



# North Sea – Mediterranean TEN-T Core Network Corridor

*3<sup>rd</sup> Phase (prolongation)*

*3<sup>rd</sup> Final Report*

*November 2023*

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## Disclaimer

The information and views set out in the present report are those of the author(s) and do not necessarily reflect the official opinion of the Commission. The Commission does not guarantee the accuracy of the data included in this study. Neither the Commission nor any person acting on the Commission’s behalf may be held responsible for any potential use which may be made of the information contained herein.

## Abbreviations

AC	Alternating Current
BE	Belgium
CDG	Charles de Gaulle
CENT	European Conference of Transport Ministers
CNC	Core Network Corridor
CNG	Compressed natural gas
DC	Direct Current
DE	Germany
EDP	European Deployment Plan
EEIG	European Economic Interest Grouping
ERTMS	European Rail Traffic Management System
ETCS	European Train Control System
EU	European Union
HAROPA	The ports of Le Havre, Rouen and Paris
ITS	Intelligent Transport Systems
IWW	Inland waterways
km	kilometer
KPI	Key performance indicator
kV	Kilovolts
LPG	Liquefied petroleum gas
LNG	Liquefied natural gas
m	meter
MoS	Motorways of the Sea
NL	The Netherlands
NSMED	North Sea - Mediterranean
PIR	Project Implementation Reports
RFC	Rail Freight Corridors
RIS	River information system
RRT	Rail-road terminals
SAF	Sustainable Aviation Fuel
TEN-T	Trans-European Transport Network

## 1 Introduction

The present report constitutes the 3<sup>rd</sup> Final Report of the 3<sup>rd</sup> Phase of the North Sea - Mediterranean (NSMED) Corridor Study. It summarises the results of the Key Performance Indicators (KPIs) updated in TENtec OMC (Task 3.6) for the NSMED corridor and a qualitative analysis and problem analysis of the Corridor resulting from this update. It demonstrates the current state of implementation per infrastructure section and transport node.

## 2 Compliance of the Corridor with the technical infrastructure requirements of the TEN-T regulation

The North Sea - Mediterranean Core Network Corridor stretches from Dublin, Limerick and Cork in the north-west to Lille, Paris and Strasbourg in the centre, Marseille in the south, and extends north-east to Benelux towards Amsterdam via Luxembourg and Brussels. It covers five countries, namely Belgium, Ireland, France, Luxembourg and the Netherlands. It includes some of the most significant economic and production centres in Europe, as well as key European ports (Northern Range ports, Marseille, Irish ports). It reaches the German and the Swiss borders, connecting to the Rhine Alpine Corridor with onward links through the Alpine region to Italy. It also connects to the Mediterranean, Atlantic, North Sea – Baltic and Rhine - Danube Corridors opening up to wide European regions.

It provides links to the land border with Northern Ireland and offers maritime connections with Great Britain. It consists of 5,452km of railways, 3,233km of roads and 4,019km of inland waterways<sup>1</sup>.

**Figure 2-1: Schematic alignment of the North Sea – Mediterranean Corridor, 2023**



Source: Panteia

<sup>1</sup> Including existing sections as well as sections still to be constructed/completed.

The NSMED is part of an EU-wide network and offers connectivity to the rest of the EU via its connections to other Corridors, as well as through its ports (see Figure 2-2: TEN-T Core Network Corridors).

**Figure 2-2: TEN-T Core Network Corridors**



*Source: European Commission*

The state of implementation of the Corridor's infrastructure was defined via KPI calculations per section and node, according to the infrastructure targets and definitions set out in Regulation No. 1315/2013. In this reporting period, the Corridor KPIs have been updated in TENtec for the years 2021 and 2022 for the 11 KPIs<sup>2</sup> found in the table below.

The update was carried out as follows:

- The updates involved the existing sections (excluding planned sections), which are not compliant yet;
- The update is based on the narrow update of the project list (PIR 2023-1), data of the consultants and network statements of the infrastructure managers;
- The work has been carried out in close cooperation and work sharing between the 9 CNC consultants' teams;
- The work was carried out between July and August 2023.

The following sections provide per mode of transport a qualitative analysis and problem analysis resulting from this update. For KPIs outside the scope of this update,

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<sup>2</sup> As per ToR requirement

information from the previous Corridor study update is given, so that a complete overview of the entire Corridor is provided.

**Table 2-1: TEN-T Key Performance Indicators to be updated in TENtec OMC**

**Key performance indicators**

- (1) Rail: Loading gauge ( $\geq$  P400)
- (2) Rail: Maximum train length ( $\geq$  740m)
- (3) Rail: Max axle load ( $\geq$  22,5 tonnes)
- (4) Rail: Line Speed ( $\geq$  100km/h)
- (5) Rail: Track gauge (1435mm)
- (6) Rail: Electrification
- (7) Airports: Connection to rail
- (8) IWW: RIS implementation
- (9) IWW: Permissible height under bridges ( $\geq$  5,25m)
- (10) IWW: Permissible draught ( $\geq$  2,5m)
- (11) IWW: CEMT IV class ( $\geq$  IV)

Source: Panteia

## 2.1. Railways infrastructure

Rail compliance is considered for the following parameters: electrification, track gauge, freight train axle load, freight speed and freight train length. The current compliance (as of December 2022) of the railway network with the TEN-T KPIs is shown in the figures and table below.

**Figure 2-3: NSMED Rail compliance with TEN-T regulations, status December 2022**

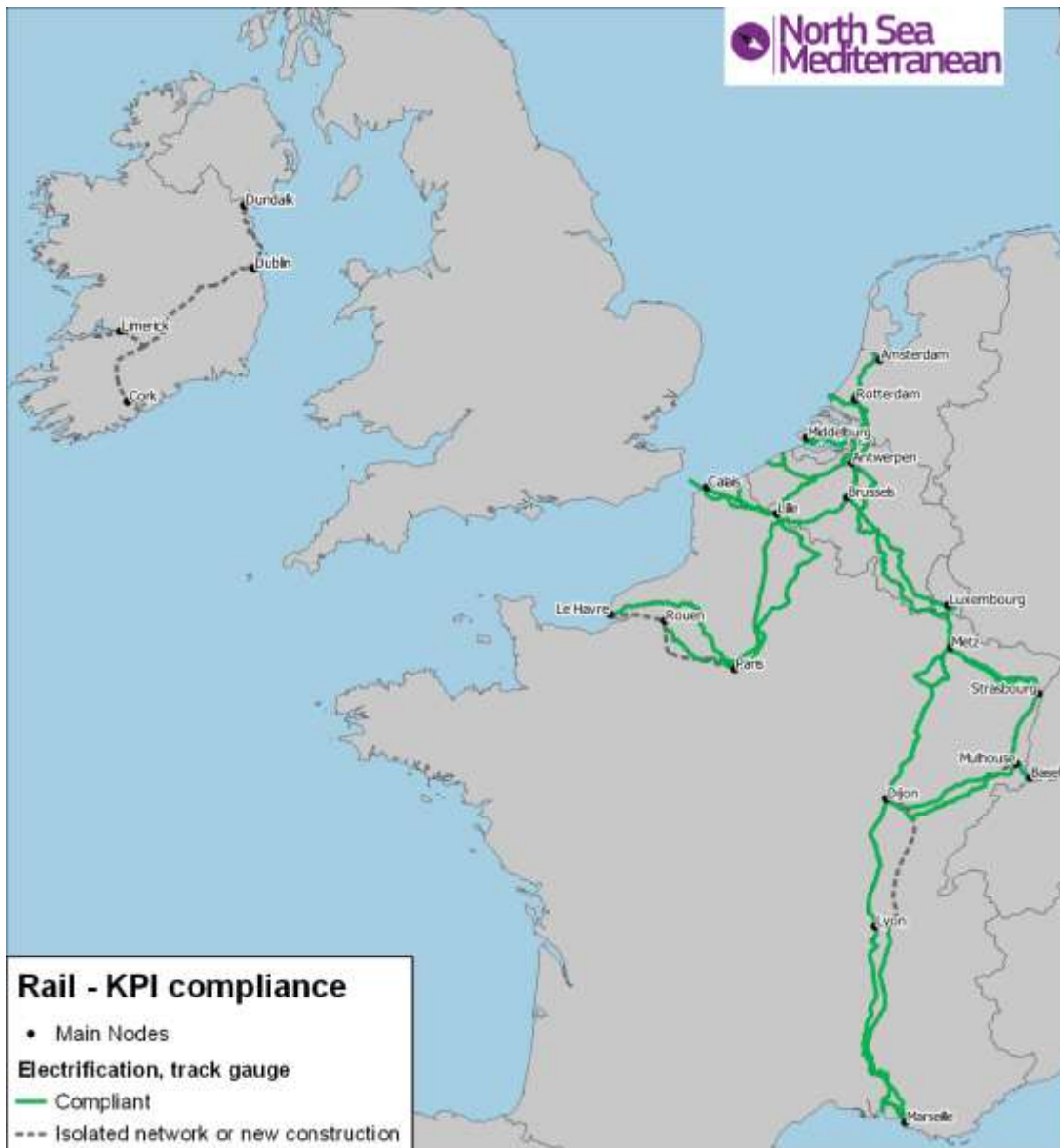


Source: Panteia, based on TENtec

The NSMED rail network comprises three main categories of sections: isolated, conventional (for freight and/or passenger trains), and high-speed lines. Ireland, with a non-standard track gauge, is deemed an 'isolated network' and is exempt from TEN-T requirements. In the continental Corridor, all sections adopt the standard European track gauge (1435 mm). Non-isolated lines, including high-speed passenger lines, must provide electrification and the European Rail Traffic Management System

(ERTMS). Freight lines, catering to both passenger and freight trains, must meet specific standards for train length, axle load, and line speed. While all non-exempt sections comply with track gauge and electrification, voltage standards vary in the NSMED Corridor. The French network south of Dijon uses 1.5kV DC, the northern part of the French network, Luxembourg, and a segment of the Belgian network uses 25 kV AC. The rest of the Belgian network employs 3kV DC. The EuroCap-Rail project aims to equip the majority of the Brussels-Luxembourg axis with 25kV, enhancing interoperability. The Netherlands uses 1.5 kV DC, except for high-speed lines using 25 kV AC. Voltage system disparities pose potential interoperability challenges, especially at border crossings, necessitating dedicated locomotives with different voltage systems or locomotive changes.

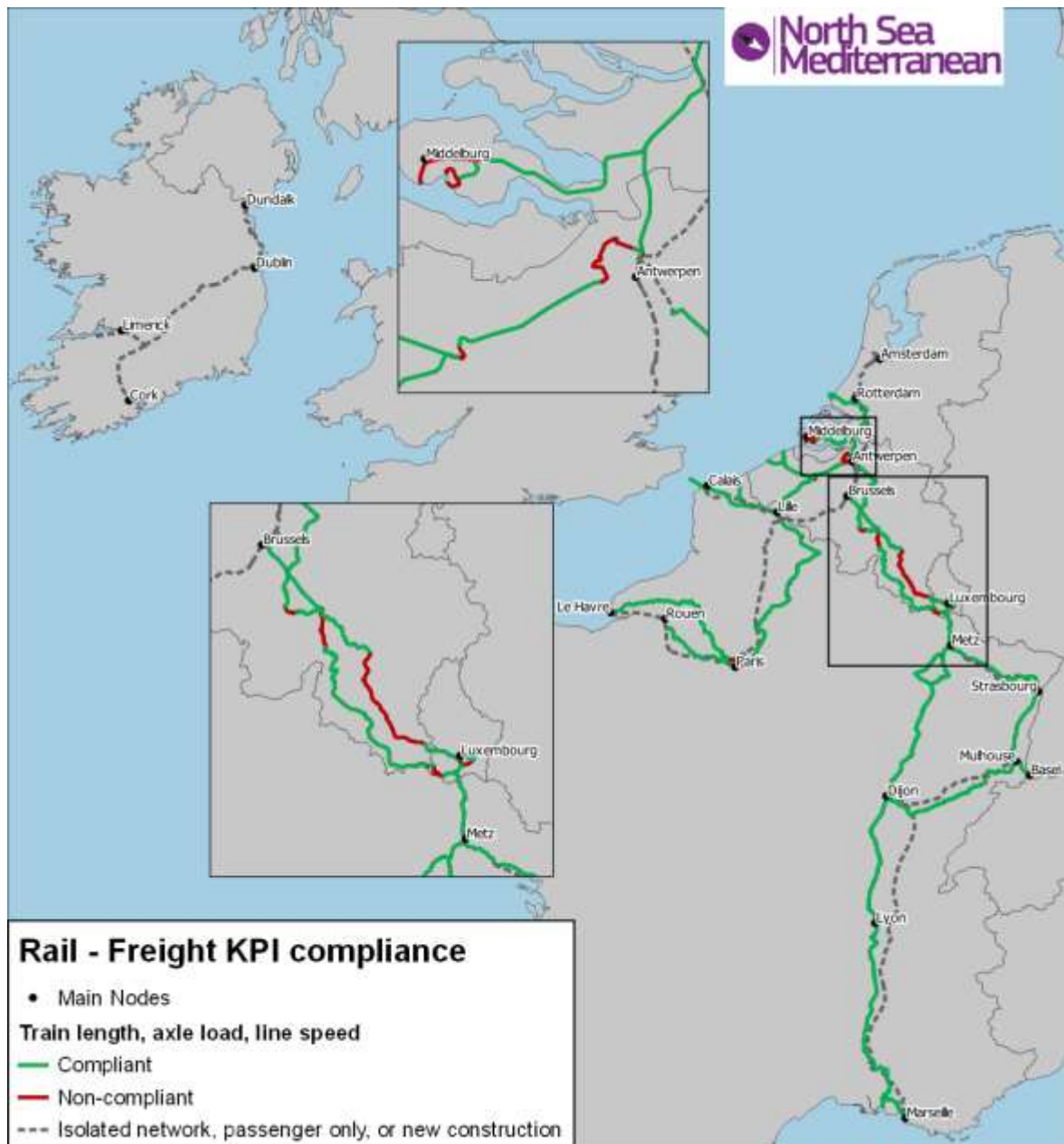
**Figure 2-4: NSMED railway network – KPI Compliance ‘Electrification’ and ‘Track Gauge’, status December 2022**



Source: Panteia, based on TENtec



**Figure 2-5: NSMED railway network - KPI Compliance 'train length', 'axle load' and 'line speed', status December 2022**



Source: Panteia, based on TENtec

The NSMED Corridor has high compliance with line speed (96%). Many sections permit freight speeds exceeding 120km/h. Some urban areas and specific locations, including Antwerp, Paris, Namur, Luxembourg's border with Belgium, and the route to the Port of Vlissingen, face speed constraints. Ireland, though exempt, allows speeds over 100km/h on most sections.

Axle load compliance is nearly universal (99%), except for a 20t axle load allowance on the Vlissingen city line in the Netherlands and a short non-compliant section between Calais Port and Fréthun in France. Climate-related soil instability poses additional concerns in the Netherlands.

Despite an overall 97% compliance with the 740m train length mandate, challenges persist. France and Luxembourg allow 850m trains on a designated axis. However,

operational restrictions in Belgium and the Netherlands, especially during peak hours, limit trains to 650m. In Belgium, the Marloie-Arlon section is restricted to 700m (excluding the locomotive), with plans to achieve full compliance by 2030. In the Netherlands, despite a suitable network for 740m trains, practical restrictions exist. Investments are deemed necessary, and doubts linger regarding meeting the 2030 deadline to lift all restrictions.

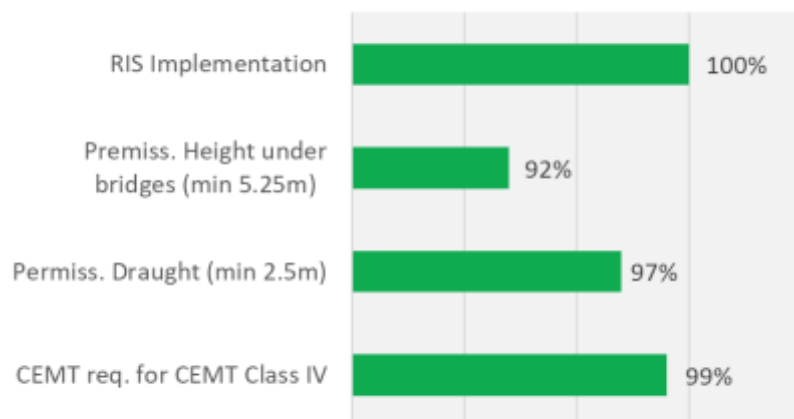
### Remaining gaps:

- There are five non-completed rail sections (missing links) in the Corridor:
  - the reinstatement of the rail connection from Limerick to Foynes - ongoing, to be completed by 2030;
  - the Antwerp bypass between Lier and the Port - ongoing;
  - the new Paris-Le Havre line - sections to be started by 2030, but not completed before 2040;
  - the second phase of the Eastern and Western branches of the Rhine-Rhône highspeed line (35km near Mulhouse, 15km Auxonne-Dijon) - is not foreseen to be built by 2030;
  - the southern branch (Lyon-Dijon) of the Rhine-Rhône high-speed line - not to be built by 2030.
- There are rail capacity bottlenecks around urban nodes, in particular in Lyon, Antwerp, Marseille, Brussels, Lille, Paris, Luxembourg, Amsterdam, Metz and Strasbourg. Ireland also faces traffic congestion in its largest nodes of Dublin and Cork and enhancing their urban rail systems is part of the strategy to address it. Various projects are underway to address rail capacity constraints across the Corridor.
- Along the NSMED Corridor, the P400 loading gauge is currently feasible within the railway networks in Belgium, the Netherlands and Luxembourg, but there are issues in France, most notably between Metz and Strasbourg. This creates an obstacle for the development of a P400 route along the NSMED Corridor towards Switzerland and Italy. Further loading gauge bottlenecks were identified close to Marseille. The P400 loading gauge restrictions in France are not expected to be solved by 2030.
- By 2030 it is expected that the majority of issues related to line speed will be solved. However, full compliance on train length is still uncertain.
- It will not be possible to meet the ERTMS EDP deadlines in this Corridor by 2023. ETCS deployment will only be on prioritized routes.
- Operational barriers preventing trains from crossing borders smoothly and efficiently remain.

## 2.2. Inland Waterway infrastructure

Overall, the NSMED waterway network is steadily moving towards full compliance with the TEN-T parameters, with more than 90% of the Corridor being compliant.

**Figure 2-6: NSMED IWW compliance with TEN-T regulations, status December 2022**



Source: Panteia, based on TENtec

Regarding CEMT Class IV, only 40km of existing infrastructure remains non-compliant, mainly located in Belgium and France. The Corridor is almost compliant for permissible draught (97%), with 106km not compliant. This includes 71.5km in Belgium on the Boven Zeeschelde, (which is tidal) and on the Dorsale Wallonne, including the CondéPommeroeul (due to sedimentation). The main remaining issue relates to bridge height, with a total of 269km of waterway sections being non-compliant in Belgium and France (for example bridges near Brussels, Mons, Bocholt, Avignon, Nancy and on the Petite Seine). Navigational problems can occur under conditions of high water along the Seine in Paris due to the height of certain bridges.

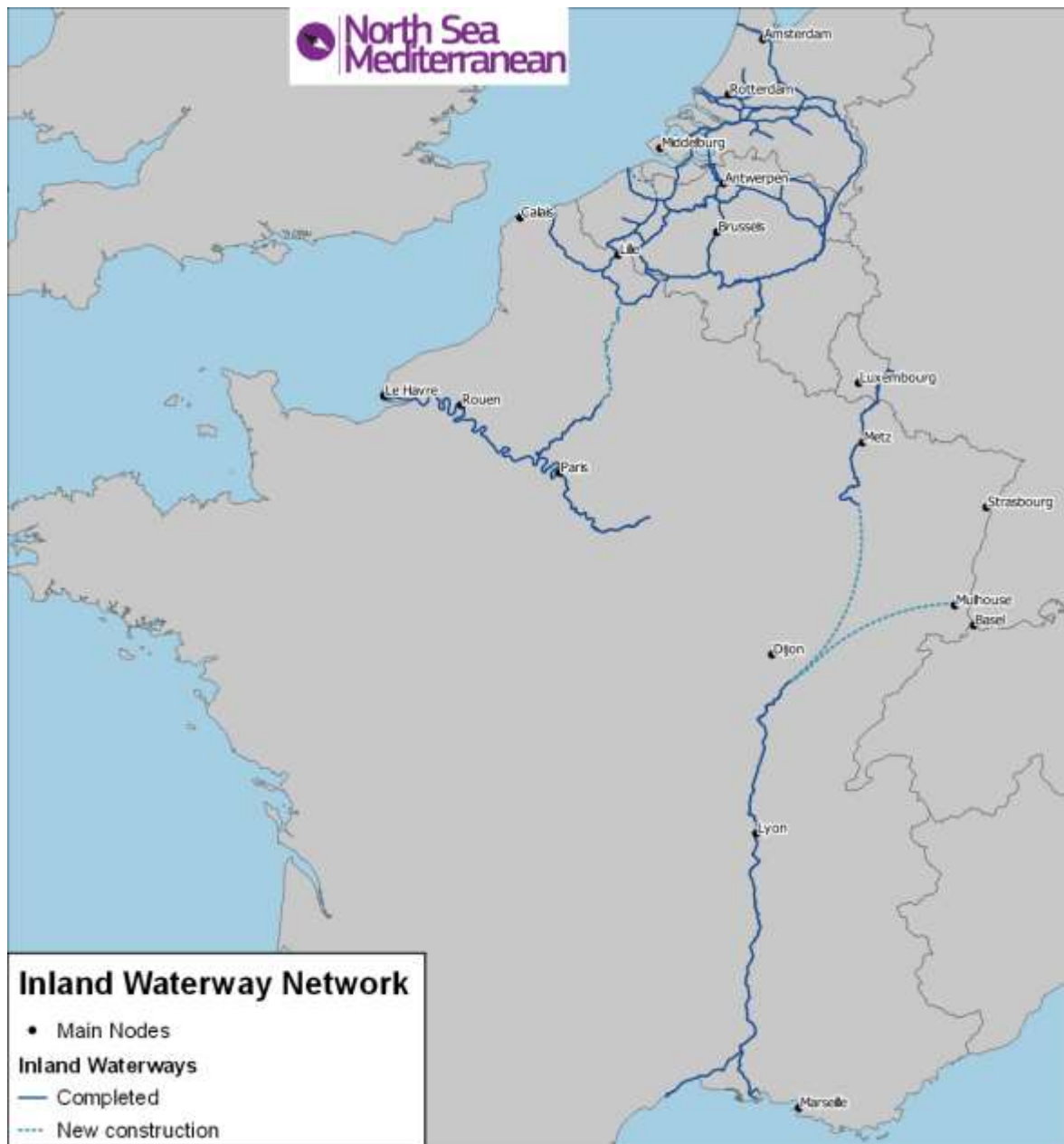
Regarding RIS, there is only one minor exception close to the Port of Fos (the section is directly managed by the Port). However, discrepancies still exist between the national systems. RIS has helped to standardize practices within the EU, but not to the full extent possible.

#### Remaining gaps:

- Several of the issues related to CEMT Class IV and depth issues in Belgium and France are currently being addressed as part of the Seine-Scheldt project, and by 2030 most of them are expected to be solved.
- In addition, the TEN-T Regulation foresees the construction of four canals by 2030: the Seine-Nord Europe canal, a new canal bypassing Brugge between Ghent and Zeebrugge, as well as the Saône-Rhine and Saône-Moselle canals. The two latter missing connections in Eastern France will not be built by 2030. The Seine-Nord Europe canal is planned to be completed by 2030. The canal between Ghent and Zeebrugge bypassing Brugge is under study and is expected to be completed only after 2030.
- The inland waterway connection to Zeebrugge will be improved in the short to mid-term through an upgrade of the existing waterways as well as through the facilitation of the navigation of estuary vessels via the Western Scheldt River.
- Although the Corridor is close to full compliance for CEMT Class IV, one of the aims of the NSMED Corridor is to develop efficient high-capacity waterways, of CEMT Class V or higher and with higher bridge heights on certain itineraries, generally to allow for 3 layers of containers, in some cases even 4 layers. This is needed to be competitive with other transport modes.

- In France, the Marseille-Rhône-Saône axis benefits from a wide-gauge waterway infrastructure up to close to Dijon, serving Marseille (Port of Fos), Lyon and several cities and inland ports along the way. However, it still has a low share of river freight traffic.
- Finally, climate change has been testing the resilience of the Corridor waterways and challenging the maintenance of good navigation. The drought periods have been posing issues, creating transport restrictions and supply chain disruptions.

**Figure 2-7: NSMED IWW network**



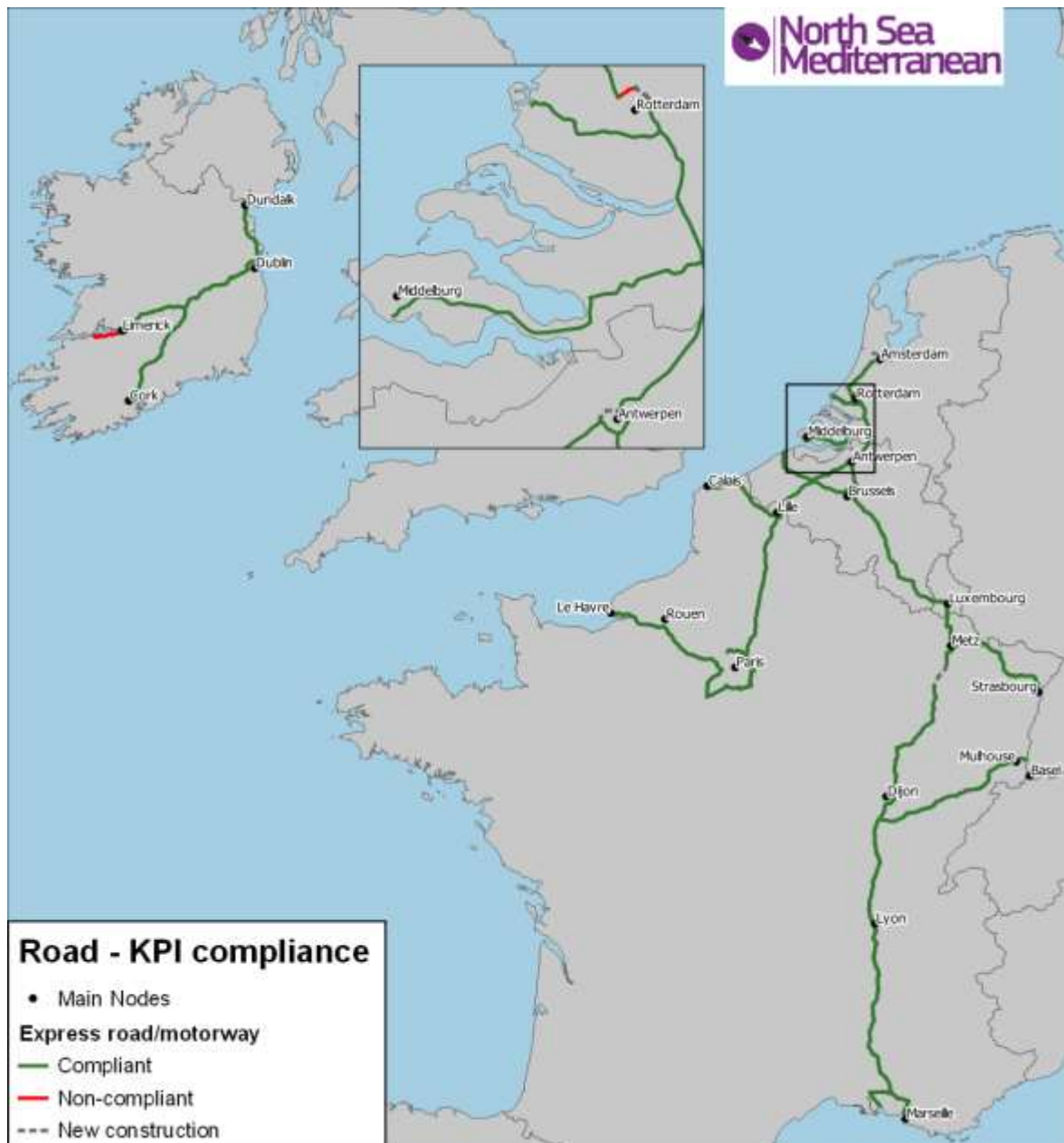
Source: Panteia, based on TENtec

### 2.3. Road infrastructure

The most recent compliance (as of December 2020) of the NSMED road network with the TEN-T KPIs is shown in the figure below. Around 99% of the road network is compliant with the 'road class' parameters. Two sections are classified as non-motorway or expressway:

- The N69 between Limerick and Foynes, which is a mainly single-carriageway road with open junction. This will be addressed by 2030 through the construction of a new section.
- The N209 close to Rotterdam-The Hague Airport, which is also a single-carriageway road. The upgrading of this section to a motorway is part of the ongoing construction of the A16 bypass, which will be ready in 2025.

Figure 2-8: NSMED Road network - Compliance December 2020



Source: Panteia, based on TENtec



### Remaining gaps:

- The NSMED road network has three missing links:
  - The A31 Bypass around Nancy (Dijon-Metz section). There is a project foreseen to relieve traffic on the Toul-Nancy-Metz-Luxembourg axis, however this is not expected to be built before 2030.
  - The A16-A13 bypass around Rotterdam (Rotterdam node). It will be completed before 2030.
  - The north-west section of the R1 Oosterweel ring-road in Antwerp. It will be completed by 2030.
- The construction of missing links addresses road congestion in given areas, but congestion needs to be tackled further, in particular around urban areas. Cork, Amsterdam, Rotterdam, Antwerp, Brussels, the Luxembourg-Metz stretch, Paris, Strasbourg, Lille, Lyon and Marseille can be mentioned.
- With regards to safe and secure truck parking, there are shortages in terms of number of facilities and the capacity they offer. This is particularly the case in Ireland and Luxembourg and to a lesser extent in France. However, progress is being made, especially in the central part of the Corridor between Calais, Brussels, Antwerp, and the south of the Netherlands.

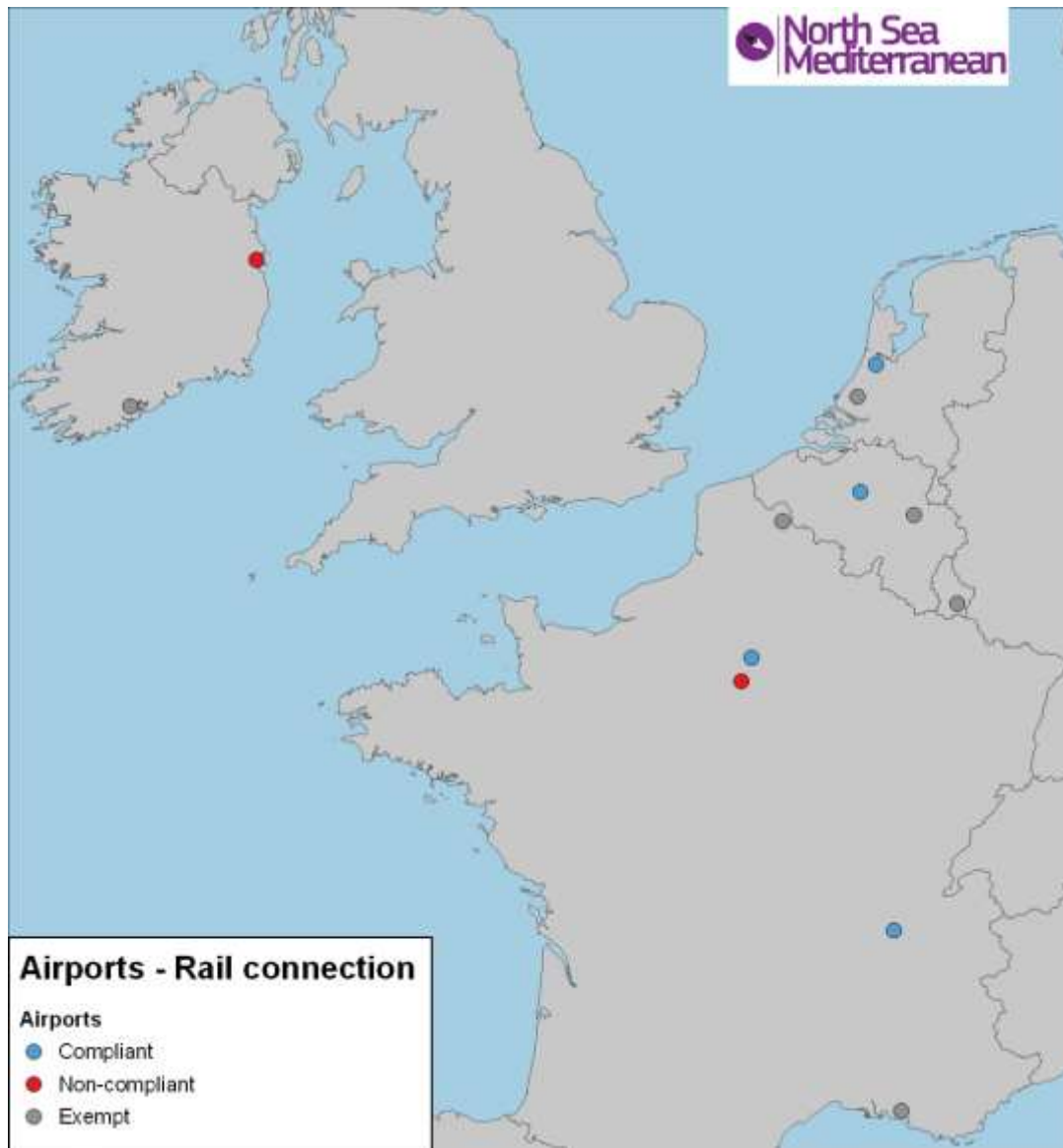
## 2.4. Airport infrastructure

The “main” TEN-T airports, following Article 41 of the TEN-T Guidelines, are required to have rail connections by 2050, except where there are physical constraints. In general, to promote air-rail connectivity, TEN-T airports should be integrated into the rail network wherever possible. Additionally, airports are required to make available alternative clean fuels.

### Remaining gaps:

- Out of a total of twelve airports, six are exempt, four are compliant (Amsterdam, Brussels, Paris CDG and Lyon St-Exupéry) and two are considered non-compliant:
  - Paris-Orly has a light rail connection of limited capacity. The extension of metro line 14 to Orly airport, for which works are ongoing and are to be finished in 2024, will connect the airport to the new rail station Pont de Rungis. The new high-speed station will not be directly located in the airport.
  - Dublin airport has no rail connection yet, but a light rail connection, which will interchange with the existing light and heavy rail networks in Dublin city centre, MetroLink, is under development. It is expected to be completed by 2034.
- The use of alternatives to conventional aviation fuels is still in its infancy, and currently policy is directed towards the use of sustainable aviation fuel (SAF), in practice blended biofuels, as well as schemes for offsetting CO2 emissions.

**Figure 2-9: NSMED airports - Compliance December 2022**



Source: Panteia, based on TENtec

## 2.5. Port infrastructure

The Corridor includes three of the top 5 seaports in Europe, namely Rotterdam, Antwerp-Bruges and Amsterdam - both in terms of tonnes and containers handled - along with other major ports on the continent such as Marseille, Le Havre, Dunkerque, Zeebrugge and North Sea Port. The Irish ports Dublin, Cork and Shannon Foynes provide important short sea connections to Ireland.

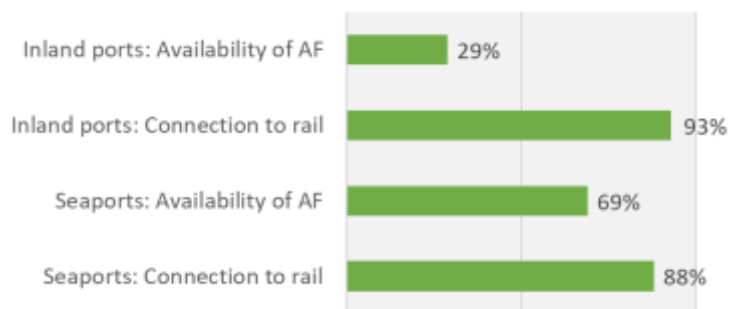
Rail connectivity is well-established in continental ports, while Irish ports Shannon Foynes and Cork lack active rail connections, with plans for reinstatement by 2030 under Iarnród Éireann’s Rail Freight Strategy. Ongoing studies target re-establishing rail links to Shannon Foynes, while Marino Point in Cork is planned for rail reconnection to facilitate bulk commodity transport by 2030.

In terms of waterway access, all non-exempt maritime ports meet the required CEMT class IV or higher connection. Calais relies on the CEMT class I Calais-St-Omer canal, deemed sufficient for its primarily UK truck and car traffic. Marseille lacks direct inland waterway access, but Fos-sur-Mer, linked to the Rhône, serves its logistics activities. A project aims to develop the river from Fos to Lyon. Zeebrugge has a compliant class IV connection, with capacity set to increase as part of the Seine-Scheldt project.

Currently, 26 of the 28 inland ports in the Corridor have a rail connection to the port, all have CEMT Class IV waterway connections (or higher). Bergen-op-Zoom and Nijmegen have no freight rail connection, but the latter has a rail freight terminal (Park15) on the opposite side of the River Waal. Only 29% of the inland ports offer alternative clean fuels (all inland ports offering clean fuels are also maritime ports).

The definition of "availability" regarding alternative clean fuels lacks clarity, specifically whether it pertains to fixed or mobile facilities. Currently, 69% of maritime ports and 29% of inland ports provide some form of alternative clean fuels for shipping (e.g., CNG, (bio) LNG, onshore electricity, hydrogen). If the availability of bunkering ships for (bio) LNG were considered, the percentages could increase.

**Figure 2-10: NSMED port compliance with TEN-T regulations, status December 2020**



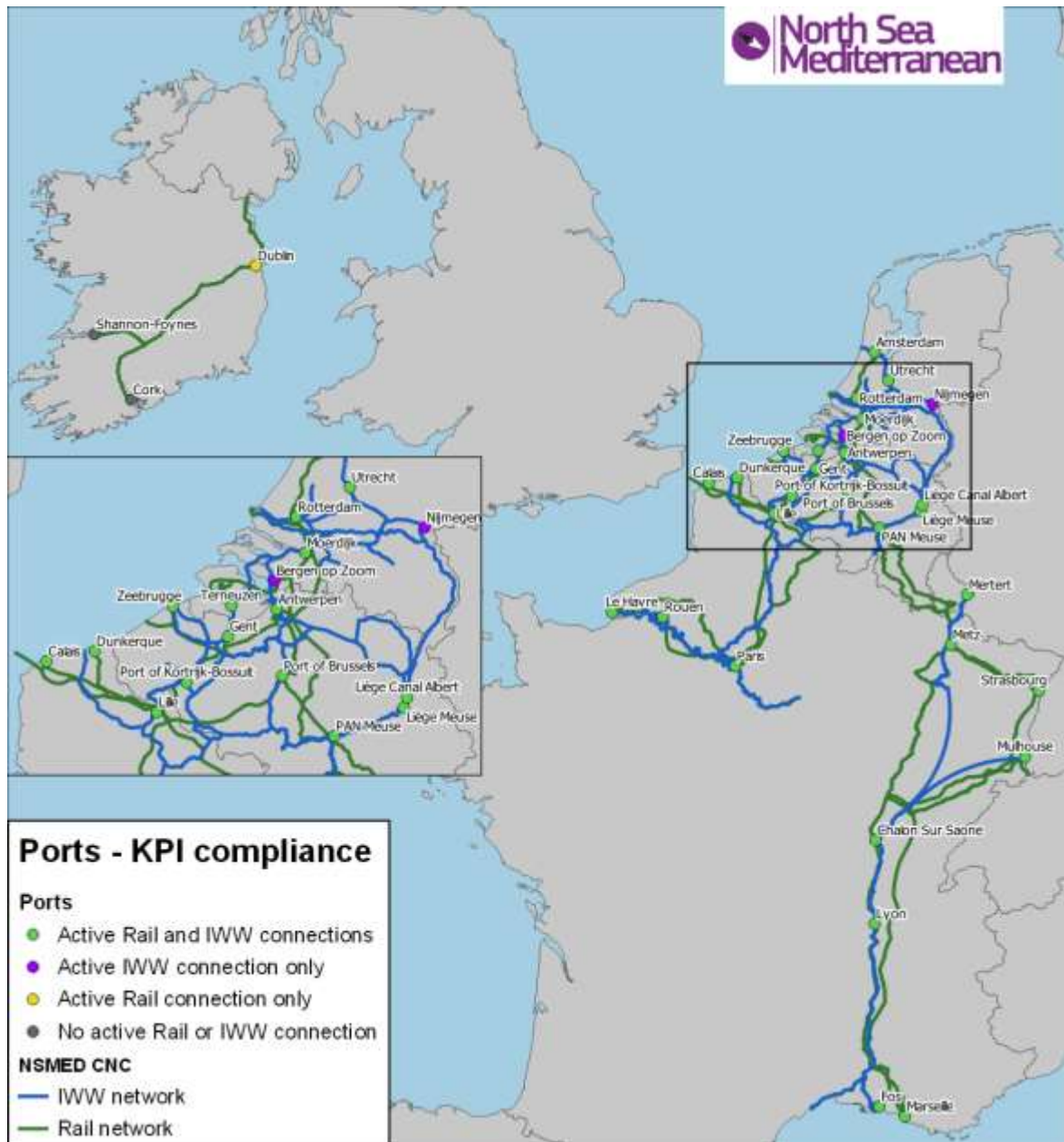
Source: Panteia, based on TENtec

### Remaining gaps

- Certain ports face rail or waterway capacity shortages and infrastructure modernization needs. Priorities include a second rail freight access to the Port of Antwerp, railway infrastructure development and track construction in Zeebrugge, and improved rail connections between Ghent and Terneuzen for North Sea Port. Rail freight access to the Port of Rotterdam has been enhanced with the Theemswegtracé railway section. Terneuzen undergoes major investments, including a new lock opening in late 2023/early 2024. Infrastructure upgrades to accommodate 740m trains are planned for Belgian and Dutch seaports.
- NSMED ports are actively addressing port capacity concerns through mid- to long-term plans. Noteworthy examples include the Port of Cork, which expanded capacity with the Ringaskiddy Container Terminal in 2022, and ongoing projects at the Port of Dublin, such as the Alexandra Basin Redevelopment Project for unit load traffic. Shannon-Foynes is planning additional capacity for new traffic. Continental ports, like Dunkerque, are engaged in major projects to increase handling capacities. The new Port of Calais, inaugurated in September 2021, is part of this expansion effort.



**Figure 2-11: NSMED ports - Compliance December 2020**



Source: Panteia, based on TENtec

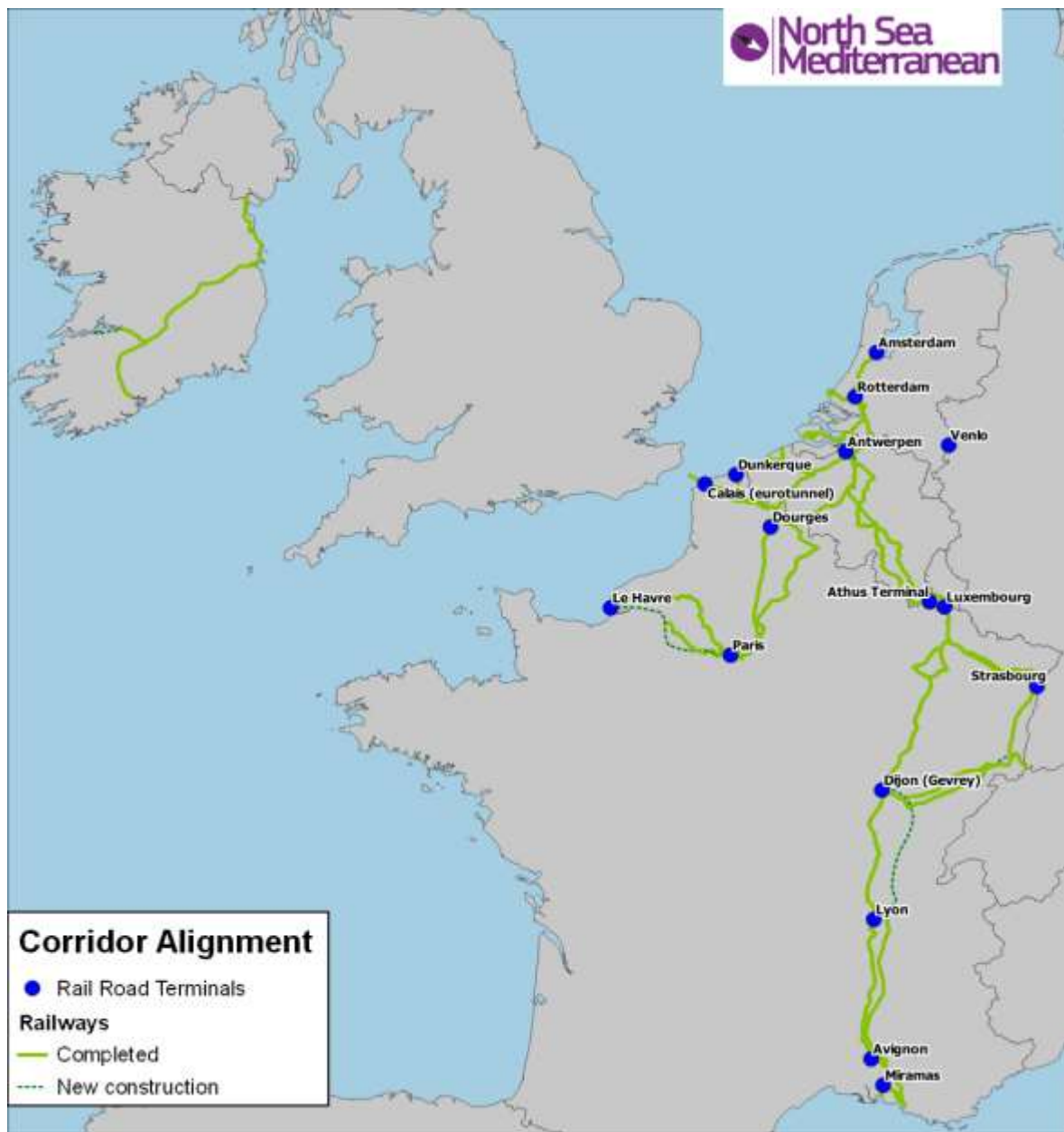
- In response to Brexit challenges, Channel ports are making collective efforts, such as expanding waiting areas for RORO traffic. The HAROPA Port strategy plan outlines rehabilitation and development plans for port areas until 2025. Notably, the Port of Antwerp and the Port of Zeebrugge have agreed to merge, focusing on containers, breakbulk, RoRo traffic, and chemicals. The Port of Rotterdam is planning upgrades for combined transport facilities nearing maximum handling capacity.
- Initiatives for producing or storing alternative clean fuels within ports are underway in Dunkerque, Antwerp, Zeebrugge, Amsterdam, North Sea Port, Rotterdam, and Marseille. These efforts include the development of hydrogen production and storage facilities, including green hydrogen. In Ireland, plans for substantial future development in the offshore wind sector may present

opportunities for certain ports to produce alternative fuels, such as hydrogen, leveraging a relatively low-cost source of zero carbon electricity.

## 2.6. Rail Road Terminal infrastructure

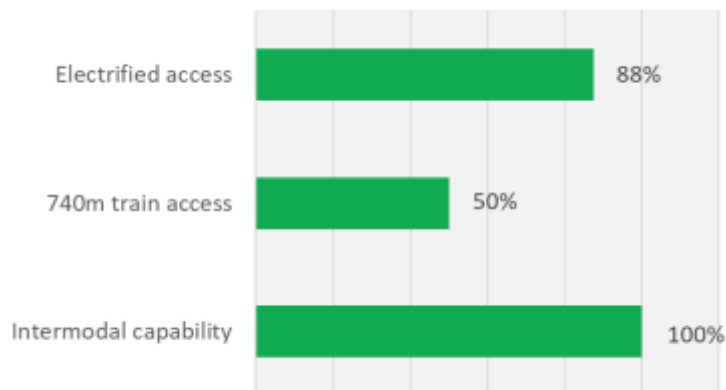
The NSMED Corridor has seventeen TEN-T rail-road terminals (RRT) within the continental part of the Corridor. All RRT on the NSMED CNC are fully compliant with selected TEN-T standards, with the exception of RRTs in France, of which most don't offer 740m train access. In addition, Calais and Strasbourg do not have electrified access.

Figure 2-12: NSMED RRTs



Source: Panteia, based on TENtec

**Figure 2-13: NSMED RRT - Compliance December 2020**



Source: Panteia, based on TENtec

### 3 Outlook to the future

Compared to the compliance analysis performed in 2020, there are no significant changes in the compliance of the NSMED Corridor until 2022. On average, the large majority of the Corridor is compliant with the TEN-T KPIs. Nevertheless, challenges remain:

- Monitoring progress in the deployment and use of alternative fuels.
- Gaining a better understanding of innovations in the area of ITS, especially for the road sector.
- Improving the methodologies being used for analysing climate change resilience and climate change impacts.
- Understanding and measuring the extent to which inter-regional cohesion can substitute near-sourcing for global sourcing, and how this affects Corridor planning.
- Developing quantitative methods for project evaluation which relate more closely to the stated objectives of the Corridor, including operational and service performance.
- Increasing the involvement of urban nodes.
- Increasing co-ordination with overlapping Corridors, ERTMS, MOS, and with key stakeholders RFC-NSMED and Seine-Scheldt EEIG.





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