Railway standard

Possible extension of the ScanMed Corridor from the Mälardalen

Task 5.3 Catching the goods transport from the northern areas to CNCs'

Responsible partner: Region Örebro County

Version: Final draft, 2017-12-14

Region Örebro County
REGION BLEKINGE
Lead Partner
Interreg Baltic Sea Region
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Abbreviations

BSR	Baltic Sea Region
BSRP	Baltic Sea Region Programme 2014-2020
CNC	Core network corridors
ScanMed Corridor	Scandinavian-Mediterranean Corridor
TEN-T	TransEuropean Network - Transport
ERTMS	European Rail Traffic Management System
EU	European Union
EUSBSR	EU Strategy for the Baltic Sea Region
RÖC	Region Örebro County

1. Summary

TENTacle opens up for a broader group of stakeholders and a wider geographical area, which requires tackling major capacity challenges. These are, for example, related with a low awareness and deficient understanding of how the CNC implementation can help improve accessibility and connectivity challenges in specific territories, which is what TENTacle will foster in the coming years. By working across the borders and sectors we will: Improve stakeholder capacity to reap benefits of the core network corridors implementation for the prosperity, sustainable growth and territorial cohesion in the Baltic Sea Region.

This report aims towards showing the current state of the railway standard for the possible extension of the ScanMed corridor, to the northern-most BSR areas. It is important that stakeholders not directly situated at the ScanMed corridor will reap benefits from the CNC. Due to this it is fundamental to get an understanding of stakeholder behaviour and the usage of railway, and the basis of this is to study the current status of the railway lines.

With the same parameters and framework as the ScanMed report this report is a supplement with railway data for the northern part of Sweden and Norway. For details about the parameters and more information about the ScanMed Freight Corridor, see ScanMed Final Report from 2015.

The analysis studies the number of tracks of the specified network. Some ongoing projects and bottlenecks are presented and described to get an understanding of what is to be expected in the future.

The conclusion chapter describes e.g maximal operating speed is above 100 km/h in about 75% of the network. The line in Norway does not fulfil this requirement. Regarding Sweden, a big part of the speed limitations is located along the Iron Ore line (about 45% of the restrictions in Sweden).

2. Introduction

2.1 TENTacle

The TEN-T core network corridors (CNC) is a new instrument of the EU transport policy, aimed to improve mobility, intermodality and interoperability on the major transport axes across Europe. The Baltic Sea Region (BSR) is intersected by three core network corridors being Scan-Med, North Sea-Baltic and Baltic-Adriatic.

A broad range of stakeholders are expected to be involved in a joint action to remove physical, technical, operational and administrative bottlenecks along these corridors by the year 2030. Implementation of the three core network corridors has a large but untapped potential to stimulate positive effects in the BSR beyond the pure transport sector and beyond the immediate geographical areas they cross.

Opening it up for a broader group of stakeholders and a wider geographical area requires tackling major capacity challenges. These are, for example, related with a low awareness and deficient understanding of how the CNC implementation can help improve accessibility and connectivity challenges in specific territories. And this is what TENTacle will foster in the coming years. By working across the borders and sectors we will: Improve stakeholder capacity to reap benefits of the core network corridors implementation for the prosperity, sustainable growth and territorial cohesion in the Baltic Sea Region.

In practise, this means that by the end of 2019:

- All territories in the BSR can profit from the CNC, irrespective of the geographical location;
- The involved public authorities and market players are able to deliver effective growth and prosperity policies and strategies, and work out effective logistics solutions complementing the CNC investments;
- European Coordinators leading the CNC implementation receive an organised project-based support in mobilising stakeholders both in and outside the specific corridors to a joint work;
- Transport authorities around the Baltic Sea are aware of the two policy coordination instruments of CNCs and the EUSBSR, and are able to use the synergy gains in routine planning, management and implementation processes;
- Other European macroregions are inspired by the BSR way how to reap benefits of the core network corridors for the purpose of prosperity, growth and cohesion.

2.2 Present situation

The Scandinavian-Mediterranean Corridor as defined in Connecting Europe Facility (CEF), stretches from Valletta in Malta to Oslo in the southern part of Norway, to Örebro (Hallsberg) and Stockholm in the middle of Sweden and to the Finnish-Russian border in the South of Finland.[1]

Figure 1: The ScanMed Corridor, rail and road network

Source: http://ec.europa.eu/transport/infrastructure/tentec/tentec-portal/map/maps.html?corridor=5
Processed by: Region Örebro County

[1] https://ec.europa.eu/transport/themes/infrastructure/ten-t-guidelines/corridors/scan-med_en

Sweden's main exports (measured in weight) come from the northern part of the country and are destines for supply of the main industries in Central Europe with raw material. This makes a functioning railway system of high quality between Northern Scandinavia and Central Europe essential and an extension of the European TEN-T core network corridor to the northernmost areas should be considered.[2] The Bothnian corridor is a part of the TEN-T core network and stretches on the Swedish side from Narvik and Haparanda in the North to Mjölby and Stockholm in the South.[3]

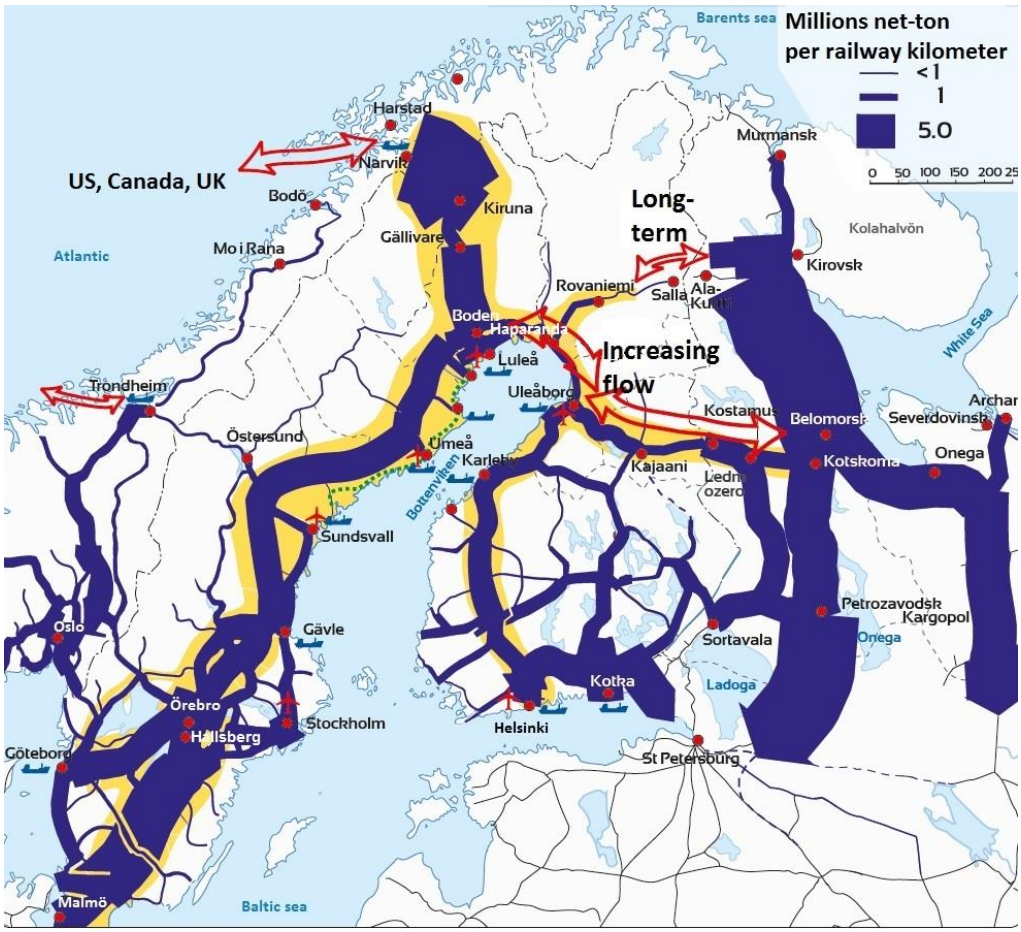

Figure 2: Freight flow

Source: Botniska korridoren Systemanalys 2016-11-04, p44. Processed by Region Örebro county

With the same parameters and framework as the ScanMed report this report is a supplement with railway data for the northern part of Sweden and Norway. For details about the parameters and more information about the ScanMed Freight Corridor, see ScanMed Final Report from 2015.

[2] *Botniska korridoren- övergripande systemanalys 04.11.2016*
[3] http://bothniancorridor.com/sv/vad/

2.3 Objectives

"The aim is to create a single European transport area, which is efficient and sustainable, to increase the benefits for its users and to support inclusive growth".

This is how the ScanMed report describes the aim of the trans-European transport network. The objectives shall strengthen the social, economic and territorial cohesion of the European Union. The objectives are determined by the Member States and agreed upon to be fulfilled latest by 2030.[4]

MODE	*OBJECTIVES*
Rail	Full electrification Axle load 22.5 Line speed 100 km/h, minimum 740 m freight trains ERMTS fully implemented Standard gauge 1435 mm for new lines

Table 1: Objectives

2.4 Purpose

This report will show the current state of the railway standard for the possible extension of the ScanMed corridor, to the northern-most BSR areas. It is important that stakeholders not directly situated at the ScanMed corridor can reap benefits from the CNC. In order to fulfil this purpose it is fundamental to get an understanding of stakeholder behavior and the usage of railway from regions currently not included in the ScanMed corridor.

The parameters used in this report are same parameters used in the ScanMed report. The aims for the ScanMed corridor is to fulfill these parameters by 2030 while these parameters are not today required for the possible extension of the ScanMed corridor (the network covered in this report), since it is not included in the CNC. This report intend to show the current status by using these parameters, and by doing so, see the railway standard in relation to the requirements and how well they are fulfilled for the possible extension.

[4] *ScanMed Draft Final Report version 07.11.2014*

2.5 Length and lines

The railway network analyzed in this report has a length of more than 1900 km (see appendix 2 for information about the calculated network length). The network reaches from Örebro (Hallsberg) and Stockholm all the way to the northern parts of Norway and Sweden; Narvik and Haparanda. 98 % of the railway is in Sweden and only 2 % is in Norway.

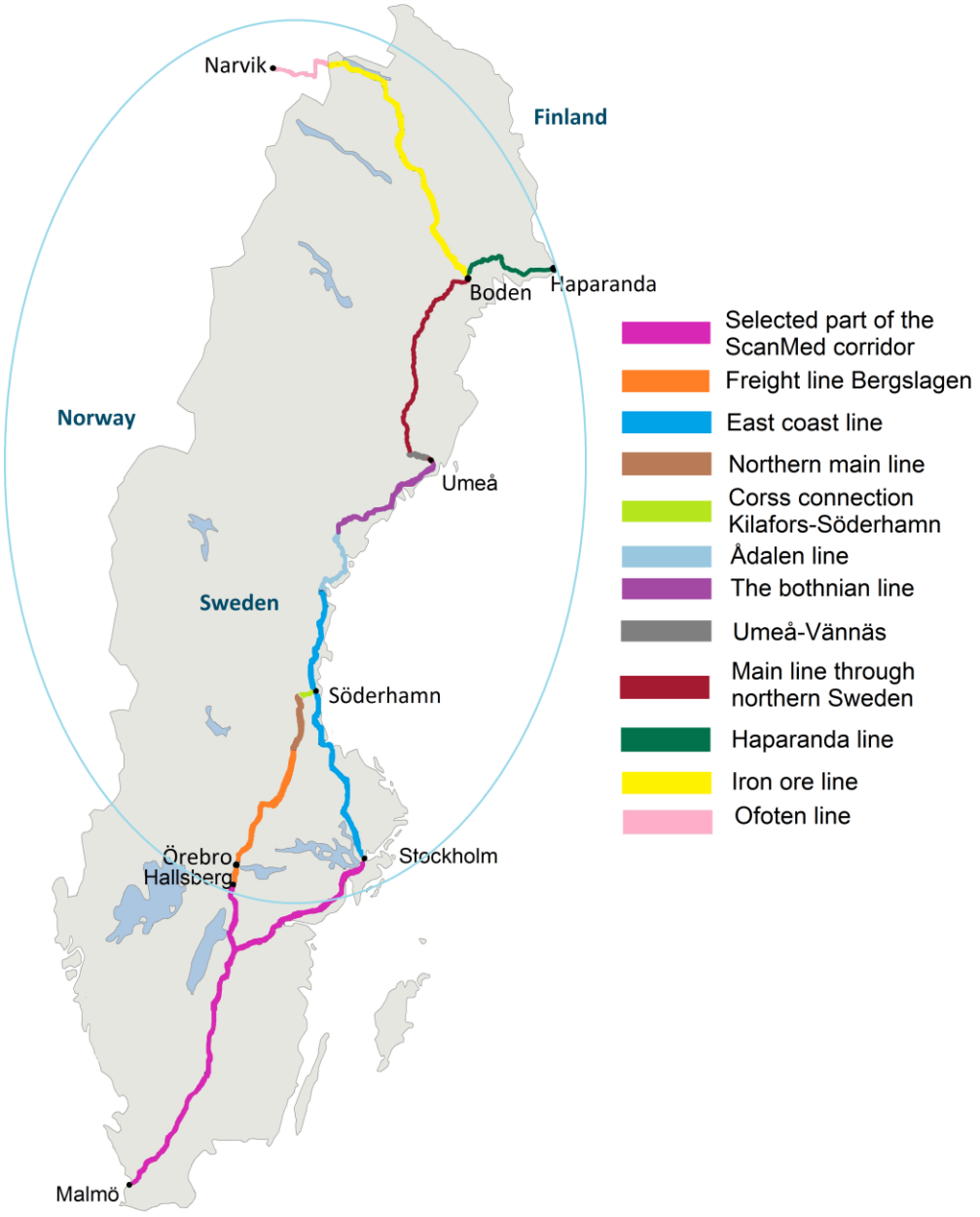

Figure 3: Extended version of the ScanMed corridor to northern parts

Source:http://www.trafikverket.se/contentassets/32728f4f04714890b7f8659e94ed5212/jarnvagsnat_stor.jpg. Processed by Region Örebro County

COUNTRY	*NETWORK LENGTH [KM]*	*SHARE [%]*
NO	40.42	2%
SE	1917.27	98%
Sum	1957.69	100.0%

Table 2: Network length

The table below shows the names of the lines of which the extension of the ScanMed corridor would include.

SWEDEN	NORWAY
FREIGHT LINE BERGSLAGEN	OFOTEN LINE
EAST COAST LINE	
CROSS CONNECTION KILAFORS-SÖDERHAMN	
NORTHERN MAIN LINE	
ÅDALEN LINE	
THE BOTHNIAN LINE	
CROSS CONNECTION GIMONÄS-VÄNNÄS	
MAIN LINE THROUGH NORTHERN SWEDEN	
IRON ORE LINE	
HAPARANDA LINE	

Table 3: Lines

Between Umeå and Luleå this document is analyzing the "Mainline through Northern Sweden". However, the selected missing link in the core network is "The North Bothnian line" which will complete the "Mainline through Northern Sweden" and create a double track function north of Umeå. Works on the first part of the North Bothnian line are planned to begin in the spring of 2018. [5] See chapter 3.5 for further information.

[5] *http://www.trafikverket.se/nara-dig/projekt-i-flera-lan/Norrbotniabanan/*

2.5.1 Cross connection Kilafors-Söderhamn

This line is closed for traffic since 2007 and will open again in December 2018. The data in this report is based on the current tracks. This means the length may differ up to a couple of kilometers (a triangle track is to be built). Please see chapter 3.3.3 for further information.

3. Parameters

The priorities and infrastructure requirements in terms of railway transport for which the following analysis was made are defined by the ScanMed Final Report 2015. For further information about the parameters used in this analysis please see the mentioned report.

Regarding the parameters; the status of the analyzed railway collected is the current situation. This means that the cross connection Kilafors-Söderhamn will fulfil some of the parameters when it reopens in December 2018, but this won't show in the tables below (chapter 2.1-2.6). Please see chapter 3.3.3 for further information regarding the positive effects the upgrade will have.

3.1 Requirement: track gauge 1435 mm

All lines along the possible extension of the ScanMed corridor feature the standard track gauge of 1435 mm.

3.2 Requirement: full electrification

This requirement is fulfilled by 98.4 %. The only link without electrification is the cross connection of Kilafors-Söderhamn, a length of 32.1 km. When the rebuilding is finished in December 2018 this part will be electrified, which means this requirement will be fulfilled within 2 years. [6]

Corridor:	**Extension of ScanMed**				
Parameter:	**No electrification**			RÖC	14-12-2016
TENtec Technical Data Railways-Deviation for the main parameters			**Length of section**	**No electrific.**	Length of section (percentage)	Remarks
Country	**Section Name**		**[m]**		**[%]**	
SE	Kilafors	Söderhamn	32100	x	1.7%	
SE	sum:		32100		1.7%	
SE	Network Corridor: ScanMed extension		1918090		100.0%	
NO	sum:		0		0.0%	Bjørnfjell-Narvik
NO	Network Corridor ScanMed extension		40420		100.0%	
	sum Corridor ScanMed extension (no electrification):		32100		1.6%	
	sum Corridor ScanMed extension		1958510		100.0%	

Table 4: Electrification

[6] *Information provided by Swedish Transport Administration, 27.12.2016*

3.3 Requirement: axle load 22.5t

Except for a small part in Sweden (same as previously mentioned) all lines on the corridor network allow an axle load of 22.5 t. When the stretch between Kilafors and Söderhamn reopens it will allow an axle load of 25.0 t.[7] Sweden has the ambition to expand the whole rail network to an axle load of 25.0 t.[8]

Corridor:	**Extension of ScanMed**					
Parameter:	**Max. Axle Load <22,5 t**				RÖC	23-12-2016
TENtec Technical Data Railways-Deviation for the main parameters			Length of section	A.L. <22,5 t	Length of section (percentage)	Remarks
Country	**Section Name**		**[m]**		[%]	
SE	Kilafors	Söderhamn V	32100	x	1.7%	
SE	sum:		32100		1.7%	
SE	Network Corridor ScanMed extension		1918090		100.0%	
NO	sum:		0		0.0%	
NO	Network corridor ScanMed extension		40420		100.0%	
	sum Corridor ScanMed extension (max axle load <22.5 t):		32100		1.6%	
	sum Corridor ScanMed extension		1958510		100.0%	

Table 5: Axle load

[7] *Information provided by Swedish Transport Administration, 27.12.2016*

[8] *http://www.trafikverket.se/resa-och-trafik/jarnvag/Sveriges-jarnvagsnat/Jarnvagstermer/*

3.4 Requirement: operating speed 100 km/h for freight

The part in Norway does not fulfil this requirement and almost 435 km (22.7 %) of the network in Sweden does not fulfil it either. The parts which do not fulfil the requirement are often very short. Only six of these shares are sections of 10 km or longer. A big part of the speed limitation is located along the Iron Ore line in Sweden, this part is about 196 km in total. As a result, 45 % of the speed restrictions are located along the Iron Ore line in the northernmost part of Sweden.

Of the 435 km that do not fulfil the requirement of an operating speed of 100 km/h, more than half (58%) are enabling 90-100 km/h. Below, there is a shortened version of the speed limitations. The complete list can be found in Appendix 1.

Speed restrictions in Sweden and Norway are based on a number of different parameters. Table 6, below, shows the speed limitation with an axle load of 22.5 ton.[9] If the train has a lower axle load the train might be able to have a higher speed. E.g. Ofoten line in Norway: if the axle load of a train is lower than 18.0 ton, the allowed maximum speed increases to 100 km/h.[10] Other parameters affecting the speed are e.g length, number of axles, breaking weight, wagons, breaking number. The length of the train and the number of axles are also important factors to study to know maximum speed. I.e if the train is longer than the standard length it may need to have a restricted speed other than what is found in the linjeboken and streckningsboken.[11] With this said; there are a number of parameters to consider. The maximum speed showing in the table below demonstrates the speed limitations as they are defined in Swedish Transport Administration's "linjeboken" and in Bane Nor "strekningsboken".

In addition, there also exist some local restraints that must to be considered, both in Norway and in Sweden. For local restraints at Swedish lines please see annex B in "Linjeboken" and "Järnvägnätsbeskrivningen, annex 3B". For local restraints at the Norwegian lines please see "Strekningsanalysen" or "Målevognfoto".

Table 6 demonstrates different sections and speed restrictions within these sections. E.g. the stretch between Harrträsk and Ripats has three sections with speed restrictions for 22.5 tons axle load. First a section of 1935 meters with a maximum speed of 85 km/h and then a section with an operating speed of 100 km/h or more (this is not shown in the table because it is fulfilled) and then another section of restricted speed (1590 meters, 90 km/h) followed by another section of fulfilled requirement, and so on.

[9] *There are some exceptions which can be found in "Linjeboken", part 2, Swedish Transport Administration*
[10] *https://brage.bibsys.no/xmlui//bitstream/handle/11250/227070/138/3.3.2.2.1%20Aksellast%20-%20Axle%20load.pdf*
[11] *http://orv.jbv.no/ns/doku.php?id=ns2017en:infrastructure*

Corridor:		Extension of ScanMed				
Parameter:		Max. operating speed < 100km/h			RÖC	DATUM
TENtec Technical Data Railways- Deviation for the main parameters			Length of section	Max. operating speed	Length of section (percentage)	Remarks
Country	Section Name		[m]	[km/h]	[%]	
SE	Harrträsk	Ripats	1935	85	0.10%	
SE			1590	90	0.08%	
SE			2258	95	0.12%	
SE	…					
SE	…					
SE	sum:		434950		22.68%	
SE	Network: ScanMed extension		1918090		100.00%	
NO	Narvik	Bjørnfjell	40420	70	100.0%	
NO	sum:		40420		100.0%	
NO	Network: ScanMed extension		40420		100.0%	
	sum Network ScanMed extension (Vmax<100km/h):		475370		24.36%	
	sum Network Network ScanMed extension		1958510		100.0%	

Table 6: Operating speed, see the entire version in appendix 1

3.5 Requirement: 740 m train length

The requirement is that the tracks enable freight trains to be 740 meters including locomotive(s). The allowed length is determined by different parameters such as operating speed, infrastructure, inclination, meeting stations, timetable etc.[12,13] This means that concrete values for specific sections normally are not published in the network statement. To find those the Swedish Transport Administration and Norwegian Bane Nor have to be contacted.

Swedish and Norwegian networks allow a train length of 700 m or more regarding the specific breaking and/or operating conditions (see the table below)[14]. In Sweden, the standard train length is 630 m.[15] Currently, the stations having the possibility to facilitate trains longer than 630 meters are generally spoken too few and as a result it requires careful planning to run trains longer than that. Stations with long-enough tracks function as meeting points for "long freight trains".[16] At a traffic disruption the traffic might have to be rescheduled and in such cases the train length is a very important parameter. It is possible to run trains longer than 630 m (for example the ore train at Ofoten line) but restrictions due to timetabling can apply and the operational situation can have an impact on the actual possible train length.[17]

As mention above, the train length standard in Sweden is 630 meters. There are no further restrictions for trains longer than 630 m; it is simply a planning issue. When building new operating sites (stations and meeting tracks) and when extending existing operating sites, the standard is 750 meters or longer.[18] See figure 4, below, for information about the meeting stations in Sweden for selected part of the ScanMed corridor in Sweden and for the possible extension of the ScanMed corridor in the northernmost parts of the BSR areas.

[12] *https://trafikverket.ineko.se/Files/sv-SE/12111/RelatedFiles/100780_att_trafikera_jarnvagen_2017.pdf*
[13] *Information provided by Swedish Transport Administration, 21.12.2016*
[14] *http://orv.jbv.no/ns/doku.php?id=ns2016no:infrastruktur and http://www.trafikverket.se/contentassets/98ba2b2ed8cf4dc39f882f2bea1185eb/modul_11_broms_20170601.pdf*
[15] *http://www.trafikverket.se/contentassets/32a43e0bd6fd42bda85f95a437b22f7c/jnb2017.pdf*
[16] *Både http://www.banenor.no/contentassets/1310c139b88a44dd8041c9f350ed763d/jbv_godsstrategi_2016_trykk.pdf and information provided by the Swedish Transport Administration 21.12.2016*
[17] *Information provided by Swedish Transport Administration, 21.12.2016*
[18] *Information provided by Swedish Transport Administration, 27.03.2017 and by Jernbanedirektoratet, 30.03.2017*

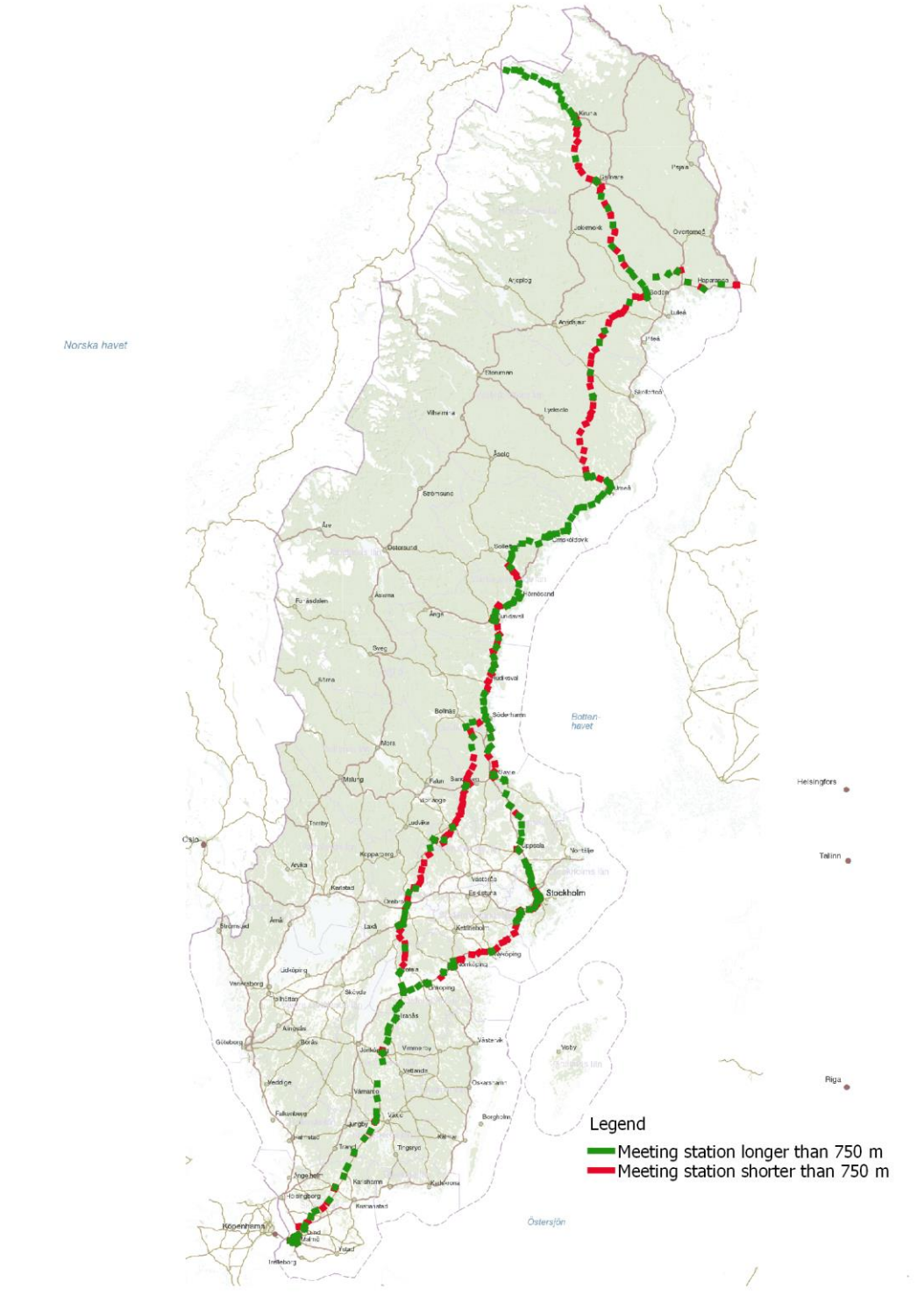

Figure 4: Meeting stations for selected lines in Sweden

Source: map-Lantmäteriet, data- Swedish Transport administration, processed by Region Örebro County

Norway does not have a standard length for freight trains, the standard train length differs from line to line. The average combined freight train is about 450 meters and a train with timber has an average of 350-400 m. One of the aims expressed in the Norwegian freight strategy from February 2016 is to facilitate trains as long as 740 m in order to follow the European TEN-T network standard. In additions to this, under certain conditions, e.g at night, it is already possible to run longer trains than during daytime. An opportunity will open up in the 2017 timetable to perform longer trains in regular service.[19] Today there are certain ore trains that are 746 meters (including locomotives) running Ofoten line to and from Narvik.[20]

Corridor:	**Extension of ScanMed**		
Parameter:	**Max. train length**	RÖC	14-12-2016
TENtec Technical Data Railways- Deviation for the main parameters			
Country	**Max. train length**	Remarks	
NO	700 m / 850	Break operating conditions P, Break operating conditions G	
SE	730 m / 880 m	Break group P/R Break group G	

Table 7: Train length

[19] http://www.banenor.no/contentassets/1310c139b88a44dd8041c9f350ed763d/jbv_godsstrategi_2016_trykk.pdf
[20] *Information provided by Swedish Transport Administration, 02.12.2016*

3.6 Requirement: full deployment of ERTMS

The deployment of ERTMS has started on pilot lines in both Sweden and Norway. Ådals-, Botnia- and Haparanda lines. Both Sweden and Norway have decided that ERTMS Level 2 is the most suitable solution. [21, 22]

Some parts of the possible extension of the ScanMed corridor to the northern most parts of the BSR have already implemented ERTMS. The Pilot deployment of ERTMS is done on TEN-T Core Network. Following pilot projects are in operation: Ådalen-, Bothnian- and Haparanda line. Next up is the Iron Ore line, the part between Boden and the border to Norway. The Iron Ore line is one of Sweden's most important railways for freight transports. [23] Currently the Swedish Transport Administration is moving from an 18-months planning phase to the coordination of the upcoming construction phase. The Iron Ore line is the first line outside the pilot lines to be implemented with ERTMS. Planning and design is underway and construction is planned for a deployment between 2021-2023.[24] ERTMS will gradually be implemented in the entire Swedish network and in 2035 the main railway links will have ERTMS. Sweden and Norway aim to deploy ERTMS on the complete Core Network till 2030. Decisions for the Swedish implementation plan were taken by the Swedish Transport Administration Director General in November 2015.[25]

BaneNor has in its latest forecast scheduled for ERTMS deployment on Ofotenbanan 2022. The implementation plan for the country is to be completed by 2030 for all the main lines. [26] The development of ERTMS will require a substantial coordination between Norway and Sweden. [27]

[21] http://www.jernbaneverket.no/globalassets/documents/ertms/brochure-ertmsimplementation plan.pdf
[22] http://www.trafikverket.se/for-dig-i-branschen/teknik/ny-teknik-i-transportsystemet/trafikstyrningssystemet-ertms/om-ertms/
[23] http://www.trafikverket.se/nara-dig/Norrbotten/projekt-i-norrbottenslan/Malmbanan
[24] http://www.trafikverket.se/for-dig-i-branschen/teknik/ny-teknik-i-transportsystemet/Trafikstyrningssystemet-ERTMS/utbyggnad-av-ertms/malmbanan/
[25] http://www.trafikverket.se/for-dig-i-branschen/teknik/ny-teknik-i-transportsystemet/Trafikstyrningssystemet-ERTMS/Planering-ERTMS/
[26] http://www.jernbaneverket.no/globalassets/documents/ertms/brochure-ertms-implementation-plan.pdf
[27] http://www.jernbaneverket.no/Prosjekter/Utredninger/Jernbaneverkets-Utredninger/Anbefaler-tett-samarbeid-for-okt-kapasitet-pa-OfotbanenMalmbanan/

Corridor:	Extension of ScanMed					
Parameter:	ERTMS implemented				RÖC	23-12-2016
TENtec Technical Data Railways- Deviation for the main parameters			Length of section	ERTMS implemented	Length of section (percentage)	Remarks
Country	**Section Name**		[m]		[%]	
SE	Sundsvall*	Västeraspby	124240	x	6.5%	Ådalen line, *starting slightly west of Sundsvall
SE	Västeraspby	Gimonäs	183540	x	9.6%	Botniabanan
SE	Buddbyn	Haparanda	155900	x	8.1%	Haparandabanan
SE	Sum:		463680		24.2%	
SE	Network Corridor ScanMed extension		1918090		100.0%	
NO	Sum:		0		0.0%	
NO	Network Corridor ScanMed extension		40420		100.0%	
	sum Corridor ScanMed extension (ERTMS implemented):		463680		23.7%	
	sum Corridor ScanMed extension		1958510		100.0%	

Table 8: ERTMS implemented

The figure below shows the implementation plan for ERTMS in Norway and Sweden. It shows the planned deployment of ERTMS in Sweden. The green lines are already fulfilling the requirement. As seen the ERTMS deployment will start in the existing ScanMed corridor and on the Iron Ore line (blue line). After finishing those parts the rest will be implemented with ERTMS (red lines). [28]

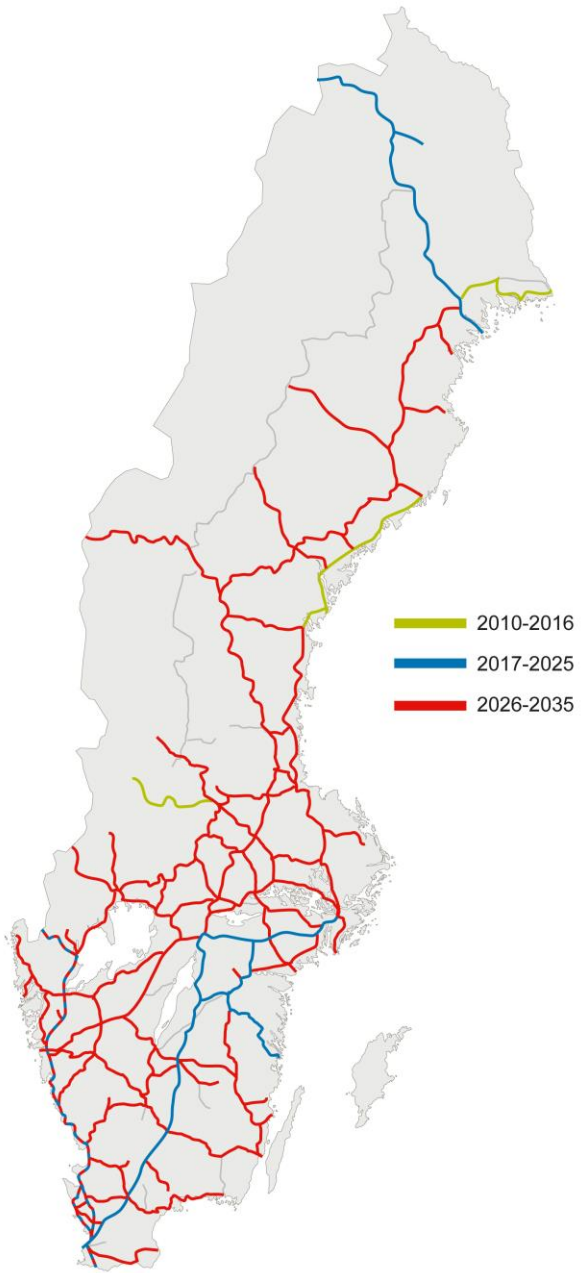

Figure 5: ERTMS deployment

Source: http://www.trafikverket.se/contentassets/bdb5055dfe4f491d93870396eba2e41a/inforandeplan_svensk-ertms 20150903.jpg. Processed by Region Örebro County

[28] *http://www.trafikverket.se/contentassets/bdb5055dfe4f491d93870396eba2e41a/inforandeplan_svensk-ertms_20150903.jpg.*

4. Analysis

4.1 Analysis of number of tracks

There is no requirement an overall double-track railway line system in the regulation. Single tracks do not necessarily need to be identified as bottlenecks. If single tracks are considered as bottlenecks depend on expected demand for rail services.[29] However, data was collected to analyze which sections/lines only have single track.

Almost 90% of the possible corridor extension in Sweden, 1915 km, is single track and 100 % of the analyses railway system in in Norway (1915 km in Sweden and 40 km in Norway).

Corridor:	**Extension of ScanMed**					
Parameter:	**Number of tracks**				RÖC	14-12-2016
TENtec Technical Data Railways- Deviation for the main parameters			**Length of section**	**Nr. of tracks**	**Length of section (percentage)**	Remarks
Country	**Section Name**		**[m]**	[-]	%	
SE	Frövi	Mo grindar	208560	1	10.9%	
SE	Holmsveden	Boden	816090	1	42.6%	
SE	Boden	Haparanda	159790	1	8.3%	
SE	Boden	Bjørnfjell	400740	1	20.9%	
SE	Gävle	Söderhamn V	78490	1	4.1%	
SE	sum:		1663670		86.8%	
SE	Network: ScanMed extension		1918090		100.0%	
NO	Narvik	Bjørnfjell	40420	1	100.0%	(Bjørnfjell-Narvik)
NO	sum:		40420		100.0%	
NO	Network: ScanMed extension		40420		100.0%	
	sum Corridor ScanMed extension (single track line):		1704090		87.0%	
	sum Corridor ScanMed extension		1958510		100.0%	

Table 9: Number of tracks

[29] *ScanMed Draft Final Report 07.11.2014*

4.2 Bottlenecks and ongoing projects

As mentioned in chapter 1.2.1, the link between Kilafors and Söderhamn is closed due to rebuilding (2016-12-14). An upgrade and a new meeting station will be in place by December 2018. Below the capacity constraints for selected parts of ScanMed corridor in Sweden and the possible extension of the northernmost parts of the BSR are seen;

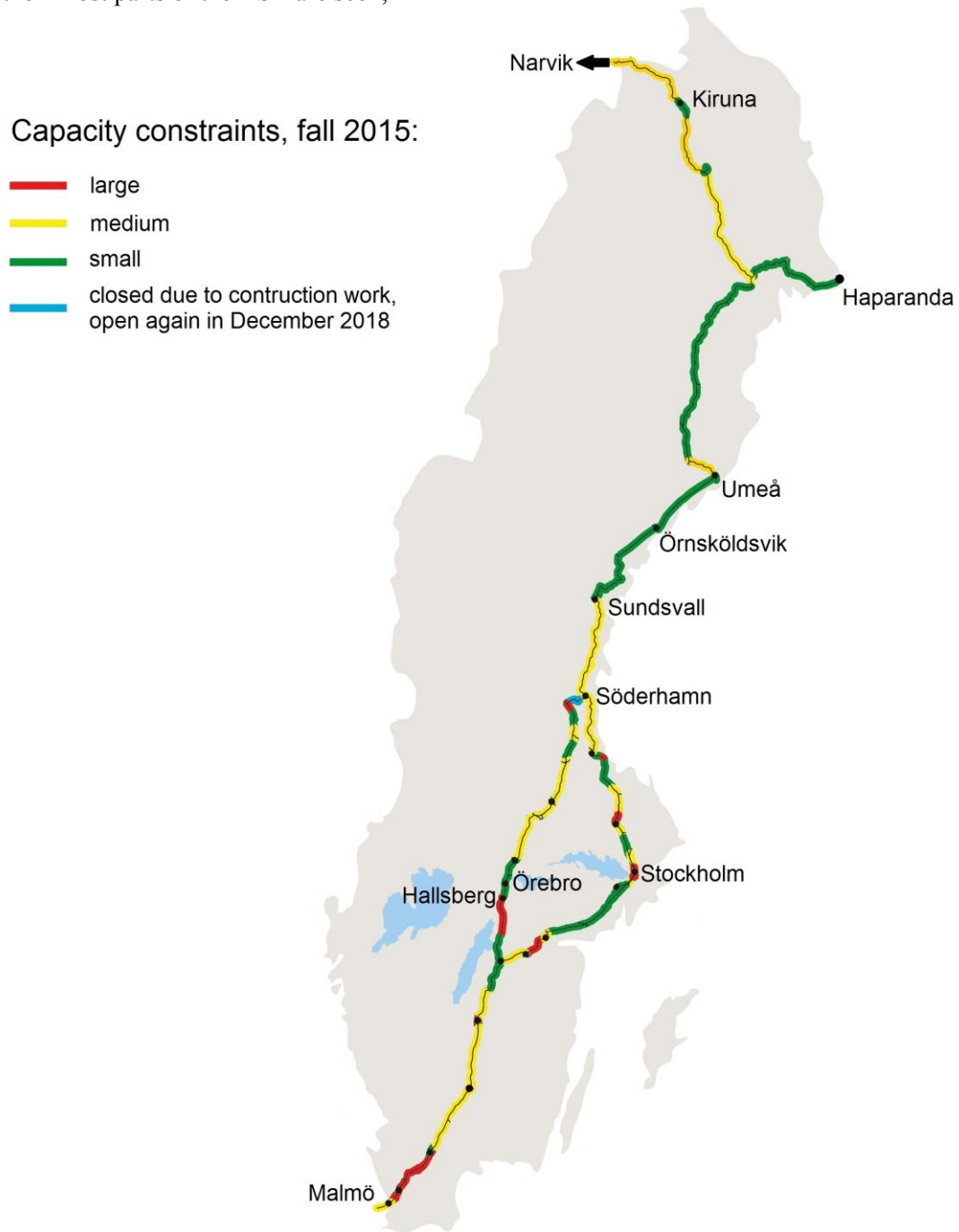

Figure 6: Capacity constraints for selected lines Sweden

Source:http://www.trafikverket.se/contentassets/e3151655a15e4cd388a611745ac0b36e/karta_kapcitetsbegr_stor.jpg. Processed by Region Örebro County

A selection of ongoing projects along the extension of ScanMed is described below.

Avesta Krylbo-Dalslund

This part is located in Dalarna and is currently a single track. Preparations are ongoing to upgrade this 5 km section to a double track. The construction shall start in 2021.

Kilafors-Söderhamn

The stretch between Kilafors and Söderhamn V is 2017 closed for traffic due to an upgrade to make the line cope with increased traffic flows associated with the launching of the North Bothnia Line.. The upgrade will improve the freight transport with longer trains because of a new meeting station and a triangular track in Söderhamn, which will give the traffic a more even flow. This implies that the capacity increases but the energy consumption is reduced. Road safety will also be improved considerably as several dangerous level crossings will be closed.

When it is finalized it will be electrified and it will be possible to pass with an axle load of 25.0 t, notice this will not show in the tables in chapter 2 as all data in this report is from December 2016. The line will open for traffic again in December 2018.[30]

Kilafors-Holmsveden

The 15 km single-track between Holmsveden and Kilafors is currently a bottleneck on the line of Norra stambanan. Swedish Transport Administration has initiated a feasibility study about possible activities to improve capacity to facilitate increased traffic.[31]

Dingersjö-Sundsvall

To increase capacity on Ostkustbanan Swedish Transport Administration plans on building a double track between Dingersjö and Sundsvall. This is seen as an investment tranche in a future double track connection from Gävle-Sundsvall. Time table:

- 2015-2019 planning process.
- 2023 the building start.
- 2027 the double track is ready for traffic.[32]

Kiruna-Riksgränsen

The Iron Ore line and Ofotbanen are currently highly utilized. The Swedish Transport Administration's studies shows that the best way of strengthening the line is to build a double track. The first phase will be 50 km between Peuravaara-Bergfors and Kopparåsen-Vassijaure, the building will at the earliest start in 2019. [33]

[30] http://www.trafikverket.se/soderhamnkilafors
[31] http://www.trafikverket.se/kilafors-holmsveden
[32] http://www.trafikverket.se/dingersjo-sundsvall
[33] http://www.trafikverket.se/nara-dig/Norrbotten/projekt-i-norrbottens-lan/Malmbanan/dubbelspar/

4.3 Freight line Bergslagen

Godstråket genom Bergslagen (Freight line through Bergslagen) is the main freight line between Northern Sweden and Sauthern Sweden as well as Central Europe. It connects the Southern main line in Mjölby with the Northern main line in Storvik and crosses at the biggest Swedish shunting yard in Hallsberg the Western main line. The line is about 311 km long and has capacity restraints. Increased capacity on railroads both further to the North and further to the South will increase the capacity shortage along the Freight line through Bergslagen.

South of Frövi the line will be a double track by 2029. The largest train number occur around the city of Örebro with about 190 trains per day, about 50% of them being freight trains and about 50% being passenger trains.

North of Frövi the line is a single track with 21 meeting stations. In order to solve bottle necks and to not just move them it is decisive that the capacity upgrade of the Freight line through Bergslagen is time and capacity wise matched with a capacity upgrade of the East coast line.

4.4 East coast line

Ostkustbanan (the East coast line) between Gävle and Sundsvall and the Ådalsbanan between Sundsvall and Härnösand is a single track railway is a low capacity railway with a high level of capacity utilization. The travel time is increasing due to increasing traffic. To meet today's and future demands of capacity the East coast line is to be completed to double tracks between Gävle and Sundsvall, increasing its capacity from todays 70 trains per day to over 200. North of Sundsvall Ådalsbanan will be modernized and straightened to Härnösand to meet the Core network standards. Works on the first parts of the project will begin in 2018.

4.5 North Bothnian line

The North Bothnia Line is a new railway between Umeå and Luleå, included in the TEN-T core network. The 270-km stretch begins where the Bothnia Line ends, and completes the coastal railway along the coast of Northern Sweden.

The North Bothnia Line will provide a shorter distance, increased capacity and speed, reduced transport costs and will together with the "Mainline through Northern Sweden" create a double track function north of Umea. Works on the first part of the North Bothnian line are planned to begin in the spring of 2018.

The North Bothnian line will have capacity for heavy and longer trains and at the same time connect the cities and industrial clusters situated along the coast. The existing mainline, situated further inland due to other considerations when it was built over 100 years ago, is difficult to enhance further for increased capacity due to its steep slopes and narrow bends. At the same time it cannot offer better communications between the urbanized centers along the coast the same way a new coastal railway can.

5. Conclusion

The compliance analysis with respect to the distinctive rail objectives is showing the following, in particular:

- The standard track gauge is supplied on all corridor lines.
- Most lines are electrified with the exception on the line between Kilafors-Söderhamn V, 1.7%, which is currently closed but about to be electrified until December 2018.
- Axle load below the standard parameter (<22.5 t) on the same line as mentioned above, the stretch between Kilafors and Söderhamn V will open again in December 2018 and when finished it will allow an axle load of 25,0 t.
- Maximal operating speed is above 100 km/h in about 75% of the network. The line in Norway does not fulfil this requirement. Regarding Sweden, a big part of the speed limitations is located along the Iron Ore line (about 45% of the restrictions in Sweden).
- All networks allow a train length of 700 m or more depending on specific breaking and/or operating conditions. With breaking operating conditions/break group G it is possible to have trains up to 880 m in Sweden and 850 m in Norway. However, this is more of a theoretical length, due to restrictions of timetabling and operational challenges etc, the standard train length is 630 m. Though, there are certain ore trains that are 746 meters (including locomotives) running Ofoten line and Ore line to and from Narvik.
- ERTMS is implemented in 24,2 % of the possible extension of ScanMed. The Norwegian part (Ofotenbanen) is scheduled to be finished 2022 and the Swedish Malmbanan [Iron Ore line] by 2021-2023. Sweden plans for the fulfillment of ERTMS deployment on the entire TEN-T core network by 2030 and nation-wide by 2035.

Appendices

Appendix 1 – Requirement: operating speed 100 km/h for freight table

Corridor:		Extenstion of ScanMed				
Parameter:		Max. operating speed < 100km/h			RÖC	2017-01-30
TENtec Technical Data Railways-Deviation for the main parameters			**Length of section**	**Max. operating speed**	Length of section (percentage)	Remarks
Country	**Section Name**		**[m]**	**[km/h]**	**[%]**	
SE	Bjørnfjell	Vassijaure	7286	70	0.38%	Linjeboken Bjørnfjell-Boden
SE	Vassijaure	Abisko Östra	31112	80	1.62%	
SE	Abisko Östra	Stordalen	3342	90	0.17%	
SE	Stordalen	Kaisepakte	1201	90	0.06%	
SE			8200	90	0.43%	
SE	Stenbacken	Torneträsk	2525	90	0.13%	
SE	Torneträsk	Rensjön	16376	70	0.85%	
SE	Rensjön	Rautas	524	90	0.03%	
SE	Rautas	Krokvik	9954	90	0.52%	
SE	Råtsi	Kalixfors	11132	90	0.58%	
SE	Gäddmyr	Lappberg	6309	90	0.33%	
SE			616	90	0.03%	
SE	Lappberg	Fjällåsen	1260	90	0.07%	
SE	Fjällåsen	Harrå	1012	90	0.05%	
SE	Harrå	Håmojåkk	3989	90	0.21%	
SE			12080	90	0,63%	
SE	Linaälv	Sikträsk	488	90	0,03%	
SE	Sikträsk	Gällivare	1999	90	0,10%	
SE	Gällivare	Koijuvaara	1722	90	0,09%	
SE			1368	40	0,07%	
SE			868	70	0,05%	
SE			3097	85	0,16%	
SE			603	75	0,03%	
SE			993	85	0,05%	
SE			4198	90	0,22%	
SE	Harrträsk	Ripats	1935	85	0,10%	
SE			1590	90	0,08%	
SE			2258	95	0,12%	

Corridor:		Extenstion of ScanMed				
Parameter:		Max. operating speed < 100km/h			RÖC	DATUM
TENtec Technical Data Railways- Deviation for the main parameters			Length of section	Max. operating speed	Lenght of section (percentage)	Remarks
Country	Section Name		[m]	[km/h]	[%]	
SE	Ripats	Nuortikon	1779	90	0,09%	
SE			577	90	0,03%	
SE			362	85	0,02%	
SE			2834	90	0,15%	
SE			794	85	0,04%	
SE	Nuortikon	Kilvo	1691	90	0,09%	
SE	Kilvo	Nattavaara	1550	80	0,08%	
SE			1991	80	0,10%	
SE			1410	85	0,07%	
SE	Nattavaara	Koskivaara	1009	80	0,05%	
SE			335	95	0,02%	
SE			2525	85	0,13%	
SE			488	75	0,03%	
SE			964	80	0,05%	
SE			2593	90	0,14%	
SE	Koskivaara	Polcirkeln	993	90	0,05%	
SE			296	95	0,02%	
SE			6145	90	0,32%	
SE	Polcirkeln	Murjek	687	80	0,04%	
SE			195	75	0,01%	
SE			3175	80	0,17%	
SE			1247	85	0,07%	
SE			1388	85	0,07%	
SE			4561	90	0,24%	
SE	Tolikberget	Näsberg	762	85	0,04%	
SE	Näsberg	Lakaträsk	1266	95	0,07%	
SE			332	90	0,02%	
SE			1886	95	0,10%	
SE	Lakaträsk	Gullträsk	454	85	0,02%	
SE			2710	95	0,14%	
SE			1361	90	0,07%	
SE			3327	80	0,17%	
SE	Gullträsk	Sandträsk	521	80	0,03%	
SE			1969	95	0,10%	
SE			1224	80	0,06%	

Corridor:		Extenstion of ScanMed				
Parameter:		Max. operating speed < 100km/h			RÖC	DATUM
TENtec Technical Data Railways- Deviation for the main parameters			Length of section	Max. operating speed	Lenght of section (percentage)	Remarks
Country	Section Name		[m]	[km/h]	[%]	
SE	Gullträsk	Sandträsk	521	80	0,03%	
SE			1969	95	0,10%	
SE			1224	80	0,06%	
SE	Sandträsk	Gransjö	269	90	0,01%	
SE	Ljusså	Holmfors	310	95	0,02%	
SE	Bruksberget	Morjärv	270	90	0,01%	Haparanda-Boden
SE			842	70	0,04%	
SE			524	80	0,03%	
SE	Morjärv	Sågbäcken	728	95	0,04%	
SE			1855	90	0,10%	
SE	Sågbäcken	Gåsträsken	650	90	0,03%	
SE			532	95	0,03%	
SE			3980	95	0,21%	
SE			1050	95	0,05%	
SE			782	90	0,04%	
SE	Gåsträsken	Bjurå	389	90	0,02%	
SE			908	95	0,05%	
SE			588	90	0,03%	
SE			495	95	0,03%	
SE			181	90	0,01%	
SE			210	70	0,01%	
SE			302	90	0,02%	
SE			790	90	0,04%	
SE			1835	90	0,10%	
SE	Bjurå	Niemisel	641	90	0,03%	
SE			948	90	0,05%	
SE			270	90	0,01%	
SE	Niemisel	Hundsjön	1064	90	0,06%	
SE			195	65	0,01%	
SE			3265	95	0,17%	
SE			1000	90	0,05%	

Corridor:		Extenstion of ScanMed				
Parameter:		Max. operating speed < 100km/h			RÖC	DATUM
TENtec Technical Data Railways- Deviation for the main parameters			Length of section	Max. operating speed	Lenght of section (percentage)	Remarks
Country	Section Name		[m]	[km/h]	[%]	
SE	Hundsjön	Buddbyn	541	90	0,03%	
SE			1270	90	0,07%	
SE			727	90	0,04%	
SE			215	80	0,01%	
SE	Buddbyn	Boden	1155	90	0,06%	
SE			505	40	0,03%	
SE	Boden	Boden Södra	475	40	0,02%	Boden-Vännäs
SE			464	80	0,02%	
SE			3254	90	0,17%	
SE	Laduberg	Älvsbyn	780	90	0,04%	for stax D
SE	Karsbäck	Bastuträsk	1304	70	0,07%	
SE	Åsträsk	Lubboträsk	859	90	0,04%	
SE	Lubboträsk	Ekträsk	3181	95	0,17%	
SE	Ekträsk	Yttersjön	1560	85	0,08%	
SE	Yttersjön	Hällnäs	2050	85	0,11%	
SE			2291	85	0,12%	
SE	Hällnäs	Vindeln	495	95	0,03%	
SE	Tvärålund	Tväråbäck	1954	90	0,10%	
SE	Vännäs	Brattby	392	70	0,02%	
SE			1079	90	0,06%	
SE			1645	95	0,09%	
SE			812	95	0,04%	
SE	Brattby	Brännland	2301	95	0,12%	
SE			1944	90	0,10%	
SE	Brännland	Klockarbäcken	1030	90	0,05%	
SE			8222	95	0,43%	
SE	Umeå godsbangård	Umeå C	1277	85	0,07%	
SE	Umeå C	Gimonäs	4510	70	0,24%	
SE	Örnsköldsvik norra	Örnsköldsvik c	8073	90	0,42%	Gimonäs-Sundsvall
SE	Västeraspby	Dynäs	1353	95	0,07%	
SE			971	75	0,05%	
SE	Kramfors	Frånö	1016	90	0,05%	
SE			387	75	0,02%	
SE			2982	90	0,16%	

Corridor:		Extenstion of ScanMed				
Parameter:		Max. operating speed < 100km/h			RÖC	DATUM
TENtec Technical Data Railways- Deviation for the main parameters			Length of section	Max. operating speed	Lenght of section (percentage)	Remarks
Country	Section Name		[m]	[km/h]	[%]	
SE	Frånö	Sprängsviken	4701	95	0,25%	
SE			412	90	0,02%	
SE	Sprängsviken	Mörtsal	200	80	0,01%	
SE			4197	75	0,22%	
SE	Svedje	Härnösand	231	95	0,01%	
SE			2997	80	0,16%	
SE	Härnösand	Hällenyland	1983	90	0,10%	Boden-Vännäs
SE			1383	80	0,07%	
SE			2730	90	0,14%	
SE			2469	95	0,13%	for stax D
SE	Hällenyland	Häggsjön	662	80	0,03%	
SE			1527	95	0,08%	
SE			1468	85	0,08%	
SE			1332	95	0,07%	
SE	Häggsjön	Hussjöby	1458	85	0,08%	
SE			1082	95	0,06%	
SE			9195	90	0,48%	
SE	Hussjöby	Söråkers södra	1264	85	0,07%	
SE			1870	90	0,10%	
SE			1622	95	0,08%	
SE			354	90	0,02%	
SE			6996	95	0,37%	
SE	Stavreviken	Solbacka	322	90	0,02%	
SE			415	95	0,02%	
SE			374	90	0,02%	
SE			1147	80	0,06%	
SE			2817	95	0,15%	
SE	Solbacka	Timrå	2188	90	0,11%	
SE	Timrå	Skönvik	2064	80	0,11%	
SE			349	85	0,02%	
SE	Skönvik	Birsta	560	80	0,03%	
SE			2251	85	0,12%	

Corridor:		Extenstion of ScanMed				
Parameter:		Max. operating speed < 100km/h			RÖC	DATUM
TENtec Technical Data Railways- Deviation for the main parameters			Length of section	Max. operating speed	Lenght of section (percentage)	Remarks
Country	Section Name		[m]	[km/h]	[%]	
SE	Birsta	Sundsvall C	6622	95	0,35%	
SE			2323	85	0,12%	
SE			282	80	0,01%	
SE			3286	90	0,17%	
SE			1047	60	0,05%	
SE			1242	40	0,06%	
SE	Sundsvall C	Svartvik	10579	95	0,55%	Sundsvall - Uppsala
SE	Tjärnvik	Gnarp	2906	95	0,15%	
SE	Stegsskogen	Via	7847	95	0,41%	
SE	Via	Hudiksvall	1408	85	0,07%	
SE			1502	65	0,08%	
SE	Källene	Söderhamn V	1656	95	0,09%	
SE	Strömsbo	Gävle godsbangård	1710	40	0,09%	via gäb
SE	Gävle godsbangård	Gävle C	91	30	0,00%	
SE			1489	40	0,08%	
SE	Samnan	Löten	411	70	0,02%	
SE			521	70	0,03%	
SE			497	70	0,03%	
SE	Tomteboda övre	Karlberg	332	80	0,02%	
SE	Karlberg	Stockholm C	968	70	0,05%	
SE			833	30	0,04%	
SE	Söderhamn V	Kilafors	32100	-	1,68%	Closed
SE	Kilafors	Röstbo	1665	80	0,09%	
SE	Julardo	AvestaKrylbo	2211	40	0,12%	
SE	AvestaKrylbo	Hökmora	183	70	0,01%	
SE	Snyten	Fagersta C	191	90	0,01%	
SE	Fagersta C	Dagarn	1518	75	0,08%	
SE	Skinnskatteberg	Krampen	1920	80	0,10%	
SE	Sällinge	Frövi	2782	80	0,15%	
SE	Hovsta	Örebro C	2823	80	0,15%	

SE	sum:	434950		22.68%	
SE	Network: ScanMed extension	1918090		100,00%	

NO	Narvik	Bjørnfjell	40420	70	100,00%	
NO	sum:		40420		100,00%	
NO	Network: ScanMed extension		40420		100,00%	

	sum Network ScanMed extension (Vmax<100km/h):	477060		24.36%	
	sum Network Network ScanMed extension	1958510		100.0%	

Appendix 2 – Network length

The length of the network in Sweden is calculated based on ”linjeboken”. The network on the Norwegian side is based on “togstrekning”. Please see Swedish Transport Administration’s “linjebok” and Norwegian Bane Nor “togstrekning” for extended information.

Bodens linjebok:

Boden-Haparanda				
Km post:	Meter:	Km post:	Meter:	Distance [m]
1144	375	1217	887	73512
0	256	85	783	85527
			tot	159039

Boden-Buddbyn				
1144	375	1148	262	3887

Vännäs norra via Vännäs-Boden				via triangle track in vns
857	230	857	660	430
858	652	887	749	29097
887	838	990	962	103124
993	0	1083	638	90638
1084	0	1115	56	31056
1116	0	1144	375	28375
			tot	282720

Boden-Björnfjell				
1144	375	1161	834	17459
1162	0	1413	1118	252118
1414	0	1416	1438	3438
1417	0	1542	573	125573
				398588
Subtract Boden-Buddbyn (already included in bdn-hp)			tot	394701

Ånges linjebok:

Vännäs-Gimonäs				
857	230	858	1274	2044
859	0	882	1970	24970
883	0	893	554	10554
			tot	37568

Sundsvall-Gimonäs				
Km post:	Meter:	Km post:	Meter:	Distance [m]
347	343	435	893	88550
442	0	464	886	22886
465	0	479	94	14094
483	0	479	94	3906
483	0	551	655	68655
5	614	0	109	5505
5	865	114	956	109091
894	651	893	554	1097
			tot	313784

Gävles linjebok

Söderhamn v-Sundsvall				
192	810	193	331	521
200	0	202	767	2767
208	0	252	548	44548
254	0	347	343	93343
			tot	141179

Kilafors-Frövi				
300	207	160	104	140103
161	270	267	687	106417
			tot	246520

Uppsala-Söderhamns v				
65	880	66	582	702
0	703	55	362	54659
56	0	72	531	16531
73	0	111	766	38766
112	0	192	821	80821
				191479

Stockholms linjebok

Stockholm-Uppsala				
0	0	6	872	6872
7	0	65	880	58880
			tot	65752

Hallsbergs linjebok

Hallsberg-Frövi				
Km post:	Meter:	Km post:	Meter	Distance [m]
3	96	0	0	3096
199	419	249	572	50153
			tot	53249

Söderhamn V-Kilafors	
Swedish Transport Administration	32100

Tot Sweden	1918091

Bjørnfjell-Narvik	
Bane Nor Togstrekning	40420

Tot distance network Sweden and Norway [m]	**1958511**