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Scandinavian Mediterranean

Fifth Work Plan of the European Coordinator

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Disclaimer

Abbreviations

AF	Alternative Fuels
ATM	Air Traffic Management
b/bn	Billion
CEF	Connecting Europe Facility
CINEA	European Climate, Infrastructure and Environment Executive Agency
CNC	Core Network Corridor
DG MOVE	European Commission – Directorate General for Mobility and Transport
EC	European Commission
EDP	ERTMS European Deployment Plan
EIA	Environmental Impact Assessment
ERTMS	European Rail Traffic Management System
ERDF	European Regional Development Funds
EU	European Union
ICT	Information and Communication Technologies
ITS	Intelligent Transport Systems
IWW	Inland waterway
km	kilometre
KPI	Key performance indicator (set of indicators based on the TEN-T Regulation)
M	metre
m	Million
MoS	Motorway(s) of the Sea
MoT	Ministry of Transport
MS	Member States (of the European Union) here of the Scan-Med Corridor that means including Norway
n.a.	not available / not applicable
Scan-Med	Scandinavian-Mediterranean (Corridor)
p.a.	per year / annual
RFC	Rail Freight Corridor
TEN-T	Trans-European Transport Network

Country Codes after ISO 3166:

AT	Austria
DE	Germany
DK	Denmark
FI	Finland
IT	Italy
MT	Malta
NO	Norway
SE	Sweden

1 Towards the Scan-Med Corridor Fifth Work Plan

1.1 Introduction

Since the finalisation of the Fourth Work Plan of the Scan-Med Corridor in 2020, important events have occurred, which affected our lives, transport and the economy in general. The **COVID-19 pandemic** marked this period with unprecedented border closures, movement restrictions and serious disruption of supply chains that led to significant reduction in traffic volumes, both of persons and freight. To keep freight moving freely and efficiently across the EU, the European Commission adopted the **Green Lanes initiative** in March 2020, which was then further extended in October 2020 to ensure an EU-wide multimodal connectivity.

This period has also been marked by important political developments. In particular, the European Commission adopted the **European Green Deal (EGD)** in December 2019, which sets the overarching objective for the EU to become the first climate-neutral continent by 2050. For transport, it foresees a 90% reduction in emissions to be achieved in the perspective of 2050. Subsequently, the Commission proposed the **Sustainable and Smart Mobility Strategy (SSMS)** presenting concrete actions in the field of transport to contribute to the goals set in the EGD. The Strategy sets tangible targets concerning the modal shift to and travel by rail to be reached by 2030 and 2050. It outlines pathways to achieve those goals including a recommendation to better align the Core Network Corridors with the Rail Freight Corridors.

In July 2021, the European Union adopted two important legislative documents: the new Connecting Europe Facility Regulation **(CEF 2)**[1] and the **Smart TEN-T Directive**[2]**.** The **CEF 2** describes the new financial framework for the use of EU funds in supporting the development of the TEN-T network in line with the EGD objectives for the period of 2021-2027. The **Smart TEN-T Directive** sets out the streamlining measures aimed at reducing delays encountered in the implementation of TEN-T projects.

Lastly, the European Commission presented the proposal for a **revised Regulation for the development of the trans-European transport network (TEN-T)** on 14 December 2021. The proposal for a new TEN-T Regulation aims primarily at reinforcing the contribution of TEN-T to the decarbonisation and digitalisation objectives of transport policy (more detailed information in chapter 6).

The **Fifth Work Plan of the Scan-Med Corridor** includes the ramifications of the above-mentioned EU legislation that have been up-to-date approved, but also considers the evolving policy context.

This document focuses on current and future compliance issues within the Scan-Med Corridor, identifies the persisting bottlenecks, and presents the most important recommendations regarding implementation, financing and funding of projects. It also addresses key aspects related to the deployment of alternative fuels, the development of urban nodes, the Green Deal and the Recovery and Resilience Fund, the new CEF 2 Regulation, and the inclusion of the military mobility in the network development.

As previous Work Plans, this Work Plan takes into account results of the many discussions and exchanges with ministers, officials and stakeholders from the Corridor countries. In particular it builds on the results of consultations in the three Corridor Fora (March, June and November) and the four regional workshops ("Bothnian", "STRING", "Brenner" and "Mediterranean") held throughout 2021. In addition, many discussions with the European Coordinator on the challenges of rail took place on board the **Connecting Europe Express**. This train travelled for 36 days across 26

[1] Regulation (EU) 2021/1153 of the European Parliament and of the Council establishing the Connecting Europe Facility for the period of 2021-2027.

[2] Directive (EU) 2021/1187 on streamlining measures for advancing the realisation of the trans-European transport network) was formally adopted by the European Union (EU).

countries and visited more than 100 cities and towns. Among those were important urban nodes along the Scan-Med Corridor, including Rome, Bologna, Verona, Bolzano, Innsbruck, Munich, Leipzig, Berlin, Hamburg, Copenhagen, Malmö and Stockholm.

This Fifth Work Plan for the Scan-Med corridor has been drafted drawing on all those contributions and the invaluable assistance of the team of consultants and of DG MOVE.

1.2 Achievements along the Corridor

The indicative Project List[3] for the nine Core Network Corridors now includes 903 projects that are relevant for the Scan-Med corridor. The total official known costs of these projects amount to €217.3bn. Out of those 256 projects with a total official cost of €34.9bn have already been completed between the adoption of the TEN-T Regulation and end of June 2021 (63 between 2014-2016, 183 between 2017-2020, and 10 in 2021).

Within the reporting period of the current fifth Work Plan between January 2019 and June 2021, 126 projects with a total official cost of €5.9bn have been completed. While the highest number of projects has been completed in the road category (29), the highest share of investment (€3.3bn) has gone to rail projects. The following table provides an overview of the distribution of the completed projects by country and project category. The subchapters below highlight major projects completed in the reporting period by mode of transport.

Table 1: Number of projects completed between 01/2019 and 06/2021, by country and project category, and their total cost in billion €

Country / Category	Rail	Rail ERTMS	Road	Mari-time	MoS	Air-port	Multi-modal	Inno-vation	Oth er	Total	Total costs bn€
FI	3						2			5	0.04
SE	5		3		1	2	1	1		13	0.3
DK	2						0			2	1.4
DE	6	1	7	6		6	3	2		31	2.2
AT			3							3	0.0
IT	2		2	8	1	5	5	3	1	27	1.2
MT	-	-	2	11		2				15	0.2
NO										0	0
Multi	3		12	2	7	3	1	2		30	0.5
Total N°	21	1	29	27	9	18	12	8	1	126	
Total official cost [bn€]	3.3	0.04	1.2	0.9	0.1	0.1	0.1	0.1	0.0 01	5.9	5.9

** Officially known costs from the project list; displayed sums may differ from calculations due to rounding.*
Source: KombiConsult analysis based on 2021 updated project list (October 2021), November 2021

[3] Updated Project List October 2021. Not all of the projects included in the Scan-Med Corridor Project List have been endorsed by the countries concerned. No financial obligation for the countries concerned derives from analyses of this list.

Rail and ERTMS

In the current reporting period, 21 Rail and one Rail ERTMS project with a total investment of €3.3bn have been finalised.

Major rail projects recently completed:

- **"New high-speed railway line Copenhagen – Ringsted":** A new dual track railway line designed for speeds of up to 250 km/h. Its total costs amount to €1.3bn. It opened on 31st May 2019 and removes a bottleneck for national passenger trains and international freight trains.
- **"ABS Berlin – Rostock":** The final part of the project upgraded the rail route from the port of Rostock to the steel plant Eisenhüttenstadt to allow axle loads of 25 tons. Total costs were €855m.
- **"Second track on S. Andrea - Bitetto":** The project enables double-track operations and enhanced capacity on the Bari - Taranto line. Its total costs amount to €499m.
- **"Speed increase on Catania-Augusta-Siracusa line":** The project upgraded the Bicocca – Augusta section in order to reach compliance with TEN-T line speed requirement for freight trains. Its total costs were €93m.
- **"Dingersjö, sidings and capacity enhancement":** The project entailed upgrades on the Söderhamn – Sundsvall section in order to increase capacity and permitted axle loa (25t) as well as to achieve compliance with the TEN-T requirements regarding permitted train length. Its total costs were €75m.

Road

Altogether 29 road projects were completed in the reporting period with almost half of them multinational (14). The total value of the road projects amounts to €1,243bn.

Major road recently projects completed:

- **A7 motorway Hamburg-Volkspark – Hamburg Nordwest (A23)**: The project upgraded the A7 motorway on this section to 8 lanes. Cost of the project amount to €370m. It is part of a global project on the section Hamburg-Othmarschen – regional border Hamburg/Schleswig-Holstein with total costs of approx. € 1.15 bn
- **DE Scan-Med Corridor Programme Road - CPR 1: Safe parking":** The project targeted the development of safe and secure rest areas on motorways of CNC Scan-Med in Germany, including provision of relevant information services. The official cost of the project amount to €260m.
- **National policy framework for the development of the market as regards alternative fuels in Germany:** The project aimed to ensure electricity supply for transport by implementing a nationwide network of recharging points for electric mobility for all road transport modes. The official cost of the project amount to €100m.
- **"URSA MAJOR 2":** The project targeted the deployment of ITS services to improve freight traffic on the road network mainly along the RHINE-ALPINE and the SCANDINAVIAN-MEDITERRANEAN core network corridors, linking Northern Seaports and the Rhine and Ruhr area with metropolitan areas in southern Germany and in Italy. The official cost of the project amount to €92,28m.
- **"Upgrading of Modal Interconnection on Malta's TEN-T (road) Core Network Marsaxlokk – Luqa – Valletta (Marsa)".** The project costing about €50m significantly improves the Marsa junction by building separated lanes and fly-overs.

Maritime and MoS

Twenty-seven **maritime projects** have been completed in the reporting period. The completed projects are located in Germany, Italy and Malta or concern "multiple countries". More than €969m were invested in these projects.

Major maritime projects recently completed:

- **Port of Hamburg**: Construction of additional waiting and emergency berths and second road access to Hamburg-Altenwerder (container terminal and logistics companies). Total costs amount to €20m for the additional berths and €16.6m for the additional access road.
- **Port of La Spezia**: Dredging in front of Garibaldi pier and in the access channel to improve sea-side accessibility to the port. Total costs amount to €20m.

In addition, nine **MoS projects** have been completed in the reporting period with total costs of €72.1m.

Major MoS projects recently completed:

- **Winter navigation Motorways of the Sea II, WINMOS II** - Secure icebreaking services in the Baltic Sea: This project aimed to further develop cooperation between Finland, Estonia and Sweden for icebreaking services. Through ten activities it will safeguard continuous and sustainable maritime services in winter conditions. The total costs amount to €19m.
- **Development of port capacity for integrated Baltic MoS link(s) on Rostock – Hanko** includes works upgrading of port capacity, efficiency and ship-to-shore integration (berth adaptation works to accommodate larger vessels and terminal area reconstruction and enlargements, to handle higher volumes in total as well as per vessel per call and increase handling safety and efficiency. The total cost amount to €12.6m.
- **NextGen Link - Upgrade of the maritime link with the port interconnection in the ScanMed Corridor** covered to upgrade the existing maritime link between two core ports (Turku and Stockholm) and one comprehensive port (Mariehamn) used when crossing the northern Baltic Sea from Finland to Sweden along the Scan-Med Corridor. The upgrade of the maritime link includes the environmental upgrade with additional environmental efforts of one new sustainable LNG-powered ro-pax vessel of Viking Line and infrastructure development in the three ports mentioned above. The project costs are €45.83m.

Airports

In the reporting period, 18 airport projects have been completed, with overall costs of €109m. These projects are located in Germany (6), Italy, Malta (2), Sweden (2) or concern ”multiple countries” (3).

Major airport projects recently completed:

- The **Helsinki-Vantaa Airport** Development Programme has been implemented as a multimodal node and was completed in June 2021.
- The realisation of Terminal 2 (of the **Berlin Brandenburg airport** (was put into operation in March 2022). This project is part of a wider medium-term expansion programme of the airport that is worth some €600m overall.
- The construction of the new railway station **"Airport Catania Fontanarossa"**, was inaugurated in March 2021, providing the airport of Catania with a connection to the rail network. Its total cost amount to €15m.
- **Deployment of a terrestrial European back-up for GNSS** (incl. GALILEO), in-line with the European ATM Master Plan, to modernise Navigational Ground Infrastructure in 13 stations of the German airport system. The total costs amount to €21.7m.
- The construction of a new engine test run facility in **Munich airport**. The total cost amount to €28m.

Rail-Road Terminals

In the reporting period, 9 Rail-Road terminal projects have been completed, with overall costs of €68m.

Major Rail-Road terminal projects recently completed:

- **Megahub Hannover-Lehrte:** The new innovative intermodal terminal with focus on rail-to-rail transhipment was put in operation end 2019. The total investment amounts to €136m (unofficial).
- **Hamburg-Billwerder:** Construction of two tracks for train composition with a total investment amounting to €5m.
- **Berlin Großbeeren:** The intermodal terminal was upgraded by the construction of two new tracks for 700 m. The total investment amounts to €5.4m.
- **Verona Quadrante Europa RRT:** New infrastructure for the road access of future development area (south). The total investment amounts to €7.8m.

2 Characteristics of the Scan-Med Corridor

2.1 The new alignment under CEF 2

The Scan-Med Corridor links the major urban centres in Germany and Italy to Scandinavia (Oslo, Copenhagen, Stockholm and Helsinki) and the Mediterranean (Italian seaports, Sicily and Malta). It covers seven EU Member States and the EEA member state Norway. It represents a crucial axis for the European economy, crossing almost the whole continent from North to South. The cartogram in Figure 1 shows the corridor's schematic alignment and its core nodes according to the TEN-T and CEF-Regulations.

Rail and road, but not inland waterways, are the key "linear" modes of transport designated in the Scan-Med Corridor. Several sections of the alignment are sea crossings ("Motorways of the Sea"), in particular the connections between Finland and Sweden, Sweden and Denmark, Denmark and Germany, Italy and Malta and the domestic link Napoli – Cagliari (island of Sardinia). The maritime dimension, however, goes far beyond the single corridor and connects European countries with each other and with the rest of the world.[4]

The other dimension of the Scan-Med Corridor is composed of "nodal" infrastructure such as airports, seaports and rail-road terminals of the core network. As regards modal and infrastructural interconnections between the trans-European regional and local transport networks, "urban nodes" are of specific importance. As multimodal "infrastructures" they facilitate the transfer between modes and generate both passenger and freight traffic. In goods transport, freight villages or "interporti" are often used to consolidate cargoes. Nine out of the 20 leading European freight villages[5], are located on the Scan-Med Corridor including the Top 3 (Bremen, Verona, Nürnberg). The newly completed terminal of Kouvola (FI) directly reached rank 13.

Table 2: Characteristics of the Scan-Med Corridor in the year 2021

Mode/ Node	Dimension	FI	NO	SE	DK	DE	AT	IT	MT	**Total**
Rail	network length [km]	644	208	3,447	920	3,541	123	3,057	-	**11,940**
Road		484	141	2,488	806	1,943	110	2,447	20	**8,439**
Airports	number	2	1	3	1	7	-	5	1	**20**
Seaports		4	2	5	2	5	-	10	2	**30**
RRT		1	2	6	3	10	0	9	-	**31**
Urban Nodes		2	1	3	2	7	0	5	1	**21**
Rail	Share of Corridor [%]	5.4%	1.7%	28.9%	7.7%	29.7%	1.0%	25.6%	n.a.	**100.0%**
Road		5.7%	1.7%	29.5%	9.6%	23.0%	1.3%	29.0%	0.2%	**100.0%**
Airports		10.0%	5.0%	15.0%	5.0%	35.0%	n.a.	25.0%	5.0%	**100.0%**
Seaports		13.3%	6.7%	16.7%	6.7%	16.7%	n.a.	33.3%	6.7%	**100.0%**
RRT		3.2%	6.5%	19.4%	9.7%	32.3%	0.0%	29.0%	n.a.	**100.0%**
Urban Nodes		9.5%	4.8%	14.3%	9.5%	33.3%	0.0%	23.8%	4.8%	**100.0%**

Source: Hacon, HPC, KombiConsult, PTSClas, Ramboll analysis, February 2021

[4] The horizontal priority "Motorways of the Sea (MoS)" is followed by a separate European Coordinator who presented a 1st Work Plan, adopted by the Member States in December 2016 and updated since then in detailed Implementation Plans: https://ec.europa.eu/transport/sites/transport/files/2020-mos-dip.pdf

[5] European GVZ Ranking 2020 - Deutsche GVZ-Gesellschaft (German Association of freight villages).

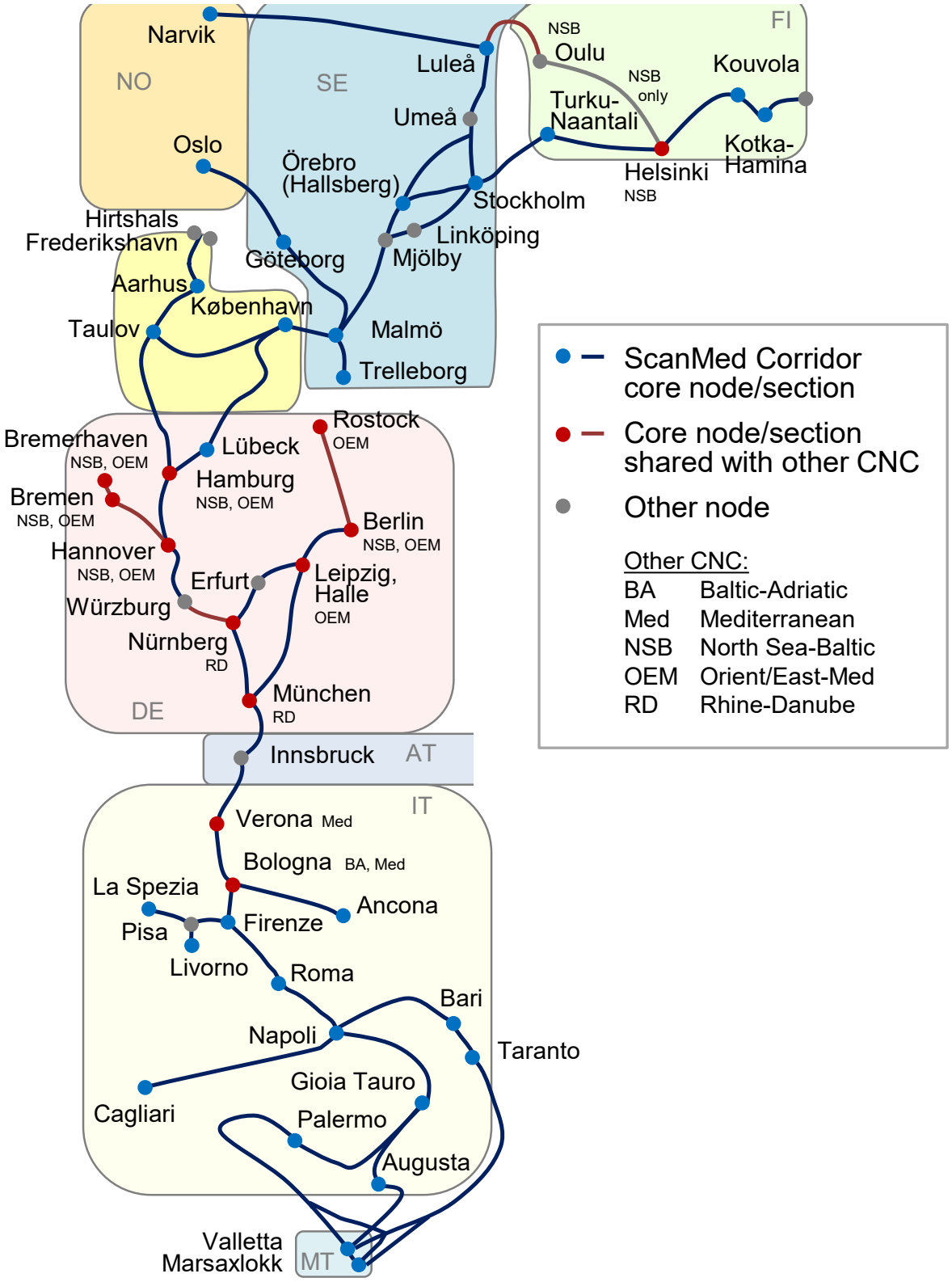
The Regulation (EU) 2021/1153 establishing the Connecting Europe Facility (CEF) for the period 2021-2027 was formally adopted in July 2021. The Regulation includes the extension of the existing TEN-T core network corridors. The quantitative characteristics of the extended Scan-Med corridor are presented in Table 2.

The new alignment of the corridor under CEF 2 (see Figure 1) was established by assigning additional sections and nodes of the core network defined in the TEN-T Regulation to the corridors. The following specificities need to be noted with regard to the new alignment of the Scan-Med corridor:

- In the north, the corridor starts in Oulu (Finland) and Narvik (Norway) respectively.
- From these two starting points it runs towards the Swedish town of Luleå. This stretch along the Bothnian Gulf is shared between Scan-Med and NSB Corridor. The FI/SE border crossing both for rail and road is located in Tornio / Haparanda.
- The core ports of Narvik and Luleå are included in the corridor but no airport as on the comprehensive network[6].
- To the south the corridor continues to Umeå. Here the exact alignment of the core network rail line has not yet been defined. Today's rail services both for passenger and freight use the comprehensive line, which is more distant from the coast.
- Further south near Söderhamn, the core freight railway line continues to Örebro/Hallsberg, while the core passenger line, like the core road, runs via Gävle and Uppsala to Stockholm.
- West of Stockholm, the passenger railway line follows the existing line until Järna, where the planned Ostlänken (Eastlink) railway line continues to Norrköping and Linköping, while the freight line continues to Örebro (Hallsberg).
- Through the Stockholm area the corridor road alignment follows the E4 highway. The new alignment, Bypass Stockholm, is under construction and is planned to be opened 2030. It connects in the north in Häggvik and in the south at Kungens kurva.
- In Denmark, the (comprehensive) ports of Hirtshals and Frederikshavn are connected by rail and road via Aalborg, Aarhus (core port and core RRT), Fredericia, Taulov (core RRT) and Kolding to the well-known east-west routing (Malmö/Copenhagen – DK/DE border).
- In Germany, the core port of Bremerhaven, but not its RRT[7], has become part of the Scan-Med corridor.
- In Italy, the maritime route Napoli - Cagliari (with its core airport and port) was added, but no rail or road infrastructure on Sardinia, since it is all on the comprehensive network. However, the node is important as a start/end point of traffic and link to the comprehensive network.

[6] According to TEN-T Regulation (EU) 1315/2013, Annex III.
[7] see TEN-T Regulation (EU) 1315/2013, Annex II, Table 2

Figure 1: Alignment of the Scan-Med Corridor in the year 2022



Source: KombiConsult analysis, September 2022; this illustration does not distinguish rail from road

2.2 State of compliance with TEN-T infrastructure parameters in 2021 and evolution of the KPIs over time

With the first Work Plan a baseline value for the Key Performance Indicators (KPIs) was established and progress monitored since then. As reported above the Scan-Med corridor alignment changed significantly at the beginning of 2021. Consequently, KPIs are provided for that new alignment (Status 2020 and Status June 2021 respectively) without modifying past years.

The sub-chapters below report, by mode of transport, on the compliance of the corridor infrastructure with the 2030 TEN-T target values and with the objectives agreed upon in the first Work Plan at the cut-off date 30.06.2021. Furthermore, they give an overview on the development of the Key Performance Indicators (KPI's) since the adoption of the Regulation, thus in the period 2014-2021.

Rail - Situation by June 2021

The southern part of the corridor is fully **electrified**. Non electrified corridor sections are located in Denmark (Fredericia – Frederikshavn/Hirtshals), in Finland (Laurila – Tornio – Haparanda (Border FI/SE)) and in the eastern part of Germany (Hof – Regensburg). Moreover, the northern and southern access routes to the planned Fehmarn Belt fixed link in the DE/DK border region are not yet compliant.

All rail lines along the Scan-Med Corridor feature the **standard track gauge** of 1,435 mm, except for Finland, which uses a track gauge of 1,524 mm due to its connection with the same gauge on Russian territory. The Finnish rail network is thus "isolated" and as such exempted from the requirement of realising the standard track gauge.

Almost the entire corridor (92%) provides for a **line speed** of at least 100 km/h. Some non-compliant sections are located in Italy on the southern access line to the Brenner Pass[8], on several sections between Napoli and Foggia and in Sicily between Catania and Fiumetorto. In Norway, the section Halden – Kornsjoe (border NO/SE) and the line from Narvik to the NO/SE border do not fulfil the requirements. Moreover, some countries show small incompliant sections within the nodes, particularly in the surroundings of big stations (e.g. Halle, Firenze, Napoli).

Most parts (92%) of the corridor provide **axle loads** of at least 22.5 tonnes already today. All non-compliant sections are located in Italy, namely on the lines Roma – Napoli (conventional Tyrrhenian line), Napoli – Foggia, Messina – Catania and Catania – Palermo as well as on small parts of the Roma – Firenze line located in Rome.

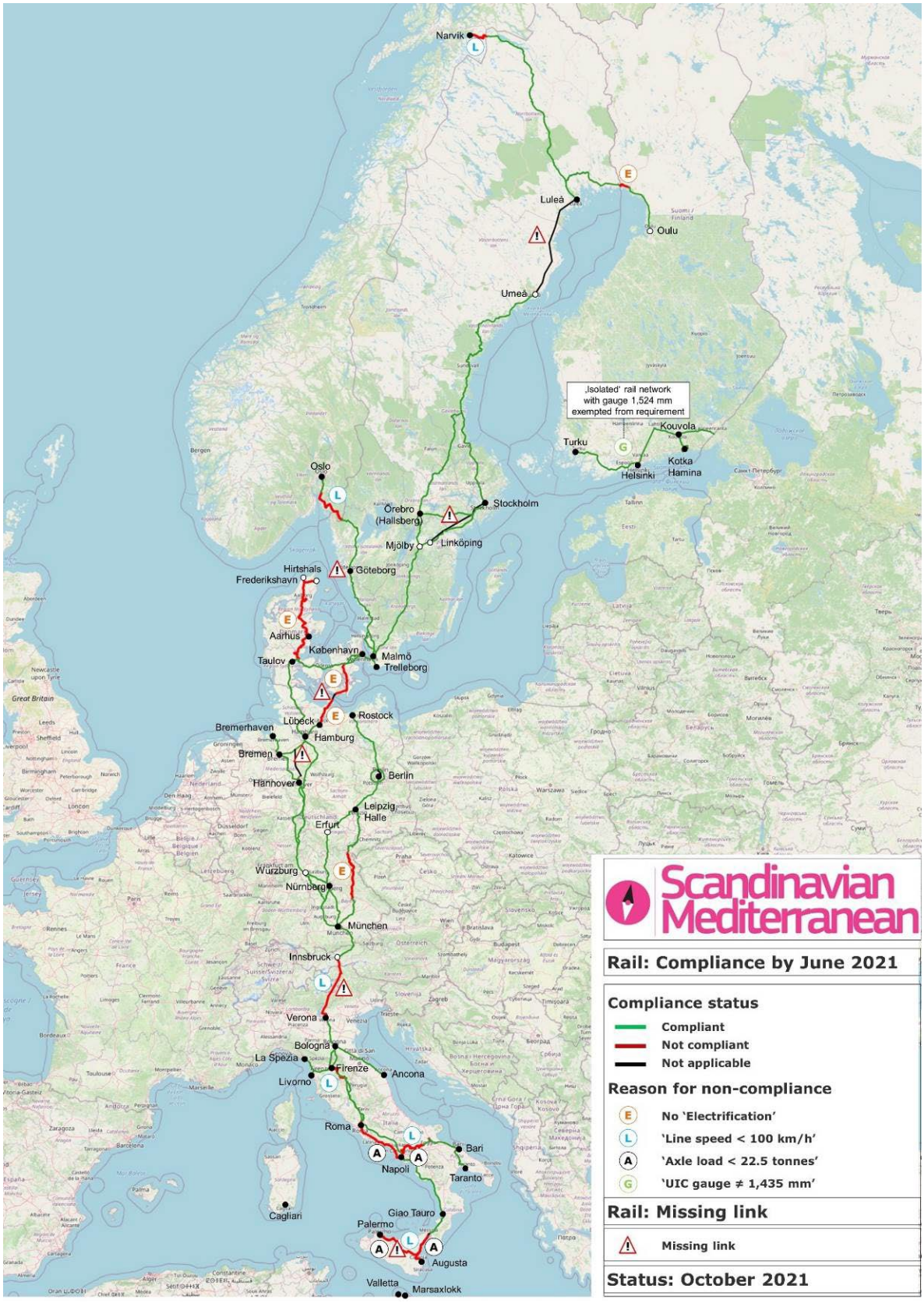
Next to these technical standards, also the completeness of the infrastructure is necessary for the operability of the corridor. In this respect, the following sections are still incomplete/missing ("**Missing links**") with view to the 2030 target alignment:

- Sweden: Gothenburg West Link, high-speed line Järna–Linkoping new connection Umeå - Luleå.
- Denmark/Germany: Fehmarn Belt fixed link.
- Germany: North-sea port hinterland connection (formerly "Alpha-E", now "Optimised Alpha-E").
- Germany/Austria/Italy: Brenner base tunnel including northern and southern access routes.
- Italy: connection Catania – Palermo in Sicily, which, after project revision, will be closed by upgrading the existing line rather than building a new one.

Figure 2 geographically depicts the situation described above for the 4 KPIs as well as for the missing links.

[8] Limited sections between Colle Isarco–Ponte Gardena and around the urban nodes of Bolzano and Trento

Figure 2: Rail compliance by June 2021 for KPIs 'Electrification', 'Line speed', 'Axle load', and 'Track gauge' and for 'Missing links'



Source: Hacon analysis, October 2021

In addition to the parameters displayed in the compliance map, also the permitted train length for freight trains and the intermodal gauge (P/C 70/400 as market related benchmark) were analysed.

A **Train length** of 740m is permitted on all corridor sections in Norway[9], Denmark and Germany and mostly also in Finland and Austria. Almost all non-compliant sections are located in Sweden and Italy. In Sweden, 630m is the standard value for train length without special permission (730m on Rail Freight Corridor (RFC) train paths), whereas in Italy (especially in the south) the length for freight trains is often limited to 600m or below. Also, on the ramps on the existing Brenner line, there are limitations to operating conditions mainly due to the steep gradients. Next to the train length those especially impact on the permissible gross weight of freight trains and require double (or triple) traction (up-hill).

Nearly all relevant freight lines from Sweden/Norway to northern Italy allow for an **intermodal gauge** of at least P/C 70/400. Compliance gaps are located on few sections in Germany between Hof and Regensburg and in Italy south of Firenze.

Development since 2014

As the overview in Table 3 shows, the compliance rates of the TEN-T rail parameters did not show the expected significant progress over the last years.

Table 3: Development of Rail KPI 2014 to 06/2021 and target for 2030

Rail Parameter	P	O	K	Publicly available source	Baseline value 2014	Status 2016	Status 2017	Status 2018	Status 2020[6)]	Status 6/2021[6)]	Target 2030
ERTMS deployment	x	x	x	7)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	**100%**
Track gauge (1,435 mm)	x	x	x	3)	100% (95%[1)])	100% (95%[1)])	100% (95%[1)])	100% (96%[1)])	100% (95%[1)])	100% (95%[1)])	**100%**
Intermodal gauge (P/C 70/400)			x[2)]	3)	---	---	---	---	71%	69%	**n.a.**
Electrification	x	x	x	3)	96%	96%	96%	96%	93%	93%	**100%**
Line speed (≥100km/h)	x	x	x	3)	93%	93%	93%	92%[4)]	92%	92%	**100%**
Axle load (≥22.5t)	x	x	x	3)	94%	94%	94%	92%[4)]	92%	92%	**100%**
Train length (≥740m)	x	x	x	3)	63%[5)]	49%[5)]	49%[5)]	49%[5)]	46%	48%	**100%**
	1) ‚Isolated' rail network with gauge 1,524 mm exempted from requirement *2) No KPI in the sense of Regulation (EU) 2013/1315* *3) Network Statements of respective Infrastructure Managers, TENtec (since 2020)* *4) Updated infrastructure data, no infrastructure change* *5) Adjusted due to change in Network Statements/interpretation, no infrastructure change* *6) Includes CEF 2 corridor extensions, calculation based on TENtec sections and lengths* *7) Analysis made by the European ERTMS Coordinator and not provided in this format.*										

Source: Hacon, October 2021; P = Priority; O = Objective; K = KPI

In single cases, even decreases of the figures must be stated. These are mostly caused by changes in the statistical processing of the infrastructure data (see footnotes in Table 3). Compared to the compliance status of 2018, also the impact of

[9] On Oslo – Kornsjø line during the night provided that there are only a few trains on the route due to the track limitation in Halden station. Generally, freight train length is only 580m according to the MoT.

the CEF 2 extensions is visible, bringing in additional incompliant sections, especially regarding electrification and train length.

Apart from this, the stagnation of the compliance rates is also due to the fact, that the Scan-Med corridor consists of highly developed countries with infrastructure that was largely compliant already before the entry into force of the TEN-T Regulation. This can be seen, for example, from the values of the parameters "Traction", "Speed" and "Axle load" which reached compliance rates of more than 90% already in 2014. Remaining compliance gaps in Scan-Med countries are often of a particularly problematic nature and therefore in many cases require long-running, expensive projects.

Major changes in the compliance rates reported above were caused by the following developments:

- Compliance with the parameter **electrification** dropped slightly from 96% to 93%. The main reasons for this development are the newly added, non-electrified corridor sections in Denmark (Fredericia – Frederikshavn/Hirtshals) and Finland (Laurila – Tornio - Haparanda (Border FI/SE)).
- Compliance with the parameter **track gauge** decreased slightly due to the newly added sections with broad gauge in Finland. Excluding Finland, the compliance rate remains at 100%.
- The compliance rate with the parameter **line speed** remained unchanged at 92%. The decreasing effect of adding the non-compliant section Narvik - NO/SE border was balanced out by a project ensuring compliance of the Bicocca – Augusta section in IT.
- Compliance with the parameter **740m train length** has been affected by two contradictory developments: while additional non-compliant sections added in Sweden decreased the compliance rate; newly added compliant sections in Denmark and Norway as well as several projects accomplished in Sweden had the opposite effect. Nevertheless, in total the compliance level slightly decreased compared to previous periods.

Road - Situation by June 2021

High quality roads are indispensable for maintaining speed and safety standards, and to mitigate critical issues on the Corridor's road network. To avoid congestion in and around large cities or in geographically limiting areas, bottlenecks and missing links need to be addressed.

In terms of the requirement to achieve **express road or motorway** standard the network is compliant to 85% in 2021. The compliance rate decreased from 99% in the last Work Plan mainly due to the addition of non-compliant sections along the corridor extensions. These sections are located mostly in sparsely populated areas in northern Sweden, but non-compliant road sections can also be found in Finland (E18 Turku Ring Road), Italy, Denmark, Norway, and Malta (see Table 4 and Figure 3).

The situation with regard to the availability[10] of **alternative clean fuels** has progressed during the last couple of years but continues to be very heterogenous across the fuel types. While the compliance rate for the charging station network for *electric cars* along the corridor has reached 100%[11], the compliance rates for other alternative clean fuels are still significantly lower.

[10] Analysis referring to the Article 39 (2) lit c in conjunction with "Good Practice Guide" which is also used in the Study "Clean Power for Transport Infrastructure Deployment" page 26, Table 4.1 "Maximum range of alternative fuels vehicles and the corresponding optimal distance between stations".

[11] Please note that the minimum requirements set in the valid TEN-T Regulation (EU) 1315/2013 do not necessarily reflect todays needs of a charging network for electric vehicles. Thus, while indeed a full compliance may be assured from a 2013 perspective it might be insufficient in today's context and

The availability of *Compressed Natural Gas (CNG)* on the corridor is adequate and the number of CNG stations has increased in recent years. However, in Malta and along the CEF 2 extensions in northern Sweden and Finland a sufficient number of CNG refuelling stations is still lacking.

Finland, Malta, and Italy currently do not have a *hydrogen*-refuelling network on their territory. In Sweden, Norway and Austria only a few stations are available. In Germany and Denmark, hydrogen refuelling network coverage allows the operation of FCEV vehicles only with careful trip planning. However, the network is still infrequent and most refuelling stations are located near big cities.

Table 4: Development of Road KPI 2014 to 06/2021 and target for 2030

Road Parameter	P	O	K	Publicly available source	Baseline value 2014	Status 2016	Status 2017	Status 2018	Status 2020	Status 2021	Target 2030
Promotion of road safety	X				n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Express Road or Motorway	X	X	X		99%	99%	99%	99%	71%	85%	100%
ITS and tolling systems	X	X			n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Parking areas every 100 km	X	X		TENtec, TRANS Park	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Availability of alternative clean fuels points in corridor countries 1); 2); 3)	X	X	X	TENtec Internet portals on alternative fuels (see footnotes)		2,271 CNG, 7 LNG and 53 H_2 stations and 9,318 e-charging points (2016)	2,242 CNG, 7 LNG and 63 H_2 stations and 36,987 e- charging points (2017)	2,232 CNG, 45 LNG and 72 H_2 stations and 52,280 electric charging points (2017)	2,359 CNG, 84 LNG and 85 H_2 stations and 52,537 e- charging points (2020)	2,359 CNG, 84 LNG and 85 H2 stations and 52,537 e- charging points (2/2021)	n.a.
Mitigation of congestion	X				n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	1) https://www.ngva.eu/, https://www.netinform.de/, https://openchargemap.org/site/ 2) https://ngva.e/, https://www.netinform.de/, https://openchargemap.org/site/ 3) https://chargemap.com/, https://www.ngva.eu/, https://h2.live/, https://www.latauskartta.fi, https://www.linde-gas.com										

Source: Ramboll analysis, November 2021; P = Priority, O = Objective, K = KPI

further public funding (e.g. through CEF) for such infrastructures might be warranted. For example, the last years have shown a significant expansion of the electric automotive market leading to a higher need for ultra-fast recharging infrastructures along the network. The above calculation of the compliance rate for the KPI concerning the charging network for electric cars on the corridor does not focus only on ultrafast charging but integrates all types of recharging points: slow, rapid or ultra-fast.

Figure 3: Road compliance by June 2021 for KPIs 'Express Road/Motorway' and 'Alternative Fuels´

Source: Ramboll analysis, November 2021, updated June 2022

Seaports - Situation by June 2021

The TEN-T Regulation requires seaports to be connected to the rail network, provide an ECMT Class V connection to Inland Waterways and make alternative clean fuels as well as facilities available for ship generated waste and traffic management systems. Scan-Med seaports are already fulfilling many of those compliance parameters (see Fig.4). Supply of alternative **clean fuels** and **connection to rail** are the least advanced. After the inclusion of additional seaports due to the corridor extension, the value of the compliance parameter "Availability of clean fuels" decreased as those ports do not meet this compliance parameter.

With regards to the parameter **connection to rail** the Italian ports of Bari (existing connection disabled in 1993), Palermo (existing connection disabled in 1957), Augusta (existing line close to main oil refineries used for commuter trains only and did not connect the port's terminals to the national railway network in the reporting year; however there is a project to improve the situation by 2026) as well as Cagliari (connection not possible due to territorial and urban restrictions) are not yet compliant. In the case of Copenhagen, Copenhagen Malmo Port's (CMP)strategic plan of 2020 to move the container terminal to a new site (Ydre Nordhavn) did not foresee a connection to the railway network on the Danish side of CMP.[12] The Maltese ports are exempted.

Table 5: Development of Seaport KPI 2014 to 06/2021 and target for 2030

Port Parameter	P	O	K	Publicly available source	Baseline value 2014	Status 2016	Status 2017	Status 2018	Status 2020	Status 2021	Target 2030
Connection to inland waterway CEMT class IV	X	X	X	1)	50%	50%	50%	50%	60%	60%	100%
VTMIS and e-maritime services as well as SafeSeaNet	X	X		1)	100%	100%	100%	100%	100%	100%	100%
Availability of clean fuels (incl. LNG)	X	X	X	1)	12%	20%	24%	24%	18%	17%	100%
Connection to rail	X	X	X	1)	83%2)	83%3)	83%	83%	82%	87%	100%
Sea access	X			1)	100%	100%	100%	100%	100%	100%	100%
Availability of at least one freight terminal open to all operators in a non-discriminatory way and application of transparent charges	X		X	1)	100%	100%	100%	100%	100%	100%	100%
Facilities for ship generated waste	X	X	X	1)	100%	100%	100%	100%	100%	100%	100%

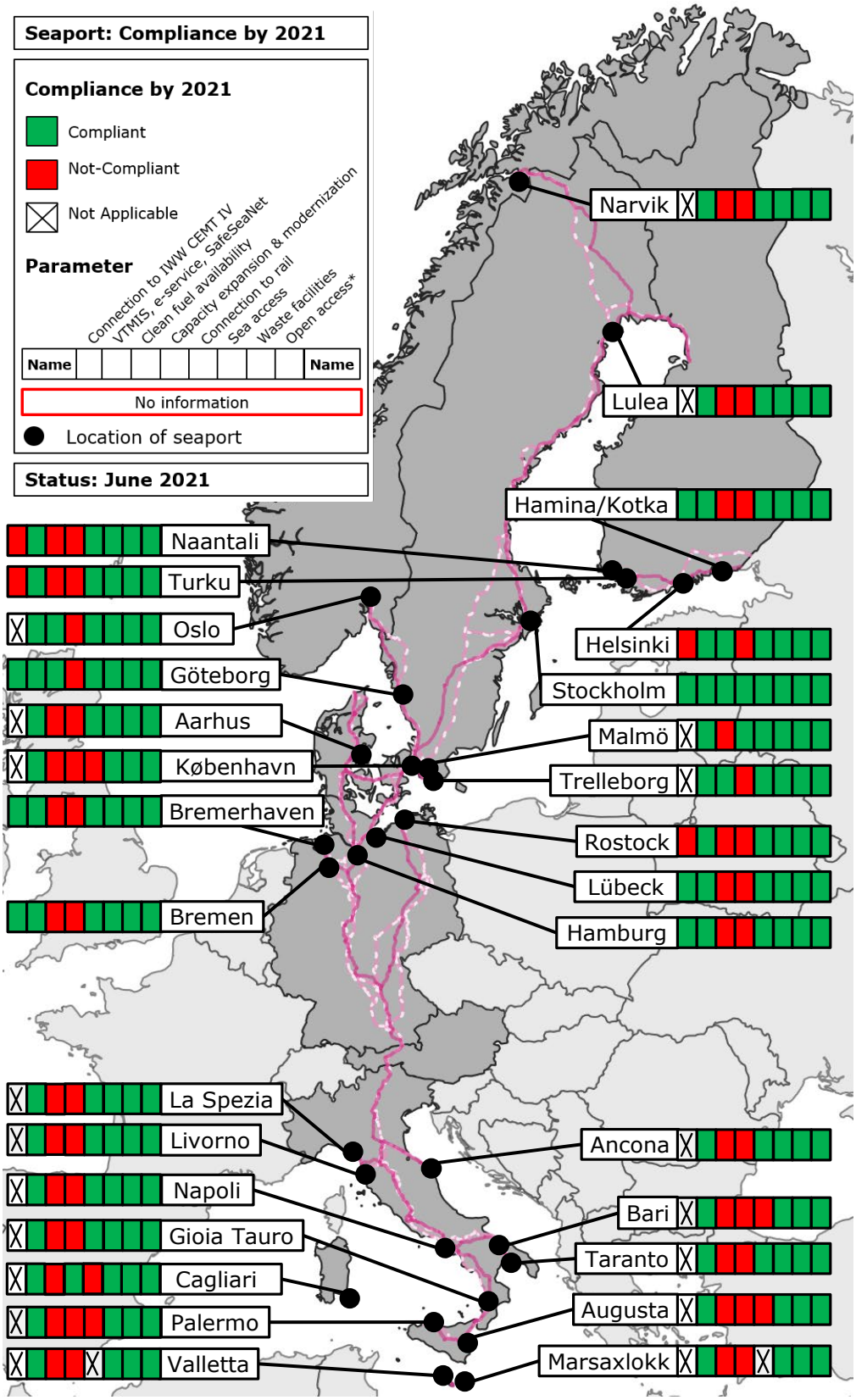
1) Websites and other information of respective infrastructure managers.
2) Erratum in previous reports: the value has been amended from 100% to 83%.
3) Erratum in previous reports: the value has been amended from 96% to 83%.
4) "Modernisation and expansion of capacity" is a TEN-T Priority which cannot be assessed in quantitative terms and is not displayed here

Source: HPC, November 2021; P = Priority; O = Objective, K = KPI

The table above shows the development of the KPI achievement for the Seaports. Since 2014, 198 port projects contributed to the improvement or achievement of a relevant KPI. Most of the projects aiming at KPI improvements or achievements are planned only for the period from mid-2021 until 2030.

[12] See: http://www.cmport.com/business/containers; http://www.cmport.com/en/business/rail

Figure 4: Seaport compliance by June 2021



Note: So far, the Port of Copenhagen did not reach compliance regarding the parameter "Connection to rail". Due to space restrictions inside and in the vicinity of the port, this parameter might not be applicable for the Port of Copenhagen. A decision by the Commission is needed, if an exemption from the requirements of the regulation can be approved.
Source: HPC analysis, November 2021, updated April 2022

Airports - Situation by June 2021

The overall KPI compliance in the airport sector on the Scan-Med corridor is very good and improving (see Table 6 and Figure 5).

All airports on the Scan-Med corridor already provide **non-discriminatory access** for operators.

With regards to the deployment of **SESAR,** the implementation actions for the Single European Sky objective are ongoing and widespread across Europe. Progress is mapped for six families of Air Traffic Management (ATM) elements which are reported in SESAR Monitoring Reports. Only in case an airport has implemented all six elements the airport is "compliant" since the TEN-T Regulation does not provide a differentiation.[13] Several projects have provided relevant results in terms of improvement of air traffic management components, however compliance with this KPI is still low. Only 5% of the Scan-Med airports have applied all six families of ATM and are thus 100% compliant with this KPI. According to the European ATM Master Plan[14], there is a need to accelerate the pace of solution development and deployment in which the cooperation among stakeholders is a key factor. To make SESAR deployment more effective, the EU Commission established an "Institutionalized Partnership" called "SESAR 3" which will be running at least until 2030 and is funded under the Horizon Europe program. The Network Manager (Eurocontrol), ANSPs, civil airspace users, the military and staff associations work together in a joint project in order to achieve operational harmonisation and therefore to establish the "Digital European Sky". With adoption of the "Single Basic Act" the new "SESAR Joint Undertaking 3" (SJU) was founded. The SJU is tasked with the development of new safety relevant systems and their swift deployment according to Implementing Regulation (EU) 2021/116.

Among the 20 core airports of the corridor 15 are already compliant with the requirement **connection by rail**. At the end of 2020 the new "Marconi Express" connecting the airport of Bologna with the central station was opened and with Cagliari airport an airport equipped with a railway connection has been included in the Corridor as a core airport under CEF 2. An airport metro link to Napoli Capodichino Airport is under construction and construction works of the railway link to Gothenburg Landvetter Airport are planned to start in 2025. No airport connections are planned to Malmö and Turku airports and the compliance parameter is not applicable for Malta.

The **availability of alternative clean fuels** has been recorded at the airport of Munich[15] which represent 5% of the total. It is worth mentioning the "Biofuel General Aviation" project that aims to create storage points for biofuels in the Cagliari airport and make it available to airlines (planned to end by 2025). Pilot projects have been carried out in other airports (such as Gothenburg, Stockholm,Oslo and Bologna). No other progress is recorded along the corridor and this parameter mainly depends on the technological development of the industry.[16]

The **capacity** of the airport system of the Scan-Med Corridor seems satisfactory. Berlin's Brandenburg Airport opened at the end of October 2020 and is planned to be further developed as part of its long-term expansion project. Other works to increase capacity are ongoing at Copenhagen, Hannover, Munich and Oslo airports. The COVID-

[13] Commission Implementing Regulation (EU) 2021/116 on the establishment of the Common Project One supporting the European ATM Master Plan indicates which airports are obliged to implement which functionality (AF1 to AF6) by 2027. For example the AMAN functionality needs to be implemented by (in alphabetical order) the following five Scan-Med airports: Berlin Brandenburg Airport, Copenhagen Kastrup, Munich Franz-Josef-Strauss, Rome-Fiumicino and Stockholm Arlanda.

[14] SESAR Joint Undertaking, "European ATM Master Plan", 2020 edition.

[15] Source: ICAO, SAF airports map, as of November 2021.

[16] A more precise assessment of the progress would require a better definition of the requirement on availability of alternative clean fuels both with respect to which type of fuel (e.g. which share of biofuel) and for which purpose (e.g. for internal means of transport, for airplanes during parking or for flying).

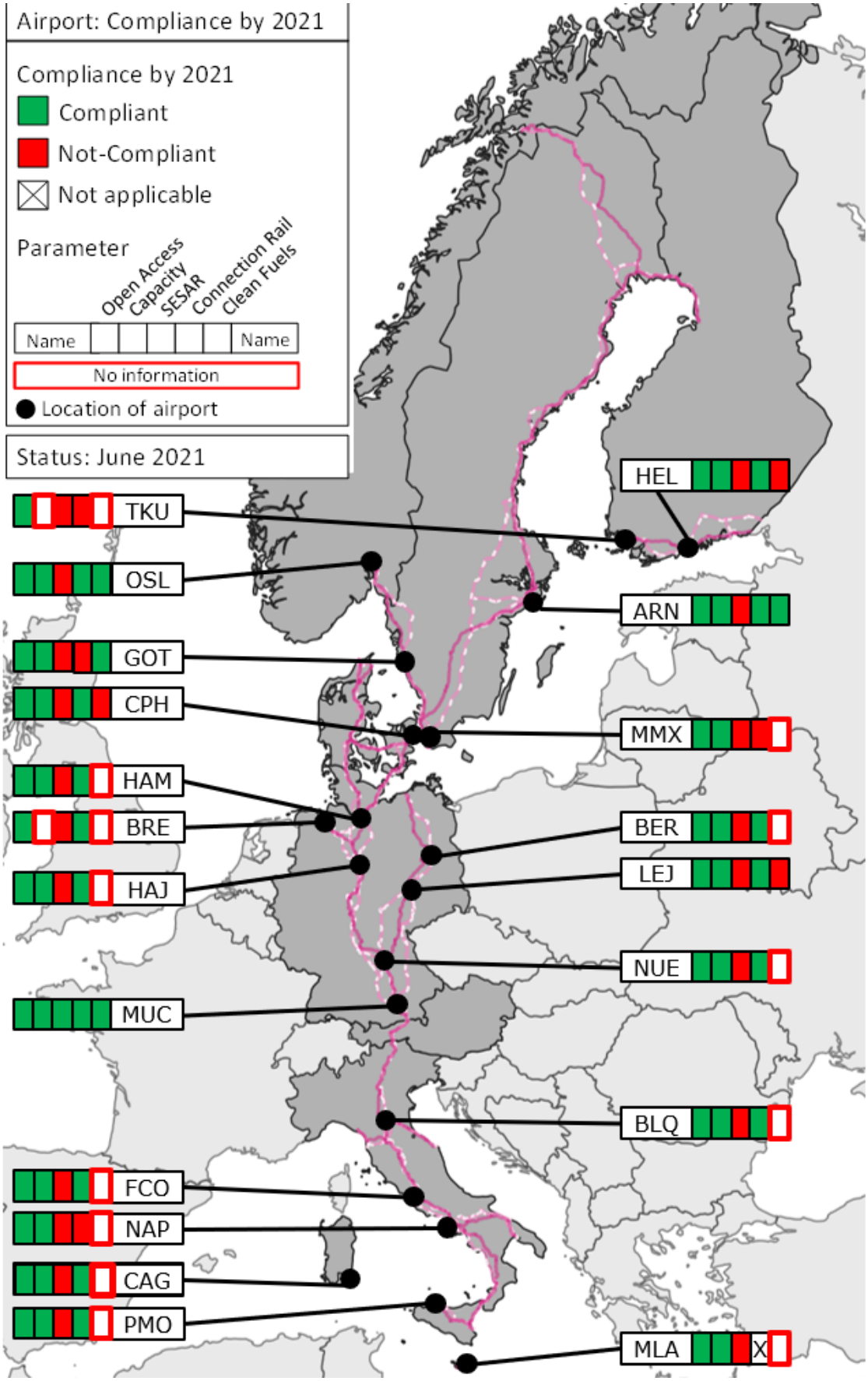
19 outbreak caused a huge decrease in the number of flights all around the world, leading to annual passenger traffic levels below the declared potential capacity of Scan-Med airports which is set at 343 mill. pax/year in 2021.

Table 6: Development of Airport KPI 2014 to 06/2021 and target for 2030

Airport Parameters	P	O	K	Baseline 2014	Status 2016	Status 2017	Status 2018	Status 2020	Status 2021	Target 2030
Open access	X	X	X	100%	100%	100%	100%	100%	100%	100%
Capacity [mn pax/year]	X	-	-	302.5	316.5	326.5	326.5	337.0	343.0	n.a.
Single European Sky - SESAR system	X	X	-	n.a.	n.a.	n.a.	n.a.	5%	5%	n.a.
Connection with rail	X	X	X	60% 85%*	68% 100%*	68% 100%*	68% 100%*	79% 100%*	89% 100%*	89% 100%*
Availability of clean fuels	X	X	X	0%	0%	0%	0%	0%	20%	100%
	* "main airports" according to Article 41(3)									

Source: PTSclas analysis, November 2021; P = Priority; O = Objective, K = KPI

Figure 5: Airport compliance by June 2021



Source: PTSClas analysis, November 2021, updated April 2022; SESAR shown for consistency with previous Workplans

Rail-Road Terminals - Situation by June 2021

Regulation (EU) 1315/2013 requires Rail-Road Terminals to be open for all operators and to be capable of transhipment of intermodal transport units. Additional requirements are the electrification of the access to the terminals and the capability to handle 740m long freight trains. With the projects accomplished since the adoption of the Regulation and other measures implemented by infrastructure managers, notable progress has been made with respect to the achievement of the KPIs (see Table 7 and Figure 6).

The 31 Rail-Road Terminals of the Scan-Med Corridor are generally connected to rail and road, provide discrimination-free access for their users and qualified handling equipment for all types of intermodal loading units. **Terminal management systems** are widely used to provide real-time information on the operational situation in the terminal and for data exchange with connected transport mode operators (railway undertakings, intermodal operators, and forwarders). **ICT system** implementation is a field where occasional improvement is needed by the owners or operators of the respective sites. If it comes to public financing, the public entities should ensure that the ICT systems fulfil the requirements of Articles 28(1)(b) and 29(c) of the TEN-T Regulation in the strict sense.

The largest challenge for the present sites is still that their **connection to rail infrastructure is outdated** (single sided, non-electrified, annex to shunting yard or port railway line). Hence, it does not correspond to the requirements of market-driven transport services and needs urgent improvement. Additional problems are caused by the limitation of the (wagon) train length by either the reception/departure siding or the transhipment track(s) which are below the target set for the rail lines (≥740m trains).

In respect of **electrified access,** the share of the terminals fulfilling this criterion made a significant step from 32% (status 2018) up to 48% (status 2021). However, this means that still only 15 out of the 31 Rail-Road Terminals fulfil this criterion. With a view to the additional criterion **"≥740 m train length"** only seven sites (23%) already fulfil this requirement, namely Bologna, Bremen, Hallsberg, Leipzig, Malmö, Nola, and Rosersberg. Some sites have extended their transhipment tracks recently, but it remains clearly below the compliance goal of "≥740 m train length".

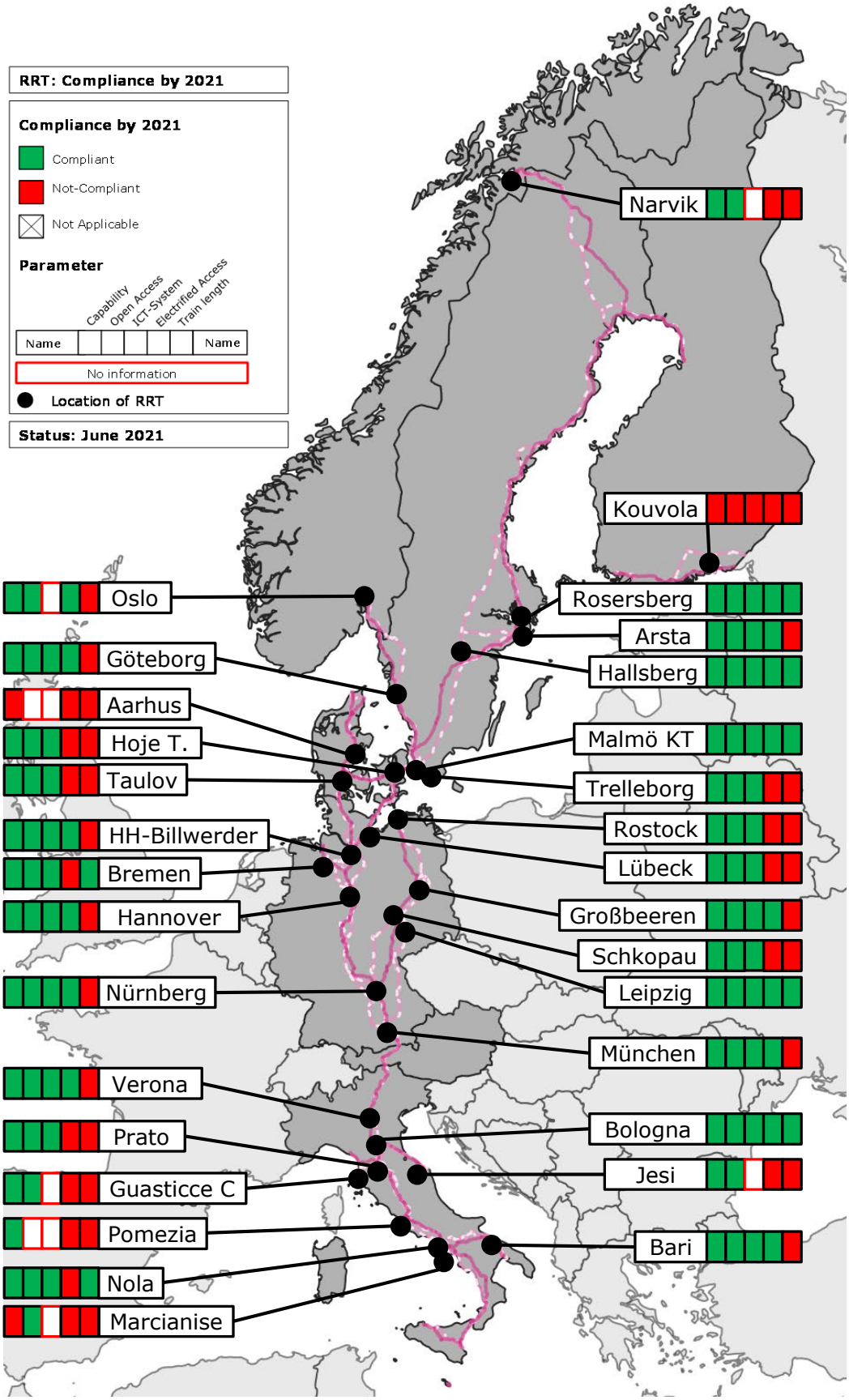
Table 7: Development of Rail-Road Terminal KPI 2014 to 06/2021 and target for 2030

RRT Parameter	P	O	K	Publicly available source	Baseline value 2014	Status 2016	Status 2017	Status 2018	Status 2020	Status 2021	Target 2030
Capability for Intermodal (unitised) transhipment	X	X	X	1)	-	71% - 100%	71% - 100%	75% - 100%	90% - 100%	90% - 100%	100%
Availability of at least one freight terminal open to all operators in a non-discriminatory way and application of transparent charges	X	-	X	1)	-	75% – 100%	75 %– 100%	79 %– 100%	87 % - 100%	90 % - 100%	100%
Information systems	X	-	-	1)	-	61%	64%	61%	74%	74%	100%
Electrified train terminal accessibility	X	X	-	1)	-	32%	36%	32%	45%	48%	100%
740m train terminal accessibility	X	X	-	1)	-	18%	14%[2)]	21%	23%	23%	100%

1) websites, other information of respective infrastructure managers and (in 2016) completed questionnaire
2) The change of the „740m train terminal accessibility" from 18% to 14% was due to a counting error and not due to a change of the physical infrastructure. "740m track length" is no TEN-T Requirement for RRT but an "additional" requirement as introduced in the first Work Plan in 2014 and maintained since then.

Source: KombiConsult analysis; P = Priority, O = Objective, K = KPI; updated November 2021

Figure 6: Rail-Road Terminal compliance by June 2021



Source: KombiConsult analysis, Status: June 2021, updated June 2022

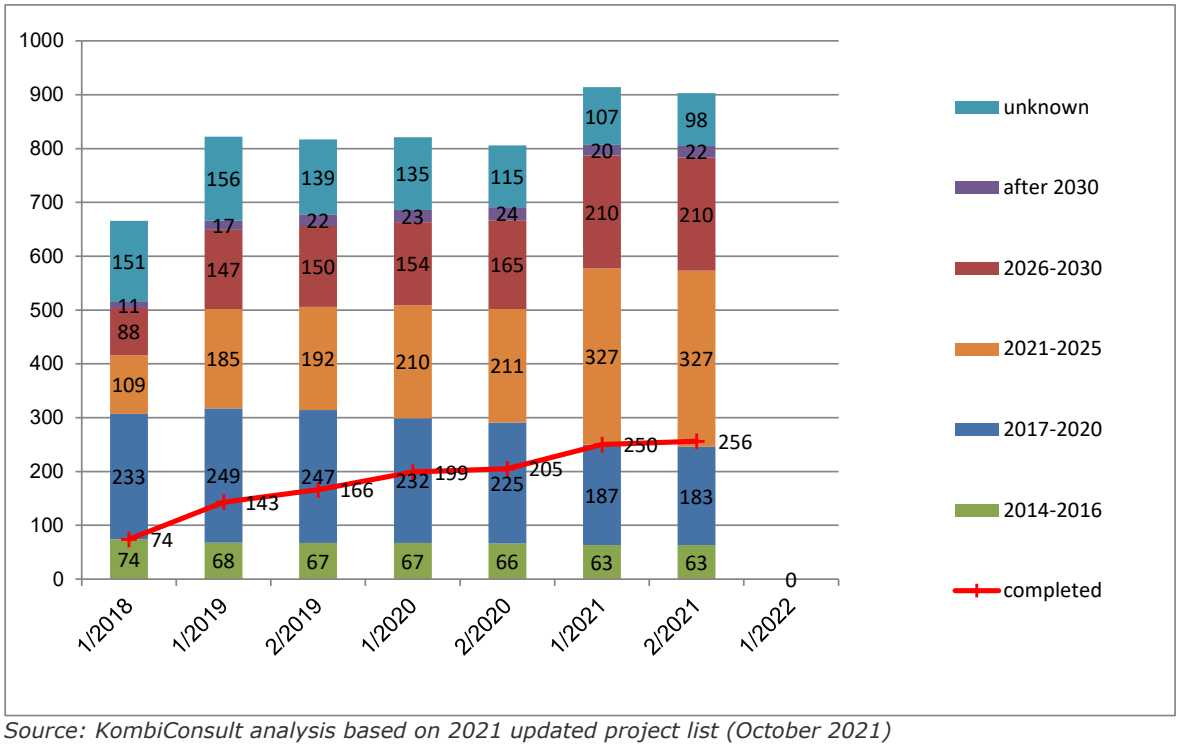
3 Inventory of what has still to be realised by 2030

This chapter reports by mode of transport on the expected compliance of the corridor infrastructure with the TEN-T requirements by 2030 and where gaps exist draws conclusions on what still needs to be done.

The October 2021 project list includes 903 projects that are currently relevant for the Scan-Med corridor. 256 projects of the 903 projects have already been completed since the adoption of the TEN-T Guidelines in 2013 (cut-off date end of June 2021). The 256 projects are composed of 63 projects completed in the 2014-2016 time cluster, 183 projects completed in the 2017-2020 time cluster, and ten projects completed in 2021 (by end of June). A further 327 projects are to be completed by 2025 and 210 by 2030, the target date of the Regulation. However, 22 projects are likely to be completed only after that target year and for 98 projects the completion date is "unknown". This missing information is partially due to the current uncertainty about the completion time, e.g. projects that are in the planning stage, and partially due to non-existent data. Nevertheless, with 783 projects (about 87%), most are expected to be completed by 2030, and it is likely that the vast majority of projects with "unknown" status will also be completed by 2030.

For a better understanding and graphical visualisation, two graphical outputs are needed: the absolute figures showing the quantity of projects, and the standardized figure (showing the relative share cumulating to 100%), see Figure 7 below:

Figure 7: Evolution of Maturity criteria "expected completion time" since the first Implementation Report (N° of projects)



Source: KombiConsult analysis based on 2021 updated project list (October 2021)

The analysis in chapter 2.2. and above shows that not all KPI requirements will be fulfilled by ongoing or planned projects until 2030. Therefore, the consultants proposed a list of additional measures designed to complete the Corridor. According to the identified compliance gaps, most of these additional measures are needed in the field of road and multimodal transport as well as in airports.

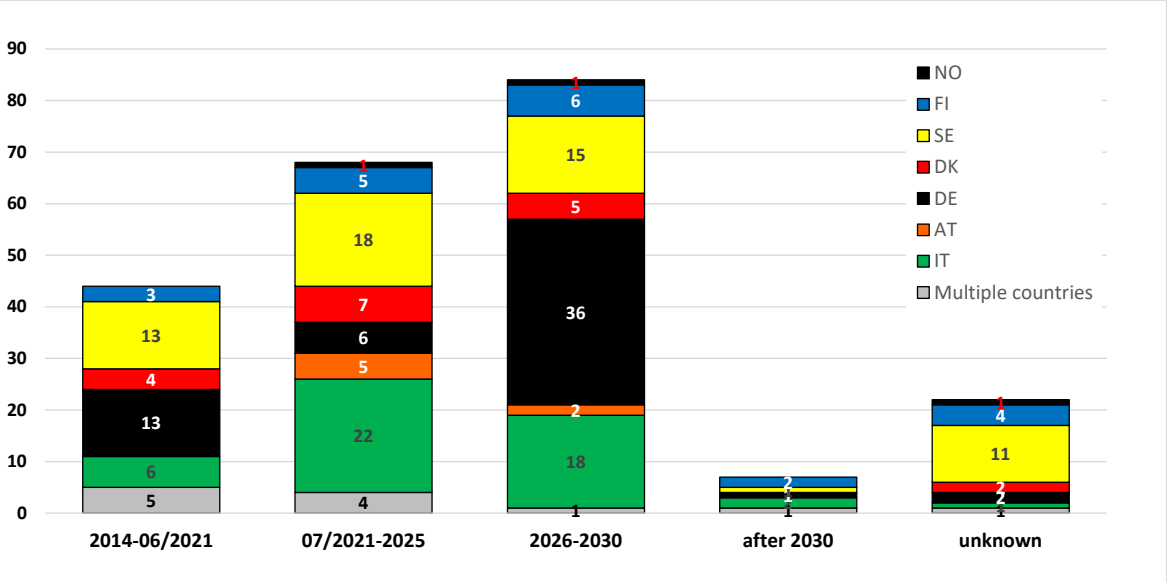
In order to reach compliance by 2030, in total 95 additional measures were identified for the Scan-Med Corridor as detailed in the following chapters.

3.1 Rail

Completion time and project costs

The previous chapters highlighted that the Scan-Med rail infrastructure shows a relatively high quality and compliance with the Rail requirements of the TEN-T Regulation[17]. Even more, most compliance gaps shall be closed with ongoing or planned projects. However, with view to the envisaged completion of the corridor by 2030, not all corridor sections will meet the requested standards of the TEN-T regulation from today´s point of view as will be explained in this chapter.

Figure 8: Rail projects by completion time and country; total = 226 projects



Source: Hacon analysis based on the 2021 updated project list (October 2021)

In total 182 projects are still planned or ongoing. Most of these (153) are expected to be finalised until 2030. Seven projects however will miss the 2030 deadline, amongst them the large-scale projects "Umeå – Luleå" (SE), the "Optimized Alpha-E" (DE) and the Brenner Base tunnel including parts of its northern (in DE) and southern (in IT) access lines. For another 22 projects the finalisation date is unknown.

About three quarters of the Scan-Med Rail projects are located in Sweden, Germany and Italy, which is in line with their share of overall corridor rail network length. Another 13 actions are allocated to several countries. Apart from pan-European studies and vehicle equipment, most of these measures refer to the large-scale projects "Fehmarn Belt" and "Brenner", but also to cross-border sections along the CEF 2 corridor extensions.

The costs of the 226 completed, planned or ongoing rail projects sum up to €133.2bn. This figure represents "official" project costs that were verified and approved by Member States and stakeholders. Nearly half of this total investment is allocated to ten large-scale projects: Salerno - Reggio Calabria (IT), Brenner base tunnel (AT/IT), Fehmarn Belt Fixed Link (DK/DE), ABS/NBS Nuremberg – Erfurt (DE), Ostlänken (SE), Upgrade Catania – Palermo (IT), Napoli - Foggia – Bari (IT), NBS/ABS Hamburg/Bremen-Hannover (Optimised Alpha E) (DE), ABS/NBS Hanau - Fulda - Erfurt / Aschaffenburg – Nantenbach (DE) and ABS/NBS Nürnberg - Ingolstadt – München (DE). Apart from ABS/NBS Nuremberg – Erfurt, all these large-scale projects are yet to be finalised.

[17] This chapter provides main results on projects related to the category "Rail". This excludes pure ERTMS projects, which are treated separately in chapter 4.1. However, some of the Rail projects, especially large-scale upgrades and new constructions, often include ERMTS implementation as well

In addition to these official project costs the consultants provided estimations for rail projects without official costs values, summing up to €13.3bn.

Expected compliance by 2030

The future compliance with the requirements of the TEN-T Regulation depends on the impacts of the 182 planned and ongoing projects. In this context it must be considered that not all these projects directly contribute to the (infrastructure) TEN-T parameters. This is partially due to the nature of the project (pure study). In other cases, projects contribute to the development of the corridor outside the KPIs of the Regulation (particularly with respect to capacity enhancement, but also regarding noise abatement, vehicle equipment or modernisation of infrastructure).

With respect to the incompliant sections identified in the previous chapter the impact of the ongoing and planned projects leads to the following expectations for 2030:

Most of the remaining gaps in the **electrification** of the corridor railway lines will be closed. Ongoing projects in Denmark and Germany will achieve compliance on the northern and southern access lines to the Fehmarn Belt Fixed Link. Further projects are foreseen to realise electrification on the Fredericia - Arhus – Aalborg line as well as between Hof and Regensburg. Remaining electrification gaps must be expected in Finland on the Laurila - Haparanda cross-border section to Sweden. Construction of the electrification of Laurila – Tornio – Haparanda line is ongoing and will be completed by the end of 2025. In Denmark, no projects are foreseen for Aalborg - Hjorring – Hirtshals and Hjorring – Frederikshavn lines.

Regarding the **track gauge** requirement, no further improvement is needed, since the entire corridor is already compliant and the Finnish rail network is exempted.

The expected development of **line speed** compliance (100 km/h on freight lines) shows a heterogeneous picture:

- In Norway projects are missing or delayed on the section Halden – Kornsjoe (border NO/SE) and on the line from Narvik to the NO/SE border).
- In Germany/Austria/Italy, the completion of the new Brenner Base tunnel is delayed and expected to open in 2032. Similarly, some parts of the access routes to the BBT are planned to be completed only after 2030[18].
- In Italy, some line sections on the Firenze Castello - Arezzo Junction line will not meet the TEN-T criterion by 2030. On the other hand, projects designed to achieve line speed compliance will be completed between Napoli and Foggia (2027) as well as in Sicily (2028).

Concerning permitted **axle load**, Italy has set up an infrastructure upgrade programme that will enable 22.5 t axle load on the entire corridor apart from a major compliance gap on the Pomezia – Napoli line as well as on small parts of the Roma – Firenze line located in the node of Rome.

Progress is also expected regarding the compliance with the parameter **"permitted train length of min. 740m"**. Upgrade programmes have been set-up in Germany, Italy and Sweden, accompanied by several single measures for dedicated sections in Sweden. Consequently, the entire corridor from Scandinavia to Austria will be compliant by 2030 with the exception of the Swedish/Finnish border section Boden - Kailx - Haparanda / Tornio-raja, for which no "work" project is planned. Also in Italy, most parts of the corridor will fulfil the criterion by 2030. Remaining gaps are expected on the Brenner Base Tunnel including its access routes (projects delayed) and on the lines Firenze – Roma, Pisa - Livorno and Pomezia – Napoli (no projects

[18] Most sub-sections of the southern access line are expected to reach compliance until 2030, e.g. by building of the new sections Fortezza – Ponte Gardena and the bypasses of the Bolzano and Trento nodes; for this compliance analysis, the sub-section with the lowest level is relevant for the entire line.

planned). The sections from Rosarno to Sicily shall be upgraded to 600m permissible train length only.

Regarding the suitability of the Scan-Med railway lines for **intermodal gauge** "P/C 70/400, a similar outlook as for the train length criterion can be given: in Germany, compliance between Hof and Regensburg will be realised by the "Ostkorridor Süd" project of DB Netz. In Italy, an upgrade programme for P/C 80 profile is performed by RFI. This programme will achieve compliance on most Italian corridor lines. Exceptions are the lines conventional Firenze – Roma and Pomezia – Napoli (no projects planned) and the sections from Rosarno southwards (only upgrade to P/C 45 foreseen).

Concerning **missing links** on the corridor, all lines listed in the previous chapter are subject of planned or ongoing projects, although with different levels of commitment and timelines: whereas the Gothenburg West Link, the Fehmarn Belt Fixed Link and the upgraded connection between Catania and Palermo are due to be completed before 2030, the German "Alpha-E" project will most likely miss this deadline. The same applies for the Brenner Base Tunnel, whose inauguration recently has been deferred to 2032, and to the high-speed line Jonkoping – Linkoping, which is not part of the current Swedish investment plan 2018 – 2029. The new Swedish line Umeå - Luleå is only partially covered by a project in the Scan-Med project list. Furthermore, this project is not foreseen to be finalised by 2030.

Moreover, some projects still face uncertainty regarding approved **financing** or even complete cost calculation. Overlapping of such financial problems with scope and schedule issues increases the risk that the required impacts will not be delivered by 2030.

The expectations regarding the fulfilment of the KPI requirements, following from the analysis above are displayed in Figure 9.

Figure 9: Expected Rail compliance 2030 for KPIs 'Electrification', 'Line speed', 'Axle load', and 'Track gauge' and remaining 'Missing links'

Source: HaCon analysis, October 2021, updated September 2022

Additional projects

In order to close the remaining compliance gaps and missing links, which are due to a lack of projects (see above), the consultants proposed "additional projects". For Rail, 10 such "additional projects" have been compiled with overall costs of about €3.7bn. According to the "missing projects" analysis, these projects are located:

- on the cross-border sections between Sweden and Finland/Norway (to comply with electrification, line speed, train length requirements),
- in Sweden (to close missing links)
- in Denmark (to comply with the electrification requirement),
- in Italy (to comply with the axle load, line speed, train length, intermodal gauge requirements[19]).

Existing or expected **capacity bottlenecks** are located in Germany. The "Alpha-E" hinterland connection from/to the North Sea ports mainly foresees an upgrade of existing infrastructure; there is controversial discussion if this concept will provide the required rail capacity for passenger and freight traffic. Moreover, this project will be finalised only after 2030. The upgrade of the Brenner access route in Germany will be developed according to traffic requirements. Therefore, the upgrade to four tracks will be completed only after 2030. In addition, the report on infrastructure condition and development 2020 by DB Netze[20] points out severe capacity constraints (today and in the coming years) for the following corridor sections: Hamburg-Harburg – Hamburg-Rainweg, Uelzen – Stelle, Berliner Stadtbahn, Berlin-Spandau Ost / Berlin-Gesundbrunnen – Großbeeren Süd, Würzburg – Fürth, Fürth – Bamberg and München node.

Administrative and operational bottlenecks

Apart from these infrastructure parameters, rail (freight) operation on the Scan-Med corridor is still hampered by differences in operating parameters. In general, distinctions in rail voltage and signalling systems are most common parameter changes on Scan-Med border sections. These require the use of multi-system locomotives or necessitate in locomotive changes at border sections. In particular on the border crossing between Austria and Italy several operating parameters are changing. Besides the rail voltage, the maximum allowed train length, ERTMS equipment and the signalling system vary.

Next to the line infrastructure, **urban nodes** are a crucial component of TEN-T corridors merging and redistributing traffic flows. Overall goal of the urban node network development is the appropriate interconnection of passenger and freight transport between all modes of transport. For rail transport, the seamless connection between long-distance TEN-T infrastructure and access points such as terminals, ports and airports plays a significant role. In this respect, the current situation of the Scan-Med urban nodes is characterised by non-compliance of the last-mile infrastructure to the access points. In particular, the train length is restricted on many access lines, requiring additional splitting/composing procedures of long-haul trains. Moreover, some access lines are not electrified or do not fulfil the 22.5 t axle load requirement. Dedicated projects designed to improve the situation on the last-mile rail infrastructure are currently missing.

[19] Intermodal gauge is not a formal TEN-T Regulation requirement, yet, but included in the analysis since it is an objective of the Scan-Med Corridor since 2014. It has been proposed by the Commission in the context of the revision of the TEN-T Regulation.

[20] "DB Netz AG, Infrastrukturzustands- und entwicklungsbericht 2020".

Commercial Delivery Time

A new indicator of the TEN-T corridor analysis is the "commercial delivery time" which basically measures the punctuality of certain rail services along the corridor. For the intermodal rail service between a Baltic Sea Port and a freight hub in Italy which focuses on general cargo. The respective times and punctuality figures were obtained for monitoring over a period of time. The number of trains increased from 448 (both directions) in the first half of 2018 to 641 in the first six month of 2021 (+43%).

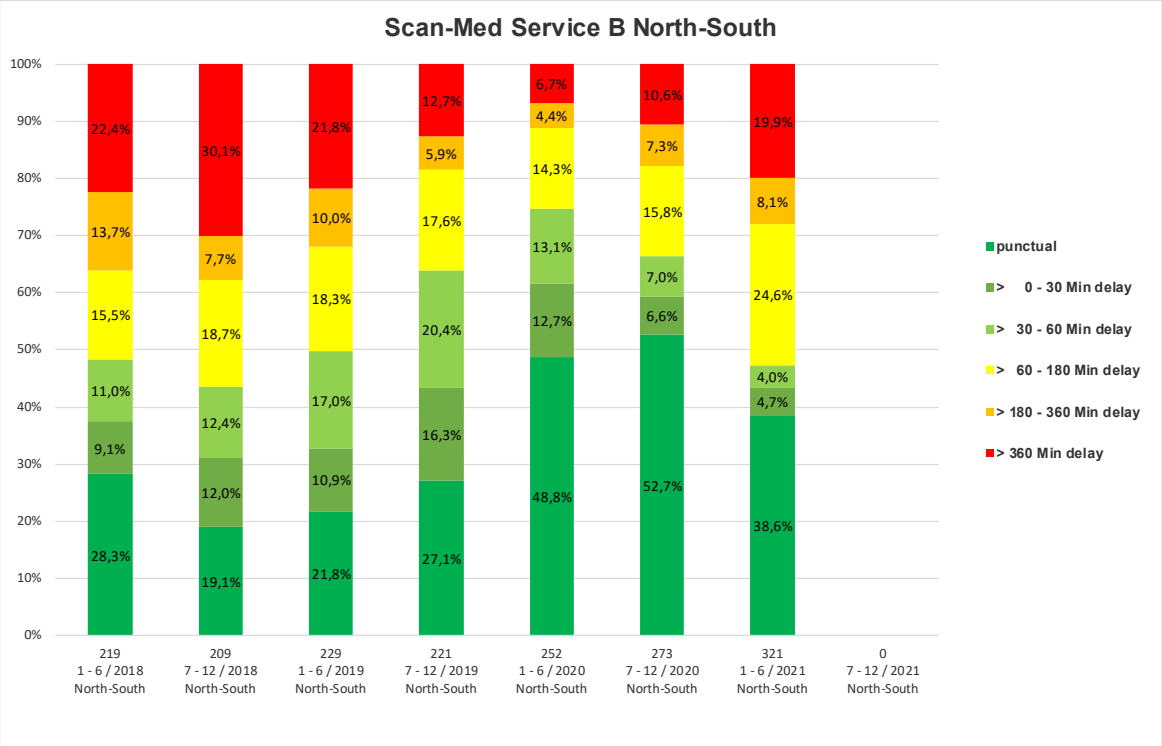
Table 8: Scan-Med Service B - Time Table Data 2020 and 2021 as well punctuality for reporting periods

Year	2020				2021			
Direction	North-South		South-North		North-South		South-North	
Month	1-6	7-12	1-6	7-12	1-6	7-12	1-6	7-12
Departure time	09:20	09:20	02:57	02:57	08:05	08:05	20:30	20:00
Pick-up time	12:00	12:00	03:30	03:30	13:30	13:30	02:40	02:00
Journey Time hh:mm	26:40	26:40	24:33	24:33	29:25	29:25	30:10	30:00
Average speed Km/h	≈ 48	≈ 48	≈ 52	≈ 52	≈ 44	≈ 44	≈ 43	≈ 43
Punctuality (< 60 Min delay)	75%	66%	75%	73%	47%		63%	
N° of services > 20/month	252 Yes	273 Yes	254 Yes	280 yes	321 yes		320 yes	

Source: KombiConsult analysis based on recent service agreement of freight forwarders

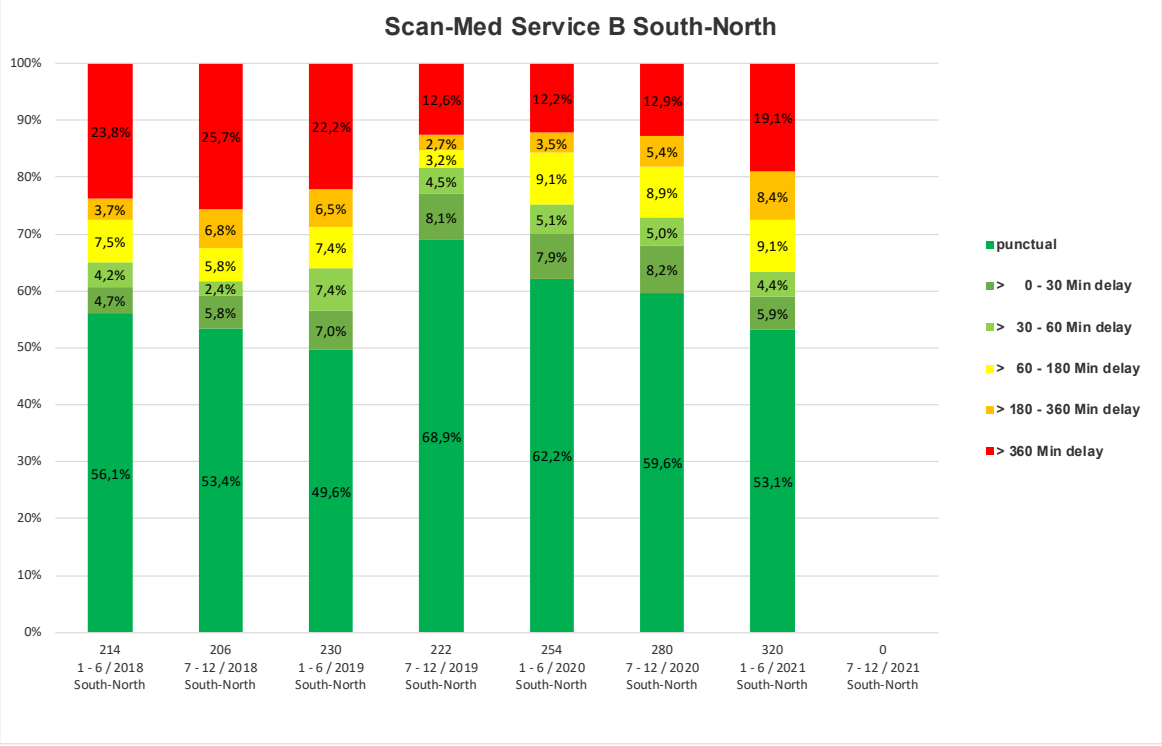
The evolution of punctuality is displayed in the following diagrams. As can be seen punctuality of south-north trains is usually better than in the opposite direction. Both directions showed a positive development until the fourth reporting period (2021). The quality declined after that. For north-south trains the punctuality - if a delay of one hour is accepted – decreased from 49.8% to 47% with a high of 75% in the first half of 2020, and for the opposite direction it decreased from 65% to 63%, despite a high of 81% in the second half of 2019.

Figure 10: Scan-Med Service B Direction North-South - Evolution of Punctuality 1-12/2018 and 1-6/2021



Source: KombiConsult analysis September 2021

Figure 11: Scan-Med Service B Direction South-North - Evolution of Punctuality 1-12/2018 and 1-6/2021

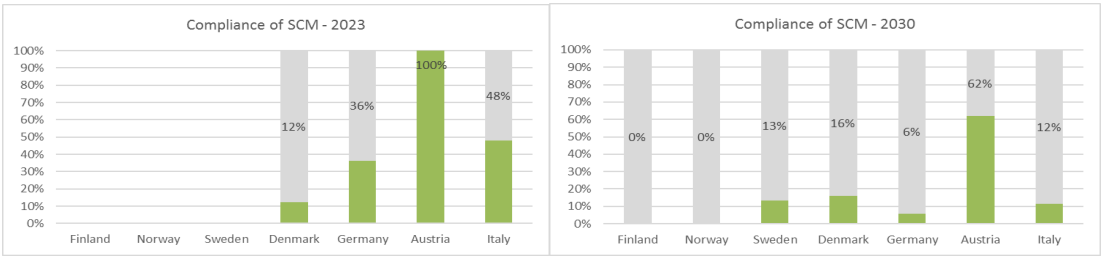


Source: KombiConsult analysis September 2021

3.2 ERTMS deployment

The ERTMS analysis is based on the ERTMS European Deployment Plan, which itself is based on National Plans[21]. The total length of the SCM corridor is 11 925 Km, including the CEF 2 extension. According to the EDP, 1 255 Km and 1 850 Km are expected to be operational by 2021 and 2023. Overall, ETCS is operational on 10% of SCM, while GSM-R is operational on 93% of the corridor. In June 2022, 37% of the SCM length planned in the EDP by 2023 was in operation with ETCS. Given the current deployment figures and considering that some Member States have already notified delays in implementation, it will not be possible to meet the EDP deadlines in this corridor by 2023. The following graphs show the status of ETCS deployment by Member States on the SCM as a percentage of the 2023 and 2030 targets.

Figure 12: Current ERTMS Compliance Scan-Med Corridor by 2023 and 2030



Source: Study preparing the ERTMS European Deployment Plan, November 2021

According to the Finnish plan, the commissioning of most SCM sections is planned by 2034 and 2038. Only one section, from Turku/Naantali to Karjaa (located between Turku and Helsinki), will be commissioned by 2030.

In Norway, there are two lines on the SCM corridor. Both lines connect Norway with Sweden. According to the Norwegian plan, the commissioning of the Narvik – Swedish border is planned by 2027 and Oslo – Swedish borderline is planned by 2034.

In Sweden, there are already some lines in operation in SCM. According to the Swedish plans, the remaining sections are planned by 2030, except for sections included in CEF 2 extension. Swedish authorities envisage full network equipment with ETCS by 2035, but there is no confirmation if CEF 2 sections will be equipped by 2030.

In Denmark, there are already some lines in operation on SCM. The remaining sections will be commissioned between 2022 and 2030, except for the line currently equipped with no train system protection, i.e., the last mile of Hjørring - Hirtshals section in the north of Denmark.

In Germany, there are already some lines in operation on SCM. According to the German plan, some sections planned in the EDP by 2023 will be delayed, and their commissioning is expected between 2025 and 2026. Regarding German sections planned in the EDP beyond 2023, although the entire German network will be equipped by 2040, most SCM sections have no specific deadlines.

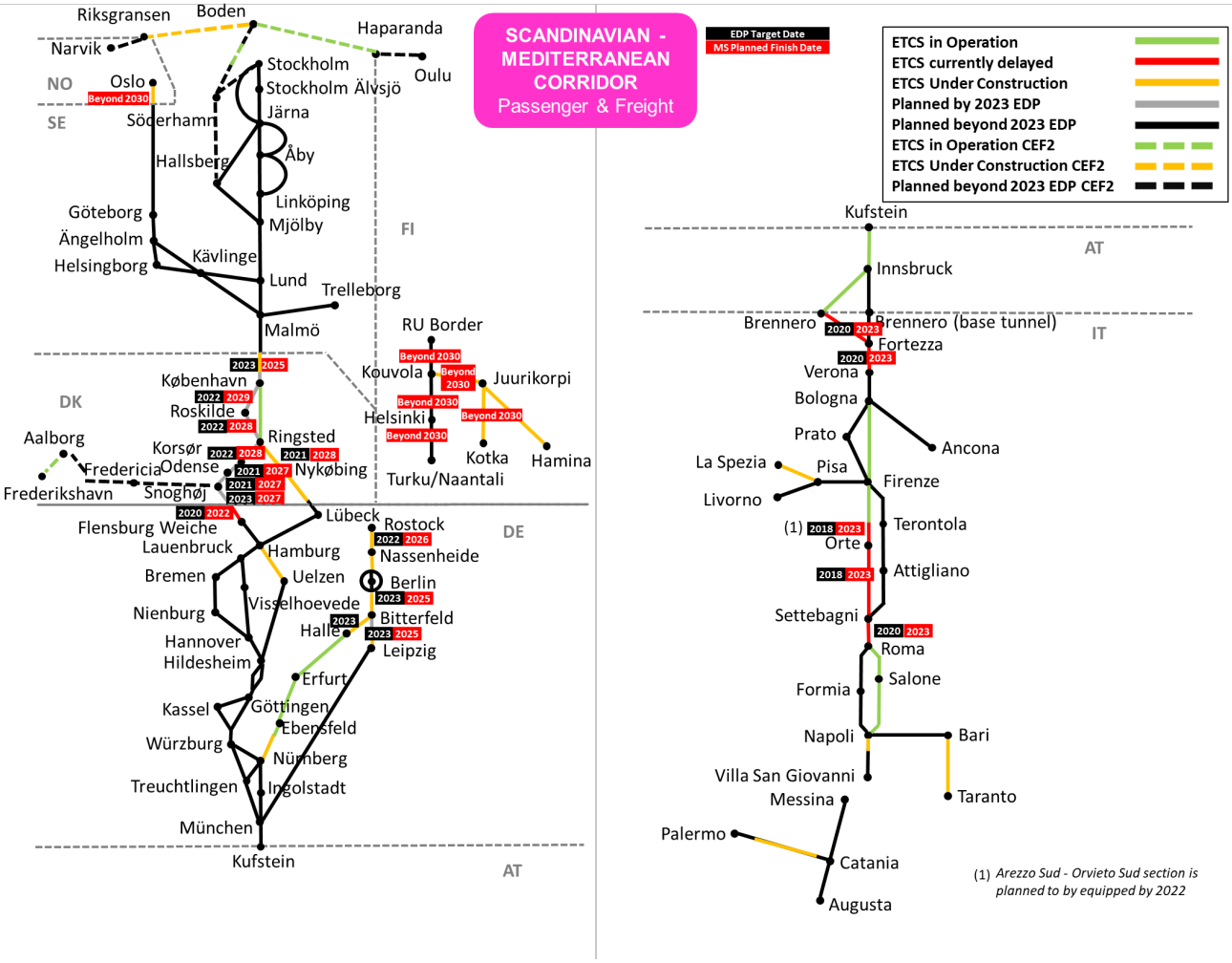
In Austria, the line from the Italian cross-border (Brenner) to the German cross-border (Kufstein) had been already commissioned when the EDP was published in 2017. According to the Austrian plans, the remaining SCM section will be commissioned by 2030.

In Italy, there are already some lines in operation in SCM. According to the Italian plans, some sections planned in the EDP by 2018 and 2020 are delayed, and their commissioning is expected by 2023. The remaining lines are planned to be equipped by 2030.

[21] This chapter was provided by the European ERTMS Coordinator.

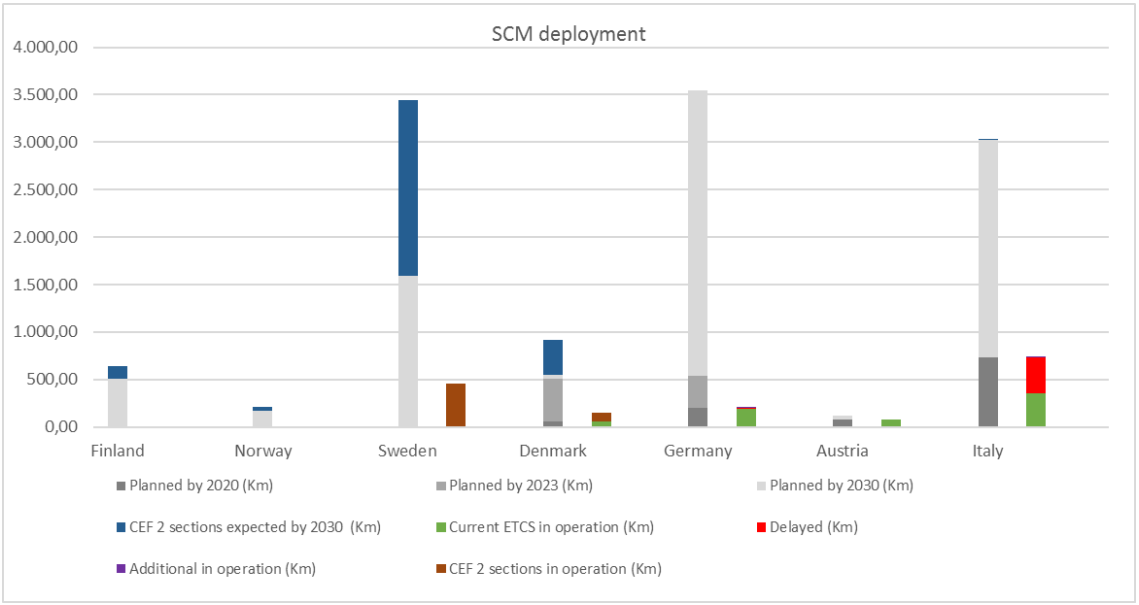
Figure 13 below shows the state and deadlines for ERTMS deployment on the Scan-Med corridor.

Figure 13: State of play and deadlines ERTMS deployment Scan-Med corridor



Source: Study preparing the ERTMS European Deployment Plan, July 2022

Figure 14: ERTMS deployment on Scan-Med Corridor in km by country



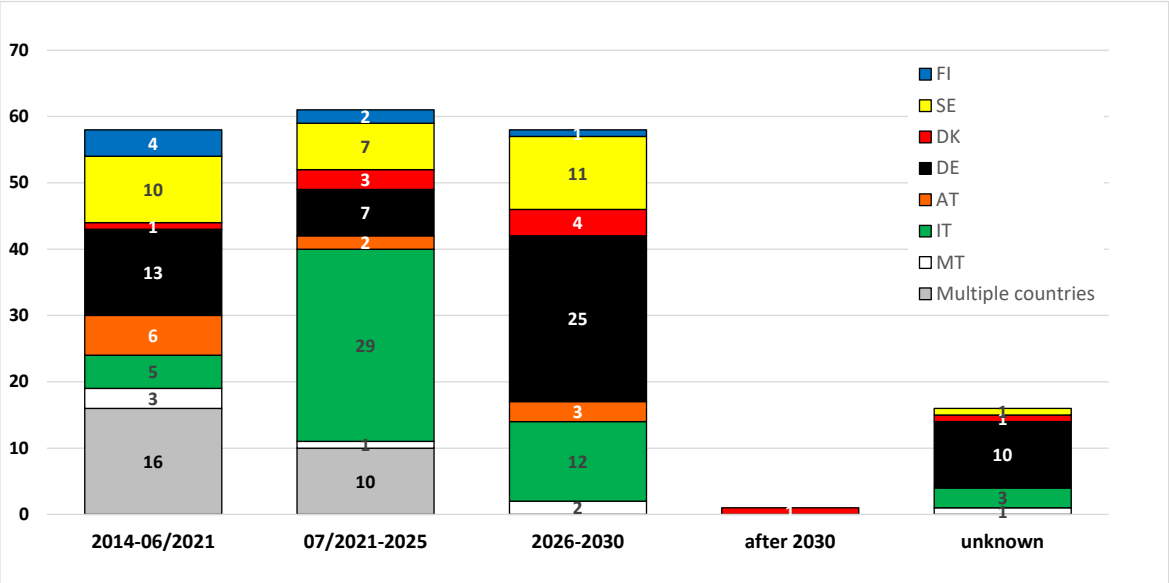
Source: Study preparing the ERTMS European Deployment Plan, November 2021

3.3 Road

Completion time and project costs

The updated project list contains 194 road projects of which 58 have already been completed by June 2021. 109 projects are either already ongoing or planned to be completed by 2030. Most projects are located in Italy (41) and Germany (32). There are 18 projects in Sweden and 7 in Denmark. Finland, Austria and Malta are listed each with less than 5 projects. 10 projects are of a multinational character. 18 of the ongoing projects deal with the implementation of ITS services along the corridor and a further 16 with the deployment of alternative fuels.

Figure 15: Road projects by completion time and country ; total = 194 projects



Source: Ramboll analysis based on the 2021 updated project list (October 2021), November 2021

The 120 on-going road projects are having total or estimated costs of €30.1bn and shall mostly be completed by 2030. While one project is planned to be finalised in 2033 for 16 projects with costs of €2.2bn the end date is unknown.

Expected compliance by 2030

With respect to the incompliant sections identified in the previous chapter the impact of the ongoing and planned projects leads to the following expectations for 2030:

The main compliance gaps related to the fulfilment of TEN-T requirements by 2030 concern the **non-motorway/expressway** sections mostly along the CEF 2 extensions in Northern Sweden. The sections are long and located in sparsely populated areas. By 2030, the compliance will improve through planned projects, but it will not reach 100 %. The non-compliant section between Valletta and Marsaxlokk in Malta connecting the two ports and the airport is expected to reach compliance by 2030.

The network for **alternative clean fuels** concerning H2, CNG and LNG stations is not expected to change significantly before year 2030 judging from ongoing or planned projects. The situation is different for charging stations for electric cars which is 100 % compliant.

Concerning **missing links** on the road corridor, the Fehmarn Belt Fixed Link shall be completed by 2029 according to the current planning, and the Stockholm bypass Project are assessed to be completed by 2030.

Additional projects

There are currently 21 additional projects of which 20 are concentrating on **upgrading of the existing network to motorway/express road** standard. The total costs of those projects is estimated at €3.4bn. These projects are located mostly in northern Sweden and Malta in line with the identified missing links and cover long distances. It is thus likely that these links in northern Sweden will be upgraded in steps so that further (part-) projects will be defined.

Operational issues

In the absence of an initiative by the EU there is still no common view between countries or regions on the issue of allowing "longer and heavier trucks" thus exempting (parts of) the road freight transport from the maximum permitted parameters defined in Directive (EU) 2015/719 amending Directive 96/53/EEC. **Larger and heavier trucks** are currently allowed in Denmark, Sweden, Finland and Norway. The potential benefits of this solution are a better use of available capacity, as well as lower emissions per ton transported and lower costs. Germany has done field tests on some roads for selected applicants. As a result, there are 5 different types of longer trucks ("Lang-Lkw-Verordnung") allowed in Germany on selected roads and routes, which are extended stepwise. In September 2021 Italy has completed a ten-year trial with about 300 semi-trailers of about 15.5 m length requiring a total truck length of 18 m instead of 16.5 m and concluded to accept those for standard operation for domestic transport on its entire territory. Thus, from the corridor countries only Austria and Malta remain concerned with regards to larger trucks as they fear this could go to the detriment of the intended shift of freight traffic from road to rail (Austria) and because of technical compatibility with the national road infrastructure network (Austria and Malta).

Figure 16: Expected Road compliance by 2030

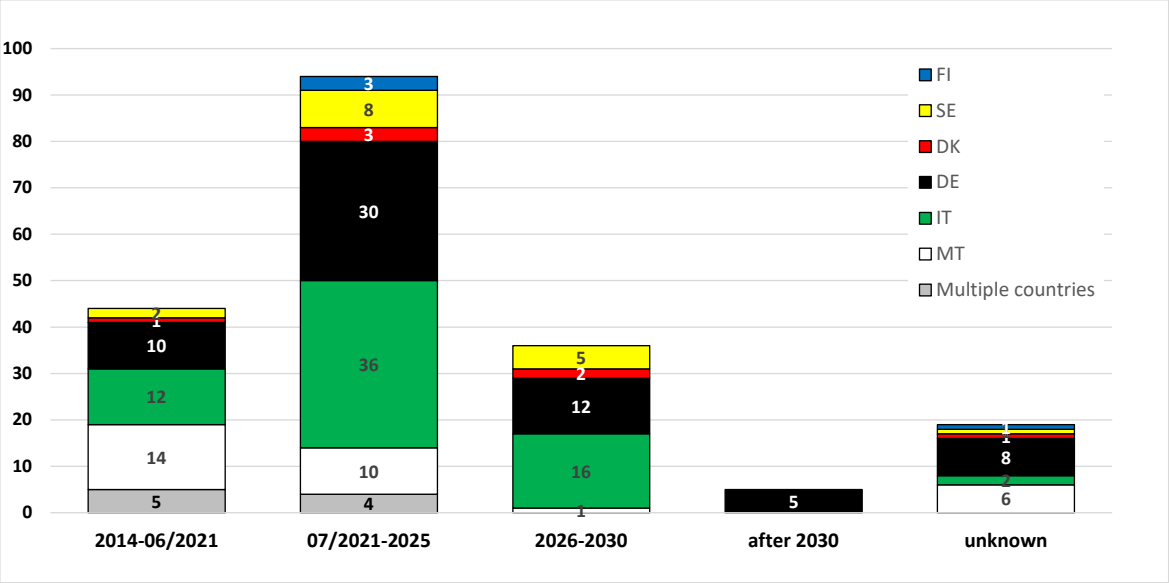
Source: Ramboll analysis, November 2021, updated June 2022

3.4 Maritime Ports and MoS

Completion time and project costs

The updated project list includes 198 projects in the maritime ports sector amounting to €16.7bn of known costs. Out of these 44 maritime ports projects (22%) have already been concluded between 2014 and end of June 2021.

Figure 17: Seaports projects by completion time and country; total = 198 projects



Source: HPC analysis, based on the 2021 updated project list (October 2021), November 2021

A further 130 Maritime port projects (66%) are expected to be completed by 2030 with total costs amounting to €10.2bn (€9,8bn million official costs and €0.4bn estimated costs). Five projects are expected to be completed after 2030 and for 19 projects there is no known date of completion.

In addition, to those projects there are 51 projects in the category of **motorways of the sea** recorded in the project list (Sweden, Germany, Italy 2 each, and multiple countries 45). Of those 41 projects (80%) have already been concluded between 2014 and end of June 2021. The remaining 10 are all planned to be completed by 2030. Their official costs amount to €260 million.

Expected compliance by 2030

In general the analysis approved in the 4th corridor Work Plan in 2020 has not changed with regard to the expected compliance of the maritime ports with the TEN-T Regulation in 2030.

Although the Scan-Med core ports have **railway access to the hinterland** the number of railway tracks often does not represent the real infrastructure capacity need. Local capacity bottlenecks may occur within the port area itself, or at the intersection between the port and the railway network. Therefore, it is important to improve linkages, build new rail stretches, consider extensions, electrify existing tracks and equipping them with appropriate traffic command systems as well as upgrading of handling operations at rail terminals. Only in case of adequate capacities can it be ensured that the ports fulfil their role in the TEN-T Core Network.

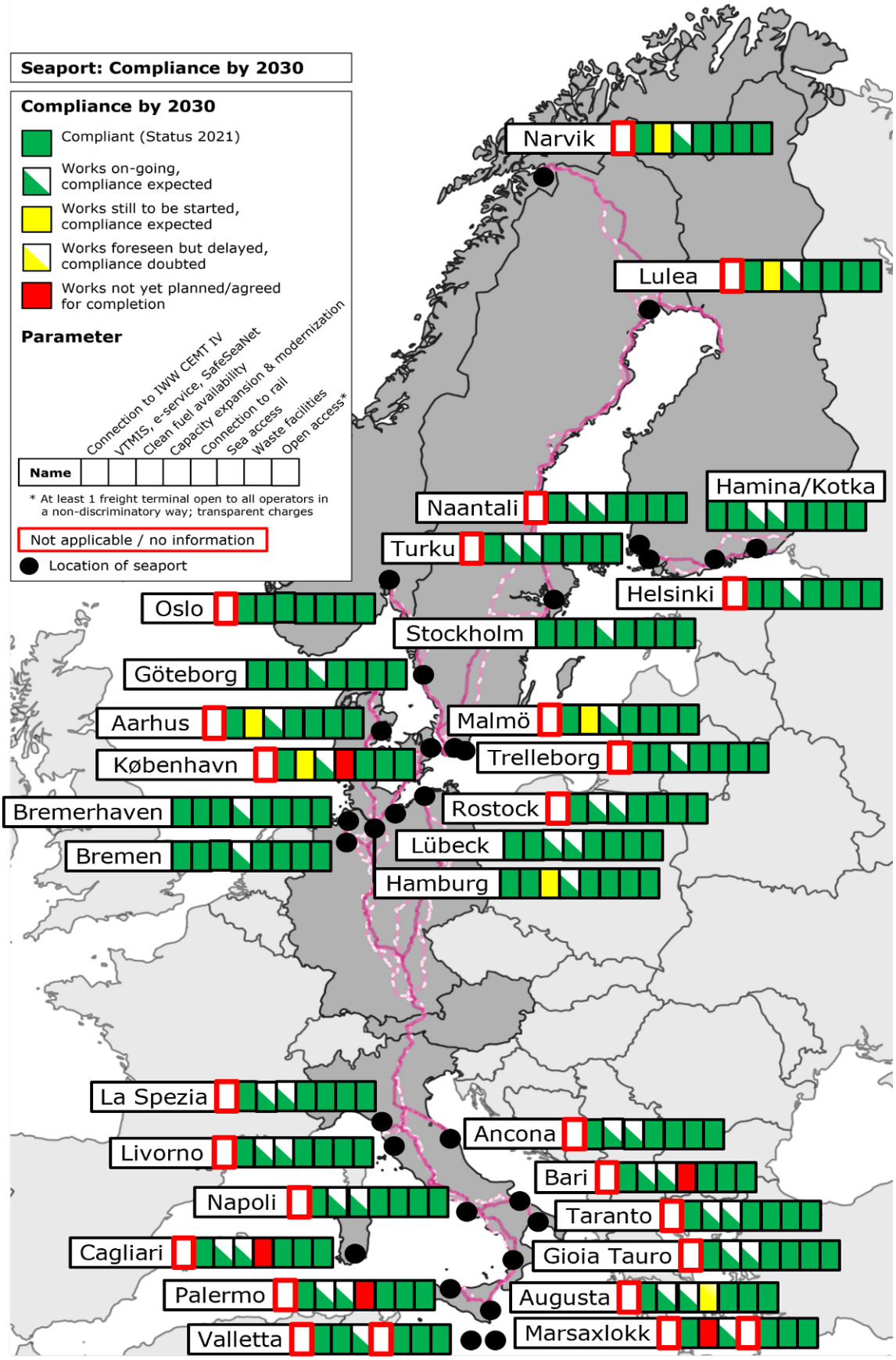
Another critical issue is to maintain **good ice-breaking capacity** throughout the year, to ensure access to the ports in the Northern Baltic Sea and the Gulf of Bothnia (e.g. Hamina/Kotka, Helsinki, Turku/Naantali, Luleå and Stockholm). It is of high importance to reconsider the impact of climate change and, in consequence, the higher likelihood of extreme weather events, including very cold periods also in the Southern Baltic Sea.

Regulation (EU) 1315/2013 and other EU legislation on sustainability, energy efficiency and CO_2 reduction require publicly accessible alternative **clean fuels** for maritime (and IWW) transport to be provided by all the maritime core ports by 2030. In general, there seems to be "sufficient" time to achieve this objective. However, progress needs to be kept under constant review.

Additional projects

In order to close the remaining compliance gaps, which are due to a lack of projects, the consultants proposed "additional projects". For maritime ports 11 additional projects with total costs of € 1.2bn. Seven projects consider the availability of clean fuels and four the connection to rail.

Figure 18: Expected Seaport compliance 2030 for selected KPIs



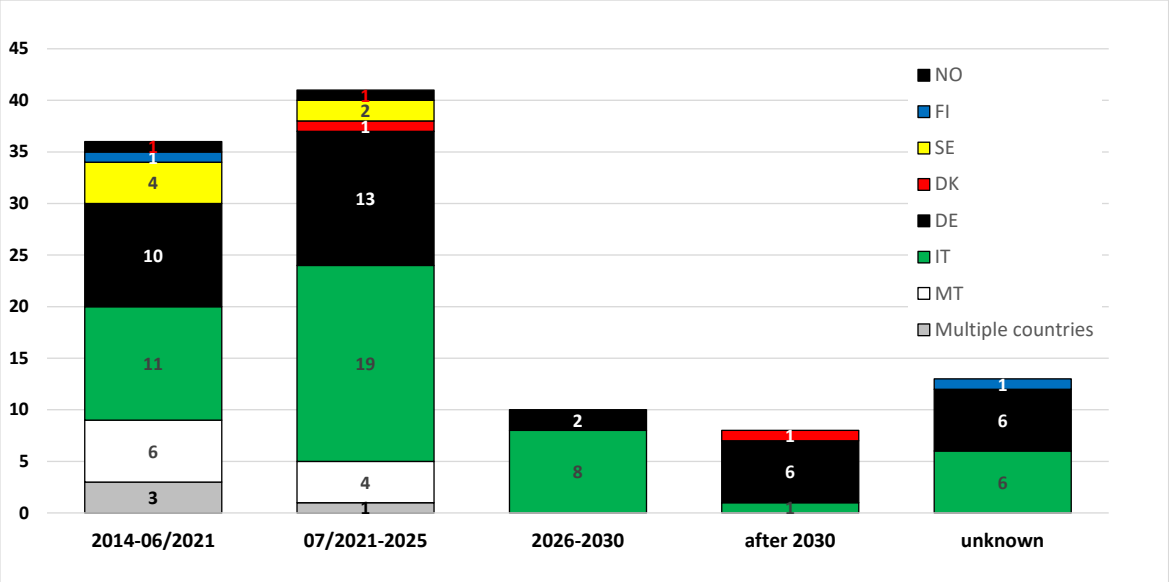
Source: HPC analysis, November 2021

3.5 Airports

Completion time and project costs

There are currently 32 airport projects[22] that are either ongoing or planned to end by 2030[23] recorded in the updated Scan-Med project list. Their total costs (either official or estimated) amounts to €4.2bn[24] (for 1 project the cost figures are presently unknown). More than half of the projects are located in Germany (12) or Italy (11). Five projects are located in Malta (1 shared with Greece), 2 in Sweden and 1 in Norway. The node accounting for most airport projects is Munich with 8 projects; the airport of Luqa in Malta, also has a relevant concentration of projects (5), as well as the Rome airport system with 4.

Figure 19: Airport projects by completion time and country; total = 108 projects



Source: PTSClas analysis, based on the 2021 updated project list (October 2021), November 2021

In terms of costs, the most relevant existing projects are the following:

- The completion the **development of Fiumicino airport** (Rome, Italy) in order to adapt the airport capacity to air traffic growth and increase the level of service. The overall cost amounts to €1.4bn. The planned end date is December 2025.
- The **new rail connection to Munich airport** eastward in the direction of Erding, costing €605m. The project is planned to end by 2030.
- The **expansion of Terminal 1 of Munich airport** with an additional pier; the project, planned to finish by June 2023, has a cost of €400m.
- The **new extra-Schengen Passenger Terminal of Oslo Gardermoen Airport**, bringing an additional capacity of 2 million pax/year, to be opened by June 2022 at a cost of €330m.

[22] Sub-projects of existing projects are excluded from the count. Counting them in, instead, the number of individual actions reaches 44.

[23] Projects whose end date is currently unknown are excluded from the count. Counting them in, instead, the projects are 41.

[24] €17.9bn if projects whose end date is unknown are also included.

Also worth mentioning are two projects whose completion dates are unknow:

- The "**Airport line**" in Finland, a 30 km railway line connecting Helsinki and Helsinki Airport with the main line between Helsinki and Tampere; the line will be a double track and travel almost the entire distance in a tunnel (28 km). The estimated cost is €2.65bn.
- The programme of **medium-term expansion of Berlin Brandenburg airport**, including the construction of Terminal 2 (which has already been completed), with a total cost of €600m.

Expected compliance by 2030

In terms of **capacity**, the situation of core airports in the Scan-Med corridor is satisfactory as compared to the current traffic requirements. Projected increases in traffic volumes will be addressed through expansion projects described in earlier chapters. Also the compliance with the parameter **connection to rail** is broadly assured by 2030.

The main compliance gaps with regard to the fulfilment of TEN-T parameters by 2030 compliance concern SESAR deployment and the availability of alternative clean fuels.

With a view to **SESAR** most airports in the corridor have plans to improve the ATM and related equipment, adapting them to the Single European Sky framework. Based on the Consultant's analysis of the project list, actions are insufficient at the airports of Oslo, Turku, Helsinki and Bremen. As the new SESAR 3 initiative has been undertaken, the widest possible participation from airports in the Scan-Med corridor is desirable.

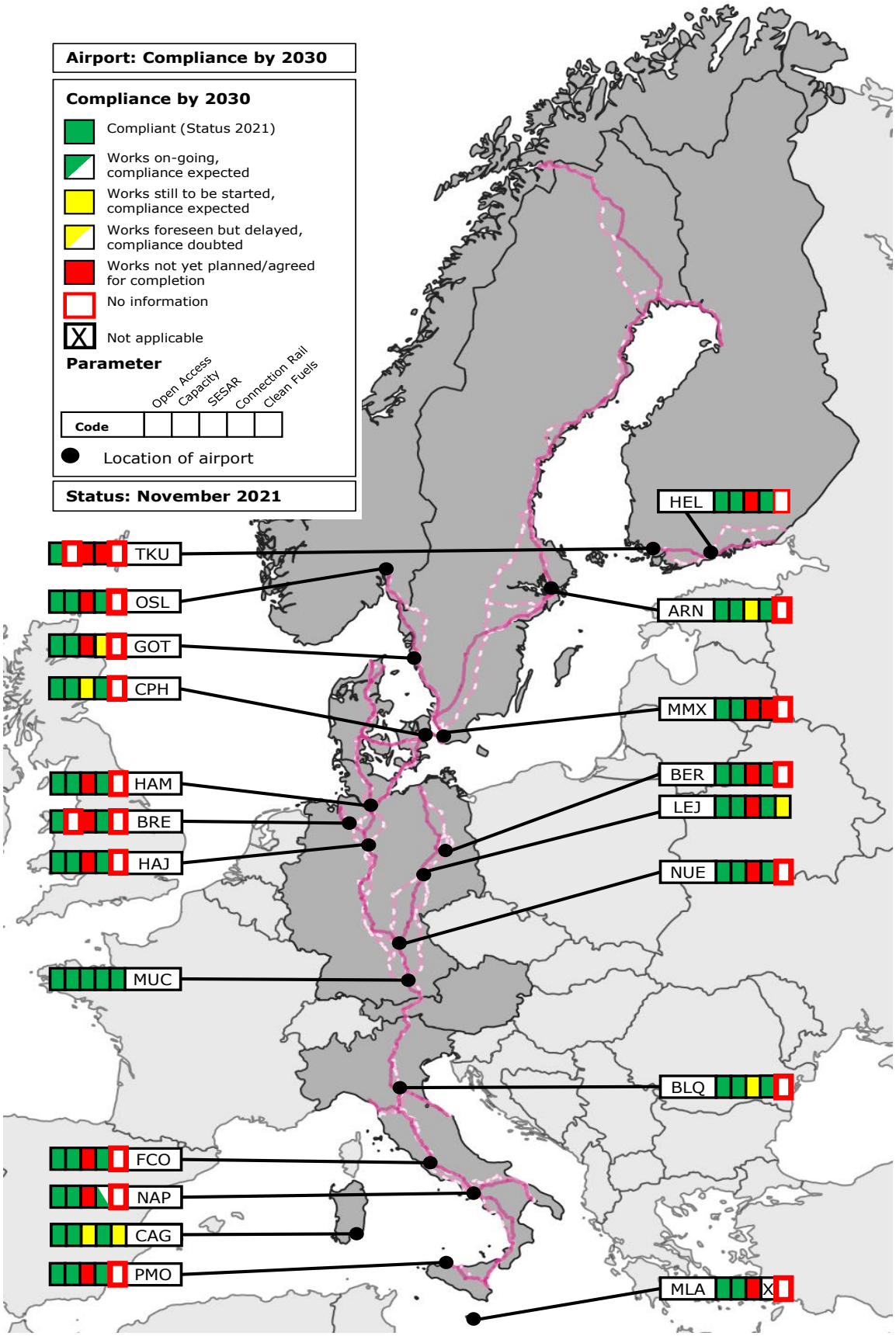
In terms of **alternative clean fuels** availability[25], only a few airports are compliant at present. While projects ongoing at the airports of Cagliari and Bologna are included in the project list, recent and accurate information is needed form the other airports: Malta International Airport of Luqa, Palermo, Naples, Rome Fiumicino, Nuremberg, Berlin, Hannover, Bremen, Hamburg, Copenhagen, Malmo, Gothenburg, Stockholm, Oslo, Helsinki and Turku. If capacity to make alternative clean fuels available is missing, initiatives are urgently needed at those airports

Additional projects

Further to the existing projects presented by the project promoters, which contribute to the achievement of the TEN-T targets, the consultants' analysis has identified **25 additional projects** which need to be programmed in order to close the remaining compliance gaps. They namely concern the parameters SESAR deployment (5 airports in 4 countries), connection to rail (2 projects in the airports of Turku and Malmö) and availability of clean fuels (18 airports located in 7 countries). It is important to underline that these additional projects can be considered as general measures conceived for the achievement of the missing parameters and, as a consequence, in most cases, an estimation of the costs of these projects was not possible.

[25] Definition according to TEN-T Regulation (EU) 1315/2013, Article 3 (w).

Figure 20: Expected Airport compliance 2030 for selected KPIs



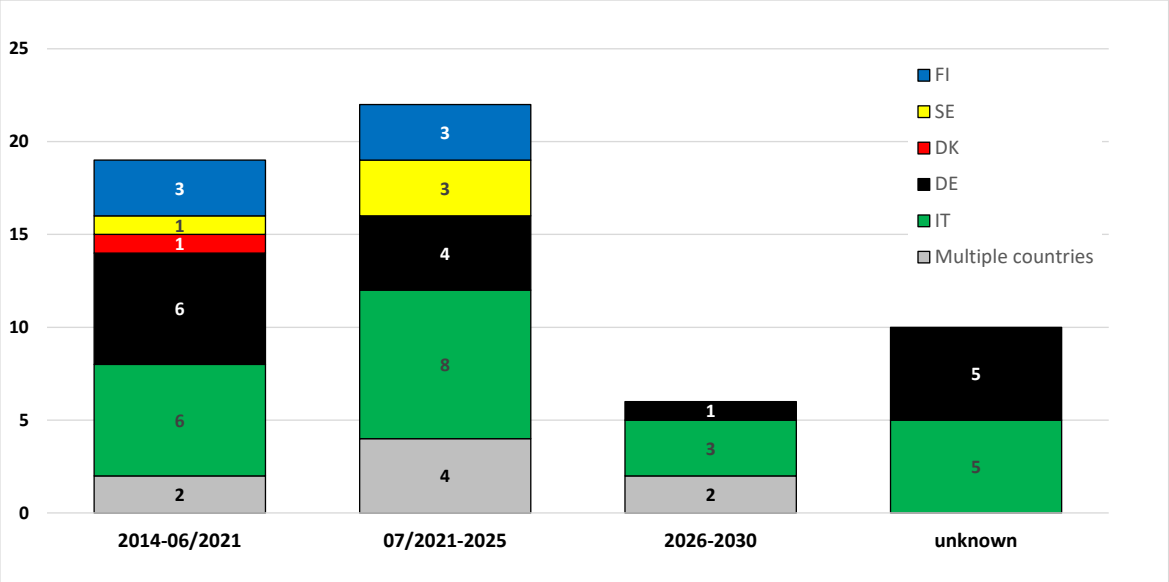
Source: PTSClas analysis, November 2021, updated April 2022; see SESAR explanation in the text

3.6 Multimodal

Completion time and project costs

In total 56 ongoing or planned Multimodal projects are contained in the updated Scan-Med project list[26] with total costs amounting to €2.8bn (€1.0bn official costs + €1.7bn estimated costs). More than two third of all Multimodal projects (38) are located in Italy (22) and Germany (16), which is approximately in line with their share of the overall corridor rail network length. Seven Multimodal projects are allocated to several countries. Apart from pan-European studies, there are also some bilateral infrastructure projects. Major RRT projects are located in Gothenburg, Lehrte, Hamburg, Helsinki, Kouvola, Lübeck, München, or Verona.

Figure 21: Multimodal projects by completion time and country; total = 56 projects



Source: KombiConsult analysis based on the 2021 updated project list (October 2021)

As 19 Multimodal projects (30%) have already been concluded between 2014 and end of June 2021, 37 projects are still open. With a view to the year 2030, 27 Multimodal projects (52%) with total costs of €1.9bn (€0.6bn official costs + €1.3bn estimated costs) are expected to be completed by then. For ten projects information about the completion date is lacking.

Expected compliance by 2030

As can be seen in figure 22, compliance by 2030 with the parameters electrified access and minimum 740 m train length[27] is in doubt for most of the terminal sites if no further necessary steps are taken.

Though at least 15 terminals already provide for **electrified access**, no further activities or projects are planned at present. Thus no further improvements in compliance are expected by 2030 and only half of the terminals will fulfil this criterion.

As concerns the **train length**, in addition to the seven sites already fulfilling the additional requirement of "≥740 m train length" (Bologna, Bremen, Hallsberg, Leipzig, Malmö, Nola, Rosersberg), sites such as Hamburg, Kouvola, Munich or Verona are committed to achieving compliance with the parameter by 2030. For the remaining sites, there are either project ideas but "works are not yet planned/agreed for

[26] This chapter provides main results on projects related to the category "Multimodal" (RRT, encoded as "Multimodal" category in the project list).

[27] "740m track length" is no TEN-T Requirement for RRT but an "additional" requirement as introduced in the first Work Plan in 2014 and maintained since then.

realisation", or there are no project ideas at all, so that only slight improvements can be expected until 2030. As mentioned above, some sites have extended their transhipment tracks recently, but clearly below the compliance goal of "≥740 m train length". Consequently, further actions at those sites cannot be expected in the coming period.

It is recommended that rail infrastructure managers and terminal managers cooperate towards realizing the track-side and terminal side improvement of those parameters in a coordinated way to work towards ensuring that freight trains with a permitted length of 740 m may enter (and leave) the terminals "in one piece" without any delay and additional time-consuming shunting procedures.

Additional projects

For the category Multimodal, "additional projects" have been compiled with overall costs of about €30m in 21 terminals[28]:

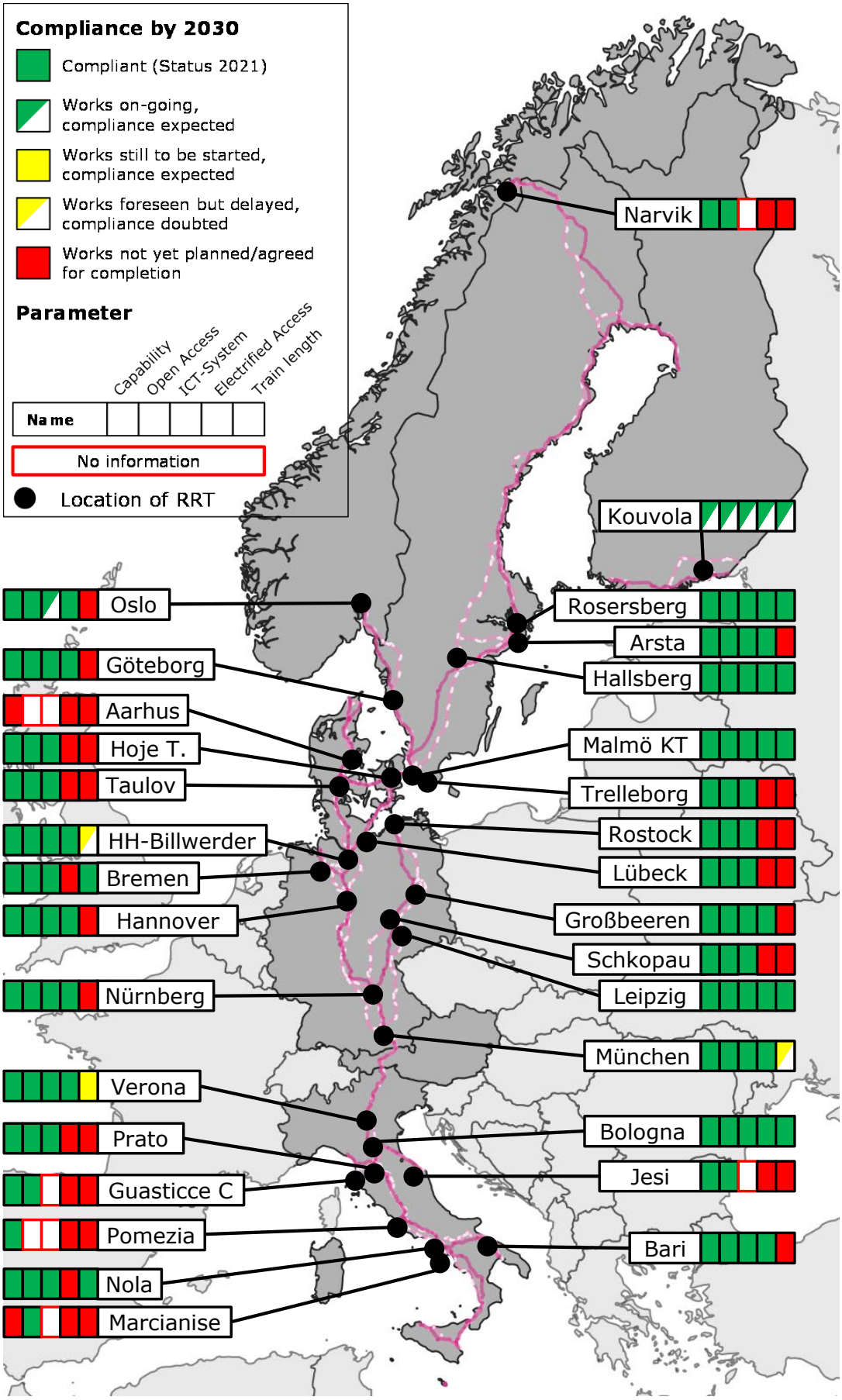
- 2 measures for missing capability of handling all intermodal units in Denmark and Sweden;
- 19 measures for enabling ≥740 m train length[29] in Norway, Sweden, Denmark, Germany and Italy;
- 15 measures for providing accessibility of electrified trains[30] in Norway, Sweden, Denmark, Germany and Italy.

[28] As one Rail-Road terminal can be affected by more than one compliance gap (capability, 740 m train length, electrified access), the single measures sum up to more than 21 projects.

[29] "740m track length" is no TEN-T Requirement for RRT but an "additional" requirement as introduced in the first Work Plan in 2014 and maintained since then.

[30] „Electrified train access" is no TEN-T Requirement for RRT but an "additional" requirement as introduced in the first Work Plan in 2014 and maintained since then.

Figure 22: Expected Rail-Road Terminal compliance 2030 for selected KPIs



Source: KombiConsult analysis, Status: June 2021, updated June 2022

3.7 Implementation difficulties

This chapter provides results on the monitoring of difficulties jeopardizing completion of the Corridor and requesting EU Coordinator's action. Corridor Forum Members were asked to state any difficulty in the implementation of a specific project. Four projects show difficulties which may jeopardize the completion of the Corridor by 2030

Table 9: Projects with stated implementation difficulties

TEN-T Project ID	Project promoter: Project name	Project category	KPI(s) achieved	Project end date	Total costs (official) m€	Total project financing approved (yes/no)
5182	Jernbanedirektoratet (Norwegian Railway Directorate): Construction of 57km of double-track railway along with capacity improvements in 4 railway stations.	Rail	- ERTMS implementation - Line speed >= 100 km/h - KPI: Axle load >= 22.5 tonnes - Train length >= 740m - Elimination of current or potential future capacity bottleneck - Removal of single-track section	unknown	unknown	no
5386	Galleria di Base del Brennero: Brenner Basistunnel BBT SE: Brenner base tunnel (BBT)	Rail	- Electrification - Track gauge 1435 mm - Structure gauge - Intermodal gauge - ERTMS implementation - Line speed >= 100 km/h (Core freight lines) - Axle load >= 22.5 tonnes (Core freight lines) - Train length >= 740m (Core freight lines) - Elimination of current or potential future capacity bottleneck - Elimination of strong incline	03/2032	7.715	Yes
5650	Jernbanedirektoratet (Norwegian Railway Directorate): Implementation of ERTMS system	Rail ERTMS	ERTMS implementation	12/2034	1.146	Yes
5786	Rostock LNG GmbH: Construction and operation of a medium-scale multimodal LNG terminal in the seaport of Rostock	Maritime	Availability of alternative clean fuels	07/2024	96,8	Yes

Source: KombiConsult analysis based on 2021 updated project list (October 2021)

4 Deployment and development plans and the revision of the TEN-T guidelines

4.1 Deployment plan of MoS

Maritime transport plays a key role for the European economy, transporting about 75% of its external trade and approximately 31% of its internal trade. Specifically, short sea shipping (SSS) makes up a majority (up to 60%) of the total maritime transport of goods to and from the main EU ports. With its large network of maritime ports on the trans-European transport network (TEN-T), the European maritime sector forms an important part of the intra-European transport system. The Motorways of the Sea (MoS) programme is a key instrument in this setting, working towards the ultimate vision of a European Maritime Space (EMS) that is Sustainable, Seamless, Smart and Resilient.

In the Detailed Implementation Plan (DIP) for MoS, the aim is to provide a sound analysis of priority investment needs to achieve the EMS, centred around four thematic pillars:

1. Sustainable: Emphasising on the reduction of GHG emissions and pollution of air, noise and water;
2. Seamless: enhancing the connectivity with the rest of the TEN-T (the CNCs in particular), other transport modes, peripheral and outermost regions, islands and European neighbourhood countries;
3. Smart: aligning maritime transport with the European digital agenda;
4. Resilient: ensuring the EMS is capable of facing exogenous shocks.

Maritime ports and their hinterland connections play a key role in achieving these goals. The port infrastructure and the hinterland connections must facilitate the transfer of the European economies to non-fossil fuels, providing appropriate handling and alternative fuels terminals, storage and hinterland infrastructure. Given that the future demand for new fuels is not yet known, investment plans need to be flexible and react quickly with regard to a developing demand and supply.

Due to its relatively high energy efficiency, maritime transport can also play an important role in reducing the climate impact of transport. Especially on long coastal routes, maritime transport should be considered as a serious alternative to road transport. Such coastal services with a reduced carbon footprint should be developed in cooperation with shippers and forwarders.

Ports and port communities are also natural digital hubs, exchanging data with seaborne and land-based transport from all parties involved in the transport chain. Simplifying procedures, harmonised data flows and a common approach to deploy interoperable ICT systems will further facilitate the use of maritime transport.

Finally, the resilience of maritime transport chains requires the cooperation of ship operators, ports and forwarders. Exogenous shocks such as extreme weather events may lead to a temporary breakdown of ports or parts of the hinterland transport chain. To address such possible shocks, alternative shipping routes should be identified for relevant transport flows. Such alternative shipping routes – may involve stakeholders along the TEN-T core network corridors with core and comprehensive network ports.

4.2 Plans for the deployment of alternative clean fuels infrastructure

The European climate law requires the Union to reduce its net greenhouse gas emission by at least 55% by 2030. Such emission reduction will require a significant contribution from transport. There is now considerable momentum as regards the market uptake of zero- and low-emission vehicles in the EU. However, in order to facilitate transition to a mass market and develop a truly common EU transport market full connectivity and a seamless user experience along the European transport network for low- and zero-emission vehicles, vessels and aircraft are needed. The TEN-T network has to provide the backbone of this endeavour.

The Commission report on the application of Directive 2014/94/EU of the European Parliament and of the Council on the deployment of alternative fuels infrastructure provides a comprehensive assessment of the state of play of alternative fuels infrastructure rollout in the EU.[31] It shows that market maturity varies considerably, depending on the mode of transport. Although some Member States have raised their ambition, the EU still lacks a comprehensive and complete network coverage of easy-to-use alternative fuels infrastructure, for all modes of transport. The European Court of Auditors has also stressed the significant differences between Member States in deploying charging infrastructure.[32]

The Commission is proposing a new Regulation on the deployment of alternative fuels infrastructure and repealing Directive 2014/94/EU. Being part of the Fit for 55 Package of 14 July 2021, the proposal seeks to provide for a dense, widespread network of publicly accessible alternative fuels infrastructure in the EU.

The proposal for a new Regulation sets forth binding requirements for rollout of an infrastructure with a sufficient amount of minimum recharging and refuelling capacity to ensure full cross-border connectivity of light and heavy-duty vehicles throughout the EU. Distance-based targets for fast-recharging infrastructure along the TEN-T network complement national fleet-based targets for recharging of light-duty electric vehicles. A combined approach of distance-based targets along the TEN-T network with targets for overnight recharging infrastructure for trucks in safe and secure parking places and targets at urban nodes should further support the electrification of heavy-duty vehicles.

Distance-based targets for deployment of hydrogen refuelling stations, including for each urban node, will also ensure necessary minimum refuelling infrastructure for light- and heavy-duty fuel cell hydrogen vehicles.

Following the provisions of the proposal for a regulation on alternative fuels infrastructure, shore-side electricity supply should be provided in maritime and inland waterway ports. In addition, an appropriate number of refuelling points for LNG should be put in place at maritime ports and on road network of the TEN-T core and comprehensive network. Finally, stationary aircraft at airports and commercial transport operation should be able to make use of external electricity supply while parked at gates or at outfield positions at TEN-T airports.

The upcoming proposal for the revision of the TEN-T Guidelines will provide per transport mode cross-references to the Regulation on the deployment of alternative fuels infrastructure and additionally address aspects of private recharging and refuelling infrastructure in certain cases such as freight terminals. Private recharging infrastructure is also likely to be addressed in the upcoming proposal for the revision of the Energy Efficiency of Buildings Directive.

[31] COM (2021) 103 final

[32] Special Report 05/2021: Infrastructure for charging electric vehicles: more charging stations but uneven deployment makes travel across the EU complicated

4.3 The development of Urban Nodes by 2030

Urban nodes represent most of the points of origin and destination of transport flows on the Corridors. The effectiveness of the Corridors is therefore impacted by the effectiveness of the first and last miles of the journeys in those urban nodes and it is important to ensure sufficient multimodal connections. Urban nodes can also contain bottlenecks and missing links on the Corridors; conversely, they can be impacted by the negative aspects of traffic on the Corridors in terms of pollution, noise and safety.

In that perspective, urban nodes do not receive sufficient attention in the work of the Corridors as well as in the TEN-T Regulation. On a case by case basis it could be appropriate to set up a Working Group on Urban Nodes in Corridor Fora and to organize meetings on a regular basis.

Regarding the TEN-T Regulation, the Commission adopted on 14 December 2021 a proposal for a revised Regulation which more clearly defines the role of the urban nodes on the network and their constituent elements, and which sets additional requirements that the Member States should ensure. Those additional requirements include the development of Sustainable Urban Mobility Plans (SUMPs), the use of sustainable urban mobility indicators and the development of multimodal passenger hubs and freight terminals. In addition, the proposal extends the list of recognised urban nodes from the previously limited list of 88 "network defining urban nodes" to all cities of at least 100.000 inhabitants and, for NUTS2 regions without such a large city, the capital of those regions. Depending on the final version that will be adopted by Council and Parliament, the number of urban nodes per corridor would thus significantly increase.

In this Work Plan, we are still referring to the current list of urban nodes and highlight the key points that still need to be addressed at their level to ensure a good effectiveness of the Corridor.

4.4 The revision of the TEN-T guidelines

On 14 December 2021, the European Commission adopted a legislative proposal for a **revised Regulation for the development of the trans-European transport network (TEN-T)**. The proposal is the result of a comprehensive evaluation of the existing legal framework, extensive Member States and stakeholder consultation and an in-depth assessment of the impacts of the changes proposed.[33]. The revised TEN-T Regulation shall contribute to the objectives of the **European Green Deal (EGD**) and of the **Sustainable and Smart Mobility Strategy (SSMS)**. The proposal is accompanied by an update of the 2013 TEN-T planning methodology, a report on the implementation of TEN-T during the years 2018 and 2019 as well as a communication on the extension of the TEN-T network to the EU neighbouring third countries.

To adequately address the objectives of the EGD and SSMS, the revision of the TEN-T Regulation aims at reinforcing the contribution of the TEN-T to the decarbonisation and digitalisation objectives of transport policy. In particular, the revised Regulation makes sure that the appropriate infrastructure basis to alleviate congestion and reducing GHG emissions is provided. To that end, the revised TEN-T Regulation includes firm incentives to shift transport demand towards more sustainable forms of transport. The aim is two-fold: a) to increase the number of passengers travelling by rail through the development of a competitive and seamless high speed rail network throughout Europe; and b) to shift a substantial amount of freight onto rail, inland waterways, and short sea shipping.

[33] Please note that the measures described in this chapter solely reflect the content of the Commission's proposal of 14/12/2021. This proposal is now subject to negotiations with the European Parliament and the Members states and thus might be subject to change.

The overall objective is to develop and complete a competitive and interoperable TEN-T network at highest standards, which is gradually developed in three steps: the core network by 2030, the extended core network by 2040 and the comprehensive network by 2050.

To that end, the revised TEN-T Regulation introduces a number of **new or reinforced infrastructure requirements**, which promote the development of infrastructure of sustainable forms of transport.

With regards to **rail transport,** the proposal foresees the requirement to enable the P400 loading gauge on the entire network and the extension of existing core network requirements to the entire comprehensive network (22.5 tons axle load, 740 m train length) or to the extended core network (100 km/h line speed). In addition, a minimum line speed of 160km/h is introduced for passenger lines of the core and the extended core network and the installation of ERTMS on the entire network by 2040 while decommissioning existing national class B systems is made mandatory. In terms of **waterborne transport**, the revised Regulation defines a "good navigation status" through minimum requirements (2.5 m navigable channel depth and 5.25 m height under bridges) that shall be complemented by specific requirements per river-basin. **Short sea shipping** shall be promoted in a wider perspective by integrating all components of the maritime dimension into a new concept called European Maritime Space. In the field of **road transport**, the focus is on improving the quality of roads as to increase road safety and to augment the number of rest areas and safe and secure parking along the TEN-T network. Finally, the proposal for a revised Regulation foresees an increase in the number of **multimodal freight terminals** along the TEN-T in order to promote multimodality as well as the inclusion of all EU **urban nodes** of at least 100.000 inhabitants into the network, thereby also ensuring that each NUTS-2 region is represented by an urban node. For the latter, the requirement to implement a Sustainable Urban Mobility Plan (SUMP) and the development of transhipment facilities (multimodal freight terminals and passenger hubs) is imposed.

To achieve the targets and to fulfil the objectives of the EGD and the SSMS an intermediary **deadline of 2040** is proposed to be introduced for the new standards on the core network and for advancing the existing standards to the comprehensive network, notably the deployment of ERTMS.

One major new element will be the integration of the nine Core Network Corridors with the eleven Rail Freight Corridors in a common set of "**European Transport Corridors**". The alignment of these new corridors will be defined in the TEN-T Regulation and will thus repeal the existing alignment of corridors in the CEF II Regulation. While striving for maximum stability of the existing TEN-T network, this merger brings certain changes such as the identification of an extended core network which will fully integrate into the corridors.

Similarly, the current system of **European Coordinators** shall be reinforced. Based on their work plans which shall be elaborated every four years, the Commission shall adopt an implementing act for each work plan, setting clear milestones to be implemented by the respective Member States. The elaboration of the work plans shall be complemented by annual status reports. Last but not least, the role of European Coordinators as observers in single entities for the implementation of cross-border projects shall be institutionalised.

5 Funding and Financing Tools

5.1 Update the Corridor funding needs

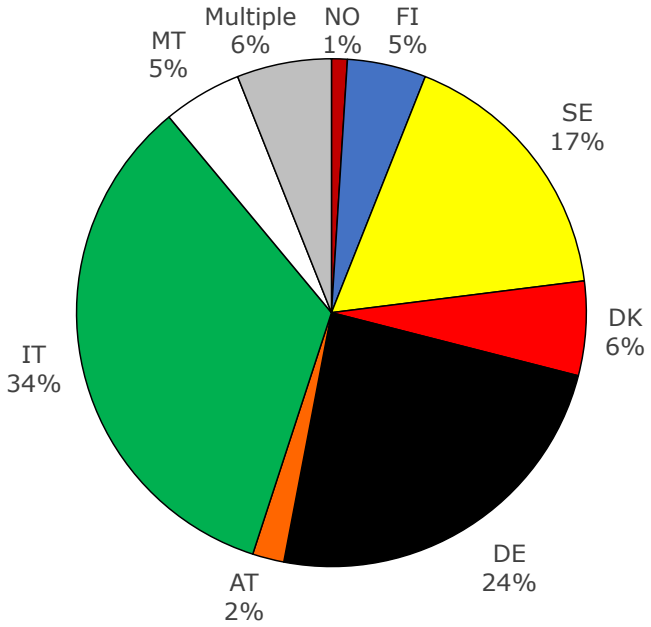
This section details the economic and financial aspects of the projects included in the Scan-Med project list and, more specifically, information on the projects' cost, maturity and financial viability. Without considering the projects completed by June 2021, there are **522 projects**[34] ongoing or planned on the Scan-Med Corridor, for a **total cost of €173.5bn** (project costs are known for 478 out of the 522 projects).[35]

An analysis of project and overall costs by transport mode shows that:

- The 134 projects in the **rail sector need the biggest share of funding in the corridor**, representing **28%** of the total number of projects, and **53% of the total costs** (€92.6bn). An additional **3%** is needed for the 15 ongoing or planned projects **in the ERTMS** programme.
- The 104 projects in the **road sector** represent **22%** of the total number of projects and **6.7% of the funding needs** (€13.8bn).
- The 41 projects in the **airport sector** (9% of the total number) account for **10% of the funding needs** (€17.9bn)
- The 122 projects in the **maritime sector** account for **25%** of the total number of projects and **8% of the funding needs** (€14.1bn). An additional **0.1%** is needed for the 7 **Motorways of the Sea** projects (3 more having unknown costs).
- Lesser shares of funding needs are recorded for projects in the **airport sector** (**8%**) and in the categories **multimodal** (**6%**), **innovation** (**2,1%**) and **"other"** (**3.1%**).

The detailed funding needs by country are illustrated in the chart below.

Figure 23: "Funding needs" on Scan-Med by country (share of total costs)



Source: PTSClas analysis (projects still to be completed after June 2021)

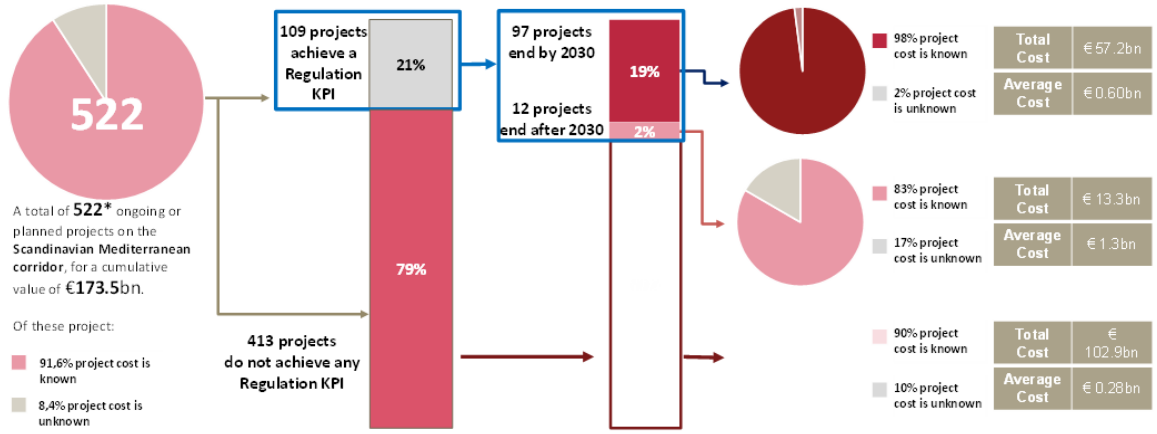
[34] The updated Final Project List of September 2021 includes 903 projects of which 256 were completed by end of June 2021 and 647 are ongoing or planned. The list includes also 22 "sub-projects" for which the cost is included in global projects. Therefore only 522 projects with known costs of €173.5bn were analysed with respect to their costs in this section.

[35] Not all projects included in the Scan-Med Project List have been endorsed by the countries concerned.

Germany and Italy together account for more than a half of the "funding needs" of the Scan-Med Corridor (**36**% of total costs **for Italy and 19% for Germany**). Projects in Sweden represent 15% of the total investment needs while projects in Denmark (6%), Finland (5%), Malta (5%), Norway (5%), Austria (0.3%) and cross-country (8%) make up for 30% of the total. [36]

Out of the 522 total Scan-Med projects, 109 (21%) achieve a Regulation KPI, while the remaining 413 (79%) do not. One reason for that is that KPIs are already fulfilled for many stretches and projects are instead aiming at the overall objectives for the corridor, such as to extend capacity, reduce bottlenecks or to update single to double tracks. Out of the KPI-relevant 109 projects, 97 (19% of the total of 522 projects) are expected to be completed by 2030 and only 2% of these projects have costs which are still unknown. Only 12 (2% of the total) will end beyond 2030, and 17% of these projects have costs which are still unknown.

Figure 24: Ongoing or planned projects: KPI-relevance



Source: PTSClas analysis, based on the 2021 updated project list (September 2021)

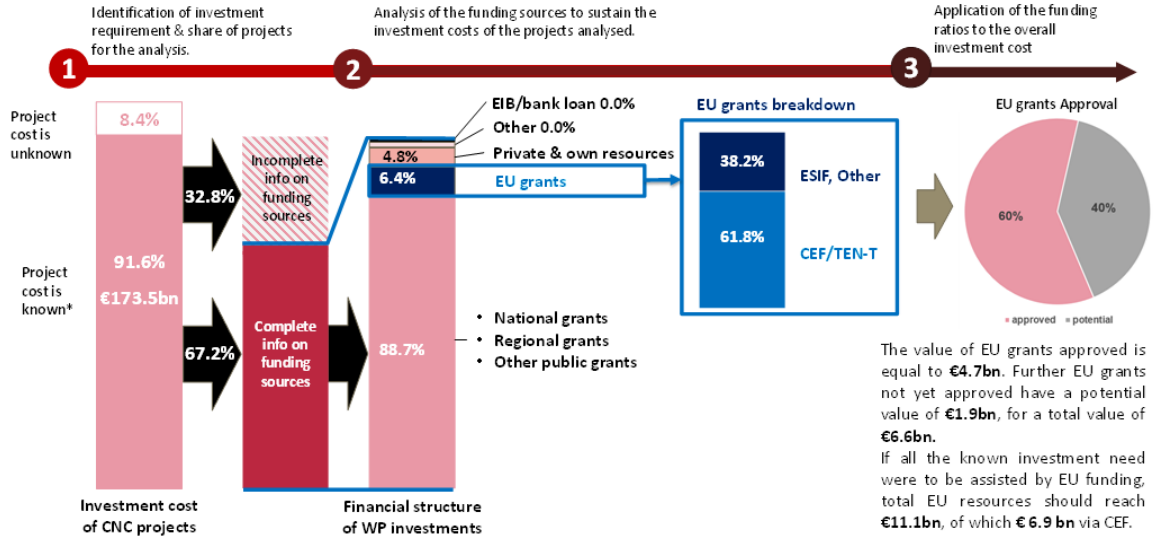
For 91.6% of the 522 on-going or planned Scan-Med projects the project cost are known. For 321 projects costing €102.9bn, complete information about funding sources is available. The largest share of costs (88.7%) are financed from national, regional and other public grants from the individual Member States; further notable sources are own resources (in 4.8% of costs) and EU grants (6.4%).

The relatively low share of European funds can be explained by the fact that most countries – apart from Malta – are not benefitting from cohesion funds with the higher co-funding rates.

Concerning the breakdown of projects funded by EU grants, CEF/TEN-T grants account for 61.8% of costs and ESIF or other funds for the remaining 38.2%. Sixty percent of the grants (€4.7bn) have already been approved. The remaining 40% are potential i.e. yet to be applied for and/or to be confirmed by grant or loan agreements. This implies that the total EU resources needed for Scan-Med projects would be in between €4.7bn and €6,6bn.

[36] The financial analysis presented in Figure 23 is based on the Project List for the Scan-Med Corridor mentioned in the footnote above. No financial obligation for the countries concerned derives from this analysis.

Figure 25: Ongoing or planned projects and their financing

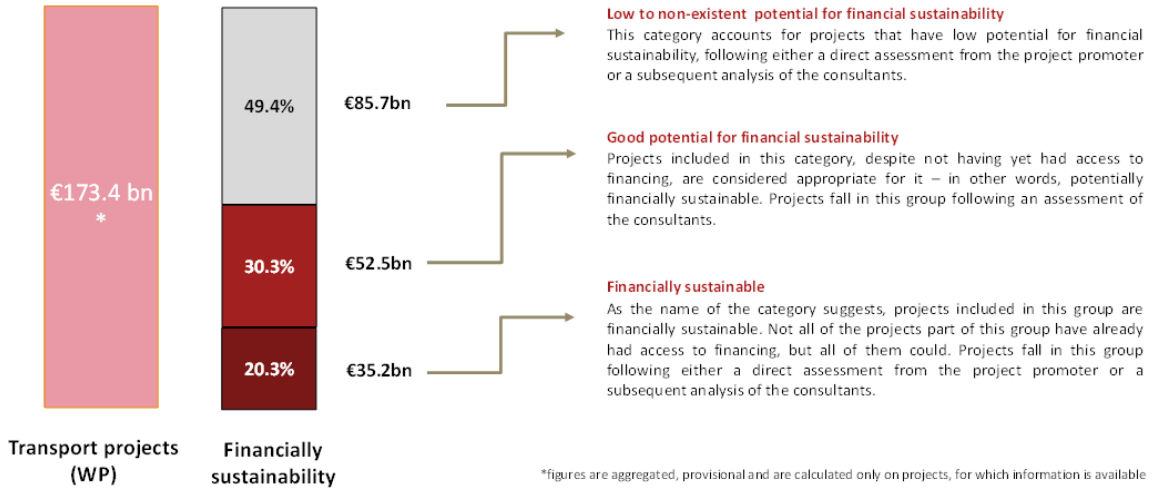


Source: PTSClas analysis, based on the 2021 updated project list (September 2021)

The final step of the analysis is determining the **financial sustainability** of Scan-Med transport infrastructure projects, i.e. the number and value of Scan-Med projects able to generate returns from the market to cover the operating costs and possibly a share of the capital expenditure. According to the findings, almost 50.6% of the projects are potentially financially sustainable as per the aforementioned definition. More specifically:

- **20.3%** of the projects in the project list, totalling **€35.2bn,** are **financially sustainable**. This is based either on a direct assessment from the project owner or on a subsequent analysis of the consultants.
- **30.3%** of the projects in the project list, for a total value of **€52.5bn**, presents **good potential for financial sustainability**. Projects included in this category, are considered appropriate based on Consultant's assessment.
- **49.4%** of the projects in the project list, amounting to **€85.7bn**, has **low to non-existent potential for financial sustainability**. This is based either on a direct assessment from the project owner or on a subsequent analysis of the consultants.

Figure 26: Ongoing or planned projects: Financial sustainability



Source: PTSClas analysis, based on the 2021 updated project list (September 2021)

Financially sustainable projects are relevant because they can be developed with less - or no - **impact on public finances**, and/or supported with softer support measures (i.e. soft loans, blending instruments, de-risking instruments, etc.). The more infrastructure is developed through projects generating returns from the market, the less the amount of grants and national public finance is needed to complete the TEN-T network. Projects in the transport sector – and in some sub-sectors in particular, i.e. rail, inland waterway, etc. – usually face difficulties being (fully) financially sustainable. Various factors, among which the presence of financing gaps can indeed, prevent the project promoter from meeting the desired returns.

5.2 The Green Deal and the Recovery and Resilience Fund

The Recovery and Resilience Facility (RRF) Regulation has made €672.5bn in loans and grants available to support both reforms and investments undertaken by Member States in the framework of national recovery and resilience plans. The aim is to mitigate the economic and social impact of the coronavirus pandemic and make European economies and societies more sustainable, resilient and better prepared for the challenges and opportunities of the green and digital transitions.

The Annual Growth Strategy for 2021 (AGS) and the Commission RRF guidelines have identified the development of sustainable, smart and safe transport as a priority for the European recovery and mentioned the deployment of alternative fuel infrastructure among the 7 European flagship initiatives national recovery plans are invited to contribute to.

In this framework and considering the national plans already submitted, the Commission expects Member States to dedicate significant parts of the RRF funding to transport, placing it among the top sectors of the economy to benefit from investments under NextGenerationEU.

While the RRF will finance a large variety of projects, priority will be given to those contributing to the decarbonisation of the transport system in the framework of the European Green Deal. Investments in the rail sector, in particular on the TEN-T network, will be a high priority. Other priorities will include sustainable urban mobility solutions (including collective transport and active mobility), inland navigation and the electrification of road fleets. In addition digitalisation of the European transport system will be accelerated by RRF support to investments in ERTMS, ITS or RIS.

5.3 The new CEF 2

The CEF 2021-2027 Regulation entered into force on 14 July 2021, applying retroactively from 1 January 2021. The total **budget**[37] for the CEF transport is €25.807bn and its division between the envelopes as follows:

- General envelope: €12.830bn
- Cohesion envelope: €11.286bn
- Military mobility envelope: €1.691bn

The **main priorities** of the CEF are:

- Completion of the network: supporting the completion of the TEN-T, with particular priority to cross-border sections and missing links of the core network corridors (60% of general envelope and 85% of cohesion envelope).
- Modernisation of the existing infrastructure: tackle much more decisively the challenge of decarbonisation and digitalisation of the transport sector, to support the transition to smart, sustainable, inclusive, safe and secure mobility (40% of general envelope and 15% of the cohesion envelope) along the core and the comprehensive network.

[37] All amounts are in 2021 prices.

- In line with the Action Plan on Military Mobility, for the first time, support the critical development of civilian-military dual-use transport infrastructure.

The CEF will contribute at least 60% of its funding to the **climate objectives** (compared to 30% of the overall target of the MFF).

Building on the previous CEF **blending** facility, a dedicated Alternative Fuels Infrastructure Facility (AFIF) has been set up. It takes the form of a rolling call for proposals, including five cut-off dates until end of 2023. With a budget of € 1.575 bn (out of which ~20% are from the Cohesion budget with higher co-funding rates), it funds alternative fuels infrastructure for renewable and low carbon fuels by the combination of CEF grants with financing from finance institutions to achieve a higher impact of the investment. The European Investment Bank (EIB) and other national promotional banks are implementing partners facilitating the combined operations, whereas also private commercial banks could be approached for providing the loan financing.

The CEF will allow the implementation of **synergies** between CEF transport, energy and digital sectors. It will be applied either as "synergetic elements" (it will be possible for each sector to accept as eligible cost ancillary elements pertaining to another sector) or through joint work programmes jointly financed from each sector involved with the possibility to apply the highest co-funding rate of the sectors concerned and 10% top-up.

The Commission adopted the first multiannual work programme 2021-2027 on 5 August 2021. This specifies the funding objectives and budget of the calls for proposals for the years 2021-2023.

5.4 The inclusion of Military Mobility in network development plans

As of 2021, military mobility will be taken into account in the Corridor Work Plans. The efforts addressing military mobility are based on 2018 EU Action Plan on Military Mobility which aims to improve military mobility in 3 key areas of action: transport infrastructure, regulatory and procedural issues, and other cross-cutting topics.

Concerning transport infrastructure, in 2019 the Council of the EU approved the Military Requirements for Military Mobility within and beyond the EU. These Military Requirements identify the geographical scope for military mobility as well as define transport infrastructure standards necessary for the military. The gap analysis performed in 2019 by the Commission services and the EEAS emphasises the synergies between TEN-T and military mobility: 93% of the military transport network is also part of TEN-T; and military transport infrastructure standards are mostly compatible with civilian transport infrastructure needs.

Owing to these synergies between civilian and military transport needs, actions aiming to complete TEN-T Corridors can also improve military mobility. The EU's new long-term budget now includes a dedicated €1.7bn military mobility envelope as part of the Connecting Europe Facility to co-fund such dual-use transport infrastructure projects. The first CEF call for proposals to improve dual-use transport infrastructure was launched on 16 September 2021. In order to be eligible, projects have to be on both the TEN-T and the military transport network, as well as to address dual-use transport infrastructure requirements identified in Commission Implementing Regulation (EU) 2021/1328[38].

[38] Commission Implementing Regulation (EU) 2021/1328 of 10 August 2021 specifying infrastructure requirements applicable to certain categories of dual-use infrastructure actions pursuant to Regulation (EU)2021/1153 of the European Parliament and the Council C/2021/5859, *OJ L 288, 11.8.2021, p. 37*.

6 The European Coordinator's recommendations and future outlook

As the Scandinavian-Mediterranean Corridor Coordinator it is a pleasure for me to add this short commentary to the 5th edition of the corridor work plan.

Offering both a review and an outlook this report marks a point of inflection in overall TEN T strategy. It is the fifth and final work plan under the 2013 TEN T Regulation. The next work plan will be guided by the new TEN T Regulation when adopted by Council and the European Parliament. For all the Core Network Corridors this is the last report under the expiring mandates of their respective Coordinators and Corridor Consultants. It offers simultaneously a granular bottom-up overview of the current state of play of all relevant modes of transport and infrastructure along the corridor and a comprehensive summary of what has been achieved and what still remains to be done. We are deeply indebted to all those, in particular the many public servants in ministries of transport and infrastructure, who contributed to the compilation of data and the elaboration of this report, as I, likewise, am indebted to our consultants led by Uwe Sondermann of Kombi Consult and to Martin Zeitler and his colleagues in DG Move.

The formal reporting period from January 2019 to June 2021 and events since speak to a period of unprecedented challenges and change. The Covid 19 pandemic from March 2020 onwards left its indelible mark on the past two years. Its impact has permeated everything we do. In terms of work, the shift from personal to virtual contact was accomplished with remarkable ease and efficiency, revealing more thoroughly than ever before the extraordinary digital capacities available to us, a lesson not to be lost in optimising future mobility services and capacity optimisation. Covid, through lockdowns and social distancing rules, impacted workplaces including major construction works on the corridor which showed remarkable resilience in the prevailing circumstances, a tribute to project managers and workers alike.

Like climate change, Covid was global, but the impact was local, causing governments everywhere to elevate to the highest priority the protection of their own citizens. This led to serial border closures and in their turn to massive disruption of supply chains of essential goods. The European Commission's Green Lane initiative was an early, timely and effective response which avoided turning the health crisis into an even more damaging economic and social disaster.

A new mandate for the European Parliament and a new European Commission brought fresh focus to EU policy making with prominent attention being accorded to the European Green Deal. For transport the aim is to reduce total greenhouse gas emissions by 90% by 2050, with significant intermediate targets for 2030 under the EU's Fit for 55 package of measures. A new Sustainable and Smart Mobility Strategy has been adopted. Financially, the Connecting Europe Facility budget - CEF2 - amounting to a total of €25.8 billion has been adopted. Its annex includes some significant Scan-Med corridor extensions. 60% of the general envelope of €12.8 billion - the part of CEF2 most relevant to the Scan-Med Corridor - will focus on the climate agenda. Moreover, projects which include synergies between all or some combination of transport, energy and digitalisation in addition to their lead sector funding also can qualify for a 10% top up.

To drive a post Covid sustainable economic recovery the unprecedented Recovery and Resilience Fund was launched. The decarbonisation of transport, investment in rail and sustainable urban mobility are all counted among its priorities, though, of course, the choice of specific priorities was left to members states to decide in consultation with the European Commission. Italy will use a substantial part of these funds for transport related projects.

To date a total of 256 Scan-Med projects have been completed at a cost of €34.9 billion. For the reporting period 127 projects costing €5.9 billion were completed. 327

projects are expected to be finished by 2025, with an additional 210 due by 2030. 22 projects will miss the target deadline of 2030 and 98 projects have been identified that so far have unspecified completion dates. Overall, an impressive 783 projects, 87%, are expected to be completed by the target schedule of 2030.

The two most prominent Scan-Med cross border projects are the Fehmarn Belt Fixed Link and the Brenner Base Tunnel. After concluding the appeal before the Administrative Court in Leipzig and granting permit the former began the construction on 1 January 2021 and since April 2021 the construction work has commenced on all four main contracts.. The Fixed Link is expected to become operational within the target deadlines. As regards the Brenner Base Tunnel, this has experienced both a geological challenge with the collapse of part of a tunnel - now resolved - and the abrogation of a contract which necessitates the preparation and issuing of new tenders. These are in hand but the sum of these matters will result in a delay probably to 2032 before the base tunnel is operational.

These major infrastructures will not reach their full potential without their associated access routes to and from the tunnels. In the case of the Fehmarn Belt Fixed Link, access routes in Denmark are under construction and planning in Germany is at an advanced stage, taking account of host community requests for increased noise protection. In the case of the Brenner Base Tunnel, Italy has started construction activities on the most important stretch immediately south of the BBT and is planning to advance the bypasses of the major cities along the route, in particular the Trento bypass using RRF finance. However, the remaining sections will only become available after 2030. In Germany Deutsche Bahn is committed to equip the existing line with ETCS before 2030 and has made major progress in planning for two additional tracks that will be required after 2030. The need for this new infrastructure recently has been reinforced by joint passenger and freight traffic forecast studies undertaken by a Brenner Corridor Platform Working Group, comprising ministry representatives of the three states, Germany, Austria and Italy and experts from their respective infrastructure managers and railway undertakings. These studies are founded on a common and rigorous methodology aiming to provide evidence-based planning leadership.

New alignments have been added to Scan-Med, the longest of which is the Bothnian Gulf - stretching for Oulu in Finland up to the Finnish-Swedish border at Tornio/Happaranda and around to Lulea and Umea in Sweden, with a spur linking Lulea to Narvik in Norway. Aalborg and Aarhus and adjacent ports are added in Denmark. Bremerhaven in Germany and Napoli – Cagliari (- Sardinia) in Italy also have been added to the Corridor's Core Network. Many KPI's specified in the current TEN T Regulation have been achieved on the corridor comparing like for like alignments. However, the addition of significant new territory not yet meeting the required specifications has had the overall effect of reducing the percentages of targets achieved.

The outlook for the future is one of continuity with change. Continuity is important. Infrastructure from conception, to planning, to permitting, construction and operationalisation takes time. Across the shared levels of TEN T governance and financing predictability in terms of mutual expectations is important and hence the value of continuity. However, the world does not stand still. New challenges and new priorities emerge and need to be integrated into our shared perspectives. A new TEN-T Regulation has been proposed by the European Commission and forwarded to the co-legislators. It is likely to become operational in 2023 all things considered. This proposes the alignment of Core Network Corridors with Rail Freight Corridors into new single European Transport Corridors (ETCs). The role of Coordinators is likely to be enhanced. The Work Plan cycle will reduce to one plan for each four-year cycle, which is the length of the term of appointment of both corridor coordinators and consultants. What already is clear is the increased emphasis to be expected on decarbonisation, digitalisation and urban nodes.

These include a shift to rail, short sea shipping, and inland waterways, alternative fuel infrastructure at scale, urban node and passenger and freight terminal first and last mile connections and their multimodal capacity enhancement. 75% of the EU's export trade in goods passes through our ports and 31% of our internal trade. Short sea shipping accounts for 60% of our total maritime trade in goods and, like inland waterways and rail freight transport, offers the potential to reduce our carbon footprint compared to similar volumes transported by road. Multimodal links also will be an important decarbonisation consideration as regards core network airports. The availability of high-speed rail links at airports can facilitate passenger transfers from short and medium haul flights to more climate friendly and fast inter-city rail alternatives.

The alternative fuels imperative requires an upscaling of ambitions and delivery to move from its current patchwork and piloting phase to a genuine cross border network. The new requirements will be binding, focusing on fleet based and distance based fast charging and hydrogen alternatives with more delivery expected also from urban nodes. Alternative fuel provision at safe and secure overnight parking facilities for HGVs will be prioritised. Ports will be expected to enhance the availability of onshore power supply and LNG refuelling facilities and TEN T airports should use external electricity for planes parked at terminals.

The capacity utilisation of infrastructure across all modes of transport, and their efficiency, safety, resilience, and user friendliness can be significantly improved through digitalisation and new technologies. Along the Scan-Med corridor many are active in these fields and some progress has been made in implementing digital and smart solutions in recent years. However, the overall picture still is of a patchwork failing to harness the full potential of digitalisation on the corridor. As mentioned in previous workplans, the Core Network Corridors can act as a readily available inter-regional and international cross-border test bed and platform for learning-by-doing beyond local and national boundaries. Achieving this will require more cooperation and exchange among key stakeholders. The deployment of traffic management systems applies to all transport modes - ERTMS for rail, SESAR for aviation, VTMIS for maritime and ITS and CITS for road transport, ensuring interoperability between maritime, road and rail freight transport in ports and terminals, and in meeting passenger needs at urban nodes.

As regards digitalisation, this report reveals gaps in terms of KPI fulfilment, some of them substantial. The most disappointing feature relates to ERTMS. With its new extensions the corridor has 11,925 kms of railway lines. By 2021 only 1,225 kms met the ERTMS specification. Only 37% of the 2023 corridor deployment plan was operational by September 2021, with Austria being the lone stand out exception. In terms of interoperability, safety and capacity optimisation ERTMS is an essential tool whose inadequate or patchy sub-optimal development overall will impose potentially avoidable future network, operator and user costs.

Urban nodes are not a new phenomenon in TEN T policy, but their number is set greatly to expand in the next policy iteration to include all core network cities of 100,000 + population or the main regional city of regions classified at NUTS 2 level. First and last mile connections, bottlenecks, missing links, multimodal passenger and freight terminals, minimum platform lengths for trains to meet TEN T requirements and alternative fuel infrastructure all will feature in this expanding shareholder universe. All urban nodes not already having done so will be expected to develop a Sustainable Urban Mobility Plan (SUMP) by 2025.

Integrating an enlarged number of urban nodes with their dense multi-agency ecosystems into our TEN T Forum community will be a challenge which with mutual understanding and goodwill can be accomplished. These may require their own stand alone pillar given the rich diversity of urban nodes and their quintessential autonomy and subsidiarity. The aim is neither to homogenise nor control but rather to seek to develop a shared vision and how best we can be of mutual assistance in its realisation.

I end, as I began, by expressing my gratitude to our entire stakeholder community for their engagement, their ideas, enthusiasm and goodwill and when warranted by sharing their frustrations. We are embarked together on a sometimes slow but always steady pathway to progressing a shared vision of a mobility framework and network fit for purpose and fit for the times we live in. As coordinator it is a special privilege to be a small part of this great undertaking.

Pat Cox *February 2022*

"Shortly after the finalisation of the chapter above Russia started its war of aggression against Ukraine which led me to reflect on the potential consequences of this unprecedented incident for Europe and more particularly for TEN-T policy and the Scan Med corridor in the following chapter. "

Addendum

Vladimir Lenin wrote in 1917 that "There are decades where nothing happens and there are weeks where decades happen." Vladimir Putin's invasion of Ukraine on 24 February 2022 proved the enduring truth of this proposition.

Changes that proved elusive over the decades since the fall of the Berlin Wall crystallised into policy reversals and reforms within days of Russia's aggressive breach of the sovereignty and territorial integrity of Ukraine. We have entered a new age of uncertainty. This war of choice marks a point of inflection in global history and is the most momentous geopolitical event so far of the 21st century, reminding Europeans especially that peace on our continent cannot be taken for granted. This new reality has been an eye-opening wake up call for many democracies across the world. More strategic decisions were taken within days of Putin's invasion than had been taken in decades before. Vacillation was displaced by decisiveness, complacency by urgency, division by unity. For all their contested politics democracies got the message loud and clear and responded to the challenge with a speed, substance, and coherence that Putin and perhaps even they could not have anticipated.

Russia has been hit by a rolling and escalating range of sanctions without precedent against a large state so deeply integrated into the global financial and energy system. These cover finance, technology, energy, software, computer chips, consumer goods, sport, culture and media. They extend from named politicians and officials and their relatives to asset freezes against oligarchs. As regards transport, Russia's planes cannot land, its ships cannot dock, its trucks cannot drive in the EU and elsewhere. Over 800 international companies have suspended activities or entirely withdrawn from Russia. A growing number of its banks are excluded from the SWIFT international clearing system. The EU is committed to progressively reducing its energy dependency on Russia starting with coal and oil and focusing next on gas.

The duration of the war is unknowable at this point in time. Ukraine claims that Russia now occupies 20% of its territory. When negotiations come, as surely, they will at some point, the empirical outcome of the fighting - of who holds what territory - will be the point of departure. For Russia what they eventually hold they may insist on annexing. For Ukrainians, territorially, politically, and psychologically this more accurately could be described as amputation, something they are not prepared to accept. For Ukraine the loss of its industrial heartland and of access to the Black Sea and the Sea of Azov would greatly diminish its future potential. Meanwhile some things are clear.

Evidence abounds of war crimes – executions, torture rape, deportation, and the use of cluster munitions against civilians. Eight million Ukrainians are internally displaced. Over one million have been deported to Russia, many reportedly to the far East. Up to six million fled as refugees. Putin may have hoped that triggering a mass wave of refugees from Ukraine would be another weapon to destabilise the European Union. He was wrong, with all EU states but especially our frontline states and Moldova showing immense generosity in their responses.

A humanitarian crisis looms with the blockage of Black Sea ports. Supplies of sunflower oil, maize and wheat have been cut off. Food prices are soaring hitting the poorest the hardest in terms of nutrition. The UN Food Prices Index reveals that prices are at their highest since records began 60 years ago. The UN World Food Programme suggests that 49 million people are threatened by famine. Fertilizer exports from Belarus and Russia are blocked and will impact the next growing season risking to deepen the food price and food shortage crisis. The World Bank speaks of a "crisis within a crisis" suggesting that as many as 60% of the poorest countries are either in debt distress or at risk of being in debt distress. Proposed EU solidarity lanes for grain export corridors at best may result in modest relief but will struggle to replace the scale of grain exports traditionally shipped from seaports.

Despite the booming energy prices the Russian economy is expected to decline this year by at least 10% of GDP. In the case of Ukraine, the decline is likely to be of the order of 40% of GDP. Energy and food price hikes have propelled inflation in the European Union to a forty year high. Growth projections for the current year have been halved. Countries already are carrying debt overhang from the Covid crisis. There is pressure on welfare budgets to compensate at least the poorest households who spend a higher proportion of their limited incomes on food and energy. This all coincides with an overdue adjustment to accommodating monetary policy witnessed by the upward creep of interest rates. All this is accompanied by a necessary adjustment from a fossil fuel to a green economy as the EU strives to deliver its net zero targets by 2050.

The long-standing peace dividend after the collapse of the Soviet Union is at an end as governments commit to increase domestic expenditure on security and defence policy. Ultimately doing this on a sustainable basis will crowd out or diminish public expenditure on some existing policies be they social, economic, or environmental. Compared to what is happening in Ukraine these costs are modest. Compared to what people have grown used to this could sow the seeds for a more contested political environment.

The implications for TEN T policy and in particular the Scan-Med Corridor are speculative at this point. Security, accessibility, and affordability of energy supplies has moved to the top of the strategic political agenda. This certainly will impact some ports as they transition to become import centres for alternatively sourced energy supplies when pipeline connections with Russia are closed. LNG imports will require significant capital investment in port LNG reception and storage facilities, in regasification plant and equipment and in connecting this gas to existing gas infrastructure. LNG as a fossil fuel investment, seeking a multi decade return on capital employed, risks embedding alternative fossil fuel supplies for some time to come even as stated EU policy is to accelerate the switch to renewables. Some ports also may become exit points for the proposed solidarity corridors for grain exports from Ukraine. A key transport challenge in transporting Ukrainian grain is how to shift the volumes needed by inland waterway, road or rail, with the latter complicated by the different railway gauges between Ukraine and EU states other than Finland, which is not a bordering state.

Finland has a border of more than 1,300 kilometres with Russia and plays a key role in trade flows to and from there. Russia's isolation and exclusion from market access to the EU and more widely will see significant changes in Finland's cross border trade flows. Introducing additional sanctions is proving to be politically challenging for the EU, which to date has preserved its unity. Russia, a large neighbouring state, cannot

be ignored forever. Vladimir Putin, the author of this war of choice, cannot be appeased. This suggests that if and when the war ends the extent to which sanctions policy may be altered is likely to remain deeply sensitive and potentially very divisive politically. I look forward to understanding how the Finnish authorities read this situation and what implications they see for our core network corridor and its priorities on their territory.

The TEN T policy now includes a dual use Military Mobility policy. Sweden and Finland both have applied to join NATO. At a recent summit meeting NATO committed to 'reset our deterrence and defence long term to face a new security reality with substantially more forces in the East". The total allocation of funds for military mobility is limited but how these changes in strategic posture and NATO membership may impact their allocation is a question that deserves reflection. Beyond this, the aspirational objective to explore and develop the concept of strategic autonomy within the EU itself may impact future developments under the heading of Military Mobility as it relates to TEN T budgets and expenditure.

When it comes to making peace Europe will have a vital role to play in reconstruction, in security architecture and guarantees and in processing Ukraine's demand for accelerated EU accession. Among the issues that will need to be addressed is the enhancement and development of transport connections with Ukraine. This will necessitate the planning and delivery of transhipment and multimodal terminals and improved rail and road connections with the aim of increasing connectivity and, to the greatest extent possible, interoperability. Post war this is likely also to stretch to the improvement and reconstruction of transport infrastructure on the territory of Ukraine itself, with the probable extension of TEN T Corridors in both Ukraine and Moldova.

The spending implications of all these initiatives is likely, again, to pose fundamental questions about the adequacy of the EU's own resources in budgetary terms. As always this is and will be a highly contentious political question but as Jean Monnet remarked many years ago "People only accept change in necessity and see necessity only in crisis'. This is a time of crisis.

Pat Cox *June 2022*

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