prolonged to the port of Ghent/Terneuzen (part of North Sea Port) as a connecting line. This was approved by the Executive Board and Management Board based on a request by the harbour. In 2020, the new Ceneri Base Tunnel was added to the RFC routing.

The RFC Rhine-Alpine stretches from the North Sea in the Netherlands and Belgium to the Mediterranean Sea in Italy and crosses the heart of the EU along the so-called "Blue Banana". This is the most heavily industrialised North-South route in Central Europe and connects Europe's prime economic regions. The "Blue Banana" includes major ports and economically strong urban centres such as Rotterdam, Amsterdam, the port of Antwerp-Bruges, North Sea Port, Duisburg, Köln, Mannheim, Basel, Milan and Genoa[1]. All these centres are served and connected by the Corridor. The countries directly involved are the Netherlands, Belgium, Germany, Switzerland and Italy.

All information on the routing of RFC Rhine-Alpine can be found in the Corridor Information Platform (link).

The following map (Figure 1) shows a section of the RFC Rhine-Alpine including the presentation of principal, diversionary, connecting and expected lines in that section.
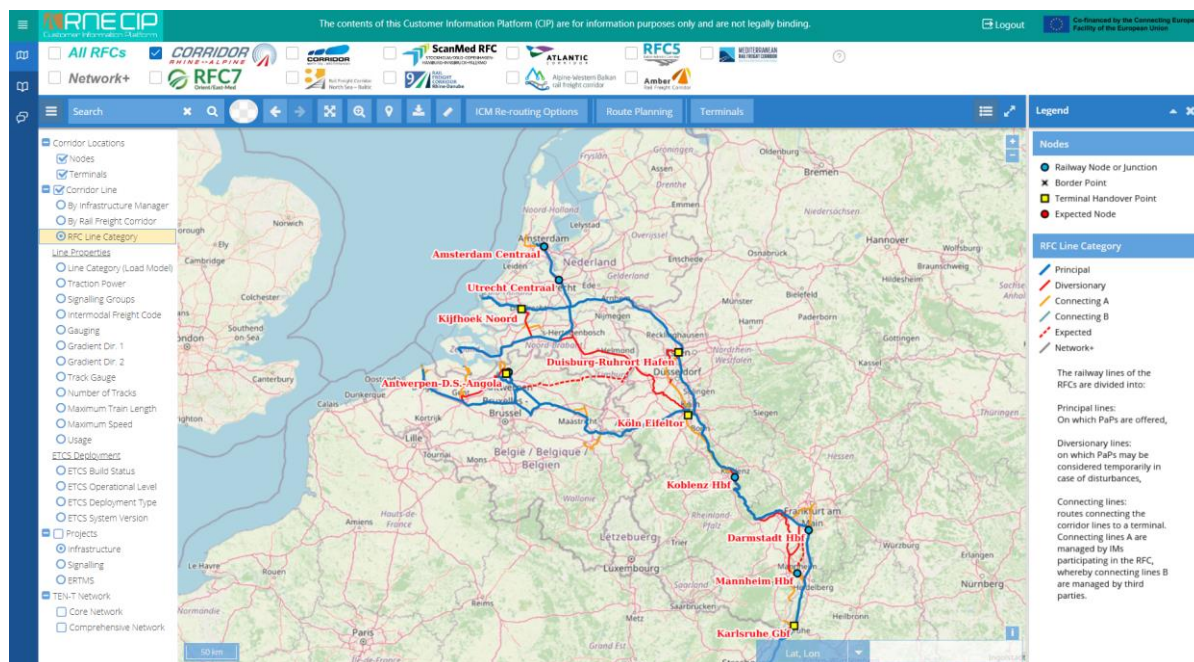
Figure 1: View of a section of the Corridor in CIP

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[1] The ports of Vlissingen, Terneuzen and Ghent merged into North Sea Port in 2018 and in April 2022, the ports of Antwerp and Zeebrugge merged into port of Antwerp-Bruges

2.1 Key parameters of Corridor lines

Regulation (EU) 913/2010 – Article 9 (1.a) also requests a description of the characteristics of the freight corridor. RFC Rhine-Alpine uses CIP to inform about the following line properties:

- Line category (Load model)
- Traction Power
- Signalling Groups
- Intermodal Freight Code
- Gauging
- Gradient
- Number of tracks.

In CIP, this information is given on the map (link). The user can select the different categories to see the applicable values on the whole corridor but also on single line sections.
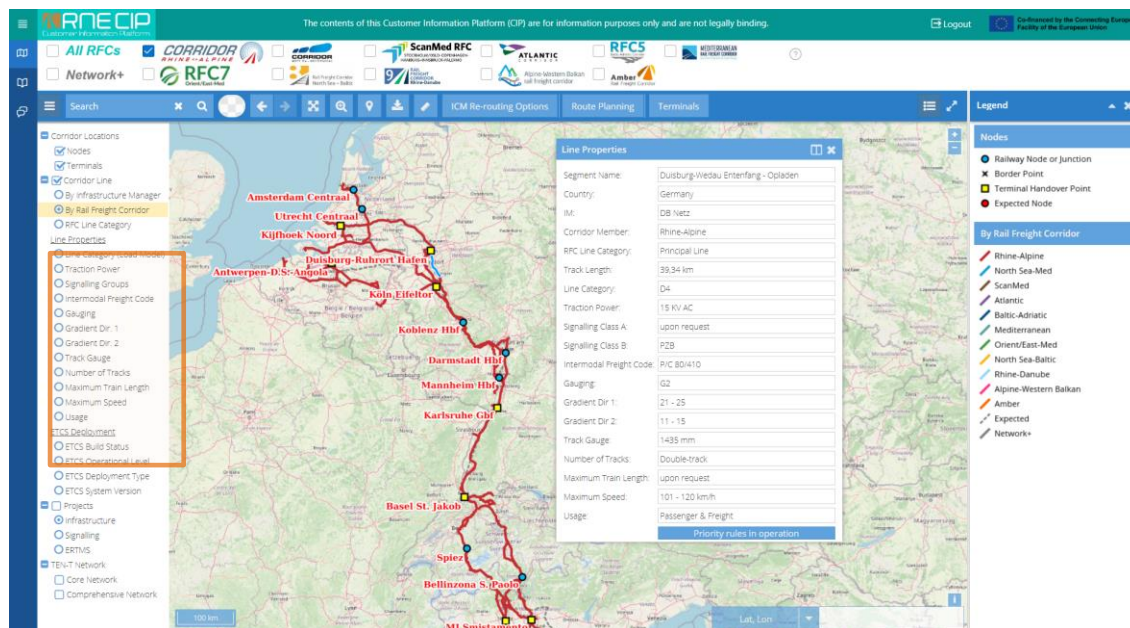
Figure 2: Information on key parameters on the map in CIP

Considering the infrastructure requirements set in Art. 39 of the Regulation (EU) 1315/2013 for TEN-T lines, RFC Rhine-Alpine informs as follows:

TEN-T requirement	included in CIP	Compliance with objectives
Electrification	X	All principal and most connecting lines A and diversionary lines are electrified (in CIP under Traction Power)
Axle load	X	Included as parameter Line Category (UIC load model) in CIP. 22.5 t axle load fulfilled on all principal and connecting lines A
Line Speed		Design speed: intended to be presented in CIP as soon as data from RINF database are available via RNE. Currently CIP includes an information on technical speeds applicable for freight trains (in CIP under maximum speed)
Train length 740 m	Partially	Status is regularly analysed for RFC Rhine-Alpine, see graphical overview in Annex A
Deployment of ERTMS	X	Separate category on the map in CIP, see also Annex D
Track gauge 1435 mm	X	Included as parameter Track Gauge in CIP. All RFC lines fulfil this requirement

Table 1: Compliance with TEN-T parameters

2.2 Corridor Terminals

The list of corridor terminals requested in Art 18 (b) of Regulation (EU) 913/2010 is published in CIP (link) The following screenshot (Figure 3) shows how to access terminal information in CIP.
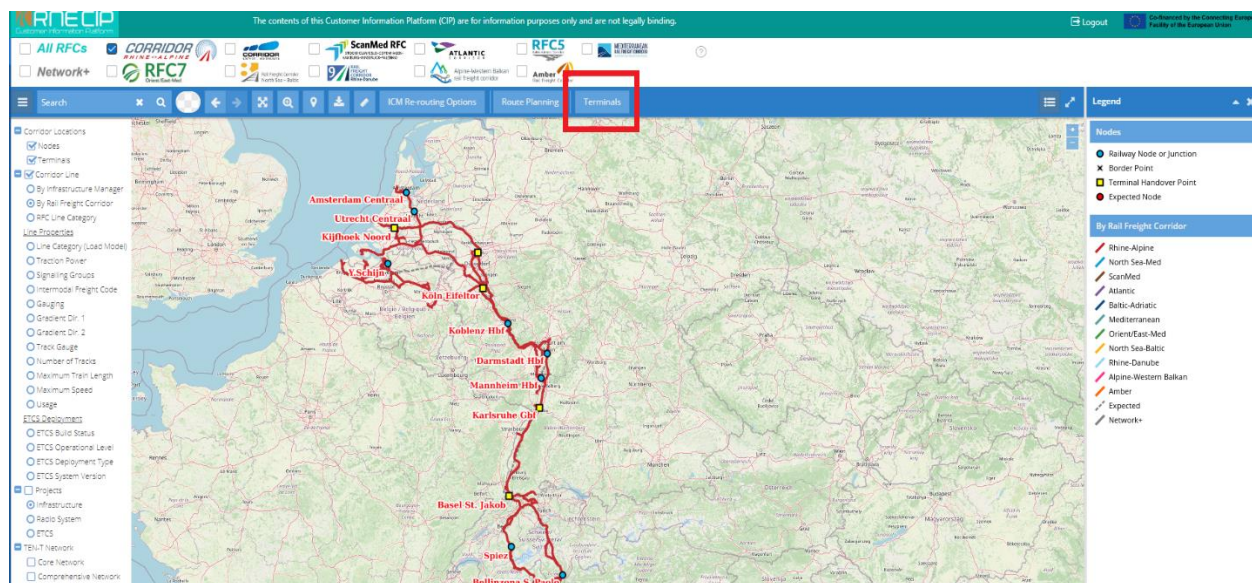
Figure 3: Information on terminals in CIP

According to the Commission Implementing Regulation (EU) 2177/2017, rail service facility operators such as terminal operators have the legal obligation to publicly provide detailed information on their infrastructure and services. A possible way to be compliant with this regulation is to provide the required information using the Rail Facilities Portal (link). RNE and RFC Rhine-Alpine support the use of the Rail Facilities Portal as joint source.

2.3 Bottlenecks

Capacity bottlenecks on the railway infrastructure are monitored. National calculation methodologies at IMs and national decision processes on infrastructure development are different and a common bottleneck analysis for RFC Rhine-Alpine turned out to be a challenging task. Therefore, in 2020, the Management board decided to draw up the Capacity Bottleneck Analysis (CBA) based on the national investment plans to identify the infrastructural bottlenecks. This is a joint corridor approach, consisting of a combination of the national information provided by the different IMs. The CBA in the present Implementation plan contains an update of the infrastructural bottlenecks.

Chapter 6.1 Capacity Management Plan (with a referral to Annex C) shows the latest CBA updated in 2023. It shows the current state of play in 2023 and the scenarios for development in the years 2025 and 2030, based on the national forecasts.

2.4 RFC Governance

Information on the current RFC Governance structure (e.g. Executive Board, Management Board, Advisory Groups, Working Groups, joint office) is given only in CID section 1 to avoid redundancies. CID section 1 can be downloaded in CIP (link) under Information Documents.

3. Market Analysis Study

No update of the Transport Market Study (TMS) of RFC Rhine-Alpine was done since the last update in 2018. In accordance with Regulation (EU) 913/2010 a summary of this study - the essential elements - is available on the [website of RFC Rhine-Alpine](#) under "others".

A TMS update is currently being carried out under the lead of RNE and will be finalised in 2024.

4. List of Measures

All measures for fulfilling the requirements of Articles 12 to 19, including one stop shop, capacity allocation, coordination of works, authorised applicants, traffic management, traffic management in the event of disturbance, information on the conditions of use of the freight corridor and quality of service on the freight corridor were implemented at the start of the Corridor in November 2013. The state of play and further development regarding concrete measures and procedures is decided by the Management Board and included in the CID section 4 "Procedures for Capacity, Traffic and Train Performance Management".

Therefore, the subchapters 4.1 – 4.6 are not applicable for updates. CID section 4 can be downloaded in CIP ([link](#)).

4.1 Coordination of planned temporary capacity restrictions

See chapter 4.4 of the CID.

4.2 Corridor One-Stop-Shop

See chapter 4.2 of the CID.

4.3 Capacity Allocation Principles

See chapter 4.3 of the CID.

4.4 Applicants

See chapter 4.3.2 of the CID.

4.5 Traffic management

See chapter 4.5 of the CID.

4.6 Traffic management in Event of Disturbance

See chapter 4.5.3. of the CID. This chapter also includes information on International Contingency Management.

4.7 Quality Evaluation

4.7.1 Performance monitoring report

See Chapter 5.3 of this Implementation Plan

4.7.2 User satisfaction survey

See Chapter 5.5 of this Implementation Plan

4.8 Corridor Information Document

The Corridor Information Document (CID), consisting of 4 sections and the Implementation Plan as an annex, is published every year in January. It is elaborated according to the "Corridor Information Document Common Texts and Structure" and can be found in CIP under "Information Documents/Corridor Information Documents" (link).

Furthermore, after a comprehensive simplification of the CID to increase usability for customers, under the coordination of RNE, Corridors now also publish their CID on the Network & Corridor Information (NCI) Portal (link).

5. Objectives and Performance of the Corridor

The performance of RFC Rhine-Alpine is monitored via different KPIs. Apart from the common RNE/RFC KPIs (see chapter 5.3), the Corridor also publishes a number of corridor specific KPIs. The Management Board of RFC Rhine-Alpine also defined strategic missions (see 5.2 below). For some KPIs, measurable objectives are defined (see 5.4 below).

5.1 Current situation on RFC Rhine-Alpine

RFC Rhine-Alpine is one of the most heavily used rail links in Europe. Stretching from the North Sea harbours in the Netherlands and Belgium to the Port of Genoa, RFC Rhine-Alpine connects a part of the economically strongest metropolitan regions in Europe.

This high importance of RFC Rhine-Alpine is acknowledged by all stakeholders and several actions to improve the performance of RFC Rhine-Alpine are underway. In 2023 the Executive Board of RFC Rhine-Alpine started a Quality Core Group consisting of representatives of Railway undertakings, terminals, freight forwarders and the Infrastructure Managers of the Corridor to collect ideas and start projects to enhance quality on Corridor lines in the short to medium term. However, in the coming years additional capacity on RFC Rhine-Alpine is scarce, even though major construction works have been completed in the last years, e.g., the new Gotthard base tunnel in Switzerland. Currently, there are several construction works ongoing on the Corridor lines, which will not be finished until 2030, for instance the Emmerich-Oberhausen line and the enhancement of the route between Karlsruhe and Basel. Due to further upgrades of the Corridor lines in the coming years, significant restrictions in the available capacity can already be foreseen now. Additional capacity on sections of the Corridor will only be available well after 2030.

Capacity and punctuality are two intertwined issues. Due to capacity bottlenecks and the high usage of the Corridor lines, punctuality on RFC Rhine-Alpine has come under increasing pressure for several years now. The main task of the Corridor work in the coming years will be to stabilise punctuality at an acceptable level despite increasing construction activity on the Corridor lines.

5.2 Strategic Missions

The objectives of RFC Rhine-Alpine were formulated as strategic missions by the Management Board in January 2021. They describe the objectives of RFC Rhine-Alpine (growth of rail freight, international harmonisation and fulfilment of regulations) and also indicate the role the RFC can realistically play in pursuing these objectives (support, push and fulfil / influence).

Figure 4: Strategic Missions

These missions are in line with the Memorandum of Understanding signed in June 2017 by the CEOs of the Infrastructure Managers/Allocation Body participating in RFC Rhine-Alpine (link). Also, the missions contribute to the Sector Statement and the ministerial declarations on rail freight.

Main activities have been identified which shall contribute to these strategic missions. Concrete tasks are agreed in work plans for each year. "We" entails all colleagues working for RFC Rhine-Alpine either on behalf of the Infrastructure Managers /Allocation Body or in the permanent team.

5.3 Train Performance Management and Common KPIs

5.3.1 Train Performance Management

The aim of the Corridor Train Performance Management (TPM) is to measure punctuality, analyse weak points and recommend corrective measures, thus managing the performance of international train services and improving punctuality across borders and handover points (See also , chapter 4.6 of the CID). Furthermore, monthly KPI reports on punctuality are published since the beginning of 2018 in CIP/Information Documents/Corridor Performance/RFC Rhine-Alpine (link to CIP).

5.3.2 Key Performance Indicators

The following KPIs published by RFC Rhine-Alpine are defined in the "RNE Guideline on Key Performance Indicators of Rail Freight Corridors", which has been agreed on RFC level and in the RNE General Assembly and were consulted with stakeholders. Most of the KPIs for capacity management derive from the Framework for Capacity Allocation on RFC Rhine-Alpine. (link to the document).
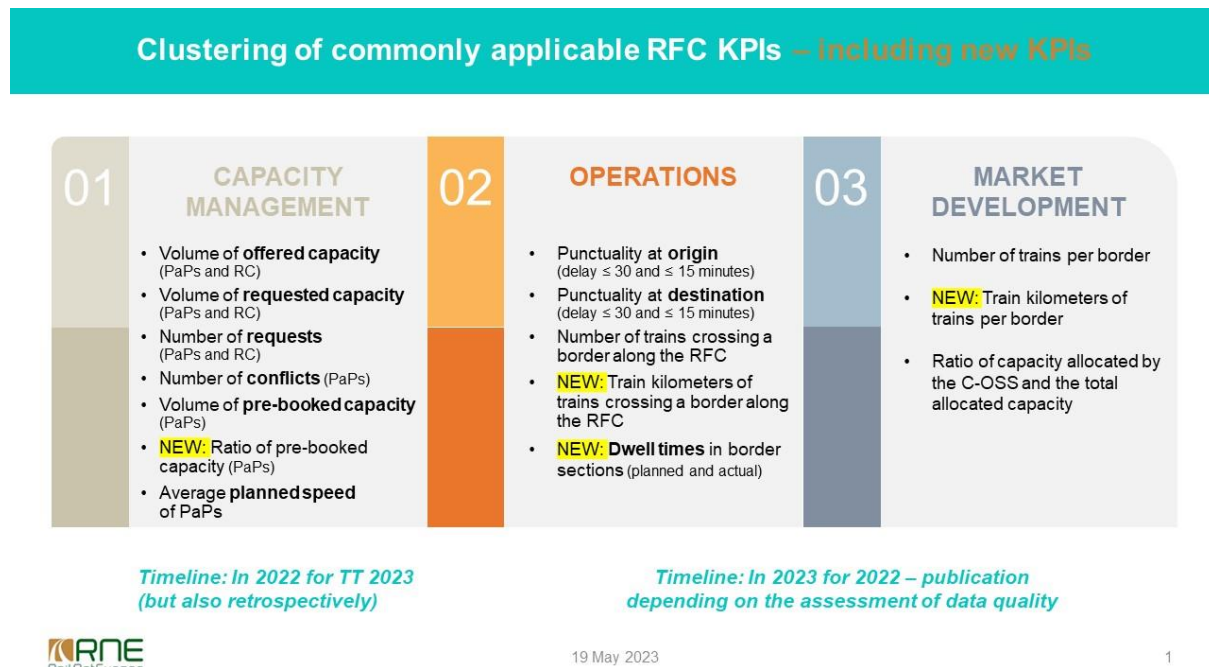

Figure 5: Set of common RNE/RFC KPIs

In addition, RFC Rhine-Alpine publishes:
- the Modal Split in selected Ports and of transalpine traffic
- Delay reasons
- Monthly number of trains per border
- Punctuality development

- Monthly RFC entry punctuality per direction
- Monthly RFC exit punctuality per direction
- Total numbers of delay minutes reported to TIS for both directions.

RFC Rhine-Alpine will publish the KPI Number of trains crossing a border along the RFC starting in 2024 for the year 2023 in its Performance Report. RFC Rhine-Alpine does not publish yet KPI Dwell times in border sections (planned dwell), KPI Dwell times in border sections (real dwell) and KPI Train Kilometres of borders.
A joint reporting of the RFCs on KPIs is available on the website of RNE (link).

Additionally, the KPIs are published as an integral part of the Annual Report of RFC Rhine-Alpine (link) and as a stand-alone report in CIP (link).

Definitions of the KPIs
The definitions of the KPIs can be either found in the RNE guideline (link), the guidelines for punctuality monitoring (link) or the Framework for capacity allocation (link).

5.4 Core Objectives

The Management Board of RFC Rhine-Alpine together with the Executive Board have defined targets for a number of KPIs. They are based on the commitment of the stakeholders to sustainably strengthen quality and resilience on the Corridor and take into account the current situation on the Corridor. Targets for RFC Rhine-Alpine for the year 2025 and the corresponding timetable year 2026 are fixed by using four KPIs in total, consisting of two already existing KPIs and two additional KPIs calculated on the basis of existing KPIs.

For the following, measurables targets were fixed:
- Delta RFC entry and exit punctuality (30-min threshold)
- KPI Number of trains per border,
- Ratio of PaP capacity offer at X-11 to Final Timetable Offer (X-3) and
- KPI Average planned speed of PaPs.

The progress of the four core objectives is published in the Annual Report of RFC Rhine-Alpine on a yearly basis. Factors that influenced target development will be explained in the Performance Report, that is an integral part of the Annual Report.

5.4.1 Delta RFC entry and exit punctuality (30-min threshold)
It is the goal of RFC Rhine-Alpine to improve punctuality and reliability on the Corridor. This goal can be reached by three methods:
1) Train Performance Management (TPM),
2) an improved harmonisation and resilience of the PaP Catalogue and
3) the description of traffic bottlenecks.

TPM is described in chapter 5.3. The removal of bottlenecks is described more in detail in chapter 2.3 and 6.1.

The setup of the yearly PaP catalogue can help to improve punctuality by implementing specific procedures on harmonisation at border points. Furthermore, an improvement in punctuality can be achieved by insisting on realistic train paths. With these three strategies, RFC Rhine-Alpine intends to contribute to the stabilisation of the punctuality on the Corridor.

Punctuality is measured at Entry and Exit. Data is taken from TIS / 30 min. threshold. International freight trains crossing a border of an RFC are considered as RFC trains in the calculation. Entry is defined as the point a train enters the Corridor lines. Exit is defined as the point a train leaves the Corridor lines. RFC Rhine-Alpine uses the delta between Entry and Exit as a basis to exclude external factors (e.g., late start in a terminal, delays on a feeder line).

The evolution of the KPI Punctuality at Entry and at Exit as well as the delta between Entry and Exit Punctuality, showing the performance on the Corridor lines, is displayed in table 2.

Taking the development from 2018 to 2022 into consideration, the target is to keep the delta of Entry and Exit Punctuality (30 min threshold) stable at 16% in 2025. This takes into account the current and expected capacity limits on the corridor lines due to major construction works in the upcoming years.

						Objective
Evolution of punctuality (30 min threshold) in %	2018	2019	2020	2021	2022	2025
Entry Punctuality	65	66	70	66	64	
Exit Punctuality	55	55	59	52	48	
Delta Entry Punctuality vs Exit Punctuality	-10	-11	-11	-14	-16	**-16**

Table 2: Evolution of punctuality on RFC Rhine-Alpine (30 min threshold)

5.4.2 KPI Number of trains per border

This KPI encompasses international freight trains crossing a border of the RFC. Data is taken from TIS from 2023, previously data from the national systems was used.

RFC Rhine-Alpine is currently monitoring the following border crossings on the Corridor:
- For NL-DE: Emmerich, Venlo, Bad Bentheim
- For NL-BE: Zelzate (from 2021 onwards)
- For BE-DE: Montzen
- For DE-CH: Basel
- For CH-IT: Chiasso, Luino, Domodossola.

The Bad Bentheim border point (NL-DE) is included to have a full picture of traffic between the Netherlands and Germany to take into account re-routed trains due to works between Emmerich and Oberhausen, even though this border point is not a part of the Corridor lines.
All trains crossing at least one Corridor border, except locos and service trains, are considered. This means that not only trains running on PaPs are included. The total sum of the figures per border do not add up to the total number of trains on the Corridor, since, among other things, double counting of trains can occur if a train crosses more than one border.

The evolution of the number of trains per border (regrouped per country) is heavily influenced by the economic growth of the corridor region and can be seen in table 3.
The new objective is to stabilize the number of trains per border until 2025. To measure the progress in this area, RFC Rhine-Alpine uses the number of trains in the last five years (2018-2022) as the base value. As a Corridor objective, RFC Rhine-Alpine aims to stabilize the amount of Corridor trains at the respective average of the 5-year timespan (e.g., for the border pairs between the Netherlands and Germany, the

target is 45,590 for 2025). This takes into account that existing capacity on the Corridor lines will be limited in the coming years and economic growth in the countries on the Corridor has significantly slowed down.

Number of trains per border	NL – DE		NL-BE		BE – DE		DE – CH		CH – IT	
	Total	Yearly change	Total	Yearly change	Total	Yearly change	Total	Yearly change	Total	Yearly change
2018	43,266	0,92%	N/A	N/A	21,640	-1,28%	53,753	4,48%	47,125	1,96%
2019	45,367	4,86%	N/A	N/A	21,412	-1,05%	51,938	-3,38%	47,182	0,12%
2020	43,572	-3,96%	N/A	N/A	19,694	-8,02%	47,387	-8,76%	42,719	-9,46%
2021	46,175	5,97%	2,069	N/A	23,446	19,05%	50,005	5,52%	45,782	7,17%
2022	49,572	7,36%	1,685	-19,04	21,777	-7,12%	49,842	-0,33%	45,960	0,39%
Average 5 years & goal for 2025	45,590		1,877		21,594		50,585		45,754	

Table 3: Number of trains per border

5.4.3   Ratio of PaP capacity offered at X-11 to Final Timetable Offer (X-3)

Each year, around X-18, the RFC Rhine-Alpine C-OSS, together with the other RFCs, organises a client survey ("Capacity Needs Announcement") to have a better view on the quantity of PaPs needed for the next PaP catalogue. Based on the outcome of this survey, the Management board makes a preliminary decision about a PaP strategy (as far as quantity and quality are concerned) based on a proposal from the C-OSS. For this proposal, other parameters are also considered:
- offer previous timetable
- quantity of allocated PaPs of previous timetable
- total of allocated paths of previous timetable
- transport market study interpretation, if applicable
- Capacity Needs Announcement
- capacity availability and strategy IM (capacity model).

This proposal is then presented to the Executive board and adapted according to the input when it is deemed relevant by the Managing board.

The PaP catalogue consists of available capacity for freight trains, that can be offered by the IMs along the Corridor. By consulting RUs and freight forwarders running on the Corridor, RFC Rhine-Alpine is working on tailoring this offer gradually to better fit the needs of the customers. For this, a yearly evaluation with the Railway undertaking Advisory Group is being performed by the C-OSS.

It is the objective of RFC Rhine-Alpine to publish a PaP offer (at X-11) on all principal Corridor lines crossing a border that fits the needs of the customers in the best possible way. The quality of the initial PaP offer (at X-11) can best be derived through comparison to the Final timetable offer (at X-3), which is closest to the actual train run. The aim is to stabilize the ratio between PaP offer (at X-11) and Final timetable offer (at X-3) at 35 % until TT2026 (will be published in 2025).

Table 4 gives an overview of the volume of offered PaPs at X-11, the Final timetable offer (X-3) and the ratio of those.

Ratio of PaP capacity offered and Final timetable offer	TT 2019	TT 2020	TT 2021	TT 2022	TT 2023	Objective TT2026
Volume of offered pre-arranged paths (X-11) in million path-km	17.6	17.2	17.6	18.2	18.1	
Final timetable offer (X-3) in million path-km	6.4	5.6	4.1	5.0	6.9	
Ratio	36.36%	32.56%	23.30%	27.47%	38.12%	35%

Table 4: Ratio of PaP capacity offered and Final timetable offer

5.4.4 KPI Average Planned Speed of PaP

The goal of RFC Rhine-Alpine is to be a high quality and fast rail link that connects some of Europe's biggest metropolitan areas and economic hubs. This objective means increasing the efficiency, reliability and durability of end-to-end rail freight traffic, thereby strengthening the railway's competitive position, in line with European freight transport targets. Therefore, it is vital to continue the harmonisation of train paths between the different IMs and ABs.

In general, the average planned speed of PaPs shows the average of the planned commercial speed of the PaPs in km/h for selected connections. The KPI is calculated by dividing the length of the PaP by the planned travel time. Thus, the average planned speed of PaPs also includes necessary stops on the route, as well as parts with restricted speed (e.g., cities). On RFC Rhine-Alpine, it is constantly adjusted from year-to-year to better fit the needs of IMs and applicants respectively, for instance taking into account necessary stops for train drivers or necessary waiting times at borders on that O/D relation. Thus, increasing the speed of a PaP does not directly lead to better quality.

The objective is based on the following parameters:
- preview of TCRs
- preview of infrastructure investments
- the evolution of the path journey time in the past catalogue
- the evolution of the timetable journey time.

The goal is to keep the average planned speed of PaPs per selected O/D on the level of TT2024 until TT2026 (published in 2025), as the current values reflect years of adapting to enable smooth running of trains on the Corridor lines.

Table 5 gives an overview of the average planned speed of PaPs on RFC Rhine-Alpine in km/h.

Average planned speed of PaPs in km/h	Length of the stretch in km	TT 2020	TT 2021	TT 2022	TT 2023	TT2024	objective TT2026
Maasvlakte - Oberhausen Sterkrade	228.1 km	72.2	71.6	70.8	70.8	71.46	71.5
Y. Schijn - Dorsfeld	211.3 km	46.5	47.4	44.7	46.1	45.73	45.7
Basel SBB RB - Novara B. TO	339.5 km	60	59.8	40.4	39.6	42.05	42.1
Troisdorf - Basel SBB RB	509.0 km	62.1	63.7	61.5	61.3	62.70	62.7
Karlsruhe Gbf - Gallarate	519.4 km	N/A	N/A	52.2	51	50.82	50.8
Maasvlakte - Milano SM	1,148.3 km	N/A	N/A	55.2	53.9	56.18	56.2
Y. Schijn - Milano SM	1,092.9 km	N/A	N/A	50.1	50.5	52.47	52.5
Basel SBB RB - Milano SM	330.3 km	N/A	N/A	49.2	47.8	48.97	49
Basel SBB RB - Chiasso SM	274.0 km	N/A	N/A	58.5	58.6	57.93	57.9

Table 5: Average planned speed of PaPs on RFC Rhine-Alpine in km/h

5.5 User Satisfaction Survey

Mandated by all the RFCs, RNE organises an annual User Satisfaction Survey among the users of the RFC, as requested by Art. 19(3) of the Regulation (EU) 913/2010. Since 2022, the possibility is offered to have the survey in the form of an interview. The survey was also simplified to take the remarks of the customers into account.

The results are presented to and discussed with all stakeholders in the Executive Board, the Railway undertaking Advisory Group and the Terminal Advisory Group. The results of the survey are published on CIP (link, see tab "Information Documents").

6. Investment Plan

According to Article 11 of the Regulation (EU) 913/2010 the Management Board shall draw up and periodically review an indicative investment plan. This chapter includes details of the bottleneck analysis, a list of the foreseen projects on the Rail Freight Corridor, and the deployment planning related to the interoperable systems (ERTMS) along the freight corridor.

Investments on RFC Rhine-Alpine are based on national investment plans and correlate with the work plan developed for the Core Network Corridor (CNC) Rhine-Alpine. Projects may include EU-funding, if applicable.

The CNCs are an initiative of the EU to implement a core network by removing bottlenecks, building missing cross-border connections and promoting modal integration and interoperability for passenger and freight traffic to turn Europe's patchwork of roads, railways, airports and canals into a 'genuinely European' unified trans-European transport network (TEN-T). The national Ministries are obliged to comply with the TEN-T requirements of the Regulation (EU) 1315/2013 on the defined network, including the deployment of ERTMS by 2030 on the TEN-T core network. As regards ERTMS, the European Commission decided on a European Deployment Plan (Implementing Regulation 2017/6/EU) which includes the corridor deployment by and beyond 2023.

RFC and CNC Rhine-Alpine cooperate to prioritise and promote planned investments (Figure 6) while the railway networks associated to CNCs and RFCs are not fully aligned.
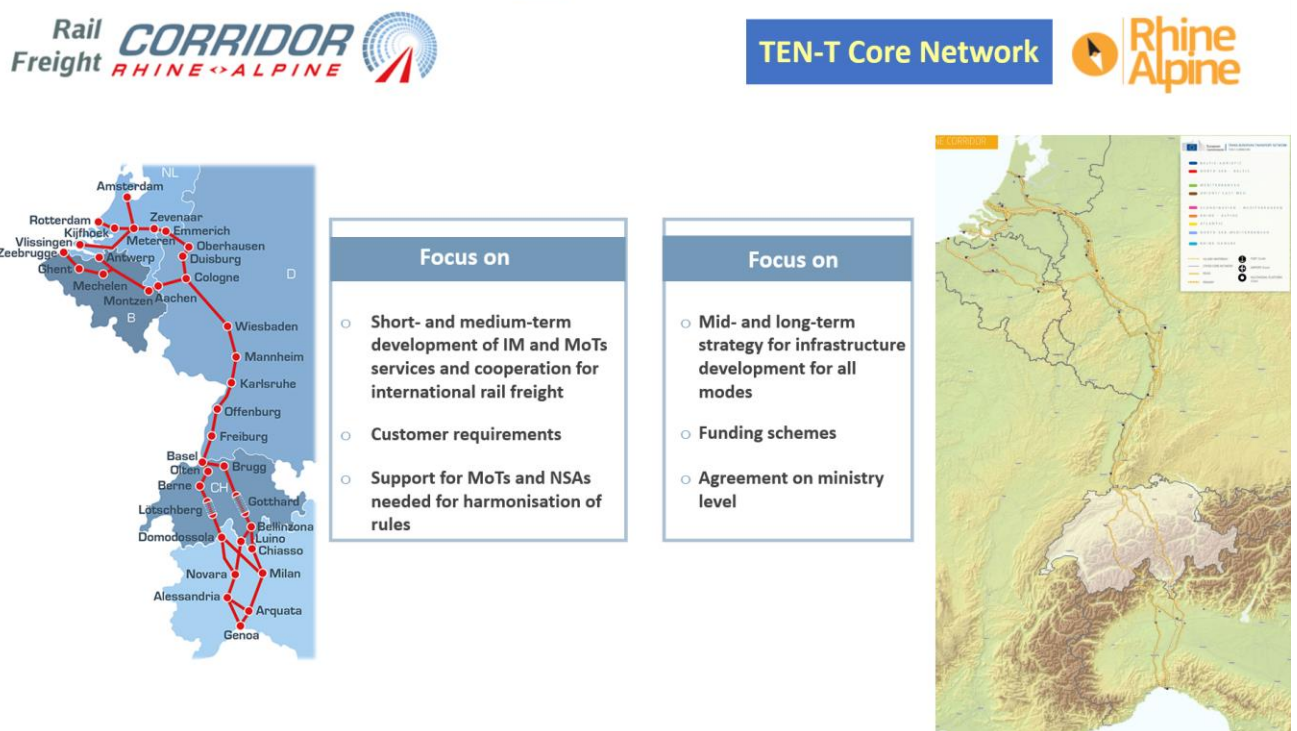
Figure 6: Cooperation RFC - CNC Rhine-Alpine

6.1 Capacity Management Plan

The Capacity Bottleneck Analysis (CBA) updated in 2023 is attached as Annex C. The list of projects in the document reflects the status of projects and investments in 2023 and can be found in Annex B.

The calculation of bottlenecks for rail infrastructure is quite complicated. National calculation methodologies at IMs and national decision processes on infrastructure development are different and a common bottleneck analysis for RFC Rhine-Alpine turned out to be an impossible task. Therefore, the Management Board of RFC Rhine-Alpine decided to set up the CBA on the basis of the national investment plans to identify the infrastructural bottlenecks. This is a joint corridor approach, consisting of a combination of the national information provided by the different IMs. The information has been compiled by the WG Infrastructure & Terminals and can be found in Annex C.

6.2 List of projects

In Art. 11, §1(a) of the Regulation (EU) 913/2010 it is requested that the investment plan includes a "list of projects foreseen for the extension, renewal or redeployment of railway infrastructure". The latest version of the RFC Rhine-Alpine list of projects is attached in Annex B.

The status of the decision-making on a project is a crucial element in the evaluation of potential future capacity bottlenecks. The decision-making processes on planning approval, building licence and financing are different from country to country. But using the available information on RFC Rhine-Alpine 5 stages are distinguished in decision-making:

How far is the decision making on a project	Meaning
Realised	Project has been completed / operational
Realisation	All necessary decisions are taken and money is available. The necessary funds are in place. The building process is ready to start or has already started.
Secured (S)	All necessary decisions are taken and money is available and the necessary funds are in place.
Planned (P)	First decisions are taken and financial reservations are planned
Study / To Be Decided (TBD)	Solutions how to solve problems are known, but no formal decisions are taken yet and financial funds are not yet known

Table 6: Five stages of decision-making

For all the projects, the decision status is mentioned in the list of projects in Annex B. The projects with the 'Realised' status are left out of the list. Also the funding source, including EU co-financing, when applicable, is shown.

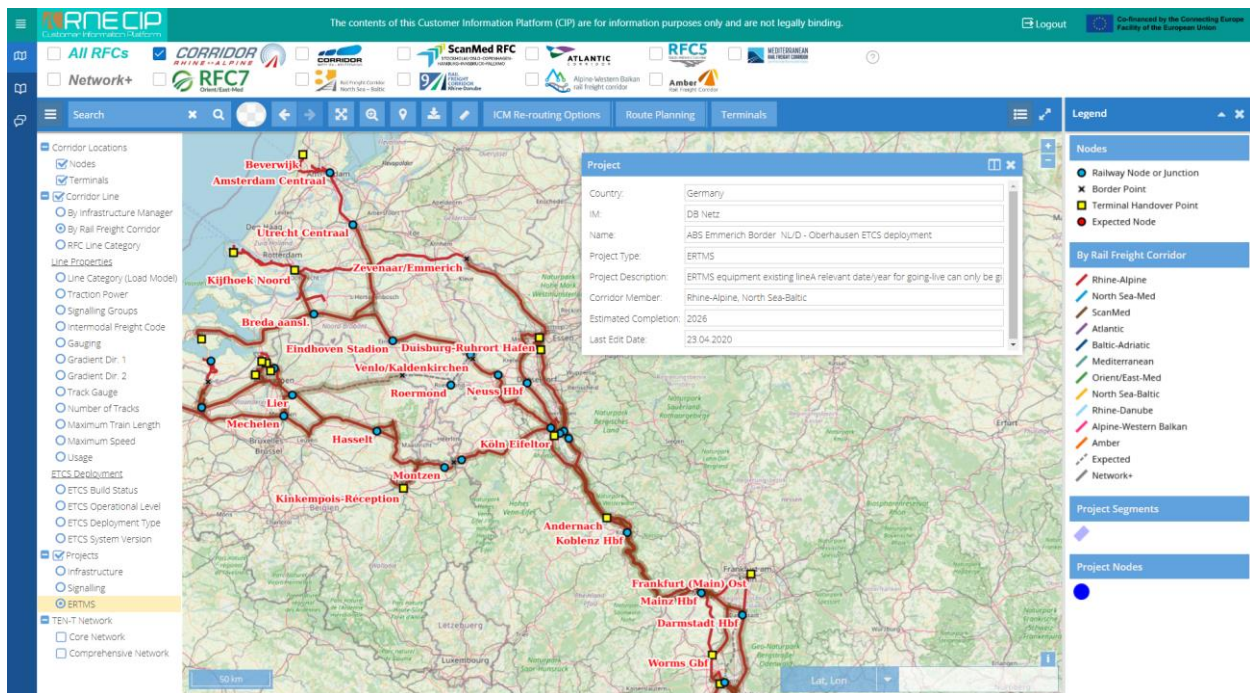Some project information is also available on the map in CIP (Figure 7).

Figure 7: Visualisation of infrastructure projects in CIP

6.3 Deployment plan (ERTMS)

6.3.1 Introduction

In order to keep up with the progress of digitalisation and growing traffic demand, the establishment of interoperability through a common European train control system is a paramount prerequisite. Subsequently, the implementation of ERTMS is part of the European policy.

The following chapter describes the ERTMS Deployment plan of RFC Rhine-Alpine (status 31.10.2023), according to Art. 11, 1(b) of the Regulation (EU) 913/2010. Legally the deployment by the Member States along RFC Rhine-Alpine is still based on the currently applicable European Deployment Plan for the European Rail Traffic Management System which is included in the Commission Implementing Regulation (EU) 2017/6 of 5 January 2017. This Regulation is expected to be updated in 2024.

In addition to the EDP, on 14 November 2017 the EU Commission published a working document on actions and associated objectives to achieve interoperability and drive ERTMS deployment (Delivering an effective and interoperable European Rail Traffic Management System (ERTMS – the way ahead)) also known as ERTMS Deployment Action Plan. It specifies that both, the CNC and RFC, which have as their constituent members certain of the addressed stakeholder groups (Ministries, NSAs and Infrastructure Managers), should also be used effectively to support ERTMS deployment.

In addition, in July 2022, Matthias Ruete, the ERTMS coordinator of DG Move, published his second work plan (link). It gives a serious look on the further implementation of ERTMS, setting the focus for the future on a more continuous and non-disruptive development.

6.3.2 Details of the corridor roll-out planning

This chapter contains details of the ERTMS deployment planning on RFC Rhine- Alpine. The information is indicative and can differ from the National Implementation Plans (NIPs) due to different update procedures, deadlines and dates for publication.

In **The Netherlands**, deployment started on the Betuweroute between Kijfhoek and Zevenaar which was inaugurated in 2007 as a dedicated freight line only equipped with ETCS B2, SRS 2.3.0d. Between 2007 and 2015 the connection to the Port of Rotterdam (Havenspoorlijn with ETCS L1) and from Zevenaar Oost to the German border (ETCS L2) have been converted to ERTMS. The further national ERTMS deployment on the main RFC Rhine-Alpine lines has been decided in 2019. The plan 2019 includes ERTMS roll out also on Rotterdam - Venlo and Amsterdam - Betuweroute by 2030. A significant update of the national ERTMS deployment plan is foreseen in 2024. At this stage it is not possible to provide more information.

In **Belgium**, the outlined ERTMS implementation of the Corridor lines is part of a country-wide migration program by 2025 in order to improve the safety level on the whole network. All vehicles in Belgium have to be operable with ERTMS in the near future, whereby ETCS L1 and L2 FS B2 and B3 infrastructure will be equipped with System Version 1.x to allow B2 and B3 locos. On the other hand, ETCS L1 LS B3 tracks shall be equipped with System Version 2.x in order to allow the operation in Limited Supervision. Railway operators are strongly encouraged to equip their rolling stock with baseline 3 to accommodate as much as possible future upgrades of the infrastructure, such as the introduction of GPRS for GSM-R.
Since December 2016, the Class B system Memor/Crocodile is put out of service on the lines equipped with ETCS Level 1 FS version 2.3.0d, allowing only trains equipped with ETCS Level 1 (minimum Baseline 2) or under certain exceptions TBL1+ to run on these tracks. Nevertheless, a Royal Decree published in 2018, with the latest revision on 6 December 2020 provides the progressive decommissioning of the Memor/Crocodile Class B system on the main tracks equipped with any level of ETCS by 14.12.2025. On the same date, TBL1+ will be decommissioned on all main tracks and Belgium will become an ETCS only network. TBL 1+ is probably available on branch routes until 2028.
In a next step, from 2026 L1 will be replaced by L2.

In **Germany**, the roll-out planning on RFC RALP has changed over the past two years in the course of developing the DSD strategy for the German network. L1 LS is no longer planned, except on border sections to Switzerland. The sections formerly planned with L1 LS are now to be equipped with digital interlockings and SRS 3.6.0 and SV 2.1.
Nevertheless, awarding of ETCS L2 SRS 3.4.0 SV 2.0 on RFC Rhine-Alpine lines in Germany has been tendered and contracted on dedicated lines since 2020. Putting into operation is expected stepwise and started in 2022. The first border crossing with ETCS will be completed in 2024 in the Basel area with L1 LS, border points in Aachen, Venlo/Kaldenkirchen and Emmerich/Kaldenkirchen are planned with L2 between 2028 and 2030. Unlike the Netherlands or Belgium, ERTMS on-board equipment of all vehicles is currently not foreseen or mandatory. The existing Class-B systems, especially PZB, will be operational in parallel to an ERTMS installation for a transition period. Decommissioning of Class-B systems is not yet decided.
The Federal Ministry of Transport, Building and Urban Affairs is currently planning to have a new "Overall ETCS Strategy" drawn up by the federal government for the economic, traffic-related and technical/operational introduction of ETCS. In September 2023, it publicly announced a call for tenders for the award of the contract. According to this, the "overall ETCS strategy" is to include the definition of a technical target image for ETCS/DSTW as well as supplementary measures from the "Digital Rail Germany" programme, the development of an upgrading and retrofitting concept for the infrastructure and vehicles as well as the development of measures to accelerate the equipping of vehicles with ETCS (e. g. funding instruments).

In **Switzerland**, the operation of ERTMS in L2 has already been well proven since years on the high- speed line from Rothrist to Mattstetten (2006), as well as on the Lötschberg base tunnel line (2007), since 2016

the Gotthard Base Tunnel and since 2020 the Ceneri Base Tunnel. In addition, miscellaneous conventional ETCS L2 lines have been taken into service, mainly on the Gotthard route and between Lausanne and Brig. The Class B systems ZUB and Signum have been replaced by ETCS L1 LS and EuroZUB/EuroSignum (Packet 44). This concept allows the operation of existing national vehicles and the use of vehicles equipped with ERTMS at the same time. ERTMS only operation with ETCS B3 vehicles is possible since 2017on the Swiss standard gauge network.

Besides this, Switzerland has already completed major investments for equipping the fleet with ERTMS. Studies for a further migration of vehicles are currently in progress.

In **Italy**, the successful operation of ERTMS in L2 has already been well proven since years on the high-speed line network, connecting Torino – Milano – Bologna – Firenze and Roma – Napoli. For the conventional lines during the last years major investments had been made to upgrade the Class B system into SCMT, which is based on the use of balises thus presenting a good basis for the implementation of ERTMS. The corridor lines will be mixed level lines with ERTMS and the existing Class B system. The operational scenario and the relevant risk management for the implementation of ERTMS L1 and L2 (the choice depends on the existing signalling systems) have been defined. Go Live of ERTMS on the Italian RFC lines started on the border sections Iselle - Domo - Domo II and Pino-Tronzano – Luino in 2018 and 2019, equipment of the RFC Rhine-Alpine network is expected to be completed stepwise until 2027. Decommissioning of the Class-B system is planned stepwise from 2023, depending on the progress of the vehicle equipment.

6.3.3 RFC Rhine-Alpine ERTMS Deployment Planning state of play

Graphical overviews and maps on the state of play of ERTMS deployment planning are provided in Annex D to this document. The corridor sections as well as some subsequent sections of adjacent corridors are shown with their planned completion dates, ETCS deployment type, ETCS system version, the planned development of the radio systems, the expected availability of class B/A-systems and an overview on the border crossings.

Selected information on ERTMS deployment is also available on the map in CIP in the area ETCS Deployment on the bottom of the left-hand side of the screen and in the information documents area (link). In the period until the next update of the ERTMS Deployment Overview the database in CIP will regularly be updated.

6.3.4 Current challenges
6.3.4.1 Solutions on cross-border sections

On RFC Rhine-Alpine, ERTMS will be applied and operated internationally, including border crossings. However, the installation and authorisation of the trackside part is still in the hands of each Member State. The currently available ERTMS specifications, product developments as well as authorisation rules will be proven on RFC Rhine-Alpine in an international corridor environment. On the cross-border sections the interaction is much more complex due to different national technical requirements and different operational rules. An overview of the cross-border solutions can be found in the figures 17 – 46 in Annex D to this document. These overviews illustrate the expected roll-out on the cross-border sections and the technical transitions to be managed in terms of the command control, voltage, and radio systems. The change in operational rules must also be considered.

6.3.4.2 Development of an ERTMS network and terminal connections

ERTMS is only beneficial for vehicle owners and railway undertakings when they can remove Class B equipment. This requires a seamless ERTMS network of lines between the major ports, terminals, and industrial loading facilities. The connection of terminals is taken into account up to the last transfer points of the national infrastructure manager, equipped with an interlocking system. Further ETCS equipment that may be required in the area of a third-party IM is not part of this overview.

6.3.4.3   Equipment of rolling stock with OBUs

Vehicle equipment is not part of the infrastructure manager's ERTMS implementation strategy. Nevertheless, the success of ERTMS is heavily depending on the availability of vehicles with the necessary on-board equipment. In this respect, the ministries and infrastructure managers of RFC Rhine-Alpine support the vehicle owners by a regular monitoring of the ETCS deployment, by participation in selected sector working groups and other initiatives. Ministries and EU are discussing coordinated funding programmes. In the Netherlands a retrofitting project is ongoing.

Different ETCS System Requirements Specifications (SRS versions) can be used on the vehicles and on the trackside. Therefore, it is important to understand their compatibility. Annex E to this document includes an overview of main definitions and schematic illustrations in this context. An updated version is in preparation to also consider the impact of the new TSI 2023 and was not yet available in time of publication of this document.

6.3.5 General issues of importance for the usage of ERTMS on RFC Rhine-Alpine

The following topics – which are naturally not part of the ERTMS deployment monitoring of an RFC – are relevant to achieve a fully workable interoperable ERTMS system and proper preparation of OBUs for ERTMS operations.

6.3.5.1   Vehicle authorisation process (in the frame of the 4th Railway Package)

Under the following link the Implementing Regulation (EU) 2018/545 establishing practical arrangements for the railway vehicle authorisation and railway vehicle type authorisation process can be found. The European Union Agency for Railways (ERA) developed a guideline for the vehicle authorisation process. This document and further explanations on the vehicle authorisation regime that applies as of 16 June 2019 with transitional provisions are available on the ERA website.
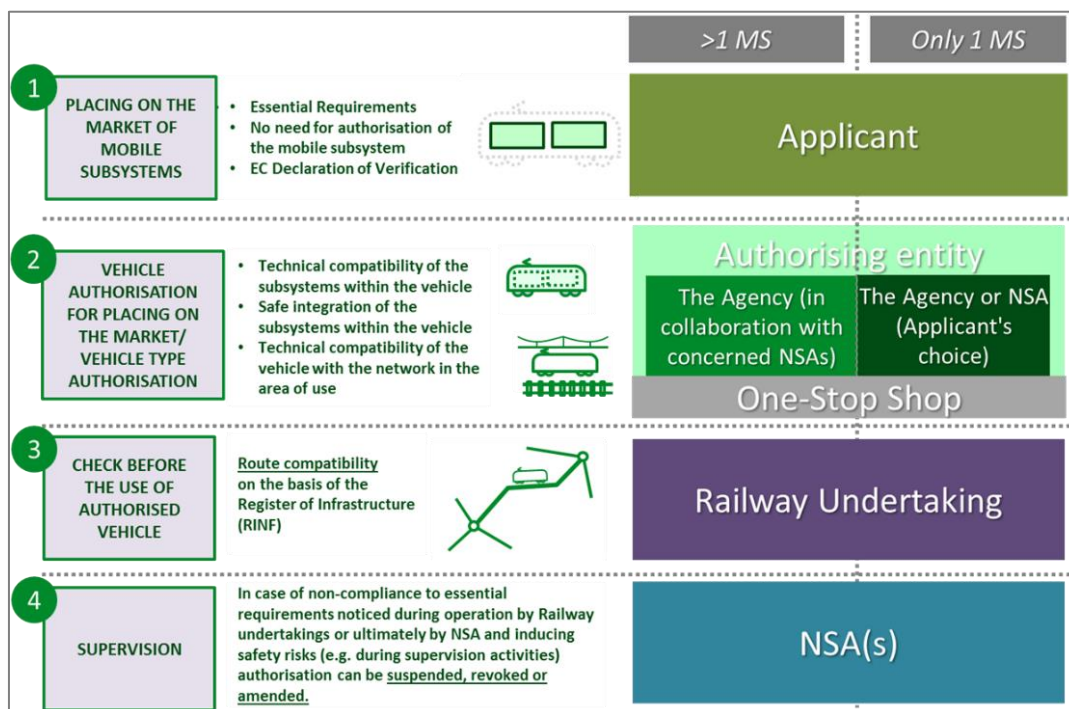
Figure 8: Overview on the technical pillar of the 4th Railway Package regarding vehicle authorisation (source: ERA)

ERA recommends conducting a "pre-engagement" for the preparation of an application before starting the official process via the ERA One Stop Shop.

One major element in the authorisation process are test cases for the ETCS and the Radio System Compatibility (ESC/RSC). The development of ESC/RSC test descriptions is in the responsibility of the IMs. Finally approved, ESC/RSC tests will be published on the ERA website. Until then, they will be published in advance on the IMs website (as far as available).

For vehicle owners it is important to know that new vehicles can no longer be equipped with B2 OBUs .

6.3.5.2   Security of the on-board – trackside communication (Key management)

ETCS L2 uses radio technology for the exchange of data. The protection of data transmission is done by encrypted codes (keys). IMs organise Key Management Centres (public KMC) for the generation, distribution, storage and communication of the keys. Users shall take care of the procedures on a national level. In general RUs/vehicle owners have to choose a Home KMC for their purposes, who will get in contact with the IMs.

Key management can be done offline or online. Currently only offline key management is offered by the IMs, although the technical specifications for online key management have been released (SRS 3.6.0, subset 114, 137). This may change due to an increase of ETCS vehicles. Also limited lifespan of keys will raise efforts for the involved parties. This will support migration to online key management.

The development of an online key management has been started at DB Netz and Infrabel, but it may be available only in certain areas of the network (WiFi-hotspots or lines equipped with GPRS, see point 6.3.5.5). Usage of online key management requires rolling stock equipped with SRS 3.6.0 and a server based online Home KMC.

Infrastructure Manager	Also Home KMC for RUs/vehicle owners	Key Lifespan	Link or contact person
ProRail	No	Unlimited	kmc@prorail.nl
Infrabel	No	Limited	kmc@infrabel.be
DB Netz	Yes	Limited	link
SBB / BLS	Yes	Unlimited	kmc-ch@sbb.ch
RFI	Yes	Unlimited	kmc@rfi.it

Table 7: ERTMS key management contacts

Experts on EEIG ERTMS Users Group - KMC Expert Group level developed a guideline on KMS (link) as a recommendation for common solutions and processes in the framework of European Rail Joint Undertaking (System Pillar). A security Domain (working group) has been established to deliver specifications of security requirements for the next TSI.

6.3.5.3   Driver Machine Interface (DMI) language

The DMI as part of the on-board equipment is an essential element of ETCS operations. Regarding the display of text information, the RU can order different language packages depending on the operational area of the rolling stock and drivers. The DMI language is part of the settings a driver must type in during the start-up procedure of his locomotive. The basic settings remain until the end of mission. Nevertheless, the DMI language can be changed manually on demand, e. g. at border stations. Nevertheless, regarding text messages transmitted by balises, the infrastructure managers can pre-set a language on their behalf. In addition, different expressions might be used for the same set of facts within a common language (e.g. "Rangieren" vs. "Verschub" (German used in Germany vs. Austrian German, Swiss German). On RFC Rhine-Alpine the following languages are used by the infrastructure managers for the transmission of text messages from balises to the DMI:

The Netherlands: English
Belgium: Dutch, French
Germany: German
Switzerland: German, French, Italian (change of language inside CH)
Italy: Italian

Train drivers shall be able to understand the content and communicate accordingly with the operational staff of the infrastructure manager when applicable. The RUs must take this into account in their SMS and instruct the drivers accordingly in their company regulations as misunderstandings between driver and operation centre can lead to safety issues.

6.3.5.4   Operational Rules

A train operated in ETCS must respect the national operational rules. On cross-border sections additional or deviating rules may apply. The relevant provisions can be found in the bilateral cross-border agreements which are available at the national infrastructure managers (part of the operational regulations relevant for network access).

International ETCS users have to take into account that the level of integration and harmonisation of operational rules is much lower in L1 than in L2 (e. g. change of braking curves at borders is included in L2).

6.3.5.5 Radio technology

GSM-R is currently the standard communication technology for railway applications along RFC Rhine-Alpine lines. As ETCS Level 2 is a digital radio-based signal and train protection system, all trains automatically report their exact position and direction of travel to the RBC (Radio Block Centre) at regular intervals, through the GSM-R network. This functionality is supported by the SRS 3.4.0.

Figure 9: Radio technology

GSM-R is expected to be phased out between 2030 and 2035. Therefore, there is a need for a more powerful radio system. Basically, the replacement of GSM-R with a 5-generation radio technology is planned and in preparation (Future Railway Mobile Communication System - FRMCS). However, the completion of the technical specification and the product development of FRMCS is not completed. Planning of a network-wide implementation trackside and on-board is not yet possible. Authorised products may not be available before 2028. ProRail, DB Netz and RFI have therefore decided to upgrade their GSM-R network partially or completely with General Packet Radio System (GPRS) as a bridge technology and thus to install significantly higher transmission capacities. Overviews can be found in Annex D, figures 9-12.

A corresponding GPRS-compatible radio module is required on the vehicle if the RU or the vehicle owner wants to benefit from the additional transmission capacities, e. g. for the usage of SRS 3.6.0 and online key management. It should be noted that vehicles with SRS 3.4.0 can continue to be used on lines equipped with GPRS. Nevertheless, from a capacity point of view the infrastructure managers are striving to ensure a high proportion of vehicles with SRS 3.6.0 from 2025 onwards until FRMCS is available.

6.3.5.6 Transmission of information in L1 with Euroloop and Radio Infill

In L1, data can be transmitted to an OBU by balises, Euroloop or Radio Infill. On RFC Rhine-Alpine, Switzerland and Italy have chosen to use Euroloop (CH and dedicated border lines to Italy) and Radio Infill (Italy). In Italy, rolling stock equipped with B2 and an STM (SCMT) does not need the Radio Infill functionality until SCMT will be decommissioned. Rolling stock with ETCS Baseline 3 OBUs need the Radio Infill functionality independent from an equipment with NTC SCMT.

6.4 Reference to Union Contribution

RFC Rhine-Alpine has been benefiting from European co-financing for several years. At the moment the Corridor is receiving a grant under the CEF II Programme – Technical Assistance (Project 101082987 – 21-DE-TG-RFC Rhine-Alpine) for the years 2021 – 2024.