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Scandinavian Mediterranean

Third Work Plan of the European Coordinator

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1 Towards the Scan-Med Corridor updated Work Plan

1.1 Introduction

Transport is a policy pillar that can make a vital contribution to boosting long-term competitiveness, sustainable growth and the development of the internal market and the wider European economy. Efficiency improvements in the transport of people and goods within the internal market and between it and the wider world, enhanced deployment of intelligent transport systems and the greening of the sector and its infrastructure are key elements of the new TEN T policy. Short-to medium-term capital investment in transport infrastructure and systems generates a considerable direct and indirect employment effect at a time when unemployment remains stubbornly high in so many EU economies. Additionally, technological and systems innovation can be expected to foster the development of supporting business ecosystems specialising in the servicing and management of ICT and sustainability challenges.

In this context, the European Coordinator presents the third generation of the work plan for the Scandinavian-Mediterranean Core Network Corridor (Scan-Med Corridor) to the Member States for appraisal and approval. This plan is founded on the provisions of Regulation (EU) No 1315/2013 of the European Parliament and of the Council of 11 December 2013, which establishes Union guidelines for the development of the Trans-European Transport Network (the Regulation)[1], and on the first and second Work Plan presented in 2015 and 2016.

It is transmitted in accordance with Article 47.1 of the Regulation, which enjoins each European Coordinator to "submit to the Member States concerned a Work Plan analysing the development of the Corridor".

The concept of the Core Network corridor, as described in Article 42.1 of the Regulation, is an instrument that acts as the centre of gravity around which our work on modal integration, interoperability and coordinated development of infrastructure orbits.

What follows is a detailed description of the key characteristics of the Scan-Med Corridor as derived from the corridor studies supported by the comments and insights of the Member States, Norway, the European Commission and invited stakeholders forming the Corridor Forum. The primary objective of this plan is the ultimate realisation of the Scan-Med Corridor between now and 2030, as a matter of common interest and shared responsibility.

This third iteration in planning the Scan-Med Corridor will permit the Coordinator to focus on the agreed key priorities with a view to ensuring that it makes the fullest contribution to realising the objectives of the Trans-European Transport Network.

The European Coordinator thanks all those organisations and public officials who contributed such valuable time and insights to this challenging and complex exercise.

[1] OJ L 348, 20.12.2013.

1.2 Road map to setting up the Third Work Plan

This Third Work Plan for the Scan-Med Corridor is the result of an iterative workflow that began in 2014 with the support of the Member States, relevant stakeholders and a team of consultants responsible for a detailed analysis of the Corridor that was summarised in the First Corridor study.

Based on the achieved results, the First Corridor Work Plan was published in May 2015 following a consultation and approval of the Member States.

Subsequently, in September 2015, work began to update and refine the First Work Plan. This second phase, set to run until the end of 2016 aimed to achieve an enhanced knowledge base for the further development of the Corridor. Three additional Corridor Forum Meetings held between September 2015 and June 2016, presented and discussed the next steps for updating the Corridor study and the Work Plan.

The interim results of the second Corridor study and identified main issues for the development of the Core Network Corridors were presented and discussed in a Corridor Meeting during the TEN-T Days in Rotterdam in June 2016.

After a presentation in July 2016 and a consultation process with the Member States, the Second Work Plan was adopted and published in December 2016.

Four more Corridor Forum Meetings were held between September 2016 and October 2017, during which the respective status of the Deliverables of the Corridor Study was presented. Alongside these Corridor Fora, dedicated Working Group meetings with the relevant stakeholders regarding Ports, Rail-Road terminals, Urban Nodes, Airports, Roads and ITS as well as rail interoperability were organised between 2015 and 2017 to discuss and gather information concerning their specific targets, critical issues and requirements.

The European Coordinator also took part in bilateral meetings at political and managerial level with both administrations and infrastructure managers, as well as participated to Coordinator's seminars and public conferences, to follow-up on the progress of the Corridor and conclude the next steps to be taken.

This Third Work Plan of the European Coordinator also includes findings on "Wider Elements" (innovation deployment, impact on environment and resilience to climate change) and additional items, such as impact on growth and jobs. The following chapters of this Third Work Plan describe the main findings of the comprehensive analysis and the stakeholder consultations, as well as the progress already made by the end of 2017 towards further developing the Scan-Med Corridor.

2 Characteristics of the Scan-Med Corridor

2.1 Alignment (including overlapping sections with other CNCs)

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 Norway and represents a crucial axis for the European economy, crossing almost the whole continent from North to South. This Corridor also needs to be looked at in the context of developing global transport routes. The cross-border section between Finland and Russia plays a significant role for the terrestrial connections to the eastern and northern markets in Russia, China and Asia, while the North Sea and Mediterranean ports provide maritime access to the American and African continents and the rest of the global trading network. The cartogram in Figure 1 shows the Corridor’s schematic alignment, sections shared with other Core Network Corridors (CNC), core nodes according to the TEN-T and CEF Regulations (in particular the Annex I, Part 1 Alignment) as well as pre-identified sections including projects.

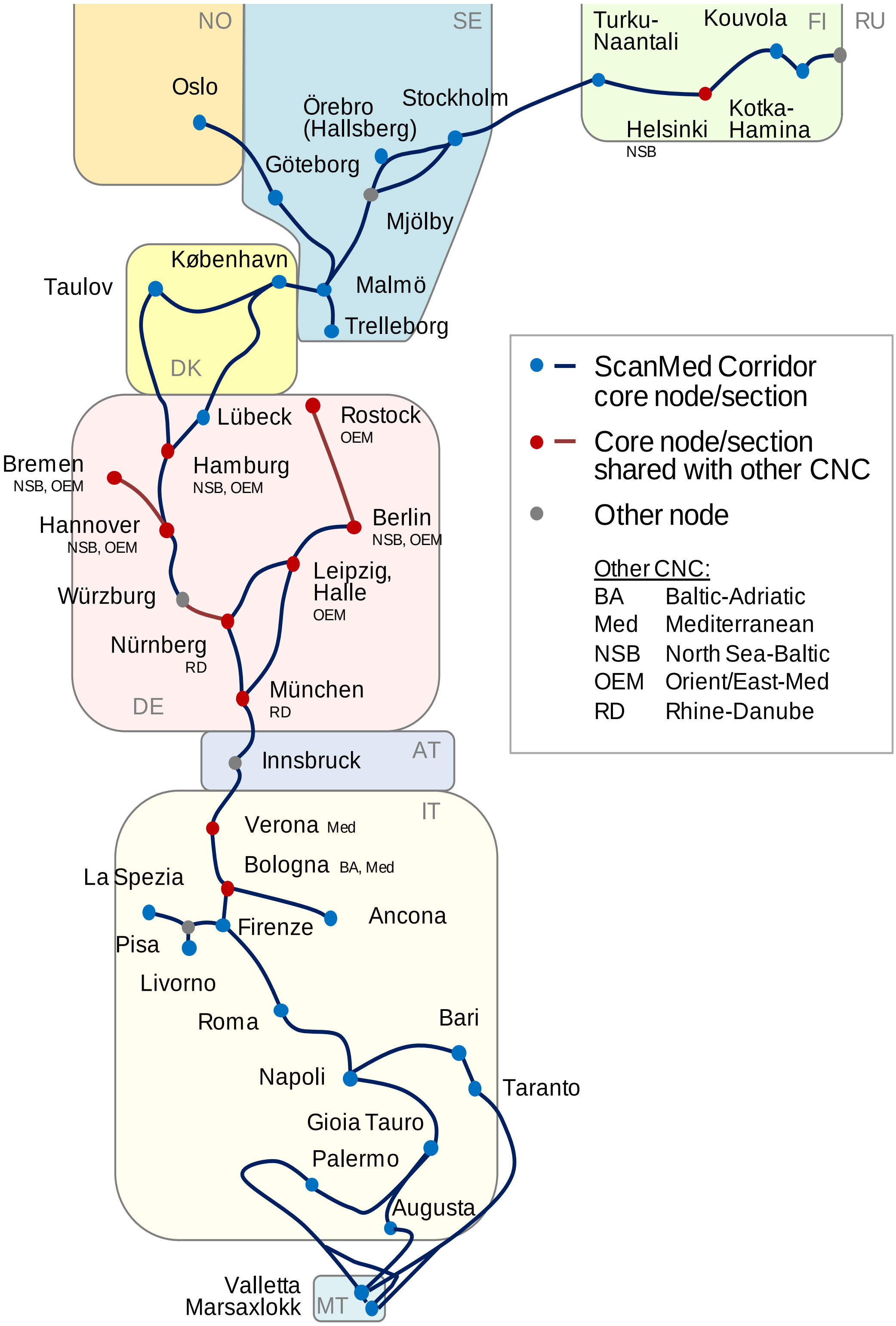
Rail and road, but not inland waterways, are the key “linear” modes of transport designated in the Scan-Med Corridor. Several sections of the alignment are sea crossings ("Motorways of the Sea"), in particular the connections between Finland and Sweden, Sweden and Denmark, Denmark and Germany as well as between Italy and Malta. The maritime dimension, however, goes far beyond the single Corridor and connects European countries with each other and the rest of the World.

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 interconnection 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.

The corridor alignment was commented upon by stakeholders during several Corridor Forum Meetings, with a view to its improvement. Suggestions included adding Bremerhaven and highlighting some very frequently used sea links between core ports such as (Lübeck-) Travemünde – Trelleborg or Rostock – Gedser. Other proposed improvements involved extending the Corridor to the north surrounding the Bothnian Gulf and thereby directly linking Sweden and Finland by the land route, and adding a few rail and road sections in Italy namely the stretch Ancona - Pescara – Bari to complement the sections already included. However, it was made clear that any such improvements would only be possible within the framework of a review of the TEN-T and/or CEF Regulations.

The Scan-Med Corridor encompasses seven EU Member States (Finland, Sweden, Denmark, Germany, Austria, Italy and Malta) and one Member State of the European Economic Area, Norway.

Figure 1: Alignment of the Scan-Med Corridor including overlapping sections with other corridors

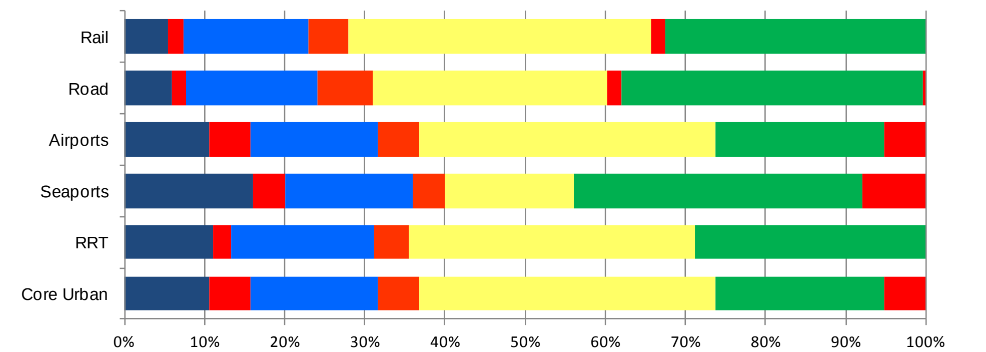


Source: KombiConsult analysis, 10/2016, this illustration does not distinguish rail from road

It is the largest of the corridors in terms of Core Network length – with more than 9,300 km of core rail and in excess of 6,300 km of core road network – together with 25 core ports, 19 core airports, 45 core intermodal terminals and 19 core urban nodes. An overview of the quantitative characteristics of the Corridor is provided in Figure 2.

Figure 2: Characteristics of the Scan-Med Corridor in the year 2017

Mode/Node	Dimension									Total
	Color Code	FI	NO	SE	DK	DE	AT	IT	MT	
Rail	network length [km]	518	169	1.462	476	3.532	163	3.053	-	9.373
Road		376	116	1.039	440	1.869	109	2.401	22	6.372
Airports	number	2	1	3	1	7	-	4	1	19
Seaports		4	1	4	1	4	-	9	2	25
RRT		5	1	8	2	16	0	13	-	45
Core Urban		2	1	3	1	7	0	4	1	19
Country Shares										



Source: HaCon, Ramböll, HPC, GruppoCLAS, KombiConsult analysis, 5/2017

With Munich, Rome, Copenhagen, Stockholm, Oslo and Berlin, 6 of the TOP 20 European **airports** are located on the Scan-Med Corridor.[2] These airports also act as hubs linking smaller airports and regions to the international aviation network. Scan-Med **seaports** also rank high for both passenger and freight transport. Helsinki, Stockholm and Naples are among the Top 10 European passenger ports, while Hamburg, Bremen (incl. Bremerhaven) and Gioia Tauro are among Europe's 10 largest container ports.[3] While other corridors focus on a few ports and concentrated trade lanes, the strength of the Scan-Med Corridor lies in its variety of ports, alternative routes and resulting flexibility for transport users.

In freight transport, freight villages or "interporti" are often used to consolidate cargoes. In the 2015 survey[4], eight out of the "Top 20" European freight villages, including the top four, are located on the Scan-Med Corridor.

[2] Eurostat for airports in the EU, Avinor for Oslo airport, in terms of total passengers carried in 2015.
[3] Eurostat, data for 2015.
[4] European GVZ Ranking 2015 by Deutsche GVZ-Gesellschaft (German Association of freight villages, November 2015.

The **regions** along the Scan-Med Corridor[5] constitute an important socio-economic area within the EU. In 2013 – the most recent year for which EUROSTAT provides consolidated data - they accounted for a population share of 15% and an employment share of almost 17% of the EU28. The Scan-Med Corridor regions generated 20% of the EU's GDP, with an above-EU-average income per capita of almost €35,200.

Table 1: Socioeconomic indicators of the Scan-Med Corridor in 2013

	Inhabitants	Employment	GDP (million €)
EU28	506,682,935	215,443,000	13,518,112
Scan-Med Corridor regions (NUTS 3)	76,687,130	36,173,000	2,697,799
	15.1%	16.8%	20.0%

Source: Prognos analysis, 5/2017

2.2 Compliance with the technical infrastructure parameters of the TEN-T guidelines in 2017

Article 4 of Regulation (EU) 1315/2013 describes the objectives of the Trans-European Transport Network, which will strengthen the social, economic and territorial cohesion of the European Union. The aim is to create a single European transport area that is efficient and sustainable, to increase the benefits for its users and to support inclusive growth. The Member States agreed to the following list of specific objectives (Table 2), to be met by the Scan-Med Corridor by 2030 at the latest. These objectives reflect the mode-specific priorities of the Regulation, complemented by specific objectives that go beyond the formal infrastructure requirements of Regulation (EU) 1315/2013.

When checking the compliance of the current (infrastructure) parameters against the target values (objectives) set for the year 2030 shortcomings in single corridor sections and nodes are revealed.

In order to measure the progress towards the objectives Key Performance Indicators (KPI) have been defined across all Core Network Corridors. The KPIs are displayed in a harmonised format, structured by generic supply-side and demand-side KPIs, and the corridor modal share based on an agreed methodology[6]. The basic concept of the KPI is to define a baseline and monitor evolution over time until 2030. It was therefore essential that the data are recorded by, and available from, public sources in order to create a time series. The baseline values were provided by the 2014 Study and refer to data for the years 2012 or 2013, published by mid-2014. "Status 2016" refers to data available by mid-2016 (mostly from 2014 or 2015) and "Status 2017" presents the currently available data from 2015/2016). In most cases, the data sources are mode managers' websites. It is envisaged to use the TENtec database of the European Commission in the future instead.

5 "NUTS-3-Regions affected by the Corridor", according to definition put forward by the Key Performance Indicators (KPI)-Working Group that covers all corridors.

6 See KPI Working Group (2016) "Core Network Corridors – KPI Framework" (MOVE/B1/2014-710)

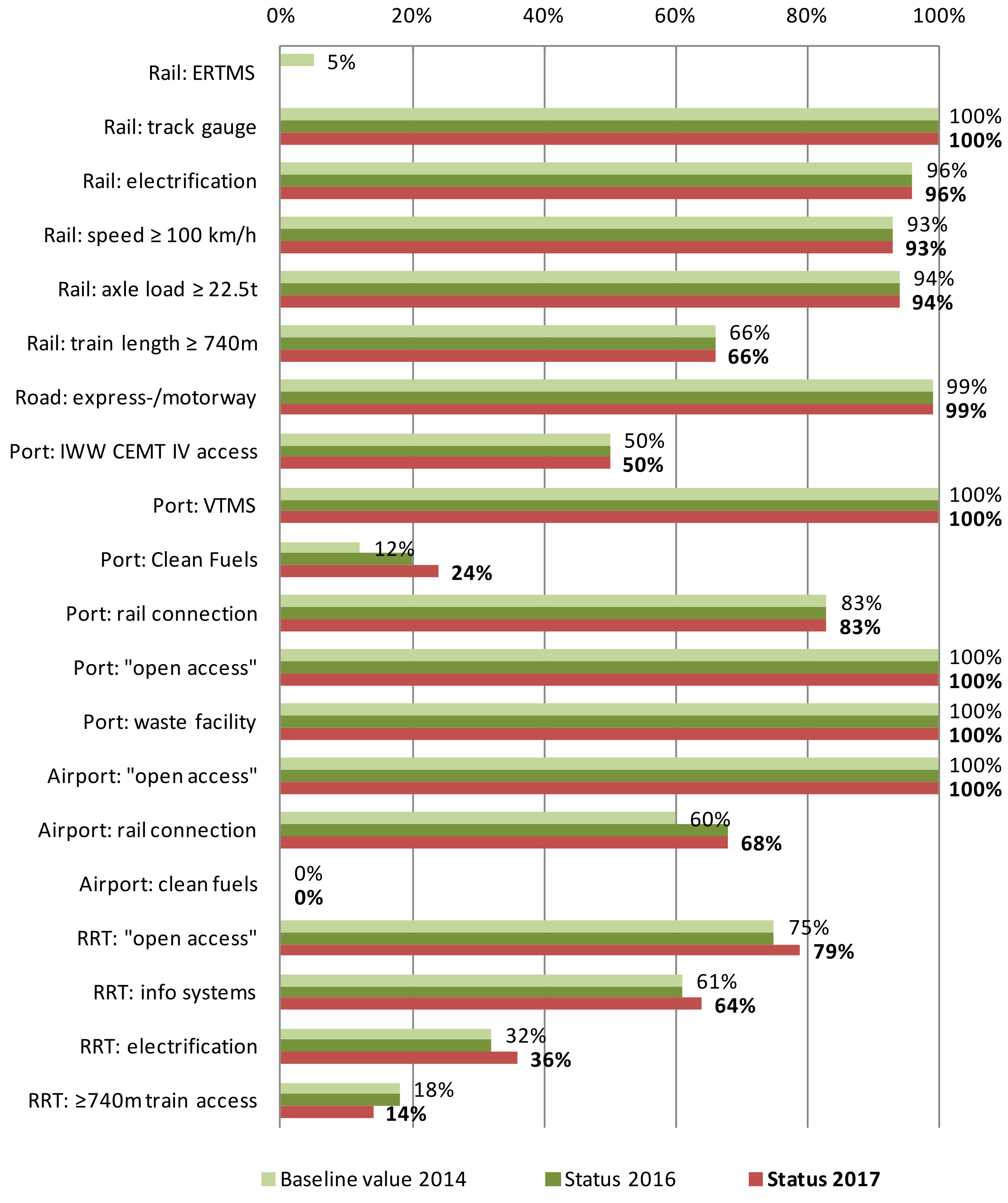
Table 2: Specific objectives set for the Scan-Med Corridor

Mode	Objective
Rail	Full electrification
	Axle load 22.5 t (for all freight lines on the Core Network only)
	Line speed 100 km/h, minimum (for all freight lines on the Core Network only)
	740 m freight trains (for all freight lines on the Core Network only)
	ERMTS fully implemented
	Standard gauge 1435 mm for new lines
Road	Express road or motorway
	Intelligent transport systems (ITS)/toll collection systems comply with Directive 2004/52/EC, Commission Decision 2009/750/EC and Directive 2010/40/EU [SE]
	Parking areas every 100 km, minimum
	Infrastructure for alternative clean fuels
Airports	Terminal open to all operators
	Infrastructure for air traffic management, SESAR
	Infrastructure for alternative clean fuels
	Main airports (according to Article 41 N° 3 of Regulation (EU) 1315/2013) connected to (high-speed) rail network except where physical constraints prevent such connection
Maritime transport, Ports, MoS	Freight terminal open to all operators
	Connection to rail, road, IWW (where possible)
	Infrastructure for alternative clean fuels
	Facilities for ship generated waste
	VTMIS, SafeSeaNet, e-Maritime services
Rail Road Terminals (RRT)[7]	Sufficient transhipment equipment on freight terminals
	740m train terminal accessibility
	Electrified train terminal accessibility
Multimodal transport	All transport modes connected at freight terminals, passenger stations, airports, maritime ports
	Real-time information on freight terminals, maritime ports, cargo airports
	Continuous passenger traffic through equipment and telematic applications in railway stations, coach stations, airports, maritime ports
Environmental targets	Specific target values, more detailed than those mentioned in Regulation (EU) 1315/2013, could be identified for specific sections of the Corridor by the Member States concerned in accordance with European legislation.

Source: Second Corridor Work Plan, 12/2016

[7] Although accessibility of 740m trains and electrification are not a direct requirement for rail-road terminals under regulation (EU) 1315/2013, the requirements set for the rail network itself make it necessary also for terminals to comply with those provisions.

Figure 3: Development of selected KPI, baseline 2014, status 2016 and 2017



Source: KombiConsult analysis, 9/2017; ERTMS baseline quoted from ERTMS Study, which monitors progress

Supply side KPIs

Compliance with most (**supply side**) parameters was already rather good along the corridor, although the values for airport connections to rail, availability of clean fuels in ports, and for road infrastructure need to be improved with respect to the baseline.

Table 3: Generic supply-side KPI, baseline 2014, status 2016 and 2017, target 2030

Mode	Generic supply-side KPI	Unit	Baseline value 2014	Status 2016	Status 2017	Target 2030
Rail network	ERTMS implementation	%	n.a.	n.a.	n.a.	100
	Track gauge 1435mm ("isolated" network with 1,524mm gauge exempted)	%	95-100	95-100	94.5-100	100
	Electrification	%	96	96	96	100
	Line speed (≥100km/h)	%	93	93	93	100
	Axle load (≥22.5t)	%	94	94	94	100
	Train length (≥740m)	%	66	66	66	100
Inland waterway network	CEMT requirements for class IV	%	n.a.*	n.a.*	n.a.*	n.a.*
	Permissible Draught (min 2.5m)	%	n.a.*	n.a.*	n.a.*	n.a.*
	Permissible Height under bridges(min. 5.25m)	%	n.a.*	n.a.*	n.a.*	n.a.*
	RIS implementation	%	n.a.*	n.a.*	n.a.*	n.a.*
Road network	Express road/ motorway	%	99	99.1	99.1	100
	Availability of clean fuels	Number	CNG n.a. LNG n.a. H2 n.a. ECP n.a.	2.271 7 53 9.318	2.242 7 63 36.987	n.a.
Airport	Availability of at least one terminal open to all operators in a non-discriminatory way and application of transparent, relevant and fair charges	%	100	100	100	100
	Connection to rail ("main airports")	%	60	63	68-100	100
	Availability of clean fuels	%	0	0	0	100
Seaport	Connection to inland waterway CEMT class IV	%	50	50	50	100
	Availability of clean fuels	%	12	20	24	100
	Connection to rail	%	83	83	83	100
	Availability of at least one freight terminal open to all operators in a non-discriminatory way and application of transparent charges	%	100	100	100	100
	Facilities for ship generated waste	%	100	100	100	100
Inland ports	CEMT Class IV waterway connection	%	n.a.*	n.a.*	n.a.	n.a.*
	Connection to rail	%	n.a.*	n.a.*	n.a.	n.a.*
	Availability of clean fuels	%	n.a.*	n.a.*	n.a.	n.a.*
	Availability of at least one freight terminal open to all operators …	%	n.a.*	n.a.*	n.a.	n.a.*
Rail Road Terminals (RRT)	Capability for intermodal (unitised) transhipment	%	71-100	71-100	71-100	100
	Availability of at least one freight terminal open to all operators	%	100	75-100	75-100	100
	Electrified train terminal accessibility****)	%	***)	32	36	100
	740m train terminal accessibility****)	%	***)	18	14	100
	*) Inland waterways and inland ports are not part of Scan-Med Corridor, these KPI are not applicable. **) Compressed Natural Gas (CNG), Liquefied Natural Gas (LNG), Hydrogen (H2) energy stations and electric charging points (ECP) in the Scan-Med Corridor countries. ***) Data only partly available from publicly available sources (terminals' websites, network statements) since it requires detailed definitions. ****) These are no direct requirements according to Regulation (EU) 1315/2013 but the requirements set for the rail network itself make it necessary also for terminals to comply with those provisions.					

Source: HaCon, Ramböll, HPC, GruppoCLAS, KombiConsult, Prognos analysis, 6/2017

Since the “isolated” broad gauge rail network is exempted from the “normal” gauge requirement all Scan-Med core network rail is built in the required 1 435 mm gauge. With regard to airports, it must be noted that according to Article 41(3) of the TEN-T Regulation (only) the “main airports indicated in Part 2 of Annex II shall be connected with the railway and road transport infrastructure of the trans-European transport network by 31 December 2050, except where physical constraints prevent such connection”. The “main airports” of the Scan-Med Corridor are Helsinki (Vantaa), Stockholm (Arlanda), Oslo (Gardermoen), Copenhagen, Berlin, Hamburg, Munich, and Rome (Fiumicino). These airports are already “connected” by rail and road, so this KPI is also fully met.

Demand side KPIs

As with the supply-side, the **demand-side** is subject to generic KPIs, of which the inland waterway freight flow is not relevant for the Scan-Med Corridor and which measure the progress compared to the baseline value without setting targets for the future. Scan-Med airports were able to increase both passenger flow (+16 index points) and freight flow (+4 index points) over 2 years. Moreover, Scan-Med ports recorded positive developments with an increase of two index points between 2013 and 2016 for both passenger and freight flows.

Table 4: Generic demand-side KPI, baseline 2014, status 2016 and 2017

Mode	Generic demand-side KPI	Unit	Baseline value 2014	Status 2016	Status 2017
Inland waterway network	Total inland waterway freight flows	index (2014=100) (Tonne Kms)	Not applicable	Not applicable	Not applicable
Seaports/ inland waterway ports	Total passenger flows	index (2014=100) (Passengers)	100 49.061.000	101 49.398.000	102 49.928.000
	Total freight flows	index (2014=100) (Tonnes)	100 522.421.000	103 535.627.000	100 520.316.000
Airports	Total passenger flows	index (2014=100) (Passengers)	100 238.723.000	110 262.517.000	116 277.259.000
	Total freight flows	index (2014=100) (Tonnes)	100 1.976.000	105 2.082.000	104 2.059.000

Source: HPC analysis based on port statistics, data for 2013, 2014 and 2015 (2016 not fully available yet); GruppoCLAS analysis based on aviation statistics, data for 2013, 2014 and 2015 respectively.

Modal Share

The modal share indicators show the share of each transport mode in the total national traffic performance, measured in person-kilometres for passenger transport and tonne-kilometres for freight transport. For the overall indicator, the national traffic performances of all Scan-Med Corridor countries are aggregated, and the respective share is calculated. Compared to the baseline value, passenger railways have gained 1 percent point from road.

Table 5: Corridor modal share, baseline 2014, status 2016 and 2017

Mode	Modal share index	Unit		Baseline value 2014	Status 2016	Status 2017
Inland Surface Transport	Modal Split in National Passenger Inland Surface Transport	Percent (%)	Passenger Cars Buses and Coaches Railways Trams and Metro	83 9 7 1	82 9 8 1	82 9 8 1
Inland Surface Transport	Modal Split in National Freight Inland Surface Transport	Percent (%)	Road Rail: Inland Waterways	70 23 7	69 23 8	69 24 7

Source: Prognos based on EU Transport in figures - Statistical Pocketbook 2015, 2016 Chapters 2.3 and 2.4; data of 2011, 2013 and 2014 respectively

Rail Freight Corridor Scan-Med

In terms of performance of the rail freight sector indicators of the Rail Freight Corridor (RFC) Scan-Med, which are available for the year 2016 for the first time, have been used. They demonstrate that only one third of the offered pre-arranged train paths were actually requested by applicants, and that a substantial amount of freight traffic is clearly allocated outside the One-Stop-Shop, according to schemes that have proven suitable in recent years. Quality, measured in train "punctuality", is low, with railway undertakings (RU) responsible for more than half of the delay minutes. Traffic volumes at the respective border stations demonstrate the relative importance of the "Brenner" traffic compared to the "northern" borders at present.

Figure 4: KPI of the Rail Freight Corridor Scan-Med 2016

Type	KPI	Unit	Value 2016		
Capacity Manage-ment	Offered Capacity	million PaP km	17		
	Requested Capacity	million PaP km	5		
	Requests	number of requests in PCS	37		
	Pre-allocated Capacity	million PaP km	3,3		
	Conflicts	number of conflicting requests	23		
Operations	Punctuality (threshold 30 min) at origin	% of on-time trains	70		
	... at destination	% of on-time trains	59		
	Delay causes	% of delay minutes according to groups of causes	Cause	Northbound	Southbound
			IM	21	16
			RU	55	57
			External	3	2
			Secondary	21	25
Market KPIs	Traffic Volumes	number of running trains monitored in national systems (border-crossing)	Border	Northbound	Southbound
			NO/SE	423	423
			SE/DK	4.152	4.302
			DK/DE	5.356	5.257
			DE/AT	14.515	15.234
			AT/IT	9.657	10.051

PaP = pre-arranged path; PCS = Path Coordination System; IM = Infrastructure Manager; RU = Railway Undertaking
Source: ScanMed RFC - 2016 Annual Report, published on 20.07.2017, p. 14 ff.

Source: KombiConsult analysis October 2017, based on the RFC Scan-Med Annual Report 2016

The following sections analyse the compliance of each mode of transport with regard to the KPIs.

The Scan-Med Rail Network

The **rail** objectives compliance analysis reveals the following, in particular:

- The standard-track gauge is available on all corridor lines with the exception of Finland, which is exempt because of its isolated network;
- Electrification is available on almost all lines. A few non-electrified sections in Germany (e.g. Lübeck – Puttgarden) and one in Denmark (the Ringsted-Rødby section, which will be electrified before completion of the Fehmarn Belt Fixed Link) require a change of locomotive and diesel traction. Most of the non-electrified lines in Germany are due to be electrified in the framework of agreed projects, “if they are part of the requirement plan”[8];
- Interoperability constraints partly result from differing electrification standards (15 kV 16 2/3 Hz in Sweden, Germany and Austria, 25 kV 50 Hz in Denmark and 3 kV DC in Italy on the existing lines used for freight and passenger transport, and 25 kV for High-Speed Lines (HSL) and new lines such as the Brenner Base Tunnel and the Fehmarn Belt Fixed Link;
- There are differing standards with regard to:
  - train length being below standard parameters, in particular in parts of Sweden (630 m)[9], on the Brenner line to Florence/Ancona (600 m), and on many sections in Italy south of Florence (400/600 m);[10]
  - axle loads below the standard parameter (< 22.5 t) on 18% of the sections in Italy;
  - loading profile for the transport of semi-trailers ("P400") in unaccompanied intermodal transport, which is not achieved on the current lines in Italy south of Florence/Bologna;
- A low rate of ERTMS, in particular ETCS[11] implementation, with the exception of Austria and Denmark[12], diverse time horizons resulting in a "patchwork" of ERTMS implementation and detailed practical challenges. The latter are caused by long realisation periods, with different ERTMS levels and software releases being applied by infrastructure managers, the rail industry and railway undertakings. This requires detailed observation and monitoring if ERTMS is to supply the intended benefits to the rail transport market[13].

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[8] Feedback provided by BMVI by e-mail, 17.10.2014.

[9] According to the Swedish Network Statement, “Normal train length on the Swedish Transport Administration's network is 630 metres. The train lengths that are permitted for specific lines are determined in the process of allocation of capacity.”

[10] According to DB Netz, “for the German corridor network, a train length up to 740m is basically possible, due to restrictions in timetabling and operational situations the actually possible train length can be influenced.”

[11] The European Rail Traffic Management Systems is basically made of GSM-R as a mobile communication standard, which is widely implemented, and the European Trains Control System (ETCS) where harmonised implementation is lacking.

[12] Denmark was originally intended to be the first country to implement ETCS (Level 2 Baseline 3) on the entire conventional railway network (expected by 2023). However, this might no longer be the case as the new roll out strategy presented Nov. 2017 estimates 2030 as end date for the rollout.

[13] See chapter 4.2.1 on ERTMS Deployment.

The Scan-Med Road Infrastructure

The **road** objectives compliance analysis reveals the following:

- Currently, the minimum road standard of Express Road or Motorway, as referred to in the Regulation, is covered by all routes with the exception of some sections in Finland, Italy and Malta, amounting to about 1% of the total distance of the Corridor;
- There is no formal requirement for a minimum number of lanes. Nevertheless, the number of lanes, together with the road standard, provides a measurement of the quality of the Corridor. The number of sections without at least two lanes in each direction in Finland, Sweden and Malta amounts to about 2% of the total length of the Corridor. However, it should be noted that measuring traffic flow management, safety and environmental aspects can equally have an impact on the quality of the roads;
- According to the TEN-T Regulation, priority shall be given to appropriate parking space for commercial users, offering an appropriate level of safety and security. Parking areas can be simple stops with access to basic sanitary facilities, or they may include restaurants, floodlighting, or even enclosures, guards and video surveillance. There is no set minimum standard. Safe parking/rest areas are more widespread in some countries than others, but all countries have such facilities;
- Traffic Management Systems, usually known as Intelligent Transport Systems (ITS), are an array of various technological tools with many purposes, including managing traffic. There is no standardised definition for ITS, but a standard for data and information exchange exists and is implemented.[14] The Issues Paper "Boosting Intelligent Transport Systems," compiled by European Coordinators, sets the scene for the future evolution of ITS along the corridors[15]. Within the framework of the Ideas Lab on Roads and ITS, the Conference of European Directors of Roads (CEDR) agreed to monitor progress of ITS on the corridors according to a common definition, and include results in their future annual reports.
- Traveller Information services are implemented in a highly fragmented manner, resulting in incoherent traveller information along the Corridor. While in some countries (e.g. Austria) national traveller information services are in place, other countries provide regional services (e.g. Germany) and some countries only provide third-party services (e.g. Finland). Furthermore, the quality, currency and soundness of the traveller information are not harmonised, which once again results in fragmented traveller information services for cross border transport.
- Alternative fuels include various different technologies and standards. At present, certain types of alternative fuel are very widespread in some countries, while practically inexistent in others. For example, along the corridor, hydrogen filling

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[14] Comprehensive work in this field is being carried out within both CEN and ISO, and numerous technical standards exist. In accordance with the Delegated Regulations 885/2013, 886/2013 and 2015/962, DATEX II is identified as the standard for data exchange.

[15] http://ec.europa.eu/transport/themes/infrastructure/news/2016-06-20-ten-t-days-2016_en.htm

stations[16] can only be found in Sweden's three largest cities, and there are none at all south of Rome. On the other hand, there are regions such as Oslo/Akershus, southern Sweden, Denmark and northern Germany, where an increasing number of alternative energy stations, including quick chargers, are being made available, and the use of appropriate vehicles needs to be encouraged in order to fulfil the National Deployment Plans.

- There are significant congestion problems on the road network in and around most large cities during peak periods. These are generally taken into account in the national and regional plans for each country. Inter-urban roads tend to have fewer congestion problems. Road infrastructure improvement measures relate not only to physical capacity, but also to the smooth flow of traffic, increasing traffic safety or avoiding demographically or environmentally sensitive areas. In some cases, such as the Fehmarn Belt Fixed Link, there will be significant timesaving compared with some ferry alternatives or the longer route through Jutland. Other important measures, not directly related to road infrastructure, such as regulations, technological improvements or improved vehicle capacity unitisation are also important.

The Scan-Med Air Transport Infrastructure

Open access is available in all 19 core **airports**. Connectivity with the TEN-T road network is available at all airports, with 12 airports also connected to rail. Implementation of Single European Sky for Scan-Med Corridor airports will be based on the "2015 European ATM Masterplan – The roadmap for delivering high performing aviation for Europe"[17].

When comparing passenger traffic and capacity indicators, a few airports appear to have reached an annual traffic level above their potential capacity, as expressed in terms of passengers/year (Oslo[18], Gothenburg, Berlin (both airports), Hamburg, Rome), while few others (Stockholm, Bologna, Palermo, Malta) appear close to their limits. Projects aimed at improving capacity, both planned and underway, should lead to compliance with the criteria set out in the Regulation. The opening of Berlin Brandenburg Airport would constitute a substantial improvement of airport capacity on the Corridor and highlight the role of the Capital Region of Berlin as an urban node at the crossroads of three of the nine Core Network Corridors.

The Scan-Med Maritime Infrastructure

The 25 Scan-Med **core ports**, as regards maritime and hinterland transport infrastructure, largely fulfil the core requirements of the Regulation . However, for the hinterland connections, a more qualitative analysis was performed within the framework of the "MoS-Study". It is important to note that port environmental infrastructure is still developing (see for example the Italian "Green Ports" priority,

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[16] http://www.netinform.net/h2/H2Stations/H2Stations.aspx
[17] SESAR Joint Undertaking, 2015
[18] The new terminal opened 2017 gives excess capacity (28 million passengers) the coming years.

which corresponds to the Italian strategy for ports (Azione 7 PSNPL[19])). Consequently, several MoS-Projects have been selected for CEF co-funding to address identified shortcomings. Infrastructure for alternatives fuels, “green” shipping (LNG fuelling, Scrubbers, Methanol), logistics platforms (Taranto), coordination among businesses (WiderMos, B2Mos) and cooperation among administrations (ANA), as well as technical modifications to classical shipping services (e.g. hybrid ferrie,s which were phased into the existing services at Rødby – Puttgarden and Trelleborg – Rostock) were among the projects completed by 2015. Information and Communication Technologies are well developed on the Corridor. Vessel Traffic Service (VTS) and SafeSeaNet (SSN) are fully implemented, while e-Maritime services need to be further developed with a focus on harmonisation of IT and data exchange, especially through “single window” solutions. MoS projects selected under both the 2014 and 2015 CEF Calls addressed this need, but individual ports had to keep this under constant review. An Ideas Laboratory on Ports was hosted by Copenhagen-Malmö Port in Malmö on 8 February 2016. The main topics discussed at the workshop were "improving the 'green profile' of ports through sustainability and modal shift and "a focus on ports’ cooperation versus competition". The recent Italian port reform established 15 Port Authorities Systems, grouping together ports that were previously managed separately. The identification of the Port Authority Systems was influenced by the TEN-T Core Network planning and was conducive to streamlined investments for more competitive and larger ports.

The Scan-Med Rail-Road Terminal Infrastructure

All 28 pure **rail-road terminals** (RRT) in the 2015 analysis met the requirements set out in Article 28 of the TEN-T Regulation. Consequently they are connected to rail and road by at least one rail track or road lane, have the technical and operational capability to tranship all types of intermodal loading units, and are open to all operators in a non-discriminatory way. An Ideas Laboratory, hosted by Interporto Verona on 19/20 of April 2016, confirmed that in most cases terminal operation systems provide information flows and data exchange between RRT managers and connected transport mode operators, such as railway undertakings, intermodal operators and forwarders. However, it was confirmed that individual improvements are needed and the use of data exchange in the logistics sector could be improved.

Although being not a direct requirement for rail-road terminals but applying for the freight lines of the core network itself, a further requirement was derived from Article 39 of the TEN-T Regulation, namely the operation of electrified trains with 22.5 tons axle load and 740 m train length. With respect to increasing the efficiency gain in seamless train operation, terminals are often challenged by the fact that access to rail infrastructure that has grown over time (single sided, non-electrified, annexed to shunting yard or ports railway line) and the limitation of the wagon train, either by the reception/departure siding or by the transhipment track(s). Only four of 28 RRT's of

[19] PSNPL = Il Piano Strategico Nazionale della Portualità e della Logistica, the Italian National Strategic Plan for Ports and for Logistics of 2015.

the Corridor provide for transhipment tracks of ≥ 740 m (Rosersberg, Hallsberg, Bremen and Bologna) and expansion options need to be examined at local level.

2.3 Progress of Corridor Development

Progress in the Corridor's development is usually achieved by undertaking projects with a positive impact on the KPIs (KPI, see previous chapter).

The Final Project List[20] (or "project pipeline") of the Scan-Med Corridor contains studies and works as well as combined 'studies and works' projects which were either submitted by corridor stakeholders or resulting from the analysis in the course of the Corridor Study. It includes 666 projects with a total of known cost of €202.4bn. 74 projects with a total cost of €14.0bn have already been completed since the adoption of the TEN-T Regulation, namely in the 2014-2016 period. The following figure provides an overview of the distribution of the projects by country and project category.

Table 6: Number of projects completed 2014–2016, 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	Other	Total
FI			3		1	1		1		6
SE	4		3	1	1		1			10
DK	2									2
DE	2		2	2		1	3			10
AT		1	1							2
IT			2	2	2	4			1	11
MT			1	2		4				7
Multiple		2		4	19		1			26
Total N°	**8**	**3**	**12**	**11**	**23**	**10**	**5**	**1**	**1**	**74**
Total cost [bn€]	**4.7**	**0.1**	**4.8**	**0.7**	**1.0**	**0.9**	**0.6**	**0.2**	**1.8**	**14.0**

Source: KombiConsult analysis, 8/2017, based on the Final Project List of 4/2017

Most projects have been completed in the "MoS" and "Maritime" categories, while the highest total costs are recorded for "Rail" and "Road" projects.

The following sections give an overview of the progress of corridor development per mode of transport.

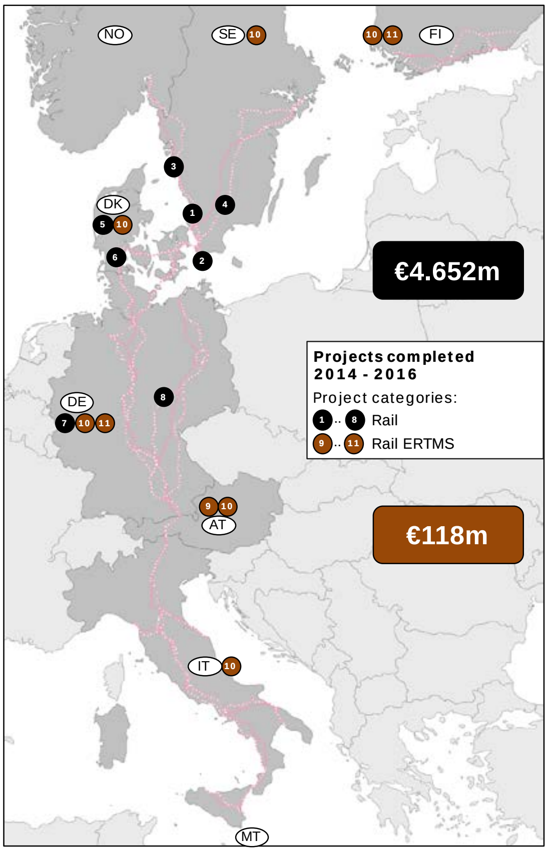
[20] Updated Final Report on the Project List dated 27.06.2017.

Scan-Med Rail Infrastructure projects

For the reporting period the Project List includes eight “Rail” projects with a total known cost of €4 652m and three “Rail ERTMS” projects (€118m) that have been fully completed. They are displayed in the following figure.

Figure 5: Projects completed 2014–2016 – Categories: “Rail” and “Rail ERTMS”

No.	Project name, scope and ID
1	Tunnel through Hallandsås, Studies and Works (ID 5164)
2	Malmö Fosieby – Trelleborg, Studies and Works (ID 5171)
3	Göteborg C Signalbox, Studies and Works (ID 5160)
4	Pågatåg Nordost (Regional railway network improvement), Studies and Works (ID 5168)
5	Reach Compliance by increasing freight train length to min. 740 m on specific sections in DK, Works (ID 5398)
6	Double track between Vamdrup and Vojens, Studies and Works (ID 5397)
7	LL Retrofit 16000 - Retrofitting rolling stock with composite brake blocks to reduce noise in densely populated areas, all TEN-T corridors in Germany, Works (ID 7900)
8	NBS/ABS Erfurt - Leipzig/Halle (VDE Nr. 8.2), Works (ID 5088)
9	Implementation of GSM-R on Austrian A-network, Lines of the ÖBB A-network, Works (ID 9074)
10	Facilitating and speeding up ERTMS deployment of the rail network of BE, ES, DE, FI, IT, AT, FR, UK, DK, SE, PL, Studies and Works (ID 9071)
11	Facilitating and speeding up ERTMS - second phase, Rail network of BE, DE, ES, FI, FR, Studies and Works (ID 9072)



Source: KombiConsult analysis, June 2017

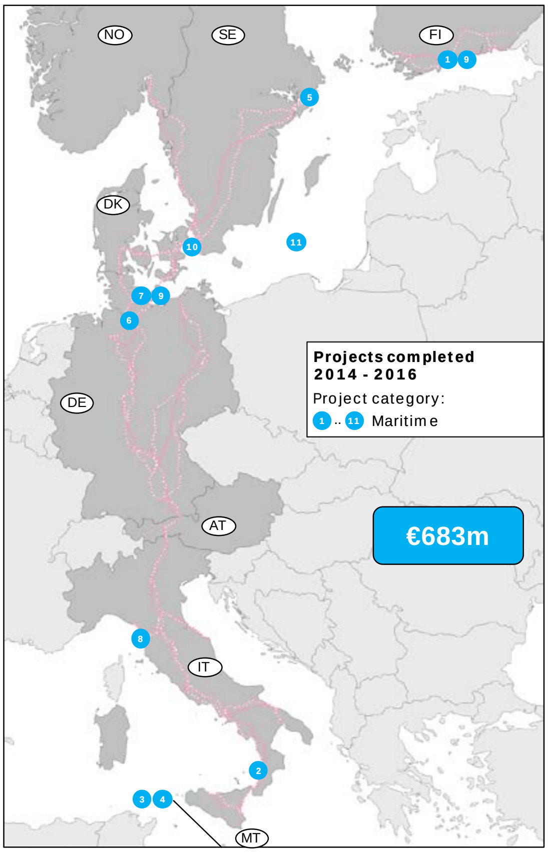
Almost all recently concluded rail projects aimed at increasing capacity do not remedy non-compliant infrastructure, as the requirements of the Regulation were already fulfilled previously. However, they adjust the configuration of rail stations to the demands of high-speed traffic, thus enhancing rail capacity and allowing for higher speed of passenger trains.

Scan-Med Maritime, Ports and MoS projects

In all, 34 projects, subsumed under the ”Maritime” and ”MoS” categories, which include ports, were accomplished during the reporting period. Their total known cost was €683m for ”Maritime” and €1 029m for ”MoS” projects. They are displayed in the following figures.

Figure 6: Projects completed 2014–2016 – Category: “Maritime”

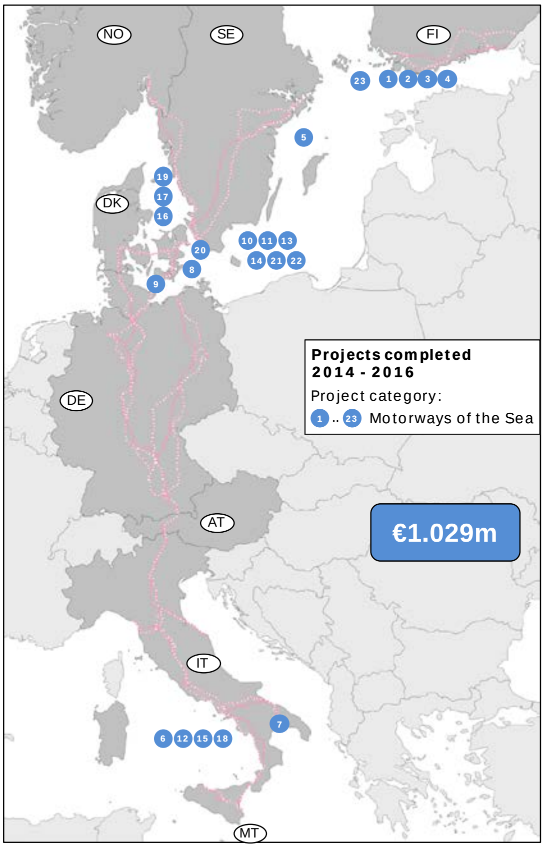
No.	Project name, scope and ID
1	Twin-Port 1, Port of Helsinki, Port of Tallinn, Studies and Works (ID 2070)
2	Seaport Hub, Port of Gioia Tauro, Works (ID 5325)
3	Cranerail Installation and Terminal 1 Yard Expansion, Port of Marsaxlokk, Works (ID 5370)
4	Investment in Quayside Cranes, Port of Marsaxlokk, Works (ID 5371)
5	Project Värtahamnen, Port of Stockholm, Works (ID 5423)
6	New Kattwyk Railway Bridge - Building of landside Links and Reconstruction of the Leading Lights, Port of Hamburg, Works (ID 5017)
7	Expansion of the terminal for combined transport (Baltic Rail Gate) and the corresponding freight station at Lübeck Skandinavienkai, Works (ID 5126)
8	New station on Darsena Toscana and connection to Tyrrhenian line, Livorno, Studies and Works (ID 5358)
9	Back from Black - The introduction of sulphur scrubber, Ports of Lübeck (DE), Rotterdam (NE), Teesport (UK), Helsinki (FI), Riga (LV), Klaipeda (LT), Studies and Works (ID 2953)
10	Zero Emission Ferries - a green link across the Oresund, Works (ID 5012)
11	FAMOS Freja: Finalising Surveys for the Baltic, Studies (ID 5554)



Source: KombiConsult analysis, June 2017

Figure 7: Projects completed 2014–2016 – Category “MoS”

No.	Project name, scope and ID
1	The Finnish NSB and ScanMed Ports, Studies and Works (ID 2069)
2	Biscay Line - Multiple port Finland-Estonia-Belgium-Spain long distance MoS, relevant to many core network corridors, Studies and Works (ID 7903)
3	Upgrading and sustaining the competitive Baltic MoS link Germany-Finland (RoRo multiple ports loop), Studies and Works (ID 5013)
4	Upgrading and sustaining the competitive core Baltic MoS link Helsinki-Lubeck, Works (ID 5011)
5	LNG Bunkering Infrastructure Solution and Pilot actions for Ships operating on the Motorway of the Baltic Sea (2012-EU-21009-M), Studies and Works (ID 5222)
6	COSTA (2011-EU-21007-S), Studies (ID 5232)
7	Logistic Platform, Port of Taranto, Works (ID 5320)
8	Green Bridge on Nordic Corridor (2011-EU-21010-M), Studies and Works (ID 5228)
9	Sustainable Traffic Machines - On the way to greener shipping (2012-EU-21023-S), Studies and Works (ID 5219)
10	LNG in Baltic Sea Ports II (2013-EU-21007-S), Studies (ID 5573)
11	LNG in Baltic Sea Ports (2011-EU-21005-S), Studies (ID 5229)
12	Business to Motorways of the Sea (2012-EU-21020-S), Studies and Works (ID 5226)
13	PILOT SCRUBBER – New Generation Lightweight Pilot Scrubber Solution installed on a Ro-Ro Ship operating on the Motorway of the Baltic Sea (2012-EU-21010-S), Studies and Works (ID 5223)
14	Winter Navigation Motorways of the Sea, WINMOS (2012-EU-21008-M), Studies and Works (ID 5221)
15	WiderMoS (2012-EU-21021-S), Studies (ID 5227)
16	Methanol: The marine fuel of the future (2012-EU-21017-S), Studies and Works (ID 5224)
17	The Baltic Sea Hub and Spokes Project (2010-EU-21108-P), Studies (ID 5230)
18	ANNA - Advanced National Networks for Administrations (2012-EU-21019-S), Studies and Works (ID 5225)
19	LNG Rotterdam - Gothenburg (2012-EU-21003-P), Works (ID 5233)
20	Sustainable Trelleborg-Swinousjcie MoS services based on upgrading port infrastructure, developing intermodal transport and integrating hinterland corridor SE-PL Sustainable Sea-Hinterland Services (2013-EU-TM-210004), Studies and Works (ID 5570)
21	Monalisa 2.0 (2012-EU-21007-S), Studies (ID 5220)
22	Upgrading and sustaining the competitive Baltic MoS link Germany-Finland (RoRo multiple ports loop), Studies and Works (ID 5513)
23	New Icebrakers, FI, SE, Works (ID 5139)



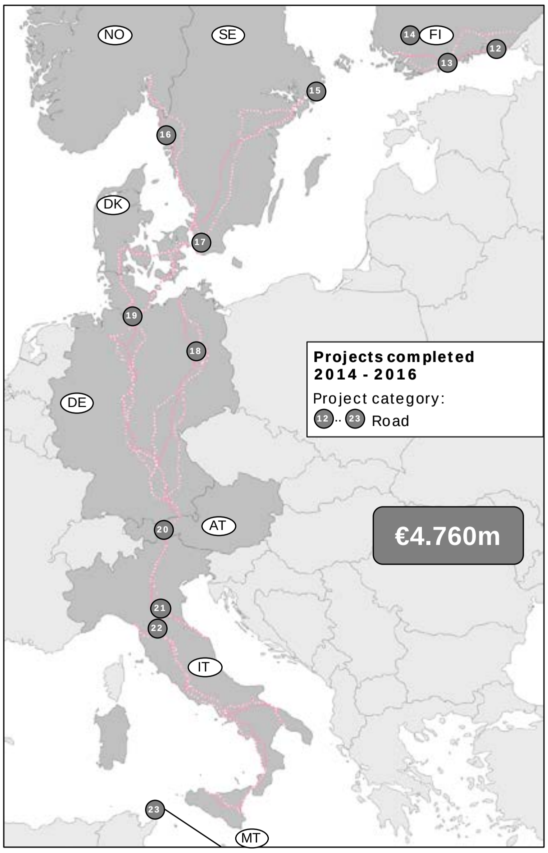
Source: KombiConsult analysis, June 2017

Scan-Med Road Infrastructure projects

For the reporting period the Project List includes 12 completed „Road" projects with a total known cost of €4 760m. These are displayed in the following figure.

Figure 8: Projects completed 2014–2016 – Category "Road"

No.	Project name, scope and ID
12	E18 Hamina bypass, Works (ID 5443)
13	Helsinki Ring Road III, the second phase, Works (ID 5444)
14	Implementing of cooperative ITS, ScanMed sections in FI, Studies and Works (ID 5218)
15	E4 Norrtull, Haga Södra – Kista, Studies and Works (ID 5143)
16	E6 Pålen – Tanumshede, Studies and Works (ID 5146)
17	E6 intersection Spillepengen, Studies and Works (ID 5152)
18	A 10 Reconstruction Dreieck Havelland [part of DE CPR 2], Works (ID 5105)
19	Hamburg: A 1, A 7, A 21, B 205 - upgrade of network influence system [part of DE CPR 4], Works (ID 5461)
20	A 13 Rehabiltation Bergisel tunnel and Sill bridge 1, Innsbruck, Studies and Works (ID 5829)
21	Bologna-Casalecchio di Reno node, Works (ID 5304)
22	"Variante di valico" between Firenze and Bologna, Works (ID 5301)
23	ITS on Maltese Roads, Works (ID 5380)



Source: KombiConsult analysis, June 2017

Scan-Med Airport projects

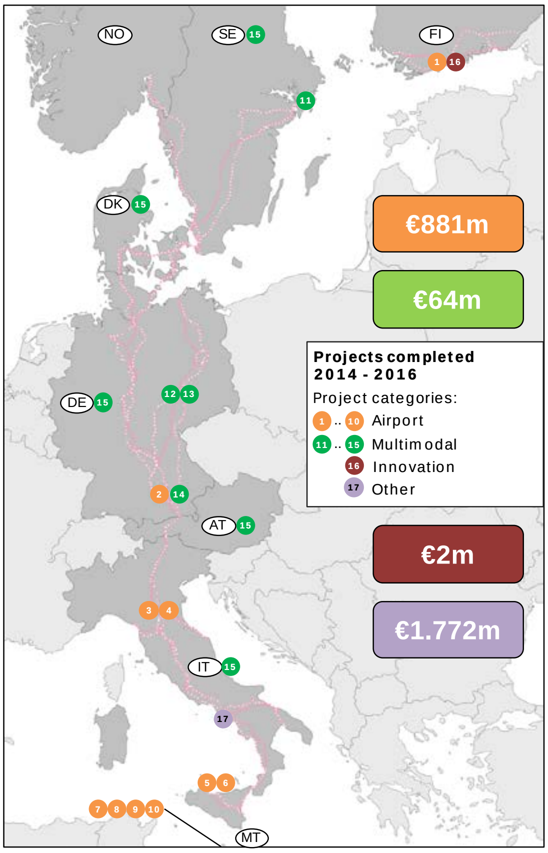
The Project List includes 10 “Airport” projects with a total known cost of €881m, completed during the reporting period 2014-2016. They are displayed in figure 9.

Scan-Med Rail-Road Terminals (RRT), incl. Multimodal and Other projects

For the reporting period the Project List includes five completed “Multimodal” projects with a total known cost of €64m and two “other” projects with costs of €2m for the Finnish Mobility as a Service (MaaS) project and €1 772m for the Naples node project respectively. They are displayed in the following figure.

Figure 9: Projects completed 2014–2016 – Categories: “Airport”, “Multimodal”, “Innovation” and “Other”

No.	Project name, scope and ID
1	Ring Rail Line, Helsinki, Works (ID 5138)
2	New railway connection between Munich Airport and the European railway corridor (TEN PP 17), Studies (ID 9023)
3	Reprovision of ATC plant room, Bologna, Studies and Works (ID 3276)
4	New highway parking, Bologna, Studies and Works (ID 3613)
5	Upgrading of the paving of the runway RWY 07/25 and 02/20 of the International Airport of Palermo and related works, Studies and Works (ID 5944)
6	Adjustment and restructuring passenger terminal - New Scenary 2020 of Palermo International Airport, Studies and Works (ID 5945)
7	Replacement of AODB (Airport Operations Database) system, Malta International Airport, Works (ID 5365)
8	Enlargement of the Non-Schengen Departures Concourse, Malta International Airport, Works (ID 5366)
9	Aircraft Movement Area Rehabilitation, Malta International Airport, Works (ID 5367)
10	Aircraft Movement Area Rehabilitation, Malta International Airport, Works (ID 5965)
11	Stockholm Nord (Rosersberg), rail connection to RRT, Works (ID 5406)
12	Extension of capacity of terminal Schkopau, Works (ID 5804)
13	Upgrade of terminal Leipzig-Wahren, Works (ID 6864)
14	Upgrade of terminal München-Riem, Works (ID 9864)
15	Swiftly-Green - Sustainable freight transport services, Studies (ID 1379)
16	ITS: Implementing Mobility as a Service (MaaS), Helsinki - Tallinn cross-border region, Studies and Works (ID 2065)
17	Metropolitana di Napoli, Works (ID 5622)



Source: KombiConsult analysis, June 2017

3 Transport Market Analysis

3.1 Results of the Multimodal transport market study (MTMS)

In 2010, the latest year for which disaggregated data could be retrieved, the international freight traffic on the Corridor amounted to 129.0 million tons by sea, of which 59.9 million tons are between core ports, 50.3 million tons by road and 36.0 million tons by rail.[21]

The **seaborne** freight transport between all ports of the Corridor countries is distinctly higher than the continental corridor flows (rail and road). The dominant relations are located in the northern part of the Corridor, mainly related to Germany and Sweden, supplemented by the flows from the remaining Scandinavian countries. These volumes amount to 64% of international sea freight flows. In 2010, approximately 80% of all exports from the Scandinavian countries to countries in the Core Network corridor were transported by sea[22].

As regards international **road** freight flows, the relations Denmark – Germany, Italy – Germany and Finland – Sweden (in both directions) are dominant with a share of almost 70%. The structure of flows illustrates a broader spatial distribution of important relations on the Corridor, locating the "centre of gravity" of road freight volumes in the southern part of the corridor and to a lesser extent in the far northern part.

The most important **rail** freight flows are, in both directions: Sweden - Germany, Austria – Germany, Germany – Italy and Italy – Austria. They amount to almost 90% of all relevant international rail freight flows. The "centre of gravity" of rail freight flows is located in Germany and Austria.

The multimodal transport market study carried out in 2014 sought to identify the “big picture” of the present and future situation of the transport market for the Scan-Med Corridor. A comprehensive overview including all relevant transport modes and infrastructure was prepared. This was based on an extensive literature review including studies, reports and forecasts, investigating corridor market sections and nodes and assembled from existing databases supplemented by additional data provided by infrastructure managers, Ministries and other stakeholders. This allowed identifying those Core Network areas with the highest expected transport volumes by 2030. For rail, both passenger and freight, they are: Mjölby – Malmö, Gothenburg – Malmö, Malmö – Copenhagen – Taulov, Bremen/Hamburg – Hannover – Würzburg, Munich – Innsbruck, Bologna – Florence – Rome – Naples. As regards road, they are: Lübeck – Hamburg/Bremen – Hannover, Würzburg – Nuremberg – Munich, Florence – Rome.

[21] Evaluation by Prognos based on ETIS Plus matrices for 2010, and AlpInfo 2012.

[22] See Final Report 2014, share of exports by FI, NO, SE, DK by sea (Table 42) in total exports by these countries (sum of Tables 40,41,42) on p.170f

It should be noted that this approach has taken into account the network load, both passenger and freight, resulting from international, domestic and regional/local traffic using the corridor infrastructures, and not only the traffic between corridor regions, which could be a (minor) subset of the global traffic volume. This is the only way of identifying traffic demand that could lead to early or future capacity constraints.

Table 7 presents estimates of performance in passenger and goods transport based on these flows. The total passenger traffic is expected to grow by 1.6% (average annual growth) between 2010 and 2030, while freight traffic is expected to grow by 2.7%.

Table 7: Evolution of passenger and goods transport performance on the Scan-Med Corridor 2010/2030

	2010		2030		2030/2010	
	Passenger traffic (Billion pkm)	Goods transport (Billion tkm)	Passenger traffic (Billion pkm)	Goods transport (Billion tkm)	Passenger traffic (evolution in % p.a.)	Goods transport (evolution in % p.a.)
Road	151	336	196	560	1.3%	2.6%
Rail	38	99	61	174	2.5%	2.9%
Total	**189**	**434**	**257**	**734**	**1.6%**	**2.7%**

Source: Prognos analysis, May 2017; evolution expressed as average annual growth

3.2 Remaining capacity issues along the Scan-Med Corridor in 2030

In general, capacity depicts the maximum amount of traffic a specific infrastructure is able to manage or handle (technical maximum capacity). However, in reality the maximum capacity might also depend on external factors, as well as qualitative conditions of the infrastructure. In rail transport, a capacity constraint appears not only when transport demand exceeds the maximum capacity, but already when demand is about to reach 80% of the maximum capacity. In this case, there is a high risk of unstable operating conditions, i.e. timetables. Corridor line sections with high or even critical capacity utilisation tend to show decreasing service quality, due to their sensitivity to transport vehicle delays which, when they arise, are likely to be passed on to other means of transportation. Often such delays cannot be reduced at short notice, since operational flexibility is not available. Furthermore, congestions make it difficult or even impossible to attract additional traffic on the Corridor. For these reasons, the provision of sufficient capacity (reserves) is a sine qua non framework condition.

The comparison of the expected traffic volumes and network loads in the year 2030 facilitates the identification of possible capacity constraints (bottlenecks).

The overview of capacity constraints and capacity utilisation provides a valuable indication that, even after the construction of new infrastructure (in particular the Fehmarn Belt Fixed Link, Brenner Base Tunnel (BBT) and their access lines, and other infrastructure included in the Project List and respective national master plans), some bottlenecks will remain along the Scan-Med Corridor. These may impede future growth of passenger and freight transport. More specifically, they include:

- In Finland, for rail: Kouvola – HaminaKotka, Luumäki – Vainikkala, Helsinki, node, Helsinki – Turku; and for road: regions of Turku and Helsinki and the section Kotka–Hamina–Vaalimaa;
- In Sweden, for rail: Stockholm and Gothenburg node, Hässleholm – Lund, Trelleborg – Malmö (- Copenhagen);
- In Denmark, for rail: (Malmö-) Copenhagen region;
- In Germany[23], for rail: nodes Hamburg, Bremen and Kassel as well as the sections Hamburg – Ahrensburg (– Lübeck), Hamburg – Hannover/Bremen – Hannover[24]; and for road: regions of Hamburg (motorway A1 and A7), Hannover/Kassel (A7), Berlin, Nuremberg (A3) and Munich (A9, A8);
- In Italy for rail, based on information provided by RFI: Verona - Ponte Gardena until the completion of all of the access lines to the Brenner Base Tunnel; Florence - Livorno/La Spezia related to port traffic development. There will also be some constraints in the traffic of urban areas and the network gap existing in the Adriatic-Ionian area;
- In Malta for the (road) connection between the port of Marsaxlokk, the airport and the capital city with its port.

For the Øresund region, stakeholders are expecting further growth of cross-border commuter traffic and have agreed to undertake a study for a cross border metro (rail) line between Malmö and Copenhagen. Another study for a new fixed connection Helsingør-Helsingborg is also ongoing.

In Austria, no capacity problems are expected after the infrastructure projects foreseen have been completed.

Almost all ports are planning to modernise and expand their capacity in case of need. Many ports are undertaking projects aimed at modernising and expanding port capacities. For Oslo no and for Turku/Naantali only one study project was recorded in the list.

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[23] Rail sections with capacity utilization ">110% Überlastung"/overloaded according to the Bundesverkehrswegeplan 2030, under the assumption that all priority projects will be completed ("Zielnetz"). If a reasonable capacity utilisation of 85-110% "Vollauslastung" is applied, more sections on the Corridor become congested. For road, the BVWP indicates sections with "frequent traffic jam (>300 hours per year)".

[24] To meet future demand, the German FTIP 2030 has ranked the upgrade/new construction Hamburg – Hannover, the upgrade Langwedel – Uelzen, Rotenburg – Verden – Minden / Wunstorf, Bremerhaven – Bremen – Langwedel (optimized Alpha-E) as first priority projects.

4 The Scan-Med Corridor identified projects to be realised by 2030

4.1 General Overview

The 2014 Study and, based on that, the (First) Work Plan of 2015 both already referred to a long list of projects. Within the framework of the 2015-2017 Study, the list was updated with regard to three elements: 1) the data included in the 374 projects was improved, 2) the number and quality of project parameters was expanded and 3) further projects were added. Several sources of information were used and coordinated across corridors:

- the 2014 Study;
- the comprehensive Project List;
- the 2014 and 2015 CEF Call results[25];
- National Transport Master Plans/Transport Operational Programme;
- The Rail Freight Corridor Scan-Med Implementation Plan of November 2015;
- Contacting stakeholders for validation/completion of project data according coordinated responsibilities for data gathering by corridor/project category;
- Coordination and data exchange with other corridors for projects which are on shared sections and nodes.

Stakeholders, Member States and Norway contributed to this exercise in two “rounds”, one in 2016 and another in early 2017. The draft Final Project List was circulated to and commented upon by the Member States, who finally “agreed” to it under the provisions laid down in the TEN-T Regulation and with respect to projects under their responsibility. This comprehensive indicative list forms the basis for the implementation of the Corridor.

As presented in the table below, the Final Project List, as completed end of April 2017, includes 666 projects and measures related to the Scan-Med Corridor (compared to 374 projects in 2014, to 543 projects in 2016).[26] Projects completed by 2013 have already been excluded from the list.

68 of these projects are located on “cross-border” sections, 69 on “last-mile” sections and 144 are qualified as “pre-identified CEF section or project”, in accordance with Annex I Part 1 of the CEF Regulation.

567 projects are related to the Scan-Med Corridor alone, while 141 are shared with North Sea-Baltic, 131 with Orient-Eastmed, 67 with Mediterranean, and 50 each with the Baltic-Adriatic and Rhine-Danube Core Network corridors. The high number of overlapping projects is an indication of the strategic and connecting role of the Scan-Med Corridor in the Trans-European Transport network.

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[25] Due to the publication of the CEF Call 2016 results after the closing date of the Final Project List, said results will have to be incorporated in 2018.

[26] Some of the projects are related to sections or nodes shared with other Core Network Corridors, such as Helsinki, Hamburg/Bremen – Hannover, Rostock – Berlin, Halle/Leipzig, Würzburg – Nuremberg, Munich, Verona, and Bologna.

Table 8: Total number of projects by mode and country, and their total costs in billion €

Category /Country	Rail	Rail ERTMS	Rail + Road	Road	Mari-time	MoS	Air-port	Multi modal	Inno-vation	Other	Total
FI	13		2	6	2	1	3	2	5		34
FI/SE						1					1
SE	26	3		14	9	2	9	4			67
SE/DK			1								1
DK	8	1		5	3		2	2	1		22
DK/DE	1		1								2
DE	41	2		40	54	1	33	17	4		192
DE/AT				3							3
AT	7	2		10							19
AT/IT	2	1									3
IT	40	4		17	44	5	28	24	7	15	184
IT/MT						1	2				3
MT				5	24		9				38
NO		4					1				5
NO/SE	1										1
Multiple	3	8		7	10	47	2	4	10		91
Total	142	25	4	107	146	58	89	53	27	15	666
Total [bn€]	122.2	9.7	7.2	30.4	9.3	1.8	15.8	0.9	0.5	4.6	202.4

Source: KombiConsult analysis on the Final Project List 27.04.2017; "Multiple" = multi-country projects.

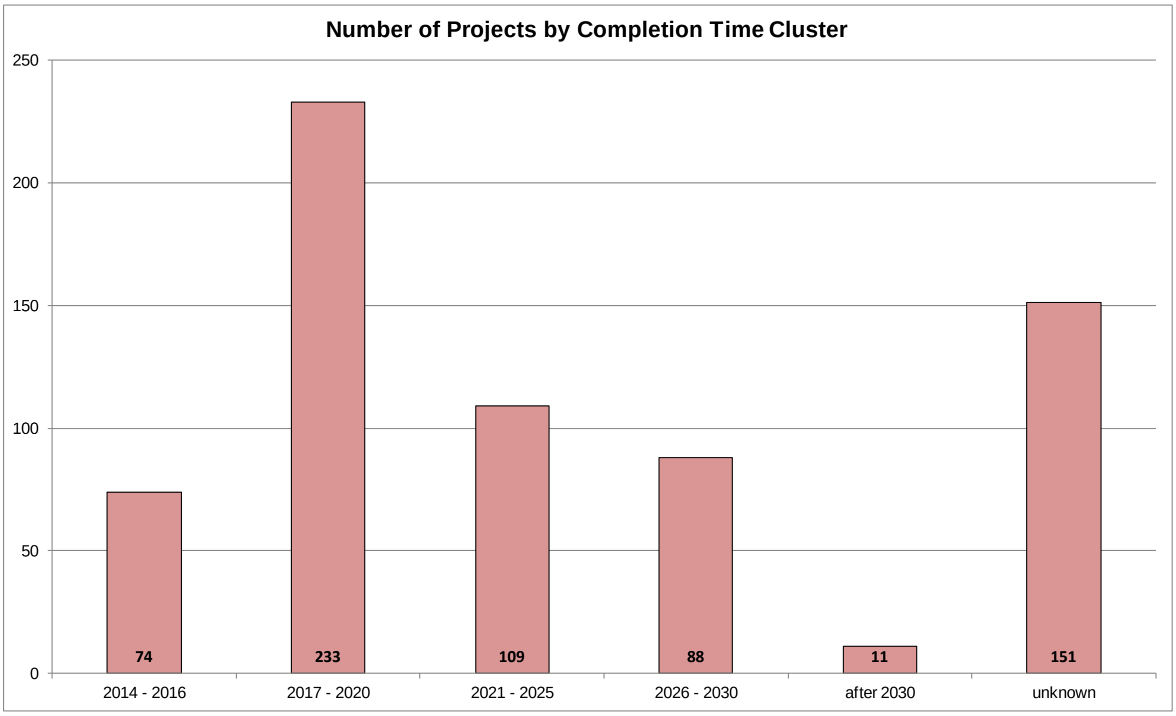
Among the projects with known **end dates**, 74 (11%) have already been completed since the adoption of the TEN-T Regulation, 233 projects (35%) are supposed to be completed by 2020 and further 197 projects (29%) after that (see chapter 2.3).

Of all 666 projects, 89 (or 13%) did not provide a **total cost** figure. Sometimes the maturity does not enable a clear figure to be established, whereas for other projects it is simply "unknown". For those projects that provided a cost figure, the cumulated total cost is €202 422m.

The projects were grouped into different cost classes according to total cost ranging from small to large projects. 19 projects (3%) are costing less than €1m, 136 (or

20%) are in the €1m-€10m class; The majority of projects (248, or 37%) range between €10m and €100m and another 96 (14%) in the €100m-€500m class; 30 projects (5%) fall under the cost class of €500m-€1bn and 49 projects (7%) are costing more than €1bn.

Figure 10: Total number of projects by completion time cluster



Source: KombiConsult analysis on the Final Project List 27.04.2017

Similarly to the number of projects, the costs are not equally distributed across the categories either. The majority of project costs are related to “Rail” (€122.2bn or 60%), followed by “Road” (€30.4bn, 15%), “Airport” (€15.8bn, or 8%), “Rail ERTMS” (€9.9bn, or 5%), “Maritime” (€8.9bn, or 4%) and “Rail + Road” (€7.2bn, or 4%). Other categories of projects such as “Motorways of the Sea” (MoS), “Multimodal” and “Innovation” and other projects make up a smaller share of €4.6bn, or less than 3% of the total cost recorded.

The different forms of financial sources were provided for 62% of the total costs amounting to €125.6bn. For projects equalling costs of €110.2bn, which means 54% of the total costs or 88% of the financed projects, the financing was already marked to be “approved”.

Against the backdrop of these findings, the tasks for the forthcoming years are to further improve the quality of data in the Project List and to ensure that the projects of highest Corridor relevance and maturity are undertaken in time.

The following analysis shall focus on the ongoing or planned projects, which constitute a subset of 592 projects of the Final Project List worth €188.5bn.

Table 9: Number of ongoing or planned projects (completion in 2017 and beyond) by country and project category and their total cost in billion €

Country/ Category	Rail	Rail ERTMS	Rail + Road	Road	Mari-time	MoS	Air-port	Multi-modal	Inno-vation	Other	Total
FI	13		2	3	2		2	2	4		28
FI/SE						1					1
SE	22	3		11	8	1	9	3			57
SE/DK			1								1
DK	6	1		5	3		2	2	1		20
DK/DE	1		1								2
DE	39	2		38	52	1	32	14	4		182
DE/AT				3							3
AT	7	1		9							17
AT/IT	2	1									3
IT	40	4		15	42	3	24	24	7	14	173
IT/MT						1	2				3
MT				4	22		5				31
NO		4					1				5
NO/SE	1										1
Multiple	3	6		7	6	28	2	3	10		65
Total	134	22	4	95	135	35	79	48	26	14	592
Total [bn€]	117.5	9.7	7.2	25.7	8.3	0.8	14.9	0.9	0.6	2.9	188.5

Source: KombiConsult analysis, 8/2017, based on the Final Project List of 27.04.2017

4.2 Analysis per mode

The following chapters present the identified projects by mode.

4.2.1 Rail (including ERTMS deployment plan)

The analysis of the Project List regarding contributions to the KPIs (line speed, electrification, axle load, train length) and other relevant parameters (line capacity, single track sections, strong inclines) has shown that substantial progress can be expected by 2030 on numerous parts of the Corridor.

In this context, the following exemplary projects, which will provide large-scale compliance with the requirements of the Regulation, can be highlighted:

- Denmark/Germany: fixed link between Fehmarn and Rødby in the form of a combined rail-and-road tunnel: Total investment: ~ €7bn, Planned completion: 2028 (depending on the result of the permitting process in Germany);
- Germany: German Unity Transport Project 8 – completion of the new HSL between Erfurt and Halle/Leipzig (total investment: ~ €3.0bn, opened in December 2015); final completion of Erfurt - Nuremberg (total investment: ~ €5.6bn) is foreseen in December 2017[27];
- Austria/Italy: in terms of rail traction, the Brenner Base Tunnel (BBT) will provide for a maximum permitted speed of 250 km/h for passenger trains and 120 km/h for freight trains, electric power supply of 25 kV 50 Hz and ETCS Level 2 equipment: Total investment: ~ €7.4bn, Planned completion: 2026[28];
- Italy: Upgrade of Palermo - Catania railway connection: Total investment: ~ €6bn, Planned completion: >2030;
- Italy: Construction of Naples - Bari High Speed railway connection: Total investment: ~ €5.8bn, Planned completion: 2030.

In all, 143 planned and on-going infrastructure projects have been identified. 126 contribute to the elimination of current or potential future capacity bottlenecks. Most of them are located in Italy (43 projects), followed by Sweden (27), Germany (24), Finland (17), Denmark (6), Norway (4) and Austria (3). Others are of cross-border nature and deal with capacity increase and elimination of strong incline by building new infrastructure in the Fehmarn – Rødby and Brenner Base Tunnel (BBT) sections.

The impact of these projects on the entire rail network, the availability of sufficient infrastructure capacity and the correspondence to actual needs is to a great extent dependent on future traffic demand, as tackled in chapter 3.1.

ERTMS deployment plan

On 5 January 2017, the European Commission adopted the Implementing Regulation (EU) 2017/6 on the European Rail Traffic Management System European Deployment Plan (ERTMS EDP), which replaces the previous deployment plan of 2009. The reviewed ERTMS EDP adapts the geographical scope of deployment to the TEN-T Regulation, and sets new targets for ERTMS deployment on CNCs until 2023. The target dates constitute the firm commitments made by Member States and Infrastructure Managers during the consultation and negotiations led by the European ERTMS Coordinator between 2014 and 2016.

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[27] Erfurt – Nuremberg was opened after final analysis of the project list on 10 December 2017.

[28] Total costs without risks at present price; For Italy: Total costs including budget for identifiable risks (7.999 Mio EUR), at life cycle prices: 8.800 Mill EUR (source CIPE Decision 17/2016); For Austria: Austrian laws also consider the budget for the non-identifiable risks. Consequently, the updated total cost of the project (Austria + Italy), including budget for identifiable and non-identifiable risks (8.661 Mill EUR), at life cycle prices: 9.917 Mill EUR (source: Rahmenplan 2017-2022)".

The ERTMS Deployment Action Plan, published as a Commission Staff Working document on 16 November 2017, defines the measures, timing, roles and responsibilities for a harmonised, efficient and effective ERTMS deployment as laid down in the EDP.

In 2023, the ERTMS European Deployment Plan will be updated again to set the precise implementation dates for the remaining part of the Corridors between 2024 and 2030. The ERTMS Coordinator proposed this two-step approach for defining the consistent deployment of CNCs by 2030, which was praised by all affected stakeholders. The approach ensures that the reviewed EDP sets out more realistic dates and can therefore serve as the basis for business planning for railway undertakings.

4.2.2 Rail-Road Terminals (RRT)

The project database of the Scan-Med Corridor includes 53 projects in the "Multimodal" category. Approximately ten of the projects concern passenger transport, including six on public transport in Rome, the "long distance commuting" project in Helsinki and the surrounding Regions, and the project aimed at "enhanced and developed multimodal personal transport in the urban node of Norrköping" in Sweden. The other 43 projects concern freight, mostly intermodal transport, in particular Rail-Road terminals. 25 of these projects are located in Italy, 17 in Germany, 4 in Sweden, 2 in Finland and Denmark. No project is reported for the Norwegian RRT while Austria and Malta have no RRT on the Corridor. Thirteen of the 25 Italian projects are located in the node (RRT) of Verona. The two Finnish projects are both linked to the "Kouvola RRT", namely the development of the site and its open access. Consequently, one can conclude that the 31 projects will be used for upgrading or constructing 14 intermodal terminals. Four projects are "placeholders" for reaching compliance with the required targets in all remaining (corridor) terminals in Sweden, Denmark, Germany and Italy; they should be further defined by the site managers.

Five of the 53 projects were already completed within the three years following the adoption of the TEN-T Regulation in December 2013, namely projects in Munich-Riem and Halle/Leipzig as well as SwiftlyGreen (see chapter 2.3 for details). Twenty projects are planned to be completed by 2020, a further seven by 2025 and eight more by 2030. For 13 of the 53 projects, the completion timeframe is "not known". They are, among other things: Kouvola (open access and intermodality), Älmhult Freight Terminal (further expansion), Verona (several interventions), as well as all six public transport projects in Rome.

Based on an analysis of the cost of the various projects, which is known for 43 of 53 projects, the three largest projects are located in Hannover (Megahub, €136m), Rome (€133m) and Stockholm (€52m) respectively. Twenty projects are in the cost class of >€1m to €10m, 17 range between >€10m to €100m, and two are even more expensive.

Concerning the distribution of the "known" costs of around €938m between the six corridor countries, the highest figure concerns German territory (€426m), followed by Italy (€339m), Sweden (€54), Finland (€48m) and Denmark (€19m). The distribution can only partly be explained by the maturity of the projects and the terminal infrastructure in the Corridor, since too many project costs are "not known".

The latter finding is also supported by the fact that for projects worth €294m, financial resources of €233m (or 79%) are "approved". Thus, it remains a general task of the coordination process until 2030 to encourage stakeholders to submit information on the financing of a given project.

When analysing the scope of work 17 projects compose of studies, 22 concern infrastructure works – upgrade, 20 infrastructure works – new construction and two administrative procedures (Kouvola and Norrköping). Furthermore 7 projects deal with telematic applications with respect to TEN-T-Regulation Article 31 and six with improved services with respect to TEN-T Regulation Article 32.

4.2.3 Maritime Ports & MoS

146 projects of the "Maritime" category and 58 projects of the "MoS" category are included in the project database of the Scan-Med Corridor.

These 204 projects are widely spread over the entire corridor. Most of them are either located in Germany (55 projects) or in Italy (49 projects). 24 projects of the abovementioned categories are located in Malta, 11 in Sweden, 3 in Finland and another 3 in Denmark. Furthermore 57 projects are located in multiple countries and two projects are shared between two countries namely Italy and Malta as well as Finland and Sweden.

Austria and EEA member state Norway are the only countries along the Corridor that are not pursuing any projects in the abovementioned categories, although Norway's transport system strongly relies on maritime transport.

About 17% of the 204 projects (34 projects) have been completed since the adoption of the TEN-T Regulation in 2013. More than half (55%) of the projects (112 projects) are expected to be completed by 2020. Within the 2021-2025 period, 8% (25 projects), and within the 2026-2030 period another 8% (25 projects) will be completed. For the remaining fifth (42 projects), the timeframe for completion is either after the year 2030 (4 projects) or unknown (38 projects).

More than half of the "Maritime" and "MoS" projects (52%) are linked to a total cost of €10m to €100m per project. One-fifth (41 projects) cost less than €10m per project. One-tenth (21 projects) belong to the cluster of projects with a total cost of €100m to €500m. Two "Maritime" projects even account for a total cost of up to one billion € each. The two ambitious projects, in the ports of Livorno and Naples, are aiming at a significant increase in capacity and/or modernisation, improvement of the multimodal infrastructure and connectivity and seaside access. For 33 projects, cost is unknown.

In all, the cost of the 171 "Maritime" and "MoS" projects for which the costs are known amount to more than €10.8 bn, of which almost nine billion € for "Maritime" and more than €1.8 bn for "MoS" projects.

Almost two thirds of the total figure spent on "Maritime" and "MoS" projects along the Corridor are shared equally between German and Italian ports, while said ports only account for half of all "Maritime" and "MoS" projects along the Corridor. Most of the projects are essential for the future functionality of the ports within the world's main trade lanes (Europe-Asia). Amongst other things, they include:

- deepening of seaside access and implementation of new terminal superstructures, for the new generation of Ultra Large Container Vessels (ULCV),
- the construction of new and higher bridges replacing older buildings too low for ULCV,
- preparation of docks and land reclamation to increase terminal capacities;
- upgrading the multimodal infrastructure, multimodal connection and innovative traffic management systems to establish ports as sustainable multimodal hubs.

It is worth noting that the cost has only been approved for some projects of the "Maritime" and "MoS" categories. For 160 projects, the cost is either unknown or financing is not yet guaranteed.

MoS - DIP

In parallel to the Work Plans of the TEN-T Corridor Coordinators the **European Coordinator for Motorways of the Sea**, delivered on the second version of the Motorways of the Sea (MoS) Detailed Implementation Plan (DIP).[29]

The document, following extensive consultations with stakeholders and Member States, presents a number of recommendations to shape the MoS programme of tomorrow in close coordination with other European Coordinators.

The DIP singles out the key three future development priorities: Environment, Integration of maritime transport in the logistic chain, Safety, Traffic Management and the Human Element.

The MoS work programme is instrumental in identifying future TEN-T policy maritime objectives and it clarifies the main areas that would require EU financial contribution in order to help the maritime industry to improve its environmental and safety performance.
It also includes a number of suggestions with the objective to contribute to the increased efficiency of the logistic chain within the 9 Core Network Corridors by pointing out shortcomings in terms of maritime links.

The MoS work programme further comprises a set of recommendations defining possible future funding objectives with regard to the maritime dimension of the TEN-T policy, paying particular attention to future trends in Short Sea Shipping in Europe and

29 https://ec.europa.eu/transport/themes/infrastructure/motorways-sea_et

the crucial MoS contribution to better connectivity with peripheral and outermost regions.

The document is supported by a full set of data on port characteristics, which are an integral part of the TEN-TEC database, and in an annex it offers a detailed analysis on ports and shipping operations covering all 331 seaports included in the TEN-T core and comprehensive network.

The document strives to characterise the main bottlenecks and investment needs in the Comprehensive Network of ports, as well as point out the main inadequacies in the current network of MoS links.

4.2.4 Road transport (including ITS deployment)

The project database of the Scan-Med Corridor includes 107 projects of the “Road” category, and 4 of the “Rail + Road” category. The “Rail + Road” category includes construction of the Fehmarn Belt Fixed Link (DE/DK) and road infrastructure works linked to the “Kouvola RRT” (FI) and the port of HaminaKotka. The third project is a Swedish/Danish study concerning possible future congestion on the Öresund Link, and mitigation measures that may require both rail and road investments. The fourth project is a study of the Helsinki-Turku-Tampere triangle, where the focus is on the road/rail development system, based on needs of comprehensive long-term development in the leading economic triangle (HKI-TRE-TKU) of the country.

The database identifies 17 projects as cross border, mainly in connection to the Brenner Corridor, Fehmarn Belt Fixed Link (although costs are borne by DK according to the state treaty between DK and DE), Öresund link and project at the Finnish-Russian border. Only two “Road” projects are defined as “last-mile” both located in Italy.

Forty projects, or 36%, are located in Germany, while 17 are located in Italy, 14 in Sweden and 10 in Austria. The number of projects in Finland, Denmark and Malta are 8, 5 and 5 respectively.

Twelve projects in the database are located in two or more countries. Three of them consists of infrastructure works (Kiefersfelden, Kufstein and Fehmarn), six of ITS and two of charging stations for e-mobility. One project is a study on possible future capacity limitations.

Thirty projects overlap two or more corridors. They are located in Helsinki, Hamburg, Bremen, Hannover, Malchow - Waren (Müritz), Berlin, Nuremberg, Munich, Bologna and Verona. A German national programme for development of alternative fuels is designed as one project, but is connected to five of the Core Network Corridors. Other projects are joint ITS projects that overlap several corridors.

Since the adoption of the TEN-T Regulation in 2013, 10 projects have been completed. 38 projects are planned to be completed by 2020 including 1 “Rail + Road” project, and 24 by 2025. A further 17 projects, including 3 “Road + Rail” projects, are planned to be completed by 2030. For 20 projects, the timeframe is not known.

The cost is known for 107 of 111 projects and amounts to €37.6bn. 64 projects are in the cost class <€100m, 26 in cost class >€100m – €500m and 8 in cost class >€500m – €1 000m. 9 projects are in cost class >€1 000m.

The Fehmarn Belt Fixed Link is the largest, with an estimated cost of over €7bn (19% of total know costs). Other larger projects are "Variante di valico" between Firenze and Bologna (€4bn/11%), the E4 motorway Stockholm Bypass (€3.5bn/9%) and a “road packet” in the Gothenburg area (€1.7bn/4.5%).

The largest share of estimated investments, apart from the Fehmarn Belt Fixed Link, are in Italy (€10.7bn), followed by Germany (€9.8bn) and Sweden (€7.1bn). Planned investments for Finland are estimated to be around €1bn, and for Denmark around €0.9bn. “Road” projects in Austria and Malta are expected to cost €188m and €164m respectively. Projects under the category “multiple countries” are expected to cost €320m and joint projects between Germany and Austria €55m.

For the category “Rail + Road”, finance of almost all costs are approved. For the “Road” category, the total cost is estimated at €30.4bn, of which financing figures cumulate to €17.5bn. €15.1bn of the project financing has been “approved”.

When analysing the scope of work the following has to be noted: 62 projects are composed of studies, 13 include infrastructure works – rehabilitation; 62 infrastructure works – upgrade, 31 infrastructure works – new construction; one Rolling Stock/Vehicles, four clean fuels, one administrative procedures, 3 telematic applications as set out in TEN-T-Regulation Article 31, and 3 improved services as set out in TEN-T Regulation Article 32. Most of the projects include several actions.

4.2.5 Airports

The project database of the ScanMed corridor includes 89 projects of the category “airport”, 33 of which are located in Germany, 28 in Italy, 9 in Malta and Sweden respectively. Three projects are in Finland, two Denmark and Norway reported one project.

The most part of the projects (42) is expected to be completed until 2020, while 17 will be completed in the timeframe 2021-2025, four between 2026 and 2030, and two after 2030 (Fiumicino North Masterplan in Italy, including the construction of a new terminal and the fifth runway). The completion timeframe for the remaining 14 is unknown.

Most of the projects (32) whose costs are known are in the group between €1m and €10m, while 17 will cost between €10m and €100m. The cost of three projects is in the cost class >€100 to €500m, while four will cost between €500 and €1 000m.

The six largest projects costing more than €1 000m are located in Rome Fiumicino (South, €1 393m and Masterplan North, nearly €4 803m as well as the airport rail connection), and each one in Oslo (€1 500m), Stockholm (€1 072m) and Helsinki (€1 500m). The cost of the remaining 19 projects is unknown.

The ‘known’ costs of around €15 758m are distributed between the six corridor countries concerned with the highest amount located on Italy (€8 036m), followed by Finland (€3 174), Norway (€1 500m), Sweden (€1 830m), Germany (€1 190m). Projects located in Malta (€20m), Malta/Italy (€4m) and multiple countries (€5m) report significantly lower costs.

For 35% of the total known costs for airport projects which correspond to €5 509m financing information was provided. For 28% of the total needs, corresponding to €4 443m resources are “approved”.

Analysing the scope of work reveals that the projects compose of studies (37 projects), infrastructure works – rehabilitation (16), infrastructure works – upgrade (28), infrastructure works – new construction (46), Clean Fuels (1, environmental mitigation measures in Naples), administrative procedures (4 namely 2 in Naples and 2 in Leipzig), telematic applications with respect to TEN-T-Regulation Article 31 (12) and Sustainable freight transport services according Reg. 1315, Article 32 (1 in Helsinki).

SESAR Deployment Programme

On 5 December 2014, the Commission appointed the SESAR Deployment Alliance as the body tasked with the deployment phase (SESAR Deployment Manager). In the framework of the 2014 and 2015 CEF Calls for proposals project applications were handed in and partly approved for funding.

110 “green projects” submitted to the 2014 CEF Call for proposals have been listed in the Deployment Programme and analysed in order to identify implementation priorities and shortcomings for the 2015 call. The final version of the SESAR Deployment Programme 2015 provides information on the projects awarded and an update on the shortcomings identified. The following list contains the CEF 2014 project awards along the Scan-Med Corridor:

- AMAN Upgrade to include Extended Horizon function (Stockholm)
- Geographic Database for Procedure Design (Italy)
- Basic A-CDM (Stockholm)
- A-SMGCS Level 1 and 2 (Copenhagen, Munich, Stockholm)
- Airport Safety Net associated with A-SMGCS (Level 2) (Rome)
- Upgrade of ATM systems (NM, ANSPs, Aus) to support Direct Routings (DCTs) and Free Routing Airspace (FRA) (Italy/Malta)
- Interface ATM systems to NM Systems (Italy/Malta)
- Stakeholder Internet Protocol Compliance (Denmark))
- Upgrade/Implement Aeronautical Information Exchange System/service (Sweden)
- Upgrade/Implement Flight Information Exchange System/Service (Italy)

The results of the 2015 CEF Call were published on 17 June 2016. Projects recommended for funding on the Scan-Med Corridor are the following:

- Deploying new radar technologies for the modernisation of air traffic management in Germany (Germany)
- Deploying Remote Tower Control for the modernisation of air traffic management in Germany (Germany)
- Upgrading of Instrument Flight Procedures to a PBN standard (Italy)
- Denmark-Sweden FAB operational harmonisation (Denmark and Sweden)
- Implementation of functional TWR at Goteborg Landvetter airport (Goteborg)
- Skavsta Access 2.0 (Stockholm)
- One synchronised ATM system -Contingency ATCC at OS/MM (Sweden)
- FRA high seas primary surveillance infrastructure (Sweden)
- Expansion of Remote Tower Services (Sweden)
- SESAR Deployment Programme implementation 2015 - Cluster 1 (several countries among which Sweden, Denmark, Germany, Italy)
- SESAR Deployment Programme implementation 2015 - Cluster 2 (several countries among which Sweden, Denmark, Germany, Italy)
- CODACAS 1B (several countries among which Denmark and Sweden)

Concerning deployment, both editions 2016 and 2017 of the Deployment Programme are proposals for update: therefore the official reference document taken into account for the study is the 2015 edition, approved by the College (College decision C(2016)2052) in accordance with Articles 11 and 12 of Regulation (EU) 409/2013.

4.3 Urban nodes roles in the CNC

Urban nodes are a crucial component of TEN-T corridors merging and redistributing traffic flows. The Scan-Med Corridor comprises 19 urban nodes. The overall goal of the urban node network development is the appropriate interconnection of passenger and freight transport between all relevant modes. Furthermore, a seamless connection between the (long-distance) TEN-T infrastructure and regional/local traffic and urban freight delivery on the last mile shall be achieved. Urban bottlenecks are to be removed, leading to the enhancement of multimodal transport solutions and a shift towards more sustainable mobility for both passengers and freight.

A compliance check of CNC lines within the urban nodes according to the requirements of the Regulation has been performed. The following rail parameters were taken into account: freight train length (≥740m), axle load (≥22,5t), line speed (≥100 km/h) and electrification. Road sections were analysed in terms of the “express road/motorway” parameter. In addition to these technical parameters, the utilisation of corridor infrastructure capacity inside the urban nodes was evaluated.

Moreover, a check of infrastructure parameters relevant for the last-mile connection between the access/transhipment points and the corridor lines was carried out for each urban node. The purpose of this analysis was to evaluate whether a seamless connection between the (long-distance) TEN-T infrastructure and regional/local traffic and urban freight delivery on the last mile is possible. The rail connection of inland ports, trimodal terminals and rail-road terminals to the core network was analysed according to the parameters axle load, electrification and train length. Rail connection to airports was evaluated based on heavy (both long-distance and regional) rail connection.

In addition, improvement projects with reference to non-compliant sections, or which were of particular relevance for the urban node, were pointed out.

Table 10: Corridor lines compliance within the urban nodes of the Scan-Med Corridor

	Rail					Road
	Train length*) (≥ 740m)	Axle load *) (≥ 22,5t)	Speed *) (≥ 100km/h)	Electrification	Capacity utilisation	Express road / motorway
Helsinki	P	P	P		P	
Turku		P			P	
Oslo						
Göteborg			**)		P	
Malmö					P	
Stockholm					P	
Copenhagen						
Hamburg	n.i.				P	
Bremen						
Hannover					P	
Berlin						
Leipzig			**)			
Nürnberg				P	P	
München						
Bologna	n.i.					
Roma	n.i.				P	
Napoli	n.i.				P	
Palermo					P	
Valletta	n.a.	n.a.	n.a.	n.a.	n.a.	

*) Criterion valid for freight lines only.

**) Line speed <100km/h; These sections are mainly separate freight lines, links and bypasses in and around urban nodes.

GREEN	Compliant
YELLOW	Partly compliant / non-compliant
RED	Non-compliant
GREY	Not applicable (n.a.)
WHITE	No information (n.i.)
P	Project for the improvement of a non-compliant parameter (according Project list 2017)

Source: HaCon, May 2017, updated February 2018

In Table 10, the overall **compliance check of the corridor lines** inside the Scan-Med urban nodes and foreseen projects for the resolution of non-compliant parameters are displayed. Considering all nodes, the technical parameters show compliance to a great extent. Problems almost exclusively refer to rail lines within the

18 nodes (Valletta has no rail connection) and here to the requested train length of 740m and to the permitted line speed on freight lines. Especially the line speed criterion is a typical problem in urban areas and often difficult to solve.

Apart from these technical criteria, “capacity utilisation” represents a major problem in most urban nodes. This is a rather typical situation, which large agglomerations of population and economy have to cope with. In fact, the project list contains measures in all affected urban nodes designed to alleviate the capacity situation.

The corridor roads in Scan-Med nodes are almost fully compliant with the Regulation. With the only exception of Valletta, where there are no motorways, all corridor roads are classified as motorways (expressways). No projects have been identified in Valletta for upgrading road corridor lines to expressways/motorways.

Table 11 summarises the evaluation of relevant parameters for the **“last mile” connections.** The underlying question for this check was whether it is possible to perform a continuous, seamless traffic from the CNC lines via the last mile connection to the respective access points and vice versa. This requirement can be considered as generally fulfilled for road connections; thus, the check of the last mile connections has been restricted to rail.

The rail connections of ports, trimodal terminals and rail-road terminals to the core network have been analysed for the three parameters “axle load”, “electrification” and “train length”, since these criteria decide whether a seamless transport from/to the access point along the last mile is possible or not. For rail connections to airports, the availability of heavy rail connection is relevant, as far as the respective airport falls under the obligation of Regulation 1315/2013, Article 41(3).

In total, 67 last mile connections inside the urban nodes of the Scan-Med Corridor have been checked. 40 of them (60%) fulfilled all relevant criteria, while 17 (25%) showed one or more technical obstacles for though-going transport chains. For the remaining 10 access points (15%), none of the selected criteria was applicable, mostly airports without mandatory rail connection.

The parameter showing most bottlenecks is “train length”, that is not sufficient on 13 last-mile connections, followed by “axle load” and “electrification” with each five cases. As these last mile connections are not part of the corridor network, the project list does not contain any project for upgrading the technical standards.

Seven core airports in the Scan-Med Corridor are obligated to provide heavy rail connection. Five of these airports show this connection already today; in Helsinki respective works are ongoing. Moreover, further airports without obligation provide rail access (e.g. Hannover, Leipzig, Palermo) or are about to establish such rail connection (Göteborg).

Table 11: Connection analysis of access points to the corridor network

Node	Access points on the core network		Connection to CNC			
	Infrastructure	Type	Axle load (≥ 22,5t)	Electrification	Train length (≥ 740m)	Connected to heavy rail
Helsinki	Vuosaari Harbour	Inland/ Sea port	✓	✓	✓	n.a.
	West Harbour	Inland/ Sea port	X	X	X	X
	South Harbour	Inland/ Sea port	X	X	X	X
	Helsinki Airport	Airport	n.a.	n.a.	n.a.	X
Turku	Port of Naantali	Inland/ Sea port	X	X	X	n.a.
	Port of Turku	Inland/ Sea port	X	✓	X	n.a.
	Turku Airport	Airport	n.a.	n.a.	n.a.	n.a.*
Oslo	Alnabru	Rail-road terminal	✓	✓	✓	n.a.
	Port of Oslo	Trimodal terminal	✓	✓	✓	n.a.
	Gardermoen Airport	Airport	n.a.	n.a.	n.a.	✓*
Göteborg	Gullbergsvass**	Rail-road terminal	✓	✓	X	n.a.
	Port of Göteborg	Inland/ Sea port	✓	✓	X	n.a.
	Göteborg-Landvetter Airport	Airport	n.a.	n.a.	n.a.	n.a.*
Malmö	Malmö RRT	Rail-road terminal	✓	✓	X	n.a.
	Copenhagen-Malmo Port	Trimodal terminal	✓	✓	X	n.a.
	Malmö Airport	Airport	n.a.	n.a.	n.a.	n.a.*
Stockholm	Årsta	Rail-road terminal	✓	✓	X	n.a.
	Port of Stockholm	Trimodal terminal	✓	✓	X	n.a.
	Arlanda Airport	Airport	n.a.	n.a.	n.a.	✓
Copenhagen	Høje-Taastrup terminal	Rail-road terminal	✓	X	X	n.a.
	Copenhagen-Malmo Port	Inland/ Sea port	X	X	X	X
	Copenhagen Airport	Airport	n.a.	n.a.	n.a.	X
Hamburg	Billwerder	Rail-road terminal	✓	✓	✓	n.a.
	Burchardkai	Trimodal terminal	✓	✓	✓	n.a.
	Eurogate	Trimodal terminal	✓	✓	✓	n.a.
	Altenwerder	Trimodal terminal	✓	✓	✓	n.a.
	Tollerort	Trimodal terminal	✓	✓	✓	n.a.
	Hamburg Airport	Airport	n.a.	n.a.	n.a.	✓
Bremen	Bremenports	Inland/ Sea port	✓	✓	✓	n.a.
	Bremen Weserport	Inland/ Sea port	✓	✓	✓	n.a.
	Bremen-Roland	Rail-road terminal	✓	✓	✓	n.a.
	Bremenports	Trimodal terminal	✓	✓	✓	n.a.
	City Airport Bremen	Airport	n.a.	n.a.	n.a.	n.a.*
Hannover	Brinker Hafen	Inland/ Sea port	✓	✓	✓	n.a.
	Lindener Hafen	Inland/ Sea port	✓	✓	✓	n.a.
	Misburger Hafen	Inland/ Sea port	✓	✓	✓	n.a.
	Nordhafen	Inland/ Sea port	✓	✓	✓	n.a.
	Hannover Leinetor	Rail-road terminal	✓	✓	✓	n.a.
	Hannover Linden	Rail-road terminal	✓	✓	✓	n.a.
	Nordhafen	Trimodal terminal	✓	✓	✓	n.a.
	Hannover Airport	Airport	n.a.	n.a.	n.a.	✓*
Berlin	Westhafen	Inland/ Sea port	✓	✓	✓	n.a.
	Spandauer Südhafen	Inland/ Sea port	✓	✓	✓	n.a.
	Großbeeren	Rail-road terminal	✓	✓	✓	n.a.
	Westhafen	Trimodal terminal	✓	✓	✓	n.a.
	Berlin-Brandenburg Int.	Airport	n.a.	n.a.	n.a.	✓
Leipzig	Leipzig Wahren	Rail-road terminal	✓	✓	✓	n.a.
	Schkopau	Rail-road terminal	✓	✓	✓	n.a.
	Flughafen Leipzig-Halle	Airport	n.a.	n.a.	n.a.	✓*
Nürnberg	Nürnberg Hafen	Inland/ Sea port	✓	✓	✓	n.a.
	Nürnberg Hafen	Trimodal terminal	✓	✓	✓	n.a.
	Nürnberg Airport	Airport	n.a.	n.a.	n.a.	n.a.*
München	München-Riem	Rail-road terminal	✓	✓	✓	n.a.
	München Flughafen	Airport	n.a.	n.a.	n.a.	✓
Bologna	Bologna Interporto	Rail-road terminal	✓	✓	✓	n.a.
	Bologna Airport	Airport	n.a.	n.a.	n.a.	n.a.*
Roma	Pomezia	Rail-road terminal	✓	✓	✓	n.a.
	Fiumicino	Airport	n.a.	n.a.	n.a.	✓
Napoli	Interporto Marcianise	Rail-road terminal	✓	✓	✓	n.a.
	Interporto Nola	Rail-road terminal	✓	✓	X	n.a.
	Porto di Napoli	Inland/ Sea port	✓	✓	X	n.a.
	Capodichino Airport	Airport	n.a.	n.a.	n.a.	n.a.*
Palermo	Porto di Palermo	Inland/ Sea port	✓	✓	X	n.a.
	Punta Raisi Airport	Airport	n.a.	n.a.	n.a.	✓*
Valletta	Valetta Harbour	Inland/ Sea port	n.a.	n.a.	n.a.	n.a.
	Marsaxlokk Harbour	Inland/ Sea port	n.a.	n.a.	n.a.	n.a.
	Luqa Airport	Airport	n.a.	n.a.	n.a.	n.a.

(green)	Criteria for last-mile connection fulfilled
(red)	Criteria for last-mile connection not or only partially fulfilled
(grey)	Criteria for last-mile connection not applicable
✓	Criterion fulfilled
X	Criterion not fulfilled
n.a.	Not applicable
n.i.	No information
*	Airport not falling under the obligation of Article 41(3)
**	After final analysis of the project list, Gullbergsvass was replaced by Arken kombiterminal (12/2017)
(ellipse)	Project for the improvement of a not fulfilled criterion

Source: HaCon, May 2017, updated February 2018

The findings were discussed within two working group meetings on core urban nodes[30]. The meetings concluded that the urban nodes are important generators of traffic, and clearly interact with the transport corridor(s) in many ways. The urban nodes stretch beyond administrative city limits and include the functional hinterland, where the terms “metropolitan area” or “capital region” are used.

The subjects dealt with in the two meetings are relevant and require further dialogue aimed at sharing more good practices. That could be facilitated by peer-to-peer exchange with multidisciplinary teams as foreseen in the “ideas laboratory” format.

The process could be continued where synergies are identified between urban nodes, be they with city governments, regions or the actors within the area, such as public transport operators and others;

In order to lift economies of scale, coordinated strategies, harmonised specifications or even joint tendering of innovative products may be an issue.

30 Ideas Laboratories on Core Urban Nodes in Munich on 17th/18th November 2016 and Copenhagen/Malmö on 23rd/24th March 2017.

5 Future challenges

5.1 How do we identify the Critical Issues (vs Corridor Objectives)

Since the relevant EU Regulations do not define "critical issues", but instead refer to "missing links" and "bottlenecks", a new definition has been developed. "Critical issues" are physical bottlenecks, technical parameters lower than the technical standards set by the objectives of the TEN-T and CEF Regulations, interoperability issues and slower implementation of planned projects due to national prioritisation, budget limitations and required public consultation in order to acquire building permits.

The following categories (see Table 12) have been used to group the sections or nodes – and finally the resulting measures and projects. If a certain section or node is characterised by at least one of these items, it is deemed a "critical issue" for the Corridor.

Table 12: Pre-identified sections and categories of "critical issues"

Category	Definition
Pre-identified	Pre-identified section according to Reg. (EU) 1316/2013, Annex I Part 1
Capacity / Bottleneck	Network capacity issues: e.g. road congestion in urban nodes, rail capacity; Physical, technical or functional barrier that leads to a system break
Missing link	Physically missing links e.g. in highway system and rail high speed lines
Cross-border	Issues located on cross-border sections, according to TEN-T Regulation (EU) 1315 Article 3 and Annex II, part 1
Interoperability /Compliance with TEN-T standards	Regulatory, technical and operational conditions, of the infrastructure in a transport mode to allow safe and uninterrupted traffic flows for that infrastructure or mode; Technical compatibility of infrastructure/vehicles and systems e.g. missing ERTMS, ITS deployment; in concrete terms, the measures resulting from the "compliance analysis"
Multimodality	Issues facilitating multimodal transport services for freight and passenger transport e.g. terminal capacity issues (expansion/upgrade/construction),
Last mile connection	Issues regarding last-mile connection: e.g. lack of rail connections to airports, ports
Externalities / Sustainability / Innovation	Issues regarding negative transport externalities e.g. noise, pollution, accidents; Issues where the transport infrastructure is potentially affected by the climate change, e.g. floods, increase of sea level, sea ice as well as innovation issues/pilot projects e.g. LNG, ICT, tracking and tracing
Urban areas	Actions implementing/facilitating TEN-T transport infrastructure located in "Urban nodes of the Core Network", according to Regulation (EU) 1315, Annex II, part 1

Source: HaCon

5.2 Technical compliance maps

The following chapter analyses the compliance of the infrastructure with the targets set in the Regulation under consideration of the present situation and that the known projects included in the Project List are implemented by 2030, and displays them in maps. The main conclusions are drawn by mode and section of the Corridor (from north to south) in the following paragraphs.

Rail, including ERTMS deployment Plan

The analysis has shown that only 40 projects – out of 143 planned and ongoing rail projects– contribute to improving KPIs from 2016 to 2030. In turn, this means that almost 72% of rail projects either have no effect at all (e.g. pure study, project without reliable timeline), or have an impact on factors other than the KPIs set in the Regulation. In most cases, these impacts relate to capacity increases, but also to noise protection, improvement of intermodality etc.

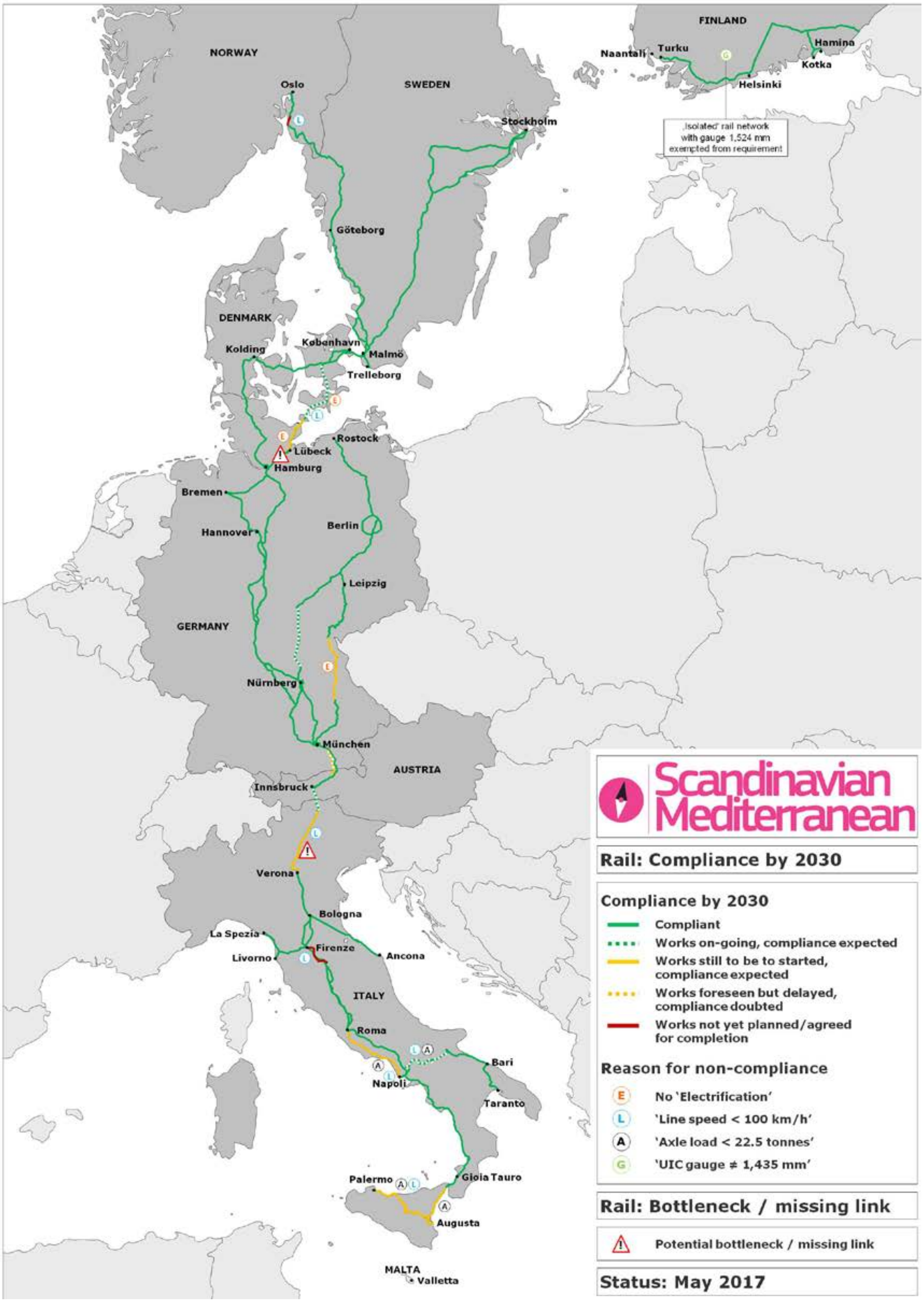
Making up the balance, the planned development of the Corridor reveals a heterogeneous picture (compare Figure 11): on the one hand, the KPIs "Axle load" "Electrification" and "Line speed", which have a high degree of compliance already today, show only small progress by 2030. On the other hand, compliance with the "Train length" parameter will increase slightly by 2030. However, the target value of 100% will be missed by far.

In conclusion, future funding should prioritise projects dedicated to the systematic elimination of critical and incompliant line sections. In this context, it is necessary to define criteria for the evaluation of the "740 m objective" on the rail lines and the nodes, find harmonised rules for the definition of requested line capacities as well to agree on a common methodology for the calculation of (corridor-wide) capacity utilisation and remaining reserves. The identification of future capacity bottlenecks is the precondition for the definition of respective projects. This issue will play a decisive role in the successful implementation of the Corridor.

Summarizing, it has to be stated that from today's point of view, overall compliance with the Regulation's rail requirements will not be achieved by 2030[31]. An overview of the expected compliance situation on the Corridor is provided in Figure 11. Critical sections are marked in red and yellow dotted lines.

[31] Reliable data regarding the mitigation of noise and vibration is not available

Figure 11: Results of the compliance analysis of the Scan-Med Corridor railway infrastructure



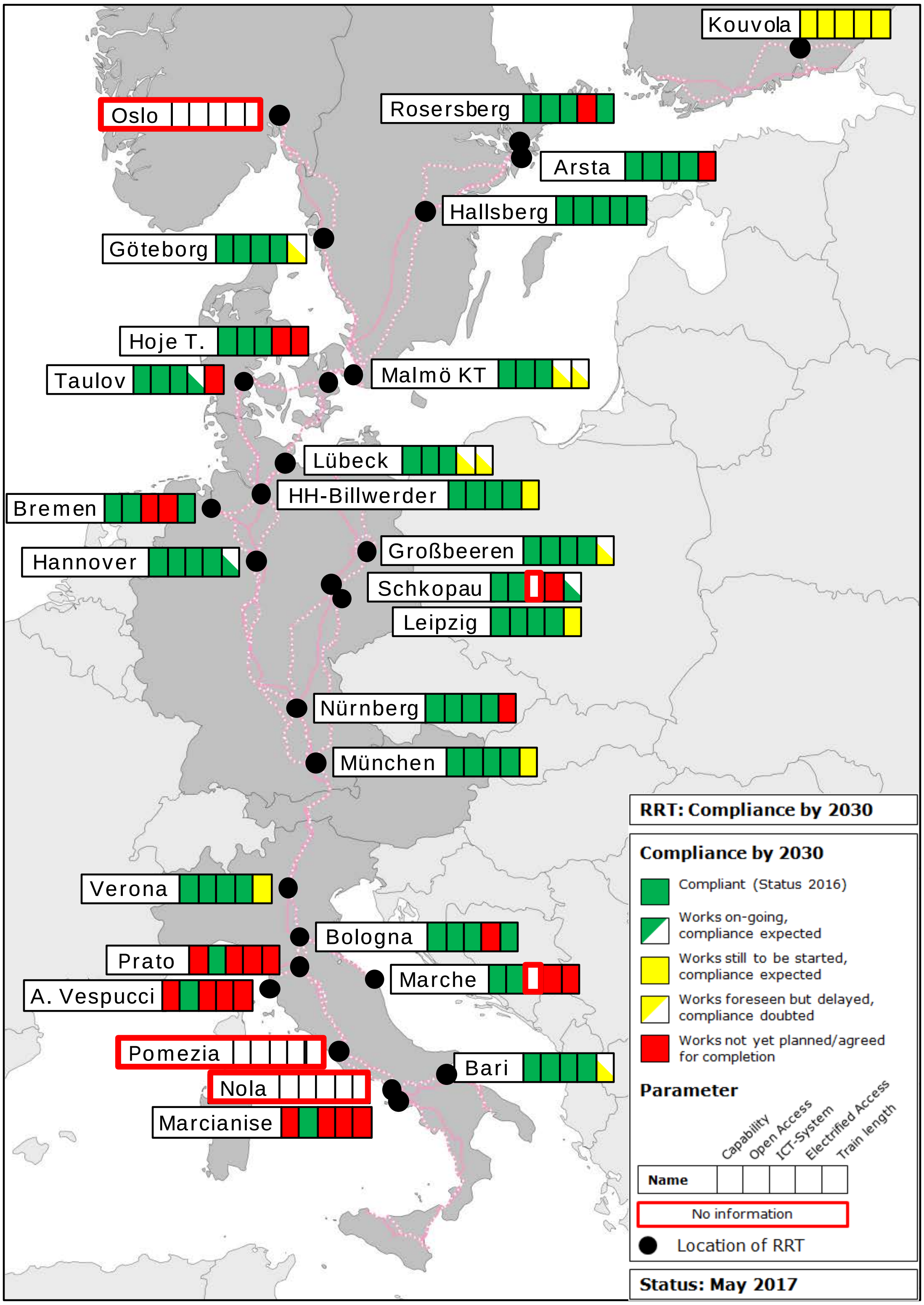
Source: HaCon, May 2017, updated February 2018

Rail-Road Terminals (RRT)

The 28 Rail-Road Terminals of the Scan-Med Corridor are generally connected to rail and road, provide discrimination-free access for their users and are equipped with qualified handling equipment for all types of intermodal loading units. Terminal management systems are widely used (except for one terminal) for providing 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 improvement measures should be taken 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 that their access to rail infrastructure has grown over time (single sided, non-electrified, annex to shunting yard or port railway line), and the limitation of the (wagon) train length by either the reception/departure siding or the transhipment track(s).[32] Alongside the present 4 sites (Rosersberg, Hallsberg, Bremen and Bologna), Kouvola, Hamburg, Berlin-Großbeeren, Munich and Verona are also committed to achieving compliance with the parameter (≥740 m train length) by 2030, while for the other terminals, there are project ideas but “works are not yet planned/agreed for realisation”, so only slight improvement is expected compared to 2016. It is recommended that rail infrastructure managers and terminal managers cooperate in a coordinated way to achieve the track- and terminal-side improvement of that parameter.

[32] However, the TEN-T Regulation does not contain any direct requirements towards rail-road terminals concerning these issues.

Figure 12: Results of the compliance analysis of the Scan-Med Corridor RRT infrastructure



Source: KombiConsult, May 2017, updated February 2018

Maritime Ports and MoS

At present, it seems that the Scan-Med ports will be 100% compliant with 4 of 8 maritime parameters by 2030. In 2030, VTMIS, e-maritime services and SafeSeaNet will be fully implemented in all Scan-Med seaports. I&C Technology and IT and data exchange will be further developed. Moreover, all Scan-Med ports will be equipped with adequate sea access as well as facilities for the reception of ship-generated waste. Current and planned projects are aimed at the ongoing improvement of the abovementioned parameters, so that future demand patterns resulting from further development within the shipping industry (e.g. increase of ship size, stricter environmental constraints and new technologies like EGCS (Exhaust Gas Cleaning System)) will be satisfied. In addition, all Scan-Med ports already possess or will possess at least one terminal that is open to users in a non-discriminatory way, and which applies transparent charges. Hence, open access will be ensured in all Scan-Med ports by the year 2030.

Almost all Scan-Med seaports (92%) implement or plan projects to modernise and expand their capacity. The only seaport that has not communicated such measures and plans is the Port of Oslo. Furthermore, one Scan-Med port (Palermo) has announced a modernisation and expansion project. However, implementation by 2030 is doubtful due to outstanding basic planning and financing issues.

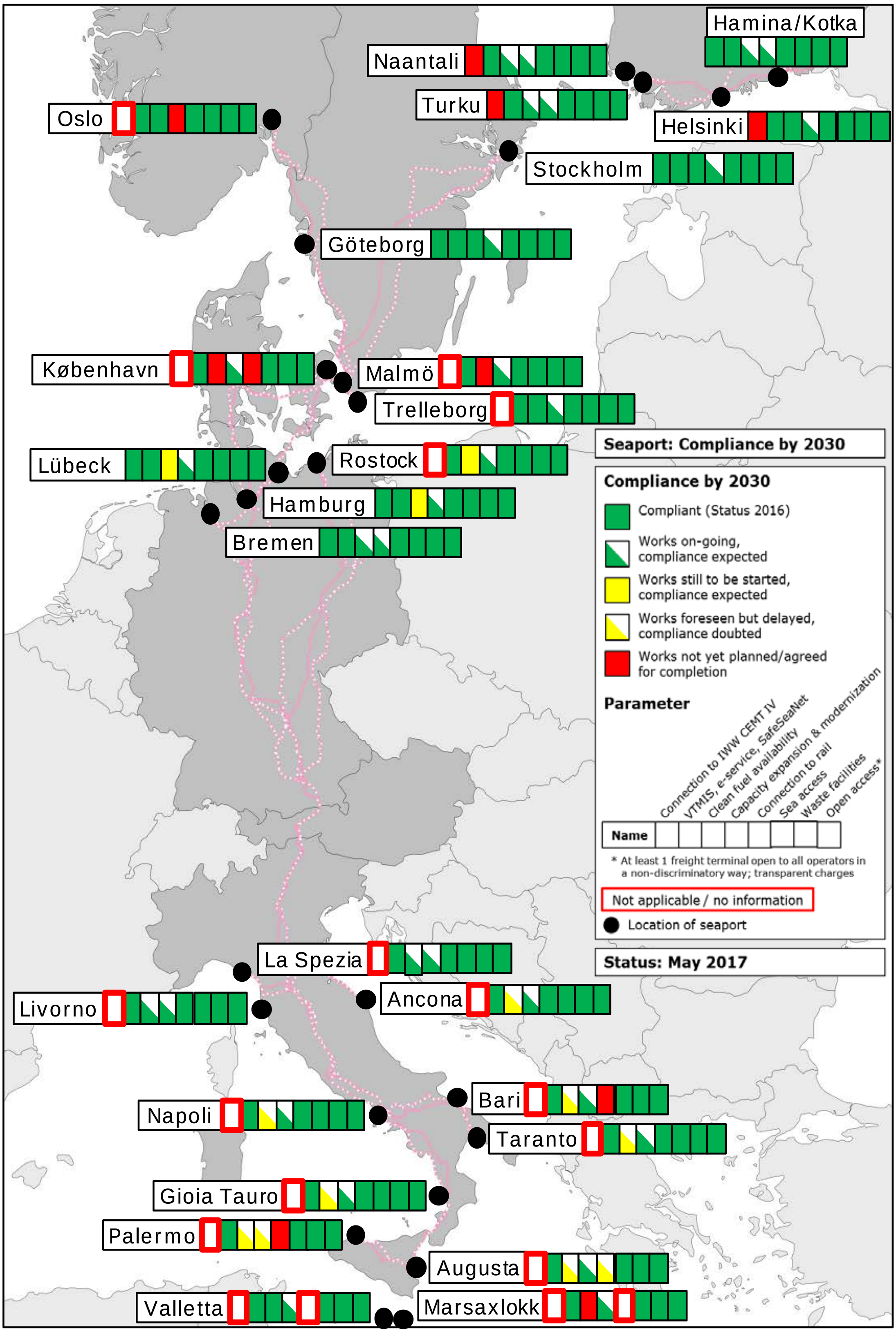
Nineteen of the 25 Scan-Med seaports are already connected with railway lines. As the ports of Valletta and Marsaxlokk in Malta are exempted, the Danish side of CMP (connected to the Scan-Med railway network on the Swedish side) and the ports of Bari, Palermo and Augusta remain the only Scan-Med seaports that are not compliant with this maritime parameter. CMP's strategic plan to move the container terminal in Copenhagen to a new site (Ydre Nordhavn) in 2018 does not foresee a future connection to the railway network on the Danish side of CMP.[33] Therefore it is assumed that it will not be compliant with this parameter in 2030. For Bari and Palermo, no projects aiming at connecting the ports to rail are known. The existing project to create rail access to the port of Augusta is pursued desultorily (preliminary analyses and financing issues are still outstanding). Hence, it is not likely that the project will be concluded before 2030.

While compliance with regard to the 6 above-mentioned parameters is already quite good, a lot of progress is needed in the field of clean fuels deployment. Currently, clean fuels are only available in 24% of the Scan-Med seaports, but many ports plan to make them available by 2030 (at least 60% of the Scan-Med seaports).There are no projects foreseen aimed at connecting an additional Scan-Med port to IWW.

Overall, from today's perspective the Scan-Med Corridor will be fully or at least strongly compliant with most of the maritime parameters in the target year 2030. Nonetheless, it has to be clearly mentioned that the aim of 100% compliance will not be reached if no additional measures are taken.

[33] See: http://www.cmport.com/business/containers

Figure 13: Results of the compliance analysis of the Scan-Med Corridor maritime infrastructure



Source: HPC analysis, July 2017, updated February 2018

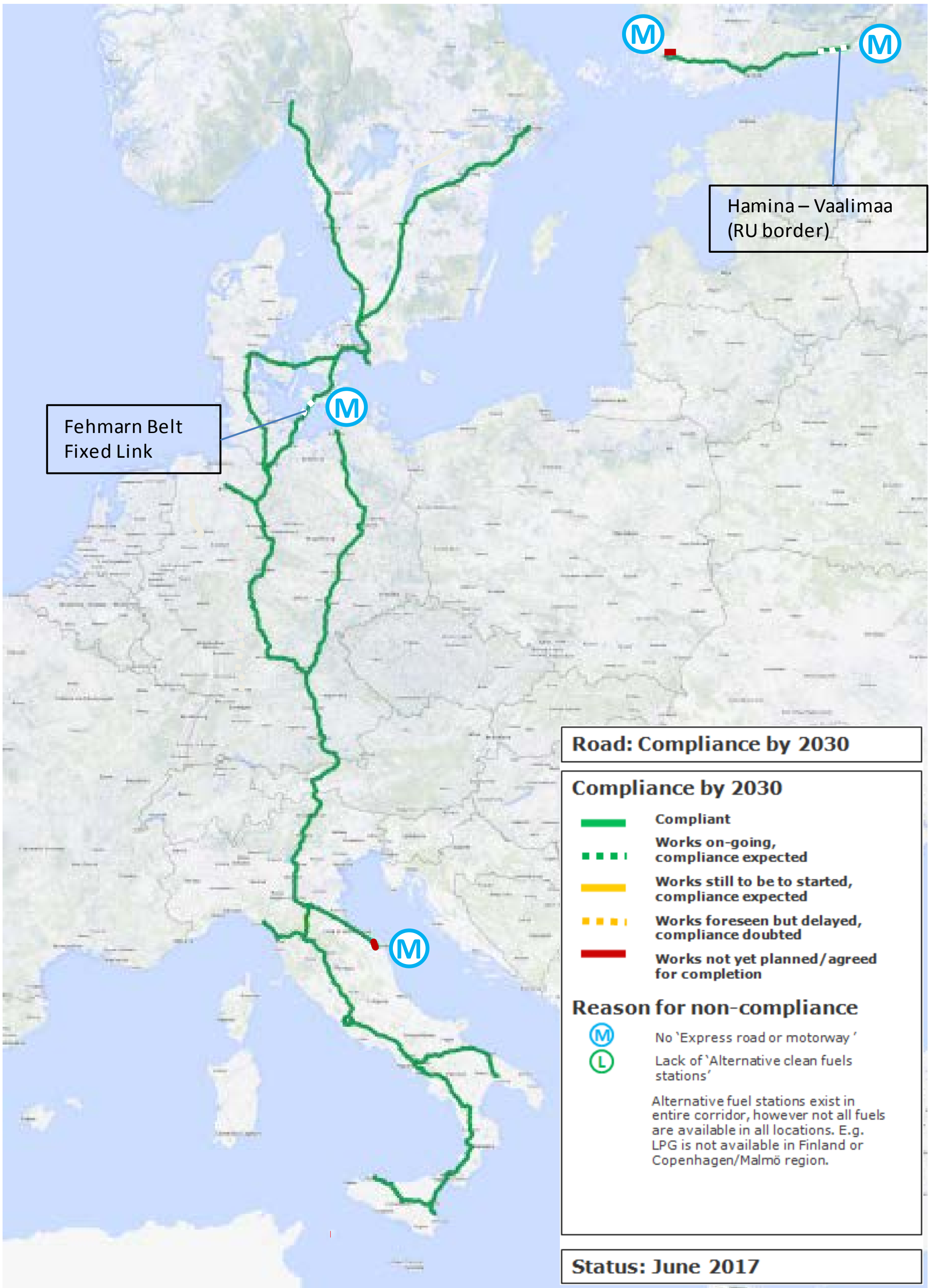
Road transport, including ITS deployment

By 2030 almost 100% of the road sections, with the exception of a small connection in western Finland and another in Italy, will be compliant with the KPI for express road or motorway. The two remaining sections are known to the authorities but have no planned developments at present.

In terms of the general KPI of alternative clean fuels, all sections of the Corridor are covered, however not all clean fuels are readily available in all parts of the Corridor today. The situation in 2030 is unforeseeable as private as well as public investment is necessary for economically viable options to be in place. Some clean energy station projects are included in the 2017 Project List, but most new stations will be developed outside of national plans. There are currently no plans to introduce LPG (Liquefied petroleum gas) stations in Finland or in the Copenhagen-Malmö region, but these might eventually be built by 2030.

The development of clean fuels has therefore been identified as one of the subjects of “Flagship Projects” (see chapter 7).

Figure 14: Results of the compliance analysis of the Scan-Med Corridor road infrastructure[34]



Source: Ramböll analysis, June 2017

34 In Malta the road connection between the ports of Valletta and Marsaxlokk via Luqa airport are part of the Scan-Med Corridor. Road access to the port of Valletta has been considered in the analysis.

Airports

The analysis of the Project List in terms of contributions to specific objectives (open access, Single European Sky, capacity, connection with rail, availability of clean fuels) has shown a heterogeneous pattern.

A high number of Scan-Med Corridor airports highlight a need for further capacity. Projects aimed at improving capacity are underway, and the foreseen outcome will allow the stakeholders to achieve compliance with the objective set out in the Regulation. The opening of Berlin Brandenburg Airport would constitute a substantial improvement of airport capacity on the Corridor.

27 projects are expected to improve the Corridor's compliance with the Regulation. They involve the following airports: Finland: Helsinki Vantaa; Norway: Oslo Gardermoen Airport; Sweden: Stockholm Arlanda; Denmark: Kobenhavn Kastrup; Germany: Berlin Brandenburg, Bremen, Hannover-Langenhagen, Leipzig-Halle, Munich; Italy: Bologna Guglielmo Marconi, Roma Fiumicino, Napoli Capodichino and Malta: Valletta Luqa. The airports of Gothenburg Landvetter (Sweden) and Hamburg (Germany) require further action in order to expand capacity.

Concerning the **connection with rail**, in 2030, 16 out of 19 airports will offer multimodal connectivity. Considering that (only) “main airports” are required to fulfil the “rail connection” target by 2050, the related KPI has already been achieved.

Moreover, the following projects are expected to improve the Corridor's compliance with the Regulation: Finland: the multimodal Helsinki node; Sweden: Gothenburg-Borås Project; Germany: Study on additional railway links to Hamburg Airport; Italy: Bologna People Mover and Metropolitana di Napoli. Turku/Naantali in Finland, Malmo Sturup in Sweden, and Luqa airport (Malta) are exempted from the Regulation requirement.

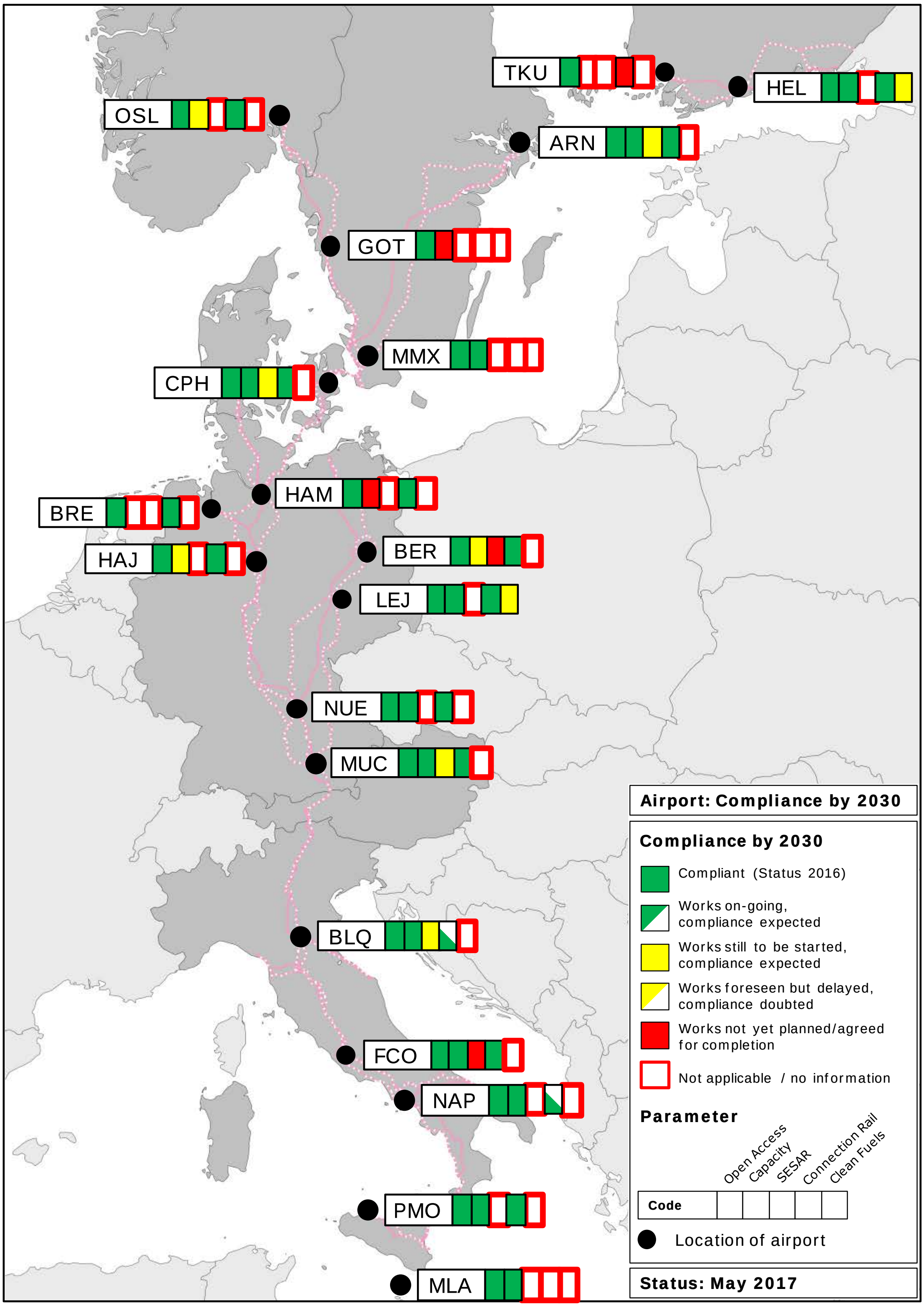
The two remaining targets, SESAR and clean fuels, highlight a different degree of expected compliance, meaning more effort is required in the coming years in terms of measures aimed at achieving said two targets.

In particular, implementation actions for the **Single European Sky** objective are in their early stages, and will begin to bear fruits in the coming years. However, 15 projects along the corridor are expected to be implemented until 2030 (8 in Sweden, 3 in Germany and Malta, 1 in Denmark).Looking at the development across Europe, the 2015 SESAR deployment manager reports information on 299 projects, showing a substantial progress with more than 20% of projects completed, and 75% ongoing.

With regard to the **availability of clean fuels**, only 4 projects (for 3 airports, Helsinki Vantaa, Leipzig-Halle, Napoli Capodichino) will contribute to achieving the compliance objective. For all others, further action is required.

The following figure illustrates the compliance of Scan-Med airports with the selected TEN-T Regulation requirements in the year 2030.

Figure 15: Results of the compliance analysis of the Scan-Med Corridor airports infrastructure



Source: GruppoCLAS analysis, May 2017, updated February 2018

5.3 Persisting bottlenecks (all modes)

The following section identifies critical issues by Member State

Railway Infrastructure

Finland is somewhat isolated from the rest of the Scan-Med rail infrastructure and is therefore exempted from complying with the European rail gauge standard. Concerning this parameter, the Finnish rail network is similar to the Russian network. A comprehensive view of the future of the Finnish railway system within Europe focuses on the Scan-Med Corridor for east-west traffic and the North Sea-Baltic Corridor for north-south traffic. Both corridors are interrelated at the node of Helsinki. Consequently, some major rail projects are located in that urban node, aimed at improving network capacity. For example: Ring rail to Helsinki Airport (the project has been completed), improvements near Helsinki end station (new track to Pasila, urban rail to Espoo, improvements at Helsinki yard) and the separation of commuter and long-distance trains to their own tracks (city rail loop), as well as the port connection. These are complemented by a measure in the freight terminal Kouvola (RRT). Further measures to mitigate additional critical issues are, in particular:

- Repairs to areas with ground frost damage and soft soils along main railway lines;
- A new shortcut railway Espoo – Lohja - Salo on the Helsinki - Turku section;
- Investigation of the Helsinki – Turku - Tampere triangle;
- Improvements to service levels along the railway section Kouvola – Kotka/Hamina: Several improvement measures for the railway yards, as well as for various railway and road sections (combined rail and road project);
- The current railway connection from the Russian border to Helsinki, which is one of the pre-identified sections included in the TEN-T Regulation, has insufficient capacity for the growing passenger and cargo volumes. A new border crossing point, especially for rail freight, is planned in Imatra to complement the existing Vainikkala border station that faces the continuously growing demand for Allegro trains between Helsinki and St. Petersburg;
- Implementation of ERMTS.

The technical parameters are fulfilled by the **Swedish** rail network, with the exception of the freight train length of 740 m and the implementation of parts the Corridor with ERTMS Stockholm – Malmö, Hallsberg – Katrineholm, Hallsberg – Mjölby. The main concerns result from current and even more ambitious future passenger and freight volumes to be transported by rail. In order to link major urban areas across Norway, Sweden, and Denmark with reasonable travel times, the network lines need to be upgraded or newly built, both in the designated urban nodes of Stockholm, Gothenburg and Malmö, as well as the relevant sections in between these nodes, in particular:

- Stockholm C – Stockholm Södra;
- Citybanan: tunnel under central Stockholm with two new stations (opened in July 2017);

- Ostlänken: new 2-track line for HS Trains on section Linköping – Järna;
- Hallsberg - Åsbro - Dunsjö - Degerön (-Mjölby): upgrade to 2-track and grade separation (elimination of level crossings) on respective sections;
- Malmö – Jönköping: HS Link study;
- Oslo-Gothenburg: studies and measures for improved capacity, travel time and quality of the cross-border section;
- Western Sweden/Gothenburg: different improvement measures including a city tunnel "West link project";
- Gothenburg: Olskroken (grade separation);
- Western and Southern Sweden: Western Main Line Ängelholm – Maria station, Åstorp – Teckomotorp - Arlöv (expansion and new stations);
- Varberg-Hamra (new 2-track), Western Main Line;
- Southern Main Line Arlöv – Lund (two sections with improvement works);
- Skåne region: capacity enhancement measures.

The Hallandsås 2-track tunnel has been opened in 2015.

The technical parameters (axle load, line speed for freight trains) are fulfilled by the **Norwegian** rail network, with the exception of the required freight train length of 740 m and the implementation of ERTMS. However, parts of the Oslo – Gothenburg link have a capacity constraint due to single-track sections between Ski (some 25km south of Oslo) to Halden, close to the Swedish border. Further south from Halden, over Kornsjö to Öxnered, a dual track line is also missing. Furthermore, there are two sections of the link with critical gradients above 12.5 ‰. They are Tistedalen, southbound between Halden and the Swedish border and Brynsbakken (in Oslo), northbound, both with 25 ‰ gradient (Network Statement 2016). The Tistedalen section is part of the Oslo – Gothenburg study, e.g. Halden – Swedish border, while the latter is not part of any study at this moment. The following sections are currently in the construction or planning stage:

- Oslo – Ski: 2-track tunnel under construction, enhancing capacity from two to 4 tracks;
- Sandbukta – Moss – Såstad: New 2-track line is in a construction planning phase;
- Haug (Råde) – Halden: new 2-track section. Preliminary planning stages are completed;
- Oslo – Gothenburg: studies and measures for improved capacity, travel time and quality of the cross-border section.

The technical parameters (axle load, line speed for freight trains) are fulfilled by the **Danish** rail network, with the exception of some areas that do not meet requirements in terms of full electrification, implementation of ERTMS, and at least 740 m freight train length on all sections. This will change in the next few years with planned projects. Currently, interoperability on the border crossing sections Malmö/Copenhagen and Padborg/Hamburg is achieved by multi-system locomotives of the railway undertakings and transition rules. Like in Sweden, current and even more ambitious future passenger and freight volumes by rail[35][36] cause concern. Consequently, network lines need to be upgraded or newly built, both in the urban node Copenhagen and the relevant sections connecting it to Sweden and Germany. Additional capacity, reduction of travel time and more efficient rail operations can be achieved, in particular through the following:

- Full attention to the completion of the Fehmarn Belt Fixed Link for road and rail by 2028 (timing depends on the plan approval in Germany);
- Ringsted – Fehmarn (northern access line of the Fehmarn Belt Fixed Link): Upgrade and renew the 115 km long railway line to a new, future-proof line (electrification, double track, 200 km/h speed, and allowing for 1,000 metre-long rail freight trains);
- New Storstrøm Bridge (primarily rail, but also includes road and bicycle lanes);
- Capacity increase on the Øresund railway line to eliminate potential future bottlenecks;
- Increase the capacity of Copenhagen central station through development of Ny Ellebjerg station;
- New HS rail line between Copenhagen and Ringsted via Køge (up to 250 km/h for passenger trains); expected opening mid-2019.
- Speed increase Ringsted-- Odense; pending final political decision.
- New railway line on Western Funen Kauslunde – Odense of approximately 35 km; pending final political decision.
- After construction of a 2-track line between Vamdrup and Vojens (opened in 2015). Now the section Tinglev - Padborg, just north of the DK-DE border, is the only remaining single-track section on the current main rail freight line between Malmö/Copenhagen and Hamburg via The Great Belt Bridge. Construction of double track on this section would increase capacity on the Scan-Med Corridor further. However, as of yet, a political decision has not been taken to go ahead with the project;
- ERTMS Level 2, Baseline 3 on the entire conventional railway network in Denmark expected by 2030 (to be implemented gradually).

As regards the capacity increase at Copenhagen Central Station, the construction act of a fly-over at Ny Ellebjerg, which is the first element in developing Ny Ellebjerg Station, was passed in April 2015. The construction works are progressing.

The Danish Parliament passed a construction act approving the Fehmarn Belt Fixed Link in April 2015. In May 2016, contracts for the major construction works were signed, but commencement of the construction works awaits planning approval from the German authorities. It is the common goal of the German and Danish authorities as well as the Danish state-owned project company, Femern A/S that the German plan

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[35] Recent data as per Trafik-og Byggestyrelsen: "Fremme af Gods på Bane", Transport- og Bygningsudvalget 2015-16, TRU Alm.del Bilag 141.

[36] The recent Danish forecast (Trafikplan 2017-32) indicates that the yearly growth in rail freight will be between 1-3 pct. However it is expected that most of this growth will not result in more traffic since rail freight services is expected to be more efficient (carry more freight pr. train kilometer).

approval is issued before the end of 2018. However, the planning approval in Germany may be subject to appeal to the Federal Administrative Court. In this case, the major construction works will commence in 2020 with an expected opening in 2028.

The Ringsted - Rødby railway line was approved when the Danish Parliament passed the construction act approving the Fehmarn Belt project in April 2015. In March 2016, it was politically decided to begin the construction works on the northern part of the Ringsted - Rødby railway line. The construction works are progressing. In 2021, the section between Ringsted and Nykøbing Falster will be upgraded to double track. A plan for the deployment of ERTMS on the line is currently being consolidated and is expected during 2018. By 2024, the section will be electrified. The construction works on the southern part between Nykøbing Falster and Rødby will start soon enough to ensure that the section will be upgraded before the opening of the fixed link.

In 2015, the construction act for the New Storstrøm Bridge was passed by the Danish Parliament, and in 2016 it was decided to advance the construction works. The construction works will begin in 2018. The road section is planned to be ready in 2022 and the rail section in 2023[37], as opposed to 2024 as previously planned.

Despite the high technical standard of the **German** rail network, some parameters are not met along entire sections of the Scan-Med, e.g. electrification, line speed and ERTMS implementation. Multi-system locomotives and transition rules currently achieve interoperability on border crossing sections Padborg/Hamburg. More ambitious passenger and freight volumes by rail require upgraded or newly built lines, both in the urban nodes and the relevant access lines connecting with Denmark and Austria. Denmark is reached in two ways: via Jutland and the Fehmarn Belt, involving the Fixed Link as a combined rail and road tunnel. Austria is reached at the Kufstein border station.

The following measures could mitigate critical issues on the German rail network:

- Completion of the Fehmarn Belt Fixed Link by the end of 2026-2028. The electrification, upgrade to double track and partially 200 km/h of the Lübeck – Puttgarden railway line (southern access line of the Fehmarn Belt Fixed Link) will be completed in due time with the opening of the Fixed Link 2026/2028. Furthermore, a reasonable and economically viable solution for the upgrade/replacement of Fehmarnsund bridge must be found;
- ERTMS deployment of the main freight corridors with clear timelines, in particular the entry points (detailed information was provided for in the ERTMS Coordinator's 2nd Work Plan, while the present ERTMS EDP distinguishes between sections and dates as either "by" or "after" 2023);
- Increasing capacity of Hamburg and Bremen nodes;
- Realisation of high priority improvements ("optimized Alpha E project") of the railway network (as foreseen in the "Bundesverkehrswegeplan 2030"). For the

[37] Source: www.vejdirektoratet.dk, 24.10.2017.

optimized Alpha E project the cost benefit analysis and the infrastructure planning phase have started. The operational and capacity benefit is currently under discussion. The start date of the project depends on the results of the analyses. Thus, completion by 2030 is doubtful and seen as a risk;

- Realisation of high priority improvements of the railway network (as foreseen in the “Bundesverkehrswegeplan 2030” on the lines Ingolstadt – Munich (until 2019), node Munich;
- Expansion of rail routes from the port of Rostock (remaining 20 km) to an axle load of 25 tons;
- New lines/Upgrades on VDE (Verkehrsprojekte Deutsche Einheit) 8.2 Erfurt - Halle/Leipzig (opened in 2015), VDE 8.1
- Nuremberg – Erfurt (will open in 2017[38]);
- Identification of basic parameters for a possible extension/upgrade for the Brenner Tunnel northern access, under a bilateral agreement between Austria and Germany (joint planning area);
- Flexible coordination and definition of market-attractive train paths on mixed lines, in particular around the nodes of Hamburg, Bremen, Hannover, Nuremberg and Munich, taking into consideration the specific needs of passenger transport;
- Improve technical parameters, by electrification of the 188 km railway line between Hof and Regensburg Hbf and by increasing capacity thanks to a third track between Regensburg and Obertraubling;
- Regional projects in the Capital Region Berlin-Brandenburg, such as the improvement of the rail connections to the terminals/freight villages and intermodal freight capacities[39].

  The following issues are to be coordinated between **Germany and Austria** (border crossing project):

- Timely completion of studies and works on the remaining parts of the northern access lines to the Brenner Base Tunnel in the area of Kundl/Radfeld – Schaftenau (Kufstein) – Rosenheim – Munich. A joint project preparation analysis has been agreed upon between Germany and Austria for the section Schaftenau – Rosenheim area and is currently carried out by DB Netz and ÖBB respectively. The adjacent sections to the south and north fall under the competencies of the respective infrastructure managers[40]. The start date of the project depends on the results of the analyses. Thus, completion by 2030 is doubtful and seen as a risk.

On the **Austrian** section of the Scan-Med Corridor, the technical parameters are achieved, with the exception of line speed on the present Brenner mountain line, which is below standard. Due to the slope, the train length (in connection with its weight) is also limited. However, Austria has made considerable progress with building

[38] Erfurt – Nuremberg was opened after final analysis of the project list on 10 December 2017.

[39] These projects will only be funded from the federal budget when they are part of the “requirement plan”.

[40] The planning process of the section Kundl/Radfeld – Schaftenau (Kufstein) is in progress, next step will be the submission of the environmental impact report in 2019. In the joint planning area between Schaftenau (AT) and the Rosenheim area (DE) also a demand-oriented capacity expansion of an additional double-track line is foreseen (expected finalisation after 2030).

the new Unterinntal railway line for high-speed passenger and freight trains. Interoperability on two border crossings (Kufstein, Brenner/Brennero) is currently achieved by multi-system locomotives of the railway undertakings and respective transition rules, which had to be modified in conjunction with the implementation of ETCS level 2 between Kufstein and Brenner. As in other countries on the Scan-Med Corridor, high ambition levels as regards rail freight and passengers traffic are expected to put pressure on the infrastructure network in the future. In order to meet these ambitious goals, the network lines need to be upgraded, newly built, or completed as follows:

- Full attention to the completion of the Brenner Base Tunnel mitigating the inherent risk elements such as financing, environmental assessment, involvement of civil society; All civil works on Italian territory have been tendered and are under construction; While the main tunnel section Tulfes – Pfons has been under construction since 19 March 2015, the Austrian tunnel section Pfons – Brenner is due to start in the first months of 2018;
- Short term infrastructural, operational and regulatory measures on the section Munich – Verona, to improve interoperability, the quality of service and efficiency until the base tunnel is in operation;
- Reconstruction of the railway station Schwaz and improvement of the freight station Hall i.T.

Further measures as part of the "framework programme 2016-2021": Data networks and mobile radio, train condition checkpoints.

On the **Italian** sections of the Scan-Med Corridor, several technical parameters, with the exception of 1435 mm gauge and electrification, are not yet fully achieved. Axle loads are compliant with the standard parameter in Regulation 1315/2013 in most line sections of the Corridor (82%). The lines Rome - Naples (via Cassino) and Salerno - Battipaglia are planned to be upgraded by 2021 and 2026. Train length is below 740 m on the Brenner line to Florence/Ancona (600 m) and on many sections in Italy south of Firenze (400/600 m). Upgrading to 750 m track length is planned on most line sections, starting from Brennero - Bologna, to be achieved in 2018. Loading profile for the transport of semi-trailers ("P400")[41] on the current lines in Italy is ensured between Bologna and Brennero and between Bologna and Ancona. Upgrading works are planned on most remaining corridor lines until 2026. Interoperability on the Brenner border crossing (Brenner/Brennero) is currently achieved by multi-system locomotives of the railway undertakings and transition rules, which will have to be modified in conjunction with the implementation of ETCS level 2 between Kufstein and Brenner and in Italy. The network lines have to be upgraded, newly built or completed as follows[42]:

[41] The loading profile "P400" is not part of the objectives included in Regulation (EU) 1315/2013. It is however of significant importance for capturing additional freight from road and to supply competitive advantages for rail freight transportation.
[42] The technical nature of the measures is described in detail in the Final Report on the Project List and the Preliminary Report on the Elements of the Work Plan which is annexed to this Work Plan.

- Timely completion of the studies and works on the remaining parts of the southern access lines to the Brenner Base Tunnel (section Fortezza – Verona including bypasses and nodes of Bolzano, Trento and Verona); the southern access to the Brenner Base Tunnel is divided in several parts. The upgrade of the railway line Fortezza – Ponte Gardena has been approved by Cipe (incl. budget) and the preliminary planning phase has started. Thus, the section Fortezza – Ponte Gardena is foreseen to be completed in line with the implementation of the BBT. However, the adjacent section south of it (Ponte Gardena – Bolzano) is foreseen to be completed only after 2030, and costs of the works are unknown. Even if capacity might not be an issue immediately after the opening of the tunnel, the operations concept for switching between the present mountain line and the new line should be clarified with RFI and the railway undertakings using the line.
- Short term infrastructural, operational and regulatory measures on the section Munich - Verona, in particular the Brenner/Brennero station, to improve interoperability, quality of service and efficiency until the base tunnel is in operation;
- Upgrading, including doubling of tracks, completion of sections and increasing speed: Naples – Bari HSL, Messina - Catania – Palermo, Salerno - Reggio Calabria, Bologna - Ancona/Bari – Taranto, Bologna - Florence - Pisa - Livorno/La Spezia, Florence - Rome - Naples - Salerno;
- ERTMS equipment: Naples – Bari HSL, Naples – Reggio Calabria, Brennero – Verona, Verona – Bologna, Bologna – Ancona, Bologna – Florence, Florence – Pisa – La Spezia – Livorno - Rome, Florence – Rome, Rome – Naples, Messina – Catania – Palermo, Bicocca – Augusta;
- Technical and infrastructural upgrade of the following nodes: Bari, Palermo, Florence, Falconara/Ancona, Naples, Foggia, Salerno, Verona high-speed node, Catania, Rome.

On various sections, which are to be identified by RFI in detail, the present non-compliance with technical standards shall be mitigated:

- Compliance with TSI in stations: improve accessibility, service quality and compliance with TSI;
- Elimination of level crossings: improving safety;
- Improving maximum axle weight to 22.5 tonne/axle;
- Deployment of ERTMS trackside equipment;
- Improving maximum speed on HS "antenna" lines: improving the maximum speed allowed on lines feeding the HS network on Scan-Med Corridor;
- Increasing line speed: compliance with standard of 100 km/h line speed for freight.
- Elimination of speed restriction on conventional railway line between Firenze-Rovezzano, Figline Valdarno and Arezzo.

In order to connect the Rail Road Terminals to international rail freight transport via Brenner/Brennero, it is essential that their access and the aligned rail infrastructure provide for the loading profile P 400. Upgrading to that standard in Italy should therefore begin in the north (Bologna/Florence) and progress south so that respective sections will become effective to the market stepwise.

A further priority would be to exploit the possibilities of permitting a higher train length in Northern Germany, Denmark and Sweden. Between Maschen (Hamburg) and Padborg towards the Copenhagen – Øresund Bridge, and in the future also, through the Fehmarn Belt Fixed Link, a train length of 835m is permitted under specific circumstances. Between Malmö and the largest Swedish rail yard in Hallsberg, it is currently possible to allow trains up to 730m, upon specific request to the annual timetable coordinator.[43]

Road Infrastructure

Despite good practice in cross-border road projects, such as the completion and operation of the Øresund Bridge, some critical issues regarding road transport should be noted. The 2nd generation of the Work Plan lists critical issues of a general nature. An indicative detailed list of concrete measures per country is available for information in the Final Report on Elements of the Work Plan (August 2017).

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. Some examples of the projects to eliminate the capacity bottlenecks:

- In Finland the E18 Hamina–Vaalimaa motorway will be built just north of the existing road. The current highway will be improved to match the new traffic situation, to reduce noise pollution and to protect groundwater in the area. The construction will be completed in spring 2018. In Helsinki region several capacity and traffic management improvement measures were implemented in the project E18 Ring Road III, the second phase, to eliminate the capacity bottlenecks. The project was concluded in 2015.
- In Stockholm region several projects aim to improve capacity and accessibility. Minor improvements of existing roads and traffic management measures on Haga södra-Kista were concluded in 2015. Other measures on E4 and E18 in increasing capacity and traffic safety will be concluded until 2019. However, the largest investment increasing road capacity in Stockholm region is building of the E4 Stockholm bypass. It is planned to be concluded in 2025. Also in Gothenburg and Malmö road measures target capacity improvements.
- In December 2017, the Danish Parliament adopted the construction of two additional lanes (one in each direction) on the motorway of Western Funen, the section Odense West – Nørre Aaby, thereby eliminating a significant current capacity bottleneck on the Corridor. The project is expected to be completed by 2022. In October 2017, the expansion of the Køge Bugt Motorway south of Copen-hagen was completed, eliminating a significant bottleneck on the Corridor.
- In Germany several projects aim to improve capacity and accessibility. As an example, in Hamburg region the project A 7 motorway: upgrade to 6-8 lanes

[43] See report https://trafikverket.ineko.se/se/tv000260 about the possibilities of running longer and heavier trains on existing network.

between Hamburg/NW (A 23) and Hamburg-Othmarschen (to be concluded by 2020) as well as A 7 Hochstraße Elbmarsch: upgrade to 8 lanes (to be concluded by 2023), target capacity improvements.

- In Innsbruck region the projects of the A 13 Rehabiltation Bergisel tunnel and Sill bridge 1 (concluded in 2016) as well as the A 13 safety upgrading of main carriageways and reconstruction of junction Innsbruck south (to be concluded by 2022) will have impacts on capacity and accessibility.
- Also in Italy several projects aim to improve capacity and accessibility. As an example, in Bologna region the projects of the upgrade of motorway connection between Bologna and Casalecchio (concluded in 2015), the realization of the metropolitan expressway road north of the A14 between Ozzano and Bologna (to be concluded by 2020) as well as the upgrading of the Bologna tolled A14 and un-tolled ring roads (to be concluded by 2021) can be mentioned.

Availability of a variety of alternative fuels and filling stations is needed along the entire corridor. The location or co-location of stations for alternative fuels should be agreed. Information systems and ITS solutions to inform and steer the traffic to/from desired routes must be implemented to avoid delays or accidents further down the network, to re-route in case of big events or simply to control the traffic flows via traffic metering. The Regulation also requires safe parking facilities along the route. General developments of vehicle technology, emission regulations, weights and dimensions regulation etc. could also have a significant effect on the Scan-Med Corridor. "Greening" is also an important element of the Corridor. Projects such as SWIFTLY Green can provide concrete advice on issues such as reducing noise and air emissions as well as increased environmental efficiency by mode. Finally, there is 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 Sweden and Finland. Denmark is testing the same vehicle dimensions on the major road network (including all state roads and national roads). The potential benefits of this solution are a better use of available capacity, as well as lower emissions per ton transported and lower costs. Others (Austria and Italy) remain concerned with regard to larger trucks as they fear an additional reason for deferring the intended shift of freight traffic from road to rail. Germany has started field tests on some roads for selected applicants that are ongoing, by an enlargement of the length of roads included in it, whereas Austria and Italy have already stated that they will not accept such vehicles.

Airports

In general, airports of the core nodes aligned with the Corridor suffer from saturated road access at peak times and capacity enlargement plans that are frequently disputed at local level. The early completion of Berlin-Brandenburg remains a key TEN-T corridor objective. Airport managers, industry representatives and residents impacted by the noise and other airport emissions, and the resulting air and land traffic, are discussing whether and how the capacity can be increased in a sustainable way.

Capacity enlargement plans are ongoing in all highlighted airports except for Gothenburg and Hamburg which, at this time, do not envisage infrastructural measures aimed at increasing capacity.

Almost all the airports are expected to comply with the Regulation in terms of multimodality and rail accessibility. A few cases will not comply due to the fact that the investment required would have been excessive with respect to the expected traffic flow and thus to the related benefit.

For the Scan-Med airports of Helsinki, Stockholm, Berlin, Hamburg, Munich and Rome, the possibility and necessity for a connection to the high-speed railway network has to be analysed and studied by these airports and regional stakeholders.

As regards airports, detailed measures and associated projects have been identified jointly with the stakeholders concerned. The indicative list is annexed to the Final Report on Elements of the Work Plan (August 2017).

Seaports

Although the Scan-Med core ports have railway access to the hinterland the number of railway tracks 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 extension and equipping of existing tracks an upgrading of handling operations at rail terminals. Only in case of adequate and matched 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 (e.g. HaminaKotka, Helsinki, Turku/Naantali, and Stockholm). It is of high importance to reconsider the impact of climate change and, in consequence, the higher likelihood of extreme weather, including very cold periods also in the Southern Baltic Sea.

Regulation (EU) 1315/2013 and other EU legislation on sustainability, energy efficiency and CO2 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.

With regard to progress on these issues, discrepancies can be observed between the northern ports and the rest of the ports of the Scan-Med Corridor. Many ports within the Emission Control Area (ECA) of the North and Baltic Sea have already established or are planning LNG bunkering facilities. In particular, Scandinavian and Finish ports already provide LNG for ships and ferries, or the appropriate facilities are under construction or planned. Planning for LNG facilities is at an early and conceptual phase at most of the ports in Germany and in the southern part of the Corridor so that much still needs to be done to fulfil the objective of the availability of alternative clean fuels by 2030.By having two advanced projects covering the supply side on the one hand, and the demand side on the other, the port of Bremen is an exception in Germany within this field. Both of these projects are CEF-funded.

Since January 2015, ships operating in the Emission Control Areas (ECAs) of the Baltic Sea and the North Sea face the challenge of the IMO conventions on emissions. The sulphur content of fumes has to be below 0.10% in these waters. These requirements can be fulfilled with the help of a so called EGCS (Exhaust Gas Cleaning System) (which are treating the fumes), the use of cleaner but more expensive fuel oil (Marine Gas Oil) or the use of alternative clean fuels (LNG and methanol). Outside the ECAs in the Mediterranean, the limit on maritime emissions will become stricter from January 2020 to January 2025. The limit on sulphur content will drop from 3.50% to 0.50%.

This issue is not directly linked to the land-based corridor approach since it targets operations at sea. However, it directly affects ferry lines operating in this area. Since the new regulations took effect in the North Sea and the Baltic Sea, oil prices have been low, mitigating the cost implications for operators. The low oil prices unburden the operators from increased costs for maritime fuels. The longer-term implications remain to be seen, if and when oil prices return to a higher plateau.

Within the area of seaports, critical issues, measures and projects have been identified jointly with the stakeholders concerned and are included in the List of Projects.

Rail-Road Terminals

With respect to rail-road terminals, the critical issues generally relate to rail and road access as well as handling and intermediate storage capacity. Recently completed enlargement programmes, initiated along the Corridor by the “Brenner Action Plan of 2003”, and updated in the “Action Plan Brenner 2009”, have resulted in sufficient capacity for the current traffic demand. The total capacity utilisation rate of the related terminals in the year 2015 was 58%. However, with ranges between 10% and 114% of the nominal capacity, action is required at some sites, such as Hannover, where a new Mega hub terminal is to be built. Among the good practices observed were double-sided electrified rail access, e.g. in Hamburg-Billwerder and Munich-Riem, and the replacement of old equipment by modern Rail Mounted Gantry Cranes, e.g. in Stockholm-Arsta or Rostock.

The Development concept 2025 for intermodal transport in Germany[44] highlighted the future capacity needs by location area (instead of single terminals) and suggested a continuation of successful financial support for infrastructure construction. According to concept, the growth of the intermodal market volume requires an increase of

[44] Entwicklungskonzept KV 2025 in Deutschland als Entscheidungshilfe für die Bewilligungsbehörden, Aktenzeichen Z14/SEV/288.3/1154/UI32;UI32/3141.4/1, Abschlussbericht, Hannover, Frankfurt am Main, November 2012.

handling capacity in several terminal areas, while leaving the decision on the exact terminal and improvement measure to the private sector.

The results of the compliance analysis, the conclusions of the Ideas Laboratory in Verona 2016 and the present Project List show that the supply of efficient access for trains with maximum permitted parameters (≥ 740 trains length, electrified), the offering of buffer storage capacity and the further improvement of ICT systems to connect with other mode operators more efficiently, are among the critical issues with regards to Rail-Road terminals.

Multimodal Dimension

Multimodality has many dimensions. Article 3 (n) of Regulation (EU) 1315/2013 defines, “multimodal transport” as “the carriage of passengers or freight, or both, using two or more modes of transport”. In the first phase of the Corridor analysis, the focus was on the port-rail dimension. Several measures were identified, for example the construction of a new Railroad Bridge Kattwyk and track doubling Nordkurve Kornweide in Hamburg as well as the Gothenburg the Port line (upgrade to double track). Needs to upgrade or construct railway lines were further identified for Italian ports (Ancona, Taranto, Naples, Gioia Tauro, Bari, Palermo, Augusta and Livorno) and for the port of Lübeck. Upgrading and construction of railway links near ports should also be taken into consideration (last-mile connection) when linking the ports to their hinterland.

Other dimensions taken into account are the following:

- Road, Rail and Sea: renewal of road, sea and rail traffic control systems in Finland (nationwide);
- Multimodal passenger traffic: long distance commuting in Helsinki;
- Enhanced and developed multimodal passenger transport in the urban node Norrkoping;
- Seaport and MoS: Improvements of maritime access as well as infrastructure and services for alternative fuels, development of intermodality and e-Freight, studies and potential services for further cross-border port interconnections;
- Rail and Airport: airport connections, upgrading of rail link and stations (Gothenburg-Landvetter, Hamburg, Catania Fontanarossa, Rome Fiumicino);
- Rail and Road: Fehmarn Belt Fixed Link, renovation and redesign of road and rail connections of the container terminal Burchardkai (Hamburg);
- Rail and Rail Road Terminals: new public siding in Bari Lamasinata Freight Village, improving of capacity of Verona Quadrante Europa terminal.

The multimodal dimension was amplified by the results of the analysis of the “urban nodes”, which was completed in June 2017 and presented in the Final Report on Elements of the Work Plan (see chapter 4.3).

5.4 Persisting Administrative & Operational barriers

Rail Infrastructure

Administrative and operational barriers occur at several corridor levels with respective consequences on interoperability.

Interoperability on the long haul

For long-haul train runs, the main technical and operational barriers on the Scan-Med Corridor can be summarised as follows:

- The required parts of the corridor are entirely equipped with standard gauge (1,435 mm). The only deviation from the standard is the Finish rail network (1,524 mm), which is exempted due to its isolated location.
- The corridor is not completely electrified. In May 2017, one quarter of the total Scan-Med rail network in Denmark was not electrified. Additionally, rail sections of about 260 km in Germany are not electrified. With regard to the whole Scan-Med CNC, 95.4% of the rail network is electrified.
- Four different electric voltage systems are being used on the Scan-Med Corridor:
    - AC 25 kV, 50 Hz in Finland, Denmark, and Italy (only high-speed lines);
    - AC 15 kV 16 2/3 Hz in Germany, Austria, Sweden, and Norway;
    - DC 3 kV (on existing) and AC 25 kV (on HSL and new lines) in Italy.
- Common signalling systems are currently used in Germany/Austria (PZB/LZB) and Sweden/Norway (ATC/EBICAB).
- Non-compliant rail sections with respect to axle load are currently only located in Italy, south of Bologna. However, compliance is expected by 2030.

Additionally, some rail sections have already been equipped with ETCS (European Train Control System) for test purposes. Table 13 shows currently existing as well as planned ETCS implementations on the Scandinavian-Mediterranean CNC.

Differences in rail voltage and different signalling systems require the employment of multi-system locomotives. Alternatively, locomotive change processes have to be optimised at border sections. With regard to loading gauges, there is no specific requirement in the Regulation, but intermodal transport is one of the backbones of rail freight traffic on the Scan-Med Corridor and may disproportionately grow in the future. Thus, the availability of an intermodal loading gauge in line with market demand (at least P/C400, allowing the transport of 4 metre-high semi-trailers in pocket wagons) is an important prerequisite for competitive rail freight services.

Table 13: Existing and planned ETCS implementations on the Scan-Med Corridor

Country	Infrastructure manager	Existing ETCS implementations	Planned ETCS implementations
FI	Finnish Rail Administration		Parts of the network and parts of the Scan-Med Corridor lines by 2025
NO	BaneNor (Jernbaneverket)	Ski – Sarpsborg (Tests, 2015)	Parts of the network and Scan-Med Corridor lines predominantly by 2025
SE	Trafikverket	Nyland – Umeå (2010), Borlänge – Malung (2012), Sundsvall – Västeraspby (2012), Boden/Buddbyn – Haparanda (2013)	Parts of the network and Scan-Med Corridor lines predominantly by 2027. (Source: Swedish National Implementation Plan, June 2017)
DK	Banedanmark		Whole network and Scan-Med Corridor lines by 2030 (Source: Banedenmark, January 2018)
DE	DB Netz	Erfurt – Halle/Leipzig (2015)	Erfurt – Nuremberg (2017); new HSL, freight corridors and replacement of LZB ("Linienzugbeeinflussung") on existing HSL estimated 2026 - 2030
AT	ÖBB Infrastruktur	Kufstein - Wörgl – Baumkirchen - Brenner	Section Kufstein-Brenner already fully equipped
IT	Rete Ferroviaria Italiana (RFI)	Rome – Naples (2005), Bologna – Florence(2006)	Brennero-Verona (2020) Parts of the network by 2030

Source: HaCon, May 2017, updated by Member States in February 2018

<u>Interoperability on cross-border sections</u>

Administrative and operational barriers affect rail transport, especially at border crossings as rail infrastructure parameters vary from country to country. As mentioned in chapter 2.2, these differences require either a locomotive change or the operation of multi-system locomotives. Five country/country rail connections are part of the Scandinavian-Mediterranean CNC. Two major projects will greatly impact the overall Scan-Med Corridor transport performance: the Fehmarn Belt Fixed Link (Denmark – Germany) and the Brenner Base Tunnel (Austria – Italy). However, Table 14 gives an overview of changing interoperability on border crossings.

According to the results presented in the table, above all else, border-crossing rail sections show changes in relevant parameters. While only minor changes occur on connections from Germany to Austria (ERTMS only), which do not extensively hamper interoperability, a total of four parameters change from Austria to Italy. Besides the rail voltage, the maximum allowed train length, ERTMS equipment as well as the signalling system vary. In general, distinctions in rail voltage are the most common parameter changes on Scan-Med border sections.

Operational and administrative procedures have particular impact on freight traffic due to differing train compositions (different types of cargo, types of wagons) with numerous regulations and for technical and commercial check as well as for authority procedures (customs clearance, police control, phytosanitary control).

Table 14: Change of interoperability rail parameters on cross-border sections

Border crossing	Coun-tries	Change of parameters with impact on interoperability							
		Trac-tion	Track gauge	Load gauge	Axle load	Rail voltage	Train length	ERTMS a)	Signal. system
Malmö/ Copenhagen	*SE-DK*					X			X
Ed/Kornsjø	*SE-NO*						X		
Padborg/Flensburg	*DK-DE*					X			X
Kiefersfelden/ Kufstein	*DE-AT*							X	
Brennersee/ Brenner	*AT-IT*					X	X	X	X

a) No ERTMS changes in 2030 displayed (ERTMS projects are not included in the scope of this study)
Source: HaCon based on Scan-Med Final Report 2014

Airports

Airport enlargement plans are usually disputed at a local level. Airport managers, industry representatives and residents impacted by the noise and other harmful emission of the airport and the resulting air and land traffic discuss whether and how the capacity can be increased in a sustainable way. In some cases, the location itself of the airport is a physical limit to capacity expansion and bigger programmes envisaging the relocation of the airport could be considered. A potential threat to the compliance of the airport with the Regulation in term of capacity is the time inconsistency of the intervention. In some cases, delays in the implementation of the plans worsen the capacity problems, as in the case of Berlin-Brandenburg (BER), which suffers from delayed completion.

In some cases, actions aimed at better connectivity are not under the direct control of the airport manager, and cannot be directly controlled. In particular, in the cases of connectivity of the airport with the high-speed rail, the involvement of other stakeholders is relevant and the interest of the airport - and the goal of the airport connectivity - could be overshadowed by other transport interests.

The same problem occurs regarding road connectivity, which seems to have become a bigger problem due to the saturated road access at peak times in most of the airports of the core nodes aligned with the Corridor.

The question should be raised with airport managers and public authorities as to whether airports as single installations should require local, regional or national coordination (e.g. the German "Flughafenkonzept" and the Italian "Piano Nazionale degli Aeroporti"), rather than, or in addition to, a European corridor coordination. As regards corridor coordination, it should however be noted that for some their "land" catchment areas cross borders (e.g. Copenhagen/Malmö). Moreover, issuing a "National Airport Plan" could lead to incoherence with the current definition of the Core Network. For example, the latest version of Italian "Piano Nazionale degli Aeroporti"[45], which provides for a cluster of 10 "strategic" airports (one per "traffic basin"), and 26 other “airports of national interest”, identifies 3 "strategic" airports that are geographically located on the Scan-Med Corridor, but are not part of the Core Network, namely Florence/Pisa, Bari and Catania.

5.5 Links with neighbouring countries

The CNC Scan-Med has land borders with neighbouring (non-European Union) countries in Sweden with Norway and in Finland with Russia. In addition to that, many of the Core Network ports serve vessels that are used on trade lanes with third countries. This is relevant in the Baltic Sea (again with Russia) and the Mediterranean Sea (with Western Balkans and Northern African countries) and many other port countries in the world.

Of the abovementioned countries, only Norway was invited to attend Corridor Forum Meetings and Ideas Laboratories and contributes to the updating of the analysis and the Project List Norway is therefore involved in supplying a coherent infrastructure for cross-border transport (E6 motorway Gothenburg - Oslo and Østfoldbanen rail line.

In the east of Finland, the E18 connects to the Russian border near Vaalimaa and continues on Russian territory to the agglomeration of St. Petersburg. For rail, the (present) corridor alignment for both passengers and freight uses the Vainikkala border crossing. The Russian side has invested in improving its rail line, which links with Imatra (on Finnish territory), with a focus on freight transport. The Imatra section is not part of the Core Network yet and would require improved coordination.

[45] Released by Italian Government on 30.09.2014.

6 Infrastructure implementation by 2030 and the environmental, socio-economic effects

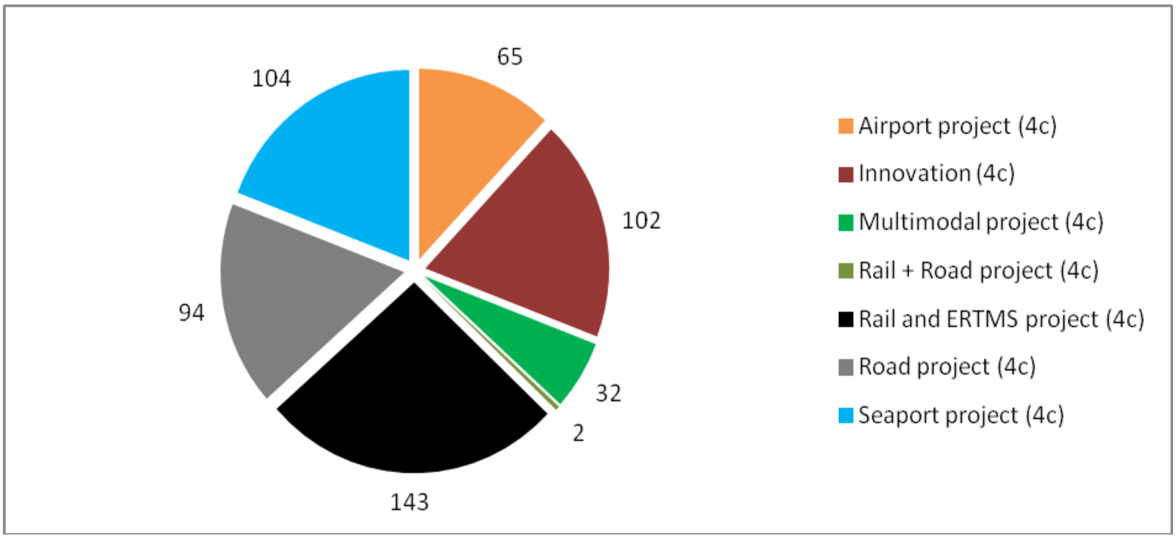
6.1 What has still to be done

One of the new elements of the Corridor analysis is the mapping of projects with respect to the priorities of the TEN-T guidelines and other criteria in a coherent way, so that a ranking of projects according to key objective criteria is possible.

Whilst taking into account only the number of projects identified along the Scan-Med Corridor, it is obvious that national, but also European financial resources will not be enough to finance the implementation of transport projects necessary to finalize the network. Furthermore, the temporal aspect of funding requirements is of utmost importance when it comes to European budget planning. Therefore, a standardized methodology has been agreed upon by all Core Network Corridors (henceforth referred to as the **mapping methodology**).

Concisely, the mapping methodology is based on two main criteria groups, namely project relevance and project maturity. Projects already concluded and pure studies are not taken into account, so that for the Scan-Med Corridor, the mapping methodology has not been applied to all 666 projects, but only to the 542 ongoing or planned non-study projects.

Figure 16: Overview of the distribution of the 542 mapped projects across all categories



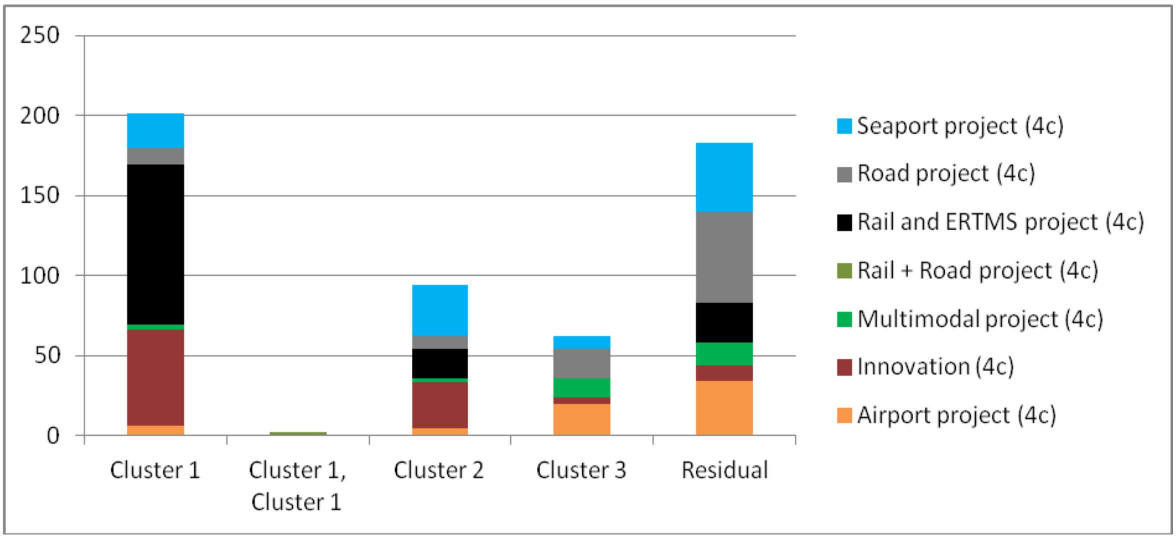
Source: HPC analysis, May 2017

The first main criteria group, **project relevance**, distinguishes between seven project categories. These project categories are new technologies & telematic applications (abbreviated as “innovation” (102 projects), rail and ERTMS projects (143 projects), IWW and inland ports projects, road projects (94 projects), airport projects (65 projects), multimodal projects (32 projects), seaport projects (104) and combined

"Rail + Road" projects (2 projects).[46] Figure 16 gives an overview of the distribution of the 542 mapped projects across all categories.[47]

According to the mapping methodology, each of the 542 projects was clustered by its project **relevance** only once. The clustering process is adapted to each project category and comprises four clusters (in decreasing order of priority), namely Cluster 1 (201 projects), Cluster 2 (94 projects), Cluster 3 (62 projects) and Residual (183 projects). Figure 17 gives an overview of the results of the clustering exercise.

Figure 17: Overview of the results of the relevance clustering exercise



Source: HPC analysis, May 2017

The two Rail + Road projects as well as Rail + ERTMS and new technologies & telematic applications projects show the highest average relevance level, while road, and airport projects are characterised by a low maturity ranking. The relevance categorisation is clearly influenced by the political priorities in the Regulation, e.g. pre-identified sections and projects that are mainly rail projects.

As indicated above, the mapping methodology comprises a second criteria group, project **maturity**. The assessment of this criteria entails using the following four criteria to evaluate each project: Technical readiness, Institutional readiness, Financial/economic maturity and Social/environmental maturity. The analysis shows that all projects are characterised by a high institutional maturity, since for all projects a project promoter is nominated. The social/environmental maturity and the technical readiness show a similar pattern, where the lowest and highest maturity levels are

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46 For the Scan-Med specific category of Rail + Road projects, the mapping methodology was applied twice one according to the category Rail and ERTMS projects and one according to the category road projects. However, both categories show the same result for both Rail + Road projects. It is displayed in the special cluster named "Cluster 1, Cluster 1" (2 projects).

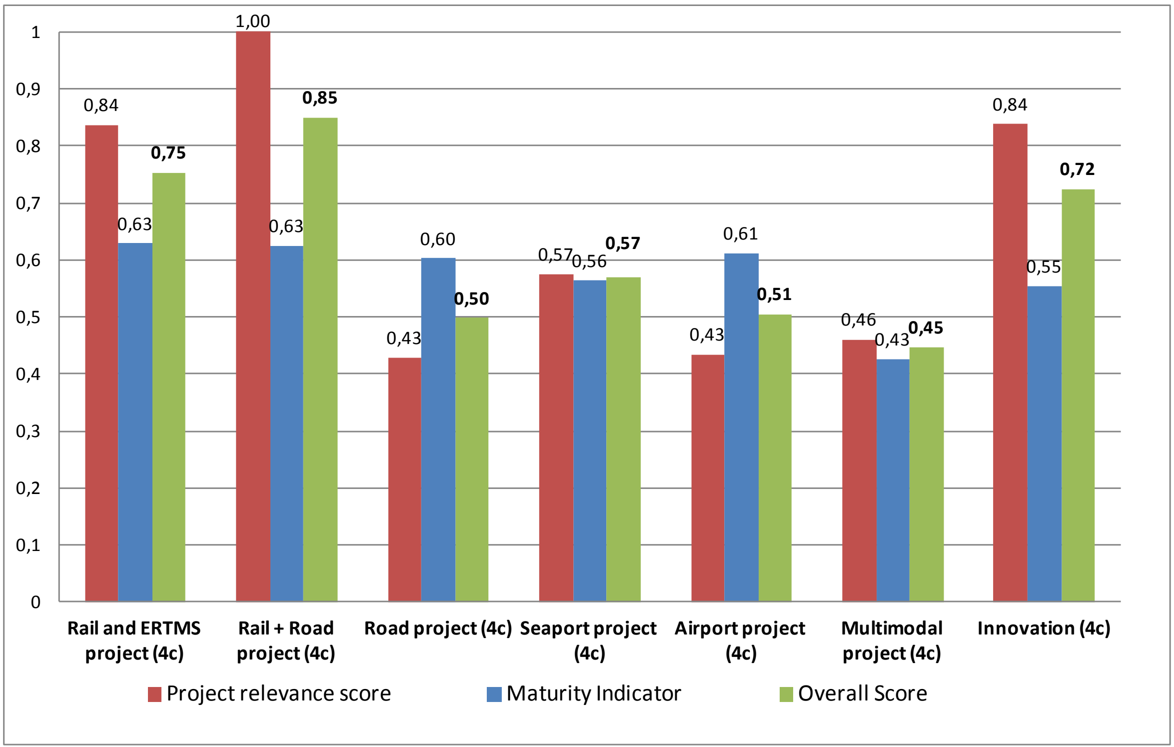
47 The term „4c" is added to each of the categories in this analysis performed within the framework of task 4c, since the definition differs slightly from the definition used elsewhere in the study (notably Tasks 2 and Task 3a) given that some "innovation" projects were shifted from the modes to the "new technologies & telematic applications" category.

engaged. Only for the financial/economic criteria, each of the three maturity levels is almost equally represented. The still relatively large number of projects in the lowest maturity pattern confirms the finding of the Project List assessment that readiness should be improved in order to make sure that projects are recognised for financing and implementation in good time.

The maturity levels for each of the four criteria are defined in the same way and converted into award points: high maturity (1 point), medium maturity (0.5 points) and low maturity (0 point). The general assumption is that each maturity criteria has the same relative importance and accordingly the overall maturity can be calculated by simply adding the four sub-criteria and dividing the result by four. After applying the maturity exercise, the average maturity level by project category can be described as follows:

Rail + ERTMS projects as well as the two Rail + Road projects show the highest average maturity level, while seaports, new technologies & telematic applications and in particular multimodal projects are characterised by a low maturity.

Figure 18: Weighed overall project rank - average score by category



Source: KombiConsult analysis, May 2017

It is notable that projects attributed to cluster 1 tend to have a high maturity, while projects attributed to cluster 2 and Residual tend to have an inferior maturity. For projects attributed to cluster 3, no clear distinction can be made. One explanation for the described constellation might be found within the mapping methodology, which evaluates projects recommended for CEF funding as completely mature. Furthermore, clear distinctions can be observed between the project categories e.g. the majority of projects of the category new technologies & telematic applications are attributed to cluster 1 and cluster 2, meaning high project relevance tends to be more mature than projects of the same category attributed to cluster 3 and residual. However, it seems that relevant projects tend to be more mature than less relevant projects.

As a next step, the mapping methodology suggests **combining** the assessment of relevance and maturity by applying a weighting: 60% for relevance and 40% for maturity. Thus, the best overall score is 1 and the worst possible score is 0.25.

Looking at the overall **weighted results of the mapping process,** it is notable that the categories new technologies & telematic applications and Rail and ERTMS projects have a much higher share of projects with a high score. In contrast, the categories airport projects and multimodal projects have a high share of projects in the lower score classes.

6.2 Innovation Deployment

The following chapter provides the summary of the **Analysis of the Corridor's potential to deploy transport innovations and its impact on the Corridor's overall performance,** which was based on a methodology developed for all nine Core Network corridors (Joint Methodology).

The Joint Methodology states that technological innovations improve the quality, safety and efficiency of transport. The introduction and uptake of new technologies helps to lower negative environmental impacts of transport by reducing or eliminating CO_2 and other emissions. Corridor projects contribute to the deployment of these innovations in transport.

Mapping and assessment of innovation projects

According to the Joint Methodology, "innovation projects" have been identified based on the Final Project List of the Scan-Med Corridor. Innovation projects in terms of this analysis are not only projects categorised as "Innovation" in the Project List, but any project dealing with innovative elements as defined in Articles 31, 32 and 33 of Regulation (EU) 1315/2013, as well as innovations mentioned in the Issues Papers of European Coordinators[48].

The Issues Papers put the Trans-European Core Network Corridors in a wider perspective of European Policy objectives and seek to create synergies between the different fields for mutual benefit. The "issues" addressed are:

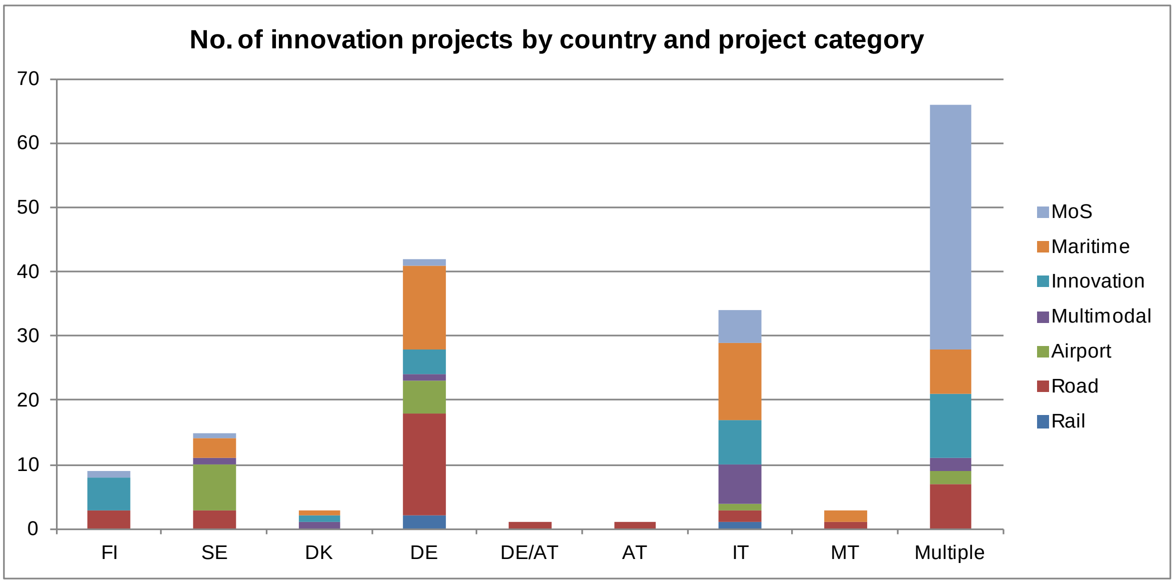
- Enabling multi-modality and efficient freight logistics;
- Boosting intelligent transport systems;
- Boosting new technologies and innovation;
- Effectively integrating urban nodes;
- Extending cooperation with third countries.

[48] TEN-T Corridors: Forerunners of a forward-looking European Transport System, June 2016.

After having exercised the innovation assessment 174 of the 666 Scan-Med related projects are to be regarded as “innovative”. Most innovation projects belong to the project categories Motorways of the Sea - MoS - (46 projects), maritime (38)[49], road (34) and innovation (27). Project categories that are underrepresented in view of innovation are airport (15 projects), multimodal (11), rail (3) as well as "rail ERTMS"[50], "Rail + Road" and "Other" where no innovation project could be identified at all.

Figure 19 gives an overview of the innovation projects by country and project category. Due to the high share of innovative MoS projects planned to take place in several Member States, multi-country projects show most innovations. Besides that, the distribution of innovation projects between the Corridor countries is comparable to the distribution of all projects in the entire Corridor Project List.

Figure 19: Innovation projects by country and category



Source: KombiConsult analysis, May 2017

The scope of innovation projects can be characterised by innovation aspects belonging to three innovation areas: telematic applications, sustainable freight transport services as well as other new technologies and innovation.

The coverage of innovation aspects for the innovation area "**telematic applications**" by projects and their total costs show: For ERTMS, no project could be identified because the respective projects of the Scan-Med Project List target only to ETCS level 2, which is not “innovative” according to the definition relevant for this assessment

[49] *Maritime" projects refer to the components included in Reg. (EU) 1315/2013, Art. 20 (MoS exempted). "MoS" projects fall under the explanations of Reg. (EU) 1315/2013, Art. 21, and/or were submitted in a CEF Call under the MoS priority.*

[50] According to Joint Methodology, page 4: "ETCS level 2 is a common standard for CNC according to the KPIs, but not an innovation." Given that none of the rail ERTMS projects explicitly targets more than ETCS level 2, all of them were assessed "non-innovative".

(see above). It could therefore be stated that the lack of deployment of ETCS Level 3 is a shortcoming on the Scan-Med Corridor, but it needs to be considered that the Technical Specification on Interoperability for ETCS Level 3 has not yet been agreed upon.

The respective management systems for the maritime sector, VTMIS, (2 projects) and air transport, SESAR, (9 projects) could be improved through additional projects, in order to assure coverage of the entire corridor. For example, main existing SESAR-related projects are located in Sweden, Germany, Denmark and Malta. For ITS, “other telematic applications” and “data sharing, cooperation systems and real-time predictive analysis for multimodal transport” no shortcomings can be identified.

The 75 projects in the area “telematic applications” have a total (known) cost of €7 446m. The distribution of costs is in line with the number of projects, with the exception of the category “other telematic applications” where the costs per project are significantly higher.

The Scan-Med Corridor Project List features only a low number of projects in the area of “**sustainable freight transport services**”. Overall, 26 projects were identified, most of them dealing with "low carbon transport & decarbonisation of the sector". No projects in the Project List are classified as “innovative transport services”. Although such services might exist along the corridor, they are not reported in the Project List, which is focusing on infrastructure improvement. With a view to “integration of remote areas”, only Malta fulfils this criterion and currently is not pursuing any project in this field.

Also in this category the distribution of cost is linked to the number of projects. The 26 projects result in cumulated costs of €1 215m.

Most of the projects in the third innovation area “**other new technologies and innovation**” are linked to the environment, and in particular to low carbon transport & decarbonisation of the sector, externalities reduction as well as climate change resilience & transport greening. Sixteen projects are allocated to safety & security whereas no projects can be found on cybersecurity & data protection highlighting a potential shortcoming.

The telematics-related aspects of data sharing, cooperation systems and real-time predictive analysis for multimodal transport, as well as other telematics applications, are covered only by few projects, if any at all.

The 104 projects in this area account for cumulated costs of €2 926m.

Cross-corridor comparison

An analysis of the **innovation deployment across the nine Core Network Corridors** concludes for the Scan-Med Corridor that:

- It carries the highest absolute number of innovation projects (174) and ranks third with respect to the share of innovation projects (26% of all Scan-Med are on innovation); only Atlantic with 29% and Mediterranean with 28% have higher share of innovation projects;

- It shows a clear focus on transport efficiency improvement through data sharing and decarbonisation (all types of energy);
- It has a relatively low number of "sustainable freight transport" projects; and
- The "contribution to the development of the European technological industry" is low in North Sea-Baltic, North Sea-Med, Orient-Eastmed, Rhine-Alpine, Rhine-Danube and Scan-Med Corridor; as well as the "Safety improvement" in Scan-Med.

6.3 Impacts to Jobs & Growth

The "Growth and jobs" effects of the Corridor projects have been calculated using "multipliers" resulting from the methodology of the "Fraunhofer-Study"[51] of 2015. Through multipliers, one can estimate the respective growth and jobs effects of the projects based on their costs.

Figure 20: Growth and Jobs multipliers to be used for the 2017 List of Projects

Category of project	GDP multiplier [bn€ GDP / bn€ investment]	Job multiplier [FTE-Job-Years / bn€ investment]
Cross-border projects	16.8	37,000
Innovation projects	17.7	38,700
Other projects	4.35	16,300

Source: MVIVE, E-Mail of 02/04/2017, updating multipliers compared to the 2015 study to take into account a different price basis (2015 rather than 2005)

The way of clustering the projects from the ten project categories and other qualifiers of the Project List into the three multiplier categories was agreed upon across nine corridors.

For the analysis, only those projects with a completion date of 2016 and beyond were taken into account. This time clustering differs from the time clustering used in the rest of the study, which categorizes the "projects completed since the adoption of the Regulation" (2014 – 2016) resulting in the absence of 49 projects, which were completed in the years 2014 and 2015 respectively.

For 84 of the remaining projects no total cost figure was recorded, so that they were not taken into account either, resulting in 533 (of 666) projects that are fulfilling the criteria. The total cost of these projects is €191.0bn.

The analysis has shown that the implementation of these projects will lead to an increase of GDP over the period 2016 until 2030 of €1 468 210m in total. Further benefits will occur also after the year 2030.

51 Fraunhofer Institut für System- und Innovationsforschung (ISI), Cost of non-completion of the TEN-T, Final Report, June 2015.

Furthermore it could be demonstrated that the investments will stimulate additional employment. The direct, indirect and induced job effects of these projects will amount to (rounded) 4 176 300 additional job-years created over the period 2016 to 2030. It can be expected that after 2030 further job-years will be created by the projects.

Looking for the contribution of the Scan-Med Corridor to the total of the nine Core Network Corridors one has to make sure that each project is counted only once: 451 projects with an investment volume of €170.6bn are in the "responsibility" of Scan-Med Corridor in this respect. Their impact on growth and jobs can be seen from the table below in detail. The table also indicates the contribution of the respective project category.

Table 15: Growth and Jobs created in and by the Scan-Med Corridor projects 2016-2030

	Number of Projects	Total Costs (million EUR)	GDP created (million EUR)	Job-years created
Entire Scan-Med Corridor	**533**	**191,039**	**1,468,200**	**4,176,300**
Cross border	54	35,732	600,300	1,322,100
Innovation	95	14,406	255,000	557,500
Other	379	140,901	612,900	2,296,700
Scan-Med Corridor contribution to all nine CNC	**451**	**170,613**	**1,339,301**	**3,776,600**

Source: KombiConsult, based on Scan-Med Project List, status: 06/06/2017

6.4 Modal shift and impact to decarbonisation and Climate Change Adaptation

Climate change due to Greenhouse Gas (GHG) emissions and health impairments due to other pollutant emissions are main challenges of the future and thus subject to transport policy strategies.

In this respect, particular solution contributions are expected from shifting transport volumes from road to rail. Such modal shift effects in turn necessarily require adequate rail infrastructure capacity. Consequently, a scenario view was performed in order evaluate the maximum modal shift effect resulting from exploiting all available rail infrastructure capacity in the corridor.

For this purpose, a joint methodical approach was discussed in an inter-corridor working group and was finally agreed with the Commission. The main framework conditions and assumptions for this procedure were:

- Time horizon: 2030;

- Compatibility of data structure with the transport market study performed in 2014;
- All rail infrastructure projects included in the project list shall be considered as finalised according to schedule;
- All additional rail capacity resulting from these projects will be available;
- No detailed analyses, but corridor-wide, overall assessment of the maximum modal shift impact and subsequent effects on GHG and other pollutants emissions;
- Focus on the supply-side (i.e. rail infrastructure capacity); the demand-(market-) side was not considered.

The result of this joint methodology is a “Maximum Potential Modal Shift Scenario”. Due to the described framework conditions, this scenario is hypothetical, of course. It should be understood as a benchmark to evaluate results of dedicated modal shift concepts rather than as a binding expectation on future traffic development.

In order to implement this scenario design using the information available from the 2014 transport market study, the following steps were carried out:

First, the theoretical capacity of each rail section on the Corridor was determined for the year 2030. To be consistent with the 2014 transport market study, the same classification into 43 sections was used. The theoretical capacity was derived from the number of tracks that will be available in 2030, taking into consideration the completion of known rail infrastructure projects until then. As a simple rule, the maximum capacity for a line with one track was set at 80 trains per day to ensure acceptable operational quality. For a line with two tracks, the maximum capacity was set at 120 trains per day. This daily capacity was multiplied with 280 operating days to arrive at the theoretical annual capacity in the year 2030.

Second, the forecasted number of trains on each corridor section in 2030 was taken from the 2014 transport market study and was subtracted from this theoretical capacity. The remainder represents the unused and therefore available “extra” capacity. Overall, 31 sections were identified to have such “extra” capacity. The identified “extra” capacity was split-up between passenger traffic and freight transport. This was done according to the forecasted ratio between passenger and freight trains in 2030 to preserve the train mix on the Corridor.[52]

Third, on each section with “extra” capacity, passengers and goods were then shifted from road to rail transport until either traffic on road fell to zero or the “extra” capacity on rail was used up.[53]. If the road section parallel to this rail section had lower traffic volumes, then all of this traffic would be shifted away from road. If the

52 For example, a rail section with an “extra” capacity of 4,430 trains per year in 2030 and a ratio of 60% passenger transport and 40% freight transport could be used to add 2,658 passenger trains and 1,772 freight trains accordingly.

53 Coming back to the example, the rail section with “extra” capacity of 2,658 passenger trains and 1,772 freight trains could be used to shift up to 318,960 passengers (2,658 passenger trains x 120 passengers per train) and up to 880,684 tonnes of freight (1,772 freight trains x 497 tonnes per train) from road to rail

parallel road section had higher traffic volumes, then all of the “extra” capacity would be used up and some traffic would remain on road.

It is important to point out, that the derivation of “extra” rail capacity based on the number of tracks of the Corridor sections disregards train mix, train speeds, signalling systems, the capacity of nodes and other exceptional circumstances. The “extra” rail capacity is therefore a highly theoretical figure. Furthermore, the Maximum Potential Modal Shift Scenario does not consider demand parameters; therefore, the resulting performance and emissions figures represent notional targets that cannot be interpreted as the impact of the Work Plan.

Table 16: passenger and goods transport performance on the SMC under the Maximum Potential Modal Shift Scenario and the Forecast for 2030[54]

	Maximum Potential Modal Shift Scenario		2030 Forecast		Difference Scenario / Forecast	
	Passenger traffic (bn pkm)	Goods transport (bn tkm)	Passenger traffic (bn pkm)	Goods transport (bn tkm)	Passenger traffic (difference in %)	Goods transport (difference in %)
Road	49	176	196	560	-75.0%	-68.5%
Rail	200	551	61	174	225.9%	216.5%
Total	**249**	**727**	**257**	**734**	**-3.2%**[55]	**-1.0%**

Source: Prognos analysis, May 2017; differences in total performance between 2030 Forecast and Maximum Potential Modal Shift Scenario are explained by differences between rail and road section lengths

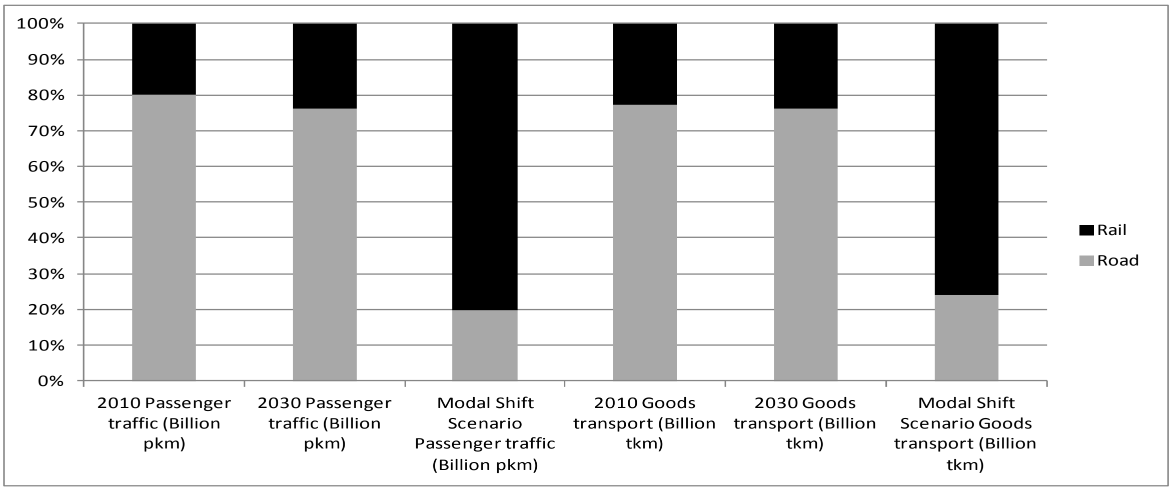
Table 16 shows the modal shift between the Maximum Potential Modal Shift Scenario and the 2030 forecast. Through using available “extra” capacity, rail transport performance on the Scan-Med Corridor could be increased to 200 billion passenger and 551 billion tonne kilometres. For passenger traffic by rail, this would represent an increase by 226% compared to the 2030 forecast. Passenger traffic on road would decrease by 75% compared to 2030 forecast. In terms of modal shares, the Maximum Potential Modal Shift Scenario would increase the share of rail in passenger transport to 80% from 20% in 2010 and 24% in the 2030 forecast.

For goods transport, the Maximum Potential Modal Shift Scenario would mean an increase of rail transport performance by 216.5% compared to the 2030 forecast from the transport market study. Correspondingly, road transport performance would decrease by 68.5% compared to the 2030 forecast. Looking at modal shares, the Maximum Potential Modal Shift Scenario would increase the share of rail in goods transport to 76% from 23% in 2010 and 24% in the 2030 forecast.

54 Baseline year 2010; comparison with the 2030 forecast shown in Table 7.

55 The total volume of passengers and goods is independent of mode choice. The small differences in total performance between the 2030 forecast and the modal shift scenario of -3.2% for passenger transport and -1.0% for goods transport are due to the differences in rail and road section lengths.

Figure 21: Comparison of passenger and goods modal shares on the SMC in 2010 with the Max. Potential Modal Shift Scenario and the Forecast for 2030



Source: KombiConsult and Prognos analysis, May 2017, modal share based on transport performance

Multiplied with the average emission factors for passenger cars, trucks and rail shown in the Joint Methodology, the transport performance estimates under the Maximum Potential Modal Shift Scenario yield the Corridor traffic emissions are shown in Table 17. Under the Maximum Potential Modal Shift Scenario, total emissions are lower compared to the 2030 forecast, because emissions per passenger- and tonne-kilometre are lower for rail traffic than for road traffic. Therefore, the large shift from road to rail implies a substantial reduction of overall emissions from transport on the Corridor. In detail, CO_2 emissions would be 51 index points lower compared to 2010 and 85 index points lower compared to the 2030 forecast. For NOx the difference would be 45 index points compared to 2010 and 82 index points compared to 2030.

Table 17: Estimated emissions from transport on the SMC under the Maximum Potential Modal Shift Scenario and the Forecast for 2030

	Maximum Potential Modal Shift Scenario			2030 Forecast			Scenario/Forecast		
	t			t			difference in%		
	CO2/a	NOx /a	PM2,5 /a	CO2/a	NOx /a	PM2, 5/a	CO2/ a	NOx/a	PM2,5/ a
Road	22,777	27	1	78,610	91	5	-71.0	-70.6	-70.9
Rail	6,758	3	0	2,118	1	0	219.0[56]		
Total	**29,535**	**30**	**2**	**80,728**	**92**	**5**	**-63.4**	**-67.7**	**-66.6**

Source: Prognos analysis, May 2017

[56] The relative increase of emissions in rail is equal to 358.6% and identical across all emission types, because passenger and freight transport have identical emission factors. The small differences for rail and total emissions across emission types result from the differences in emission factors for passenger and freight vehicles.

For emissions of particles, the difference would be 80 index points compared to 2010 and compared to 2030. Across all emission types, the reduction measured in index points are almost identical, because they are functions of the same reduction on road traffic and increase in rail traffic. The small differences are the result of variation in the relative role of passenger traffic and goods transport for each emission type.

The Joint Methodology also suggests calculating the cost of transport emissions using multipliers available for the year 2010. Applying these factors to the emission estimates for the Maximum Potential Modal Shift Scenario leads to estimated total costs for corridor emissions of €4,662m, as shown in Table 18.

Table 18: Estimated cost from transport emissions (in thousand €) on the SMC under the Maximum Potential Modal Shift Scenario and the Forecast for 2030

	Maximum Potential Modal Shift Scenario			2030 Forecast			Scenario/Forecast		
	in thousand €			in thousand €			difference in%		
	CO_2	NOx	PM2,5	CO_2	NOx	PM2,5	CO_2	NOx	PM2,5
Road	3,303	284	54	11,398	968	186	-71.0	-70.6	-70.9
Rail	980	32	9	307	10	3	219.0		
Total	4,283	316	63	11,706	978	189	-63.4	-67.7	-66.6
Total	**4,662**			**12,873**			**-63.8**		

Source: Prognos analysis, May 2017

6.5 Infrastructure funding and innovative financial instruments + Project's Financial Sustainability

The development of Core Network corridors requires, inter alia, a critical mass of investment to take place within a short time-framework. Therefore, a careful examination of potential financial sources has to accompany corridor planning. Some key criteria to be appraised are reported here. From the point of view of funding and financing needs the projects to be developed can be ranked in three different categories:

a. For several **revenue generating projects**, which are "closer to the market" in terms of development (technological components, large infrastructure of key European interest, brownfield upgrade) or service provision (terminals for freight/passengers, enhancement of infrastructure capacity/performances), a substantial component of the project funding can come from own resources (e.g. equity) and financing resources gathered by project promoters on the market (e.g. in the form of equity, loans or bonds). Private investors would need to recover their initial costs of capital and receive a reward for the risk borne (the higher the risk the higher the return required).

Projects may seek conventional lending from public and private banks, alternative financing from institutional investors (e.g. bonds) and/or financial instruments, for example to cope with imbalances in cash-flow during the construction and/or ramp-up phases. Addressing particular risks and market failures or securing lending with long maturity adds to the need to explore all financial options. Financial instruments could be sought in the form of credit enhancement or guarantees, including state guarantees (be they a specific legal or financial guarantee to ease access to financing).

b. Hard-infrastructure, Greenfield, risky, long-term projects such as the majority of cross-border railway connections as well as inland waterway navigability improvements might require **substantial public support** through public funding, even if innovative approaches can apply to project development and/or to specific components of the investment. Public funding can be structured in different ways (also depending on the budgetary constraints of the public authorities) such as lump sum subsidy (grant), fiscal incentives, operational deficit coverage and availability payment schemes.

c. In a variety of **intermediate cases**, the project will require a more limited funding component in order to reinforce its financial viability – these projects could be supported through a blending of funding (e.g. grants) and financing.

In this respect, besides the national budget, the funding contribution can effectively come from EU centralised managed funds, such as the Connecting Europe Facility (CEF) and from decentralised managed funds such as the European Structural and Investment Funds (ESIF) while the financing resources may come through the EU financial instruments, such as the CEF Debt Instruments and financial products available under the European Fund for Strategic Investment (EFSI).

For these three categories of projects, public intervention through resource transfer is justified on the grounds of high socio-economic and/or EU added value; meeting public service obligations; addressing suboptimal investment levels; market failures and distortion due to externalities.

When considering the project funding structure in a comprehensive and multimodal setting, earmarking of revenues and cross-financing solutions, applying "polluter-pays" and "user-pays" principles ought to be explored.

A project can be fully developed through project financing if the revenue stream (secured by public and/or private funding), exceeds the investment and operational costs (CAPEX+OPEX). Such an approach calls for a careful risk sharing between the Member States (project management) and private partners.

To deliver on time, quality and cost and to minimise future public liabilities user financed projects need to define clear responsibilities and risk sharing between project promoters, sponsors and implementing bodies and to consider total life cycle project cost.

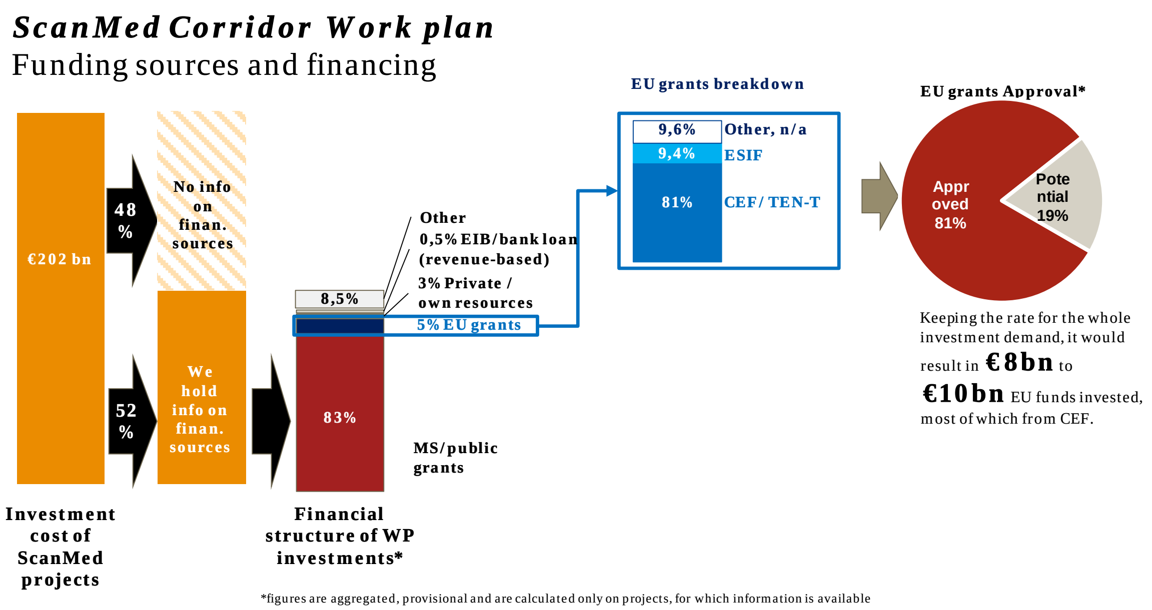
A pre-condition for project financing is a conducive regulatory and legal environment in order to set the right incentives to enhance public and private sector involvement in the delivery of infrastructure investment.

It is worth highlighting the following projects along the Corridor supported through innovative financial instruments, for their potential for cross-fertilisation:

- On the Scan-Med Corridor, the Øresund Fixed Link stands out for its model grouping cross-financing and market-based funding. This cross-border rail-road project is structured almost entirely on funds raised on the international financial markets, except for equity of approximately €7m. The Danish and Swedish states are jointly and severally liable for the loans for this cross-border project. This model is known as the state guarantee model. The project rests on a sound financial footing and is within its planned repayment period. The Danish state is now using the same state guarantee model for the upcoming fixed link across the Fehmarn belt.
- One of the significant motorway improvement projects on the German part of the Scan-Med Corridor is the upgrade of the federal motorway A7 heading from Hamburg to the Danish border on the section Bordesholmer Dreieck – Schnelsen Nord to six respectively 8 lanes (about 65 km) and the maintenance of about 59 km between Hamburg-Nordwest and Neumünster-Nord over 30 years. The project is a public-private-partnership (PPP) another form of innovative finance.

In order to leverage the information provided in the Project List and determine the presence of funding shortcomings and the potential for other-than-public-grants forms of support a detailed analysis of projects financing sources has been carried out. A joint methodology was first agreed upon between consultants and the European Commission and later confirmed with the European Investment Bank (EIB) in a meeting with the European Coordinators in January 2017.

Figure 22: Funding sources and financing on the ScanMed Corridor



Source: KombiConsult, status: May 2017

The data analysis is based on a selection of projects, for which a cost figure is included in the list, and the finance from different sources cumulates to the level of the total costs[57]; 334 projects (52%) out of 666 projects worth €106bn are fulfilling this criterion. For these projects the different finance sources such as "Member States/public", "EU funds" (CEF, ESFI or other), "Private/own resources", "EIB/bank loan /revenues" or "other" were applied.

This analysis is further broken down considering the "potential" and "approved" share of financing, when available. In order to assess the EU quota of the overall investment, the top-right pie chart in Figure 22, shows the percentage of EU funding which has already been approved. Finally, it was assumed that it is most likely not feasible to continue with the classical EU grant finance, but that different forms of finance have to be exploited. Thus, the same ratio of EU finance and share of approval to the entire project cost volume was applied. It can be seen that 83% of the finance (€88bn) is provided directly by the Member States incl. Norway, and regional or local authorities, about 8.5% have other sources of finance and about 3% (€3bn) are from "private" investors. The share of finance provided through European channels amounts to €5.3bn, which makes about 5% of the known finance for the projects in the Final Project List of the Scan-Med Corridor.

EU co-funding

Within the volume of €5.3bn, the (former) TEN-T and the (current) CEF instruments have the largest share with 81%, amounting to €4.3bn. For a comparison with other corridors or the entire Core Network Corridors, it needs to be noted that only Malta - with its relatively small network - is subject to "cohesion countries" rules with a relatively high funding rate, while all other countries are in the "normal" range of funding of eligible costs.

"ESIF", the European Structural and Investment Funds, legally includes five different funds, which are all covered by Regulation (EU) No 1303/2013 of the European Parliament and of the Council and which cover the 2014-2020 period, but for the purposes of this analysis also its precursors have been taken into account. The volume of "ESIF" financed projects in Scan-Med list projects within the EU shares is 9.4%. Other or not clearly identified – but quantified finance – makes another 9.6%. A high level of 81% of the European finance is approved and the remaining 19% potential.

Projection to the entire list

In a last step, the European investment share of the known project has to be projected to the entire list of projects under the consideration that all finance will eventually be approved or under the consideration that only the approved financing would result into actual finance. Keeping the rate for the whole investment demand

[57] In order to leverage rounding errors we have a calculated finance of 99% and more as „fully financed". Some projects seem to be "over-financed" since the cumulated finance figures are higher than the total costs, but that might be subject to local risk preventions or other.

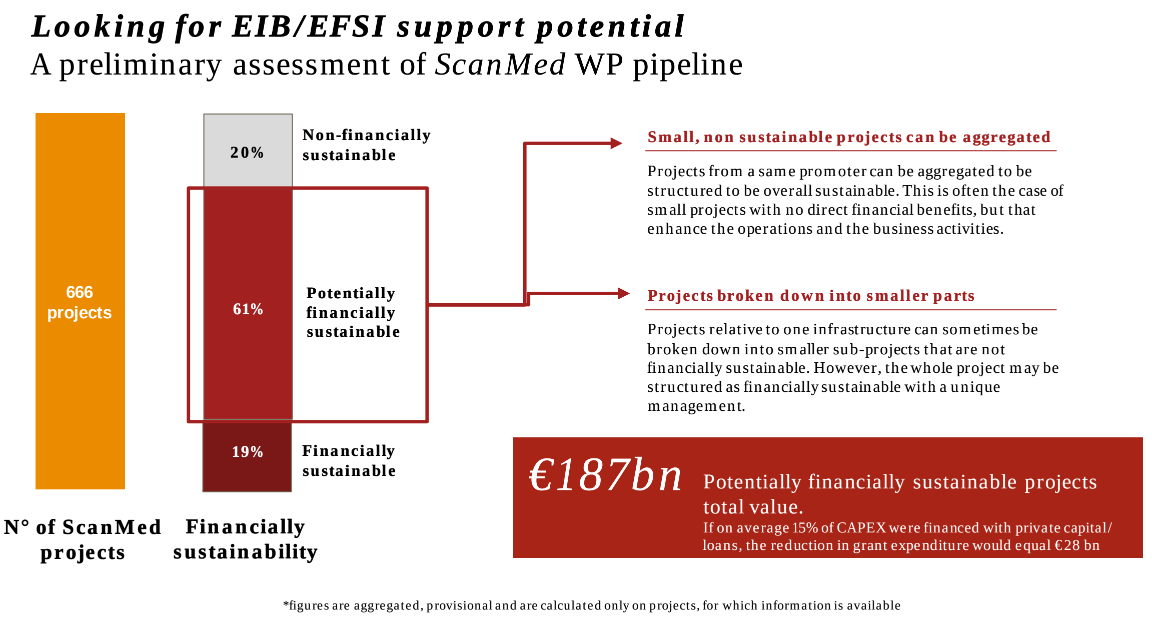
would result in a European funding volume of €8bn to €10bn, most of which from CEF.[58]

Financial sustainability

In a separate exercise, the Final Project List has been analysed with respect to the projects' **financially sustainability**. A project is financially sustainable if:

- user payments exceed the operating costs (revenue generating);
- project receives availability payments (i.e. the public sector allocates to the infrastructure manager a pre-identified amount of cash, paid during the operating phase on the basis of the infrastructure being compliant to a pre-determined set of KPIs, irrespective of demand/users of the infrastructure);
- a combination of the two options above;
- the project is not sustained by any cash-flows. However, it is part of a wider intervention and contributes to increase system efficiency, ability to respond to increased demand, etc. (e.g., port dredging is a cost, but makes it possible for vessels to dock, which is the ultimate source of revenue for the port).

Figure 23: Financially sustainable projects assessment on the Scan-Med Corridor



Source: KombiConsult, status: May 2017

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58 Despite the merits that unique analysis per corridor was done it needs to be kept in mind that the present methodology does not distinguish between (past) expenditures and (future) investments but is based on the "total project cost". In addition, the methodology does not distinguish investment, depreciation, finance and operational cost. Given the variety of projects, accounting principles and eligibility criteria it is also not possible to make this distinction afterwards.
The most important shortcoming is that the methodology derives the future "funding" needs from the past share although the political "priorities", the scope of projects and eligibility criteria have already been changed between previous TEN-T funding periods and the present CEF instrument and might be modified again in CEF II or its successors.

To be considered, a project may still require some grants in order to be financially sustainable. The difference between not-financially sustainable projects and financially sustainable projects is that in the latter, the promoter could cover at least part of the investment costs with a debt from a bank or involving the private sector, which invest own resources for a future benefit.

In theory, the following types of projects could be considered financially sustainable:

- any terminal (or logistic platforms – i.e.: Sea/Inland Ports, Airports, Multimodal platforms, large stations served with High-Speed);
- highways;
- dedicated high-speed rail connections (to airports, notably) shall/might be in part at least be co-financed;
- energy systems (including LNG, EE) are usually generating net profits, although early stage deployment on large network might require a partial/substantial incentive when a dedicated fleet/market share is not there;
- upgrades of existing bulk infrastructure that enhance its effectiveness (including signalling systems and, often, ITS).

In addition, projects could become financially sustainable after they are restructured. Two ways seem to be possible:

- Clustering of projects into global ones and with a unique management;
- Aggregation of projects from the same promoter, who may than benefit from corporate loans.

After screening of the Project List, the following picture is derived. Nineteen percent of the projects are falling into the category of "financially" sustainable projects, 61% are potentially financially sustainable and 20% are not. If looking at the costs of projects rather than the number a share of €12bn out of the total costs of €202bn, are for projects which are financially sustainable, €187bn are "potentially" financially sustainable and €3bn are financially not sustainable.

Projects with EIB finance

As a follow-up activity of the Coordinator's seminar with the EIB in Luxemburg in January 2017 a list of projects of the Scan-Med Corridor, which got/may get finance from EIB was drawn up. Following the EIB rules, only projects of a certain level of maturity and progress in the negotiations could be included in the analysis, since other information is confidential. The projects included in the Scan-Med Corridor list and the projects defined by the promoters to meet the EIB criteria are not identical; Therefore, only the part of the projects financed by EIB loans is provided rather than their total costs. The list includes in total eight projects of which four are motorway projects, one is multimodal or urban transport, one is an airport projects and two are within ports.

Table 19: Projects with EIB finance on the Scan-Med Corridor

Project-ID Project List	Project (short) title and basic parameters according to EIB website	EIB loan in m€
5435	Westmetro Espoo extension (phase II), 7km, 5 stations	€410m
5446	Motorway E18 Hamina – Valimaa, 30 km	€102m
5181	CPH airport expansion, incl. parts of Pier E, airside terminals 2+3	€168m
5101	Motorway A7 6-lane expansion Bordesholm – Hamburg (PPP)	≈ €170m
5011, 4080, …	Hamburg Port Infrastructure incl. New Kattwyk Railway Bridge, railway engine plant and others	€150m (under appraisal
5103, 5473	Motorway A7 6-lane expansion (≈ 30 km) Seesen – Nörten-Hardenberg (PPP)	€185m
9324	Motorway A3 6-lane expansion Biebelried – Fürth/Erlangen	(under negotiation)
5619,5620, 538	Port of Livorno, Darsena Toscana Terminal, incl. maritime access	€90m

Source: KombiConsult, status: June 2017, based on EIB 3/2017 and Danish MoT 11/2016; project IDs for information, all EIB projects do not match fully with them

7 Pilot initiatives

In spring of 2017, the Commission initiated to develop Flagship Projects on the Core Network Corridors. Flagship Projects shall build on the topics of the Issues Papers, promote bottom-up initiatives or projects that are driven (top-down) by transport policy objectives and will benefit from a strong involvement across the different fields of transport sector. They should be characterised by:

- a set of connected actions which – as a whole – generate, in a period of no more than 3 to 4 years, clear benefits for users or/and society, and which should be expressed in KPI such as time gains, emissions' reduction, enhanced service quality etc;
- a listing of all actions belonging to this project, relevant promoters, cost and timing; total cost and implementation time;
- an agreement of all promoters, confirming their commitment to the project as a whole.

The aim is to generate at least one such project per corridor and to cover all Issues Papers topics.

For the Scan-Med corridor, initially three projects have been identified: two on clean fuels deployment (later combined in one) and one on transport digitalisation in conjunction with the Digital Transport and Logistics Forum (DTLF).

8 The European Coordinator future policy considerations

The end of the beginning

This third and final iteration of the Scandinavian Mediterranean Core Network Corridor work plan, under the current mandate of the European Coordinator and the consultants to DG Move, marks the end of the beginning of the second phase of implementation of the TEN-T Regulation (EU) 1315/2013 and of the Connecting Europe Facility Regulation (EU) 1316/2013 of December 2013.

Collective wisdom

It is the product of the collective wisdom of all those who have contributed to the work of the highly innovative governance model deployed on the corridor. This has helped us collectively to weave together a coherent picture of what has been done, what we plan to do in future and where the gaps exist between agreed policy targets and actual performance. This is true for all relevant modes of transport along the entire corridor alignment. It represents an intimate and grainy level of detailed knowledge unparalleled and unsurpassed by any previous shared EU planning tool. It is the instrument by which the future development of the corridor will be driven and it sets out the priorities to be followed up to 2030 and beyond, subject to any revisions voted in the next CEF Annex or future changes to the TEN-T Regulation.

Debt of gratitude

To everyone involved at EU, member state, regional and infrastructure manager level who has participated in this unprecedented exercise we owe a debt of gratitude. As European Coordinator I wish to acknowledge this effort and personally to thank all those who made their contribution, too numerous to mention, but too essential to the outcome to be taken for granted. It has been a privilege to serve as coordinator to such a diverse and talented group of people. I hope that, in a grounded and modest way, all will feel a sense of personal pride in the fact that one by one we are contributing to an admirable but also very concrete expression of European public purpose and policy coherence through the power, in a very literal sense, of our constructive ideas.

To those who have directly assisted me - Leo Huberts, Menno Van Der Kamp and Martin Zeitler from DG Move and to our corridor consultants so ably led by Uwe Sondermann of KombiConsult – my especial thanks.

Funding and financing

Drawing up coherent plans is one thing, realising them is another. The corridor governance process has been uniquely successful in allocating available funds in record time. While the current CEF programme runs from 2014 to 2020, already in a span of just three years 96% of the total grant budget has been allocated, and 100% in respect of the cohesion envelope. This bears testament to the flow of projects identified in the work plans across all the TEN-T Corridors. Over 600 projects carried out by almost 2,000 beneficiaries' accounts for a total investment of €41.6 billion when finance and funding from all public and private sources is aggregated.

The project pipeline of the Scan-Med Corridor includes 666 projects with a total of known cost of €202.4bn. Seventy-four projects with a total cost of €14.0bn already have been completed in the 2014-2016 period.

While the conversion rate of money on paper into project commitments is high, in truth every call for proposals has been oversubscribed, indicating the pent up scale of infrastructure investment needs right across the European Union. The combined investment requirements identified to date to achieve the TEN-T ambitions for the entire core network comes to €750 billion by 2030.

Self-evidently, no conceivable level of available public finance at EU, member state and regional level will be able to fund such a scale of investments from the public purse alone. That is why from the outset one key governance message has been to stress the need for innovative financial instruments and the crowding-in of private finance capable of being remunerated through revenue streams based on the principles of polluter pays and/or user finance. Access to the *European Fund for Strategic Investments* (EFSI) finance has contributed to progress and has yielded EIB loans of about €1.2 billion to 8 projects on the Scan-Med Corridor to date.

Policy innovations

It bears repeating again in this Third Work Plan that as regards innovation policies and their possibilities our Corridor community is essentially a policy taker. Innovation policy needs to be accompanied by policy innovation to realise its full potential. Separately and collectively, we have the capacity to be policy innovators. To manage and deliver the scale of transformation that beckons such policy innovations will be just as important an ingredient for future success as innovation policies, be they technological, scientific or digital. It is essential to be open to developing and sharing policy innovations.

New business ecosystems, innovative economic instruments designed to 'nudge' behavioural changes and the development of new fiscal and non-fiscal instruments in the transport sector need to be encouraged and tested.

For the first time ever under the CEF, the EU experimented with a Blending Call for proposals under which up to 50% of project costs could be grant aided on condition that the balance would be financed by identifiable sources of borrowable finance. This call was responded to by projects in cohesion and non-cohesion states alike and was oversubscribed by 220%. It is expected to trigger up to €10 billion of investment and points one way to future financing needs. On the ScanMed corridor 10 projects were selected (2 maritime, 3 multimodal, 2 rail and 3 road) with total projects costs above € 1bn and a total co-funding of more than € 200 million.

In 2019 the innovative 'use-it-or-lose-it' principle will be applied for the first time ever in EU funding. This will permit the recycling of some financial commitments through a future call for proposals from projects not in a position to use their allocated funds to projects that are good to go. Discretion will be needed not to penalise or slow down viable projects that have been delayed for external reasons through no fault of their own, if they are imminently about to proceed as planned.

One innovation, recommended by the European Coordinators, but not yet resolved is the question of the on or off balance sheet treatment of major transport investment expenditure and in particular the definition of conditions for excluding some or all of these investments from the calculation of national debts/deficits. This is so in the context of commonly shared TEN-T cross-border priorities where the financial contributions of Member States are indispensable, where the commitment is to fulfilling a common European project and where the Member State is acting in concert with other states and not acting arbitrarily its own. This observation is especially relevant for Member States who maybe in breach of EU deficit rules but part of whose deficit expenditure relates to their fulfilment of common EU transport priorities.

Preserving a winning formula

Groundbreaking governance techniques, unparalleled detailed knowledge of future investment needs and project pipelines, the use of innovative financial instruments and an unprecedented rate of commitment of available CEF funds, taken together, speak to the success of the working methods that have been pioneered by the TEN-T Community over the past several years, the Scan-Med Corridor included. This is a winning formula.

As the next Medium term Financial Framework of the EU looms onto the political and institutional horizon, as European Coordinator, I would appeal to all those engaged in our Scan–Med Corridor community to use their best endeavours to ensure that this successful formula can continue to find expression in the next financial period post 2020. This can be done by ensuring our collective access to a necessary and sufficient level of EU funding to address the scale and ambition of the challenges that have been identified.

Additionally, since the TEN-T targets relate to 2030 and beyond, it would be helpful that changes, if any, to the underlying regulatory structure should not be disruptive to a process that needs predictability and continuity to reach its goals.

In short, I would urge our political leaders and legislators to preserve and develop this winning formula as an exemplar of the EU at its best, working in close partnership with its member states and the wider transport stakeholder community.

Climate challenge

The COP 21 in Paris saw commitments to act defined through intended nationally determined contributions (INDCs). On 6 March 2015, the EU submitted its INDC to the UNFCCC formally putting forward a binding, economy-wide target of at least 40% domestic greenhouse gas emissions reductions below 1990 levels by 2030. The state-by-state and sector-by-sector breakdown needs to be established. This process has begun but is not yet completed.

COP 23, held in November 2017 in Bonn, witnessed a growing number of state level national commitments through nationally determined contributions (NDCs). Seventy five percent of NDCs submitted by then mentioned transport but only ten percent of these included specific mitigation targets, dates and roadmaps. There is much still to be done in setting, let alone in realising, necessary greenhouse mitigation targets.

In 2015 the transport sector contributed 25.8% of total EU28 greenhouse gas emissions (21% if aviation and maritime are excluded). International aviation experienced the largest percentage increase in greenhouse gas emissions over 1990 levels (+105%), followed by international shipping (+22%) and road transport (+19%) despite a recession-induced decline between 2008 and 2013[59].

These increases occurred notwithstanding the many technical improvements in vehicle standards, fuel specifications and aircraft and shipping design, confirming an underlying surge in demand for transport and logistical services.

Emissions need to fall by around two thirds compared with 1990 levels in order to meet the long-term 60% reduction target as set out in the 2011 Transport White Paper. This will require transformative and not merely incremental change and necessarily will need to be a key consideration in future TEN-T and Core Network Corridor policy definition, evolution, measurement and management.

Decarbonisation

The objective of transport decarbonisation to achieve zero net emissions in the coming decades, through modal shift, deployment of alternative fuels, the move away from internal combustion fossil-fuel-burning engines, zero emission last mile delivery systems, better urban and spatial planning, low to zero emission zones in urban centres and similar initiatives, points to a quickly evolving policy landscape. The EU can make a significant contribution to this collective effort by mobilising, encouraging, incentivising, learning from and sharing with the Corridor communities, now an established and embedded feature of TEN-T policy. Technology has a role to play, so too does regulation but successfully inducing behavioural change will be a key ingredient and one where sharing and encouraging best practice will be vital.

Resilience

For transport, greenhouse gas emissions are not the only climate related challenge. The impact of climate change on road, rail, ports, airports and inland waterways is another important dimension. The resilience of all infrastructures in the face of extreme weather events needs to be known and understood. Evidence abounds of intense heat waves, cold snaps, floods, droughts, landslides, soil erosion and wildfires. Their impact on transport networks and their implications for whole network effects is a form of risk evaluation that has yet to be done systemically or, if done by some, has yet to be shared by the Corridor community at the level of Core Network Corridors. This will need to be a focus for future work and studies.

59 Data source: European Environment Agency

Digitalisation

A key element in delivering transformational change across the transport sector will be digitalisation in all its forms, smart infrastructure, smart vehicles, seamless mobility solutions, big data management, the internet of things, the autonomous, the robotic the artificially intelligent, the connected citizen, client, consumer, prosumer and producer of mobility services. We stand on the cusp of a new wave of change, a new industrial and services revolution. 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. They are open to public and private actors and public-private consortia prepared to innovate and willing to move from the abstract to the concrete in developing interoperable and seamless multimodal transport concepts and, options. It would be helpful if Corridor Forum members could assist in the identification of partners: governmental, regional, municipal, academic, commercial or others - who would be prepared to exploit this opportunity to experiment and to lead change.

One aspect of interoperability and digitalisation is the European Rail Traffic Management System (ERTMS). This is an area where insufficient progress has been made to date but one that is vital to the future competitiveness of rail operations and in particular rail-freight. Cross-border interoperability through the deployment of ERTMS can deliver early and disproportionately positive results to rail corridor operations. In this regard, it is proposed to work closely with the implementing bodies foreseen in Commission Implementing Regulation (EU) 2017/6 and the Scan-Med Rail Freight Corridor to identify the “low hanging fruit” on cross-border sections where investment in ERTMS could deliver quick wins and consequently be the subject of continuous EU co-funding.

Rail breakthroughs

The competitiveness of rail can be significantly improved over the period 2018 – 2023 through the execution of short-term, operational or administrative actions, requiring lower level of investments – through so called 'rail breakthroughs' targeted in particular at the CNC's and RFC's. The complementarity of Core Network Corridors and Rail Freight Corridors is therefore self-explanatory; their cooperation should be steered politically by the European Coordinators, hand in hand with the RFC Executive Boards. The European Coordinators will seek to facilitate the CNC/RFC cooperation and ensure national high-level political support to the RFCs, so that they are able to implement the rail breakthroughs. In order to enhance this approach, future EU investments could be conditionally linked to the operational implementation of these breakthroughs.

Significant and measurable performance results of interoperability can be expected from the Rail Freight Corridors that have an integrated and regional governance structure gathering all stakeholders: the railway undertakings, the terminals, the infrastructure managers and the Ministries of Transport. They are therefore in a unique position to identify and implement the most urgent and efficient rail breakthroughs along their corridors, and should be encouraged to ensure that the entire corridor is able to allow interoperable operations. The European Union Agency for Railways has a key role to play to support this approach, for eliminating national rules which hinder interoperability and in the further development of technical specifications of interoperability (especially on operations, to support common operational procedures).

Ideas Laboratories

At another level sustainable and innovative transport will be found through the multitude of individual initiatives taken by regions, cities, ports, airports, rail-road terminals and the transport service providers / direct infrastructure users. Such diversity is a great strength. That capacity can be multiplied through peer-to-peer exchanges. The Ideas Laboratories pioneered by the Scan-Med Corridor have sought to do just this covering issues from greening of ports, airports, efficiency increase rail-road terminals, improving urban node's connectivity, roads and ITS and cross border rail (freight) transport interoperability. Our team is especially grateful to all those who have hosted and participated in these events. It is a policy innovation we intend to maintain.

Flanking measures

As well as its positive contribution to growth, employment and competitiveness transport also generates negative external effects such as accidents, congestion, air pollution, greenhouse gas emissions and noise. In many cases, these externalities are under-costed or un-costed. Corridor coherence is greatly to be desired in the definition and delivery of flanking measures, such as road tolls, the internalisation of external costs or cross-financing schemes between transport modes. As emphasised in previous Work Plans large scale infrastructure projects take time. Contemplating, let alone adopting accompanying measures to optimise modal shift to lower carbon modes, institutionally and politically can take even more time. These issues remain politically sensitive but should not be swept under the carpet. The Corridor community has no right and no wish to replace or displace legitimate decision-making authorities but it has a duty to reflect on the policy mix appropriate to achieving shared corridor objectives and to draw such considerations to the attention of its stakeholders and to regional and national administrations.

Planning Permits

On the Scan-Med corridor, the delays on the Fehmarn Belt Fixed Link confirm the complexity of seeking to align the planning process and permitting procedures when a route alignment crosses an international border. Citizens with concerns are entitled to exercise their full rights under the law, something that must be respected, but also something, that can add considerable time and uncertainty to project planning and delivery. Since the administrative and judicial procedures, where relevant, are unlikely to change state by state any time soon and since planning objections take time to resolve, it is important, as regards cross border projects, that the authorities should plan and publicly communicate route alignments as early as possible. Access routes are essential to the completion and optimisation of major infrastructure projects. Their completion needs to be timely. This suggests as a matter of mutual expectations, loyal engagement and policy coherence that anticipated planning and permitting delays must be factored into strategic project planning. In short, this provides a compelling case for starting the public communication and consultation process as early as possible, the better to ensure that the eventual outcome is consistent with the timelines foreseen and agreed by the main contracting parties. DG MOVE has conducted a study on the streamlining of permitting procedures[60] based on which a Commission proposal will be made in May 2018 suggesting ways in which the EU may help Member States to simplify such procedures.

Conclusions

These reflections approaching the end of my current mandate as European Coordinator are based on our shared work since 2014. In most instances, in one form or another, they are likely to remain an active ingredient for the entire duration of our planning horizon up to 2030 and beyond. What they underline is that the complex process in which we are engaged is composed not only of a series of technical or financial choices but that it also remains an inherently political policy process, with a small “p”. This requires policy trade-offs to be made. As remarked above, issues of political sensitivity belong in the realm of politics and to those appropriately mandated but it is important that through corridor governance the appropriate policy mix should be identified and reflected upon and that those reflections duly should be brought to the attention of the relevant political decision makers.

[60] https://ec.europa.eu/transport/sites/transport/files/2016-12-permitting-facilitating-ten-t.pdf

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Background information with useful links:

Corridor website

http://ec.europa.eu/transport/themes/infrastructure/ten-t-guidelines/corridors/scan-med_en.htm

Downloads:

http://ec.europa.eu/transport/themes/infrastructure/ten-t-guidelines/corridors/corridor-studies_en.htm

Contact details:
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