RAIL FREIGHT CORRIDOR NORTH SEA-BALTIC

STUDY ON CAPACITY IMPROVEMENT - SCI
(ANALYSIS OF 740 METER LONG TRAINS)

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Prepared for:

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Glossary of abbreviations

BCP	Border Crossing Point
CBA	Cost-Benefit Analysis
CEF	Connecting Europe Facility
CNC NS-B	Core Network Corridor North Sea-Baltic
ERTMS	European Rail Traffic Management System
EU	European Union
ETCS	European Train Control System
IM	Infrastructure Manager
MB	Management Board of RFC NS-B
RAG	Railway Undertakings Advisory Group of the RFC NS-B
RFC	Rail Freight Corridor
RFC NS-B	Rail Freight Corridor North Sea-Baltic
SCI	Study on Capacity Improvement (the present study)
TAC	Track Access Charge
TAG	Terminal Advisory Group of the RFC NS-B
TMS	Transport Market Study
TEN-T	Trans-European Network-Transport
WG Infrastructure	Working Group Infrastructure of RFC NS-B

Country codes after ISO 3166

Belgium	BE
Czech Republic	CZ
Germany	DE
Lithuania	LT
Netherlands	NL
Poland	PL

1. EXECUTIVE SUMMARY

1.1. Introduction

Assuming as reference the 740 meter train length standard set in the TEN-T Regulation (EU) 1315/2013, the present Study on Capacity Improvement (SCI) of the Rail Freight Corridor North Sea-Baltic (RFC NS-B) aimed to:

- i) provide a description of the corridor characteristics in 2018 (representing the base year for the analysis) with reference to the technical maximum train length parameter and possible related capacity constraints;
- ii) assess the expected corridor infrastructure and operational characteristics by 2030, based on the review of the impact of the ongoing and planned investments on the possibility to operate 740 meter long trains;
- iii) identify additional measures to improve the operation of 740 meter long trains under the technical and capacity points of view, that would still be required upon completion of the ongoing and planned initiatives to remove infrastructure obstacles and allow a smooth and seamless operation of 740 meter long trains along the RFC NS-B by 2030.

The study concerned the RFC NS-B infrastructure in the following six Member States interconnected in 2018 by European standard gauge corridor railway lines, i.e. the Netherlands, Belgium, Germany, Poland the Czech Republic, and Lithuania.

In order to perform the analysis a database including the relevant information for the corridor lines and handover stations/marshalling yards/waiting-buffer locations in 2018 and by 2030 was developed based on the information provided by the concerned infrastructure managers. This database is provided in Annex A to this report. The corridor infrastructure subject of study includes a total of 7,330 km of railway lines, 89 handover stations/marshalling yards/waiting-buffer locations and 160 terminals.

To collect relevant information about the RFC NS-B terminals, a survey was performed dedicated to this study, which was based on a questionnaire submitted to the terminal operators/managers. Questionnaires were returned for 20 out of the 160 investigated terminals. The characteristics of these terminals in 2018 and by 2030 are described in the study. Due to the very low responsiveness to the survey, it was however not possible to elaborate a representative estimate of the measures and costs associated with the upgrading/expansion of the existing terminal infrastructure of the RFC NS-B.

1.2. Characteristics of the RFC NS-B in 2018 and by 2030

Table 1-1 summarises the composition of the RFC NS-B in 2018 with reference to the type of line and type of network. Data are provided for the whole corridor and the RFC NS-B lines within the individual Member States. Percentages are also indicated referring to the entire length of the RFC NS-B lines subject of study, i.e. 7,330 km.

Table 1-1 – RFC NS-B composition by type of line and network in 2018

Member State	Total corridor length		Type of line					
			Principal / Expected principal		Diversionary / Expected diversionary		Connecting	
	Km	%	km	%	km	%	km	%
NL	634.8	8.7%	367.4	5.0%	96.5	1.3%	170.8	2.3%
BE	332.2	4.5%	235.7	3.2%	15.8	0.2%	80.7	1.1%
DE	2,508.3	34.2%	1,921.0	26.2%	386.3	5.3%	201.0	2.7%
PL	3,431.7	46.8%	1,778.8	24.3%	1,524.0	20.8%	128.9	1.8%
CZ	307.5	4.2%	142.6	1.9%	152.4	2.1%	12.6	0.2%
LT	115.5	1.6%	115.5	1.6%	0.0	0.0%	0.0	0.0%
Total	**7,330.0**	**100.0%**	**4,561.0**	**62.2%**	**2,175.0**	**29.7%**	**594.0**	**8.1%**
Member State	**Total corridor length**		**Type of network**					
			Core		**Comprehensive**		**Off TEN-T**	
	Km	**%**	**km**	**%**	**km**	**%**	**km**	**%**
NL	634.8	8.7%	393.7	5.4%	241.0	3.3%	0.0	0.0%
BE	332.2	4.5%	218.7	3.0%	73.7	1.0%	39.8	0.5%
DE	2,508.3	34.2%	1,705.9	23.3%	557.4	7.6%	245.0	3.3%
PL	3,431.7	46.8%	2,172.0	29.6%	762.7	10.4%	497.0	6.8%
CZ	307.5	4.2%	173.0	2.4%	134.5	1.8%	0.0	0.0%
LT	115.5	1.6%	36.8	0.5%	78.8	1.1%	0.0	0.0%
Total	**7,330.0**	**100.0%**	**4,700.1**	**64.1%**	**1,848.1**	**25.2%**	**781.8**	**10.7%**

Source: Contractor based on consultation with the Infrastructure Managers

Table 1-2 below provides a matrix of the composition of the RFC NS-B with reference to the type of line and network, for the entire corridor.

Table 1-2 – Characterisation of the RFC NS-B by type of line and network in 2018

Type of line	Principal / Expected principal		Diversionary / Expected diversionary		Connecting		Total	
Type of network	**Km**	**%**	**km**	**%**	**km**	**%**	**km**	**%**
Core	3,675.2	50.1%	793.2	10.8%	231.7	3.2%	**4,700.1**	**64.1%**
Comprehensive	676.0	9.2%	935.3	12.8%	236.8	3.2%	**1,848.1**	**25.2%**
Off TEN-T	209.8	2.9%	446.4	6.1%	125.5	1.7%	**781.8**	**10.7%**
Total	**4,561.0**	**62.2%**	**2,175.0**	**29.7%**	**594.0**	**8.1%**	**7,330.0**	**100.0%**

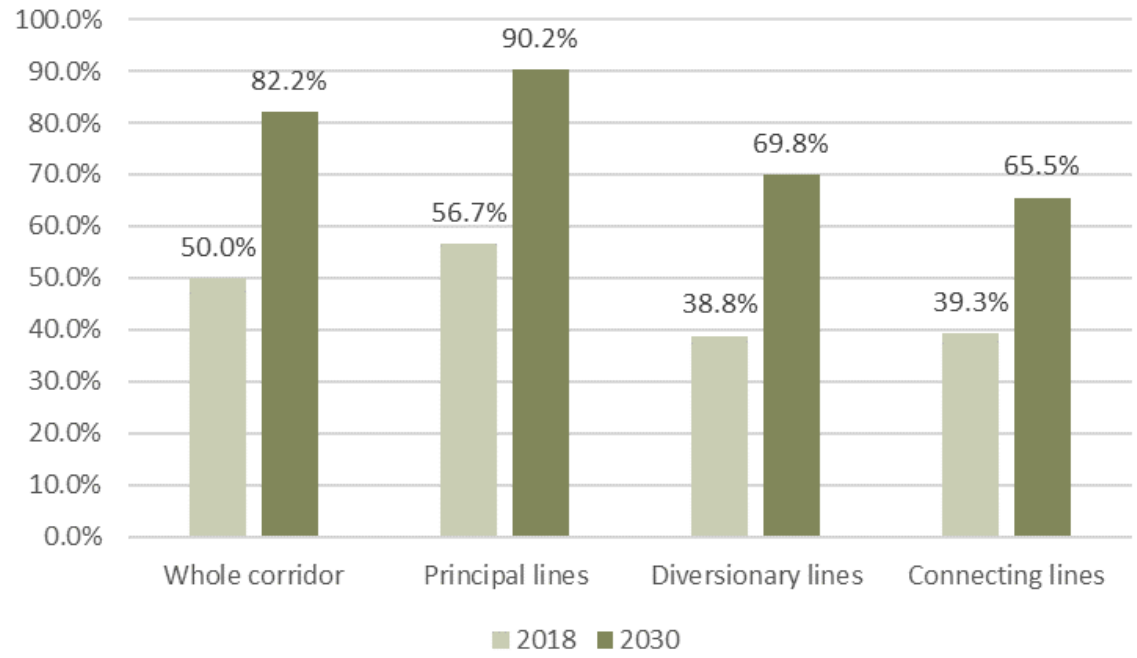
Source: Contractor based on consultation with the Infrastructure Managers

The RFC NS-B in 2018 primarily consisted of principal lines (62.2%) and core network lines (64.1%): 3,675.2 km of corridor lines, corresponding to half of the whole RFC NS-B, was made up of principal/expected principal lines belonging to the TEN-T core network. As part of the comprehensive network lines, the diversionary ones covered the highest share (12.8%), followed by principal lines

(9.2%) and connecting lines (3.2%). The same applies to the lines not belonging to the TEN-T network, as the share of diversionary lines (6.1%) was higher than the one of the principal lines (2.9%) and connecting lines (1.7%). Overall, the diversionary lines represented a relevant share of the corridor (29.7%), most of which (12.8%) belonging to the TEN-T comprehensive network. The connecting lines of the RFC NS-B were equally distributed between the core and the comprehensive networks (3.2% each), whilst only 1.7% of these lines did not belong to the TEN-T network. Referring to the corridor lines in the Member States involved in the study it is noticeable that over 80% of the RFC NS-B crossed Germany and Poland. The corridor lines in Poland in particular, represented over 45% of the total RFC NS-B length, most of them belonging to the core network.

Figure 1-1 and Figure 1-2 summarise the characteristics of the RFC NS-B railway lines in 2018 and by 2030 with reference to the possibility to operate 740 meter long trains. Details are provided for the whole corridor, for the types of lines and for the type of network. The characteristics of the corridor by 2030 reflect the impact of the ongoing and planned investments, but exclude the effects of the additional measures identified as part of this study.

Figure 1-1 – 740 meter long trains operability in 2018 and by 2030 by type of line

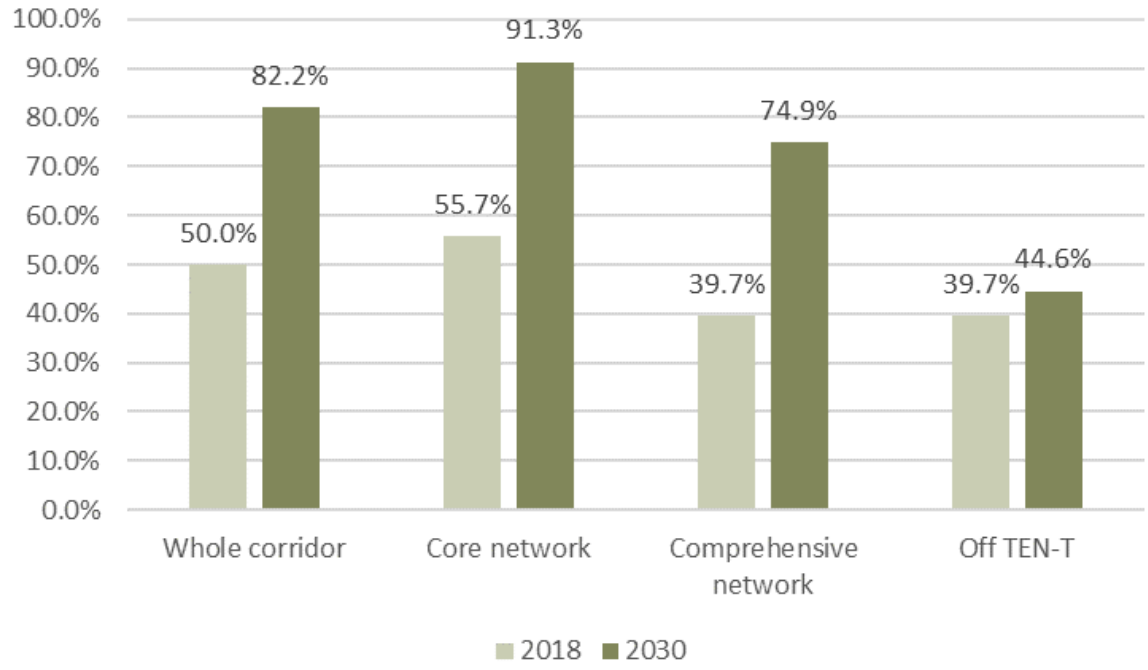


Source: Contractor based on consultation with the Infrastructure Managers

The analysis shows that compared to the situation in 2018 when technical and capacity constraints existed on 50% of the corridor lines, issues will reduce by 2030 to less than 20% of the corridor sections. Focussing on the type of lines, the ongoing and planned investments are expected to contribute significantly to

the improvement of the technical and operational conditions of the corridor, with 90.2% of the principal lines (corresponding to 62.2% of the RFC NS-B length) expected to accommodate 740 meter long trains by 2030, without capacity constraints. The same condition will characterise nearly 70% of the diversionary sections and about 65% of the connecting lines of the RFC NS-B.

Figure 1-2 – 740 meter long trains operability in 2018 and by 2030 by type of network



Source: Contractor based on consultation with the Infrastructure Managers

The review of the characteristics of the corridor in 2018 and by 2030 with reference to the type of network shows that significant improvements will be achieved on the core network lines. On over 90% of this type of network (corresponding to 64.1% of the RFC NS-B length) it will be possible to operate 740 meter long trains without capacity constraints. The same condition will apply to nearly 75% of the comprehensive network and to about 45% of the lines not belonging to the TEN-T.

Table 1-3 below provides detailed figures on the corridor extent affected by technical or capacity limitations in 2018 and by 2030. Overall the issues limiting or impeding the operation of 740 meter long trains will decrease meaningfully, with the total affected corridor length dropping from 3,668.6 km (50.0%) to 1,305.8 km (17.8%).

Table 1-3 – Corridor extent affected by technical/capacity constraints to operate 740 m long trains in 2018 and by 2030

	2018		2030	
	km	%	km	%
Corridor lines affected by technical constraints	2,707.4	36.9%	513.5	7.0%
Corridor lines affected by capacity constraints	961.2	13.1%	792.3	10.8%
Corridor lines affected by technical or capacity constraints	**3,668.6**	**50.0%**	**1,305.8**	**17.8%**

Source: Contractor based on consultation with the Infrastructure Managers

Referring to the RFC NS-B Member States, Table 1-4 provides an indication on the presence of technical and capacity constraints to operate 740 meter long trains on the RFC NS-B in 2018 and by 2030.

Table 1-4 – Technical/capacity constraints to operate 740 m long trains on the RFC NS-B in 2018 and by 2030 by Member State

Member State	Technical constraints		Capacity constraints	
	2018	2030	2018	2030
Netherlands	x	x	x	x
Belgium			x	x
Germany			x	
Poland	x	x		
Czech Republic	x			x
Lithuania				

Source: Contractor based on consultation with the Infrastructure Managers

According to the analysis, technical limitations existed in 2018 on 37% of the corridor lines in the Netherlands as well as on all corridor lines in the Czech Republic and in most of the corridor lines in Poland. Capacity restrictions applied to 13% of the corridor lines in the Netherlands, Belgium and Germany. Focussing on the operation of 740 meter long trains across at least one BCP, the most severe technical/capacity issues existed in the Netherlands, affecting the interconnection between this country and the other countries along the RFC NS-B, via Germany; in the Czech Republic, hindering the interconnection between this country and the other countries on the corridor; in Poland, hampering the interconnection between this country and the other countries along the RFC NS-B, as well as between Lithuania and the other countries on the RFC NS-B. Limitations in Poland also affected the operation of 740 meter long trains between the RFC NS-B countries and the border stations of Terespol and Medyka, towards Belarus and Ukraine, along the itineraries of the Eurasia Land Bridge.

Based on the review of the planned investments and analysis of their impact on the possibility to operate 740 meter long trains along the RFC NS-B by 2030, it is envisaged that technical restrictions will reduce to 7% of the total corridor length in the Netherlands and Poland, whereas capacity and time limitations will

be present on 11% of the RFC NS-B in the Netherlands, Belgium and in the Czech Republic. Referring to the operation of 740 meter long trains across at least one BCP, issues will still be present in the Netherlands, affecting the interconnection between this country and the other countries on the RFC NS-B, via Germany; and in Poland, hampering the interconnection between Lithuania and the other countries along the RFC NS-B, as well as between the RFC NS-B and Ukraine. In greater detail:

- The operation of 740 meter long trains by 2030 is generally expected to be possible along the corridor principal and core network corridor lines between the Netherlands, Belgium, Germany, the Czech Republic and most destinations in Poland, as well as between these countries and Belarus via Terespol; and between Tłuszcz/Sokolka in Poland and Kaunas in Lithuania via Bialystok/Ełk, as well as between Mogilno in Poland and Kaunas in Lithuania, via Ełk. Restrictions will however be present, which are described below:
    - In the Netherlands limited paths will be available in the daytime between Amersfoort and Bad Bentheim, as well as between Amersfoort, Meteren and Roosendaal. Issues will also exist on waiting tracks on the diversionary line between Kijfhoek and Weesp. Train length will furthermore be restricted for trains stopping at the intermodal shunting yards Botlek (Bot), Pernis (Ps), Waalhaven Zuid (Whz). Possibility to operate 740 meter long trains along the "Iron Rhine" will finally depend on the implementation of the "Iron Rhine Project";
    - At the BCPs between the Netherlands and Germany operational limitations on the Dutch side will be in place that will allow the transit of 740 meter long trains only based on ad hoc requests;
    - In Belgium the operation of 740 meter long trains will be generally possible, but only outside peak hours;
    - In Germany the operation of 740 meter long trains will also be generally feasible, with possible temporary limitations due to timetabling and operational specific circumstances;
    - In the Czech Republic capacity issues may be experienced, particularly in the daytime;
- The operation of 740 meter long trains along the RFC NS-B to/from Lithuania would be affected by persisting technical constraints on the following segments of the expected principal, diversionary/expected diversionary lines interconnecting the Polish with the Lithuanian networks along the RFC NS-B routes: Krusze - Tłuszcz (4.1 km long, expected principal/Off TEN-T line), Legionowo - Krusze (32.7 km long, expected diversionary/ Off TEN-T line) and Kobylnica - Mogilno (63.9 km long, diversionary/ TEN-T comprehensive line);
- Operating 740 meter long trains to/from Ukraine via Medyka towards most corridor destinations might be also affected by persisting technical problems at the short sections belonging to the "triangular connection"

starting at Długoszyn via Sosnowiec Maczki to Jaworzno Szczakowa (6.9 km long, principal/Off TEN-T line – including the very short 1.9 km long segment Jaworzno Szczakowa - Długoszyn), close to the border between Poland and Ukraine;

- The operation of 740 meter long trains along national O/Ds of the RFC NS-B will be generally possible at the same conditions described above and affecting international long distance trains (except from those problems applying only to trains crossing the BCPs between the Netherlands and Germany). In addition to the above described conditions, problems are expected to persist in Poland on the diversionary/Off TEN-T lines between (Poznań Gł.) P. Starołęka Psk - Franklinów - Stary Staw (91.8 km) along the itinerary Poznań - Stary Staw and between Głogów - Ostrów Wielkopolski - Gajewniki (242.8 km) along the itinerary Rzepin - Skierniewice and between; and the connecting/Off TEN-T line Sosnowiec Maczki - Dąbrowa Górnicza Towarowa (14.9 km).

Concerning handover stations/marshalling yards, in 2018, 740 meter long trains could not be operated at 33 out of the 89 handover stations/marshalling yards/waiting-buffer locations subject of study. This figure will reduce to 27 by 2030 thanks to the completion of the ongoing and planned investments.

1.3. Improvement measures

1.3.1. Gap analysis and additional improvement measures

The review of the ongoing and planned initiatives shows that due consideration is given by the concerned infrastructure managers to the solution of the obstacles hampering the smooth and seamless operation of 740 meter long trains along the RFC NS-B. In this regard investments are ongoing and planned in the RFC NS-B Member States and studies have been recently completed or are currently under completion/consideration to solve existing and future technical and capacity issues. Nonetheless, as also depicted in the above described corridor outlook by 2030, problems are envisaged to persist by this time horizon upon completion of the ongoing and planned investments. In order to solve these gaps a set of initiatives/measures was discussed with the concerned infrastructure managers as part of the study. For each RFC NS-B Member State, Table 1-5 provides a summary of the gap analysis and of the initiatives/measures identified as part of the study.

Table 1-5 – Summary of gap analysis and identified initiatives/measures to further improve the operation of 740 meter long trains along the RFC NS-B

Member State	Persisting gaps by 2030 and additional identified initiatives/measures
NL	Capacity constraints affecting the operation of 740 meter long trains along the RFC NS-B in the Netherlands are expected to be present by 2030, which will not be solved by the ongoing and planned investments. In line with

Member State	Persisting gaps by 2030 and additional identified initiatives/measures
	analyses recently completed by the concerned infrastructure manager, works were identified as part of this study that will be required to accommodate 740 meter long trains and achieve operational flexibility at the following handover stations/marshalling yards/waiting-buffer locations: Botlek, Pernis, Amersfoort, Almelo, Maasvlakte Oost, Europoort, Waalhaven Zuid, Kijfhoek, Crailoo, Rotterdam Noord Goederen, Rosendaal, Tilburg Goederen and 's-Hertogenbosch. In greater detail investments will be required to accommodate 740 meter long trains at Maasvlakte Oost, Botlek, Pernis, Waalhaven Zuid, Kijfhoek, Amersfoort, Rotterdam Noord Goederen, Almelo, whereas solutions to improve stability/punctuality will be needed at Crailoo, 's Hertogenbosch and Tilburg Goederen. These interventions are deemed of priority in solving current and future capacity issues along the RFC NS-B lines, also considering the results of the recently completed Transport Market Study, showing that the Netherlands is involved in all the most relevant trade/transport as well as train traffic O/D relations along the RFC NS-B. Notwithstanding the implementation of the additional investments identified in the study by the Dutch infrastructure manager, technical constraints may be present after 2030 at some Rotterdam Harbour handover stations and at the Amersfoort handover station. Capacity and time limitations may also exist at the Rotterdam Harbour handover stations and along the Kijfhoek - Weesp and Roosendaal - Bad Bentheim routes
BE	In addition to the ongoing and planned investments, studies for the further improvement of the technical and operational conditions of 740 meter long trains in Belgium are under elaboration, that are foreseen for completion during 2020. Accordingly, investments have not been identified as part of this study for the corridor lines. On the other hand gaps may still persist by 2030 concerning the following handover stations/marshalling yards, where 740 meter long trains are not possible to be operated: Antwerpen Haven - Bundel B3, Antwerpen Haven - Bundel Oorderen, Antwerpen Haven - Bundel Angola. Given that the ongoing and planned projects and analyses do not seem to include in their scope the upgrading of this infrastructure, such additional measures were proposed in this study and their costs were estimated
DE	Further to the ongoing and planned investments foreseen in the Bundesverkehrswegeplan (Federal Transport Infrastructure Plan), additional initiatives will be considered to ensure adequate operational conditions of 740 meter long trains in Germany. Accordingly investments have not been identified as part of this study for the corridor lines. Gaps appear however to exist concerning the following handover stations/marshalling yards, were 740 meter long trains are not possible to be operated: Duisburg Ruhrort Hafen, Duisburg Hafen, Duisburg Hochfeld Süd, Braunschweig, Magdeburg, Berlin Hamburger und Lehrter Bf, Frankfurt (Oder) Pbf. As no investments are currently foreseen for the upgrading of this infrastructure, solutions were proposed in this study for these handover stations/marshalling yards, to allow the operation of 740 meter long trains by 2030. Costs were accordingly estimated for these measures
PL	An ambitious modernisation programme of the Polish railway lines is currently ongoing that will significantly improve the RFC NS-B lines. Investments are either ongoing, planned and/or under definition that are expected to allow achieving the standards set in the Regulation (EU) 1315/2013 on the whole core network infrastructure belonging to the RFC NS-B by 2030, including 740 meter train length. Investments are also ongoing, planned and/or under definition that relate to the comprehensive network and lines outside the TEN-T network along the RFC NS-B. These measures will contribute to the improvement of the technical and capacity conditions of the corridor by 2030, with significant benefits also with reference to the operation of 740 meter long trains. Based on the review of the current plans, it is envisaged that additional investments would be needed by 2030 for the modernisation/upgrading of about 457.2 km of corridor lines, where technical limitations may still persist to operate 740

Member State	Persisting gaps by 2030 and additional identified initiatives/measures
	meter long trains. These include 11.0 km of principal lines, 431.3 km of diversionary lines and 14.9 km of connecting lines. In consideration of the need to modernise these sections and the stations located therein further to upgrading them to 740 meter train length operability, solutions were identified in this study that concern the modernisation of these lines. Costs were estimated accordingly. Among the additional measures identified in this study, the ones relating to the modernisation of the following sections are of particular relevance to solve 740 meter long train operational bottlenecks towards Lithuania and Ukraine: Krusze - Tłuszcz (4.1 km long, expected principal/Off TEN-T line), Legionowo - Krusze (32.7 km long, expected diversionary/ Off TEN-T line) and Kobylnica - Mogilno (63.9 km long, diversionary/ TEN-T comprehensive line), as well as the "triangular connection" starting at Długoszyn via Sosnowiec Maczki to Jaworzno Szczakowa (6.9 km long, principal/Off TEN-T line – including the 1.9 km long section Jaworzno Szczakowa - Długoszyn). The modernisation of the 14.9 km long connecting line Sosnowiec Maczki - Dąbrowa Górnicza Towarowa might be also relevant to provide adequate connection to the intermodal terminals located along this line. No measures were identified in this study relating to the improvement of the parameters of handover stations/marshalling yards in Poland as this infrastructure will be upgraded/modernised by 2030 as part of the planned investments
CZ	In addition to the ongoing and planned investments, a study is planned to be conducted in 2020 to identify measures to further enhance the operational capacity of 740 meter long trains particularly in the Prague area. Depending on the cost/benefit ratio of the identified solutions, this study may identify additional investment needs and a range of potential accompanying operational measures not currently envisaged for implementation. Accordingly investments were not proposed as part of this analysis for the corridor lines in the Czech Republic. No gaps were identified which relate to handover stations/marshalling yards
LT	The ongoing and planned investments expected to be completed before 2030 are foreseen to further enhance operations of freight trains on the RFC NS-B along the corridor lines in Lithuania. Moreover the concerned infrastructure manager is currently preparing a project – *Unified Interlockings at Lithuanian Railways* – regarding improvements on the existing standard gauge line. Foreseen to be implemented between 2030-2036, this initiative and the related costs are considered in this study to further increase the capacity of the existing RFC NS-B infrastructure in Lithuania. Measures to solve capacity limitations at the existing handover stations/marshalling yards and terminals at Kaunas and Mockava were also identified as part of the study, and the related costs estimated

Source: Contractor based on consultation with the Infrastructure Managers

Table 1-6 below summarises the cost estimates for the additional measures identified in the previous table to further enhance the operation of 740 meter long trains along the RFC NS-B by 2030.

Table 1-6 – Additional investments needed on RFC NS-B to operate 740 meter long trains

Member State	Additional investments
NL	**€ 355-660 million** to accommodate 740 meter long trains and improve capacity at handover stations/marshalling yards/waiting-buffer locations. Such investments will also improve operability of 740 meter long trains on the corridor lines
BE	**€ 1 million** to accommodate 740 meter long trains at handover stations. Studies are ongoing by the concerned infrastructure manager that may result in the identification of capacity improvement measures on the corridor lines and additional investments are not official yet
DE	**€ 13 million** to accommodate 740 meter long trains at handover stations
PL	**€ 2,342 million** to modernise 457.2 km of corridor railway lines and the handover stations located therein, which will allow accommodating 740 meter long trains
CZ	Studies are under consideration by the concerned infrastructure manager that may result in the identification of capacity improvement measures on the corridor lines and additional investments are not official yet
LT	**€ 44 million** to improve capacity on the existing corridor lines and handover stations
RFC NS-B	**€ 2,755-3,060 million** to accommodate 740 meter long trains and improve capacity at handover stations/marshalling yards/waiting-buffer locations in NL, BE, DE, PL and LT. In BE and CZ studies are also ongoing/under consideration by the concerned infrastructure managers that may result in the identification of capacity improvement measures on the corridor lines. Additional investments in these two Member States are not official yet

Source: Contractor based on consultation with the Infrastructure Managers; Note: figures rounded to the million unit

The costs related to the corridor railway lines, amounting to about € 2.4 billion, concern the modernisation of 457.2 km of lines in Poland, to allow operation of 740 meter long trains along the whole RCF NS-B by 2030 under the technical point of view, as well as infrastructure improvement measures in Lithuania. Up to € 680 million would furthermore be required to improve operational conditions of 740 meter long trains along the corridor by 2030, removing technical barriers and capacity bottlenecks at 27 handover stations/marshalling yards/waiting-buffer locations in the Netherlands, Belgium, Germany, and Lithuania.

The total cost of the identified measures, amounting up to about € 3.1 billion represents a conservative estimate as it does not include the costs of potential additional measures relating to:

- Measures to solve technical restrictions in the Netherlands at some Rotterdam Harbour handover stations and at the Amersfoort handover station, as well as capacity and time limitations at the Rotterdam Harbour handover stations and along the Kijfhoek - Weesp and Roosendaal - Bad Bentheim routes;
- Capacity improvement measures to be possibly implemented in Belgium and in the Czech Republic upon completion of the ongoing and foreseen studies;
- Upgrading of the RFC NS-B terminals, as due to the limited responsiveness of the terminal operators/managers to the SCI survey no

measures were identified in this study for the upgrading of this corridor infrastructure.

1.3.2. Relevant improvement measures

Among the additional measures identified in this study the following ones are deemed particularly relevant to further improve operation of 740 meter long trains along the RFC NS-B:

- *Solutions to technically allow operating 740 meter long trains along international relations of the RFC NS-B by 2030:*
  - The modernisation of one or more of the following sections interconnecting the RFC NS-B with Lithuania: Krusze - Tłuszcz (4.1 km long, expected principal/Off TEN-T line), Legionowo - Krusze (32.7 km long, expected diversionary/ Off TEN-T line) and Kobylnica - Mogilno (63.9 km long, diversionary/ TEN-T comprehensive line), whose estimated investment costs equal respectively € 153 million, € 233 million, € 221 million, for a total cost for the modernisation of the three lines of € 607 million;
  - The modernisation of the "triangular connection" starting at Długoszyn via Sosnowiec Maczki to Jaworzno Szczakowa (6.9 km long, principal/Off TEN-T line) and particularly the 1.9 km long section Jaworzno Szczakowa – Długoszyn, interconnecting the RFC NS-B with Ukraine, of total cost equal to € 163 million;
- *Measures to technically allow 740 meter long trains accessibility to intermodal terminals along the RFC NS-B by 2030:*
  - The modernisation of the 14.9 km long connecting line Sosnowiec Maczki - Dąbrowa Górnicza Towarowa, to provide adequate connection to the intermodal terminals located along this line, whose modernisation costs amount to € 116 million;
- *Solutions to improve the capacity of the existing infrastructure to operate 740 meter long trains along the RFC NS-B by 2030:*
  - Investments at the handover stations/marshalling yards/waiting-buffer locations in the Netherlands, Belgium, Germany, and Lithuania, whose total costs are estimated in a range of € 373-678 million. Among these ones, the initiatives in the Netherlands are deemed of specific relevance to ensure adequate operation of 740 meter long trains along the RFC NS-B lines, also considering that based on the results of the recently completed Transport Market Study, the corridor lines of this Member State are involved in the most relevant trade/transport relations along the RFC NS-B. In this regard it is also noticed that due consideration shall be given to the removal of the conditions that limit the transit of 740 meter long trains across the borders between the Netherlands and Germany only subject to ad hoc requests.

The total cost of the above listed relevant measures ranges between € 1,1-1,4 billion. Whereas the first set of solutions in Poland are of specific importance to ensure the development of a homogeneous corridor infrastructure (conforming to the 740 meter maximum train length requirement), the investments to allow accessibility at intermodal terminals and expand capacity at the handover stations along the corridor are crucial under the market point of view.

1.4. Concluding remarks

The infrastructure measures identified within the scope of this study together with the ones already ongoing and planned by the concerned infrastructure managers are expected to technically allow the operation of 740 meter long trains on all lines of the RFC NS-B by 2030, specified that some technical issues may still exist at some Rotterdam Harbour handover stations and at the Amersfoort handover station.

Capacity and time limitations may exist by 2030 at some Rotterdam Harbour handover stations and along the Kijfhoek - Weesp and Roosendaal - Bad Bentheim routes. Constraints may also be experienced particularly in the daytime and peak hours on sections used by passenger and freight traffic and/or located in urban agglomerations in Belgium and in the Czech Republic, where studies are ongoing/planned to assess the extent of such problems, also based on expected traffic projections, which were not elaborated as part of this study.

The ambitious modernisation programme of the railway lines in Poland, including significant investments on the RFC NS-B, might be affected by implementation delays, also considering the different status of the technical/financial maturity of the projects required to modernise the Polish corridor lines. Unavailability of funds and delays in the completion of the infrastructure measures considered in this study to modernise/upgrade the existing infrastructure in this Member State, may result in technical/capacity restrictions towards the operation of 740 meter long trains along the RFC NS-B in this country by 2030. This emphasises the opportunity to financially and administratively support the development of a stable and mature pipeline of projects in Poland.

The implementation of the infrastructure initiatives/measures identified as part of this study to solve existing and future technical and capacity problems along the RFC NS-B with reference to the 740 meter train length standard might be also integrated/accompanied during the period up to 2030 and afterwards, with a set of operational measures, related to scheduling and timetable planning, blocking the use of stations with short tracks and/or detouring. These solutions, that according to this study are already adopted/considered for use by the concerned infrastructure managers, are particularly useful to allow the temporary operation of 740 meter long trains along the corridor, especially in low density traffic conditions. The study demonstrates that the effectiveness and cost-benefit ratio of the applicability of these measures reduce with an increasing density of traffic on the lines and mixed use of the corridor sections

by passenger and freight transport. For a market-oriented quality approach and in light of an increased use of the corridor lines, solutions to allow technical operability and capacity improvement are ultimately more effective and efficient.

2. INTRODUCTION

2.1. Study objectives

To enhance a European network for competitive rail freight, Regulation (EU) 913/2010 stipulates the implementation of initial rail freight corridors and a package of measures to improve the competitive situation of rail freight transport on these corridors. Established in accordance with this regulation, the Rail Freight Corridor North Sea-Baltic (RFC NS-B) became operational in November 2015.

In view of the entry into operation of the RFC NS-B, a "Study on the Corridor's infrastructure characteristics" was conducted and finalized by the Working Group Infrastructure in 2014. This resulted in a list of parameters to be looked at in detail. These also included the 740 meter train length interoperability standard as one of the Key Performance Indicators (KPIs) set in the TEN-T Regulation (EU) 1315/2013 for the rail freight lines belonging to the core network and particularly to the 9 Core Network Corridors, including the CNC NS-B.

Since the entry into operation of the RFC NS-B, periodic consultations also including customer satisfaction surveys are being performed by the RFC NS-B which involve the Railway Undertakings Advisory Group (RAG) and Terminal Advisory Group (TAG). By doing so, the conditions for international rail freight transport along the RFC NS-B shall be improved and unified. One of the main improvements mentioned by the customers is the development of a homogeneous corridor infrastructure, especially with reference to the maximum permitted train length. Hence, the Management Board of the RFC NS-B decided to carry out the present Study on Capacity Improvement - SCI.

This study aims at addressing the following aspects:

- Identifying main infrastructure obstacles hampering the operation of long trains along the RFC NS-B;
- Identifying measures to remove these infrastructure obstacles, to allow a smooth and seamless operation of 740 meter long trains;
- Assessing the effectiveness of such solutions;
- Identifying infrastructure investments needed.

Further to the analysis of the train length interoperability standard, the study also assessed the current status and future outlook of the corridor infrastructure with reference to the electrification parameter. This exercise was however limited to the description of the corridor infrastructure in 2018 and by 2030 and no measures and costs were identified and estimated to address gaps specifically related to electrification.

2.2. Study methodology

2.2.1. Overall methodology

The activities performed as part of the study consisted in the implementation of the following tasks:

- Description of the characteristics of the RFC NS-B in 2018 (assumed as base year for the analysis), with reference to the technical maximum train length and possible related capacity constraints;
- Review of the ongoing and planned investments by 2030 and description of the expected corridor infrastructure and operational characteristics by 2030;
- Identification of measures to improve the operation of 740 meter long trains under the technical and capacity points of view, not already planned by the concerned infrastructure managers, but still required to remove infrastructure obstacles and allow a smooth and seamless operation of 740 meter long trains along the RFC NS-B by 2030.

In line with the requirements specified in the Terms of Reference, the scope of the study primarily concerned the corridor lines, handover stations/marshalling yards/waiting-buffer locations and terminals listed in Annex A to this report. With reference to the infrastructure subject of analysis, it is worth noticing that: i) the study is limited to the European standard gauge corridor lines, and thus to the corridor infrastructure in the following Member States: the Netherlands, Belgium, Germany, Poland, the Czech Republic and Lithuania; ii) the extension to Medyka (sections Jaworzno Szczakowa - Kraków Mydlniki - Podłęże - Medyka Gr.P.) was included in the scope of this study although it was not part of the RFC NS-B in 2018; iii) the expected principal lines Kraków Mydlniki – Kraków Gł. and Kraków Gł. – Podłęże are currently planned to be used for passenger traffic and accordingly they were excluded from the analysis; iv) the list of handover stations/marshalling yards/waiting-buffer locations was originally excluding Kijfhoek, Crailoo and 's-Hertogenbosch in the Netherlands, which were subsequently agreed to be analysed as part of the study.

In order to perform the analysis, detailed information on the parameters and operational conditions of the corridor infrastructure scope of study was provided to the Contractor by the six infrastructure managers of the Member States concerned by the study. In greater detail, the infrastructure managers provided information on the corridor lines and handover stations/marshalling yards/waiting-buffer locations. Due to the fact that the terminals are privately owned and managed, a questionnaire-based survey – SCI survey – was performed aimed at collecting relevant information on their status and likely development. Out of 160 terminals involved in the survey, only 20 responded. In line with the requirements specified in the Terms of Reference, the study was limited to the terminals that responded to the survey. Further to the list of corridor lines, handover stations/marshalling yards/waiting-buffer locations and

terminals subject of study, Annex A also includes the information collected from the infrastructure managers and the SCI survey, representing the database of this study.

Relevant methodological assumptions to perform the analysis relate to the legal definitions of 740 meter long train operations in the networks of the six RFC NS-B Member States involved in the study and the cost estimates for the infrastructure measures identified as part of the study for the smooth and seamless operation of 740 meter long trains along the RFC NS-B by 2030. The two following sections are dedicated to these topics.

2.2.2. Comparison of legal definitions of 740 meter long train operations by RFC NS-B Member State

The legal definitions of 740 meter long trains and the subsequent definition of the necessary track length for the operation of those trains in each of the involved Member States were assessed as part of the study. Table 2-1 below summarises the outcome of this exercise.

Table 2-1 – Definitions of 740 meter long trains per Member State in 2018 [m]

	NL	BE	DE	CZ	PL	LT
Total train length	740	750	740	740	740	740
Signal view	10	8	5	10	10	5
Inaccurate stopping	5	5	5		10	
Stretching protection	-	10	Up to 10	-	-	
Additional safety distance	-	-	-	-	5	
Necessary total track length	**755**	**773**	**Up to 760**	**750**	**765**	**745**
Extra distances if applicable	2 / 15 / 20	124	-	-	-	-

Source: Contractor based on consultation with the Infrastructure Managers

Further to the measuring components illustrated in the table above, the following considerations apply to the definition of the 740 meter long train operability in some of the RFC NS-B Member States:

- The Belgium network statement for the year 2019 mentions in Chapter 3.3.2.5 that "the length of freight trains is limited in principle to 750 meters, inclusive of traction units"; hence the difference in train length;
- The "extra distances" in the Netherlands apply for the merging of trains, in case of "small signals" or if a second locomotive is added at the other end of the train;
- The "extra distances" in Belgium apply for station tracks if the danger point is <30 meter to the reference point for inaccuracy of iodometry, entering of non-ETCS areas.

Although the initial length (see line 1 in Table 2-1) is identical in all countries along the RFC NS-B (except for the deviation in Belgium), the total track lengths required for the operation of 740 meter long trains adds up to a minimum of 755 meters and a maximum of 773 meters; in Belgium for station tracks under ETCS L2 even up to 897 meters.

2.2.3. Basis for cost estimates of infrastructure measures

As part of this study cost estimates were elaborated for the infrastructure measures proposed for implementation to allow operating 740 meter long trains by 2030 in addition to the already planned initiatives. To this purpose estimates already elaborated in previous analyses/studies by the concerned infrastructure managers were considered. In absence of existing estimates costs were calculated on the basis of the items and unit cost ranges listed in Table 2-2 below.

Table 2-2 – Unit cost ranges (€)

Item	Unit cost ranges(€)
Tracks	
New track (per km)	590,000-1,750,000
Switches	
New switches	135,000-660,000
Moving of switches to other locations	50,000-170,000
Electrification	
Electrification (per km)	250,000-1,300,000
Signalling	
ETCS system (per km)	185,000-800,000
Interlocking/ETCS adjustments (per km of track)	220,000-630,000
Level Crossings (road signals)	120,000-310,000

Source: Contractor

2.3. Structure of this report

Further to the executive summary and this introductory section, this report is structured into eight additional main chapters:

- Chapter 3, summarising the characteristics of the RFC NS-B in 2018 and by 2030, with reference to the technical maximum train length and possible related capacity constraints, and identifying the technical and operational measures to improve the corridor capacity to operate 740 meter long trains;
- Chapters 4 to 9, describing for each RFC NS-B Member State the characteristics of the corridor in 2018, with reference to the technical maximum train length and possible related capacity constraints; the review of the ongoing and planned investments and the expected corridor infrastructure and operational characteristics by 2030, as well as identifying the measures to improve the operation of 740 meter long trains under the technical and capacity points of view;
- Chapter 10, illustrating key findings and recommendations concerning the status and improvement of the technical and operational conditions of the RFC NS-B with reference to 740 meter long trains.

The following annexes integrate the main body of the study report, providing additional information on the subsequent topics:

- Annex A: including the SCI infrastructure database listing the corridor lines, handover stations and terminals subject of study and providing details on their characteristics in 2018 and by 2030;
- Annex B: providing the schematic maps of the RFC NS-B representing the status of the corridor infrastructure in 2018 with reference to the following parameters: type of line, type of network, number of tracks, traction and train length. Further to these five maps outlining detailed parameters for the corridor lines, two simplified maps representing the status of the possibility to operate 740 meter long trains in 2018 and by 2030 were elaborated, which are also included in this Annex. The two maps are showing where 740 meter long trains are possible to be operated (green); where they are possible to be operated with capacity restrictions (dotted orange) and where 740 meter long trains are not possible to be operated (red);
- Annex C: illustrating a virtual example of the applicability of operational measures to allow operation of 740 meter long trains.

The order of presentation of the information by Member State in this deliverable reflects the one in the list of corridor lines, handover stations and terminals annexed to the Terms of Reference of the study, as also reported in Annex A to this report.

3. CHARACTERISTICS OF THE RFC NS-B IN 2018 AND 2030 AND MEASURES TO IMPROVE ITS CAPACITY

3.1. Introduction

This section provides a summary at the corridor level of the analysis presented in the following Chapters from 4 to 9, for each RFC NS-B Member State involved in the study. This relates to i) the characteristics of the corridor in 2018, with reference to the technical maximum train length and possible related capacity constraints; ii) the review of the ongoing and planned investments and the expected corridor infrastructure and operational characteristics by 2030; iii) the measures identified to improve the operation of 740 meter long trains under the technical and capacity points of view. One section of this chapter was dedicated to each of these study elements. An additional section is furthermore included in this chapter which relates to the operational measures that could be considered to further enhance the operation of 740 meter long trains along the RFC NS-B.

3.2. Corridor infrastructure and operational characteristics in 2018

3.2.1. Railway lines

Annex A to this report lists the corridor lines subject of study, including their classification with reference to the type of lines and network, their lengths and characteristics for the years 2018 and 2030, whereas Annex B provides the schematic maps of the RFC NS-B representing the status of the corridor infrastructure in 2018 with reference to the following parameters: type of line, type of network, number of tracks, traction and train length.

Table 3-1 summarises the composition of the RFC NS-B in 2018 with reference to the type of line and type of network. Data are provided for the whole corridor and the corridor lines within the individual Member States. Percentages are also indicated referring to the entire length of the RFC NS-B in 2018, i.e. 7,330 km.

Table 3-1 – RFC NS-B composition by type of line and network in 2018

Member State	Total corridor length		Type of line					
			Principal / Expected principal		Diversionary / Expected diversionary		Connecting	
	km	%	km	%	km	%	km	%
NL	634.8	8.7%	367.4	5.0%	96.5	1.3%	170.8	2.3%
BE	332.2	4.5%	235.7	3.2%	15.8	0.2%	80.7	1.1%
DE	2,508.3	34.2%	1,921.0	26.2%	386.3	5.3%	201.0	2.7%
PL	3,431.7	46.8%	1,778.8	24.3%	1,524.0	20.8%	128.9	1.8%
CZ	307.5	4.2%	142.6	1.9%	152.4	2.1%	12.6	0.2%
LT	115.5	1.6%	115.5	1.6%	0.0	0.0%	0.0	0.0%
Total	**7,330.0**	**100.0%**	**4,561.0**	**62.2%**	**2,175.0**	**29.7%**	**594.0**	**8.1%**

Member State	Total corridor length		Type of network					
			Core		Comprehensive		Off TEN-T	
	km	%	km	%	km	%	km	%
NL	634.8	8.7%	393.7	5.4%	241.0	3.3%	0.0	0.0%
BE	332.2	4.5%	218.7	3.0%	73.7	1.0%	39.8	0.5%
DE	2,508.3	34.2%	1,705.9	23.3%	557.4	7.6%	245.0	3.3%
PL	3,431.7	46.8%	2,172.0	29.6%	762.7	10.4%	497.0	6.8%
CZ	307.5	4.2%	173.0	2.4%	134.5	1.8%	0.0	0.0%
LT	115.5	1.6%	36.8	0.5%	78.8	1.1%	0.0	0.0%
Total	**7,330.0**	**100.0%**	**4,700.1**	**64.1%**	**1,848.1**	**25.2%**	**781.8**	**10.7%**

Source: Contractor based on consultation with the Infrastructure Managers

Table 3-2 below provides a matrix of the composition of the RFC NS-B with reference to the type of line and network.

Table 3-2 – Characterisation of the RFC NS-B by type of line and network in 2018

Type of line	Principal / Expected principal		Diversionary / Expected diversionary		Connecting		Total	
Type of network	**Km**	**%**	**km**	**%**	**km**	**%**	**km**	**%**
Core	3,675.2	50.1%	793.2	10.8%	231.7	3.2%	**4,700.1**	**64.1%**
Comprehensive	676.0	9.2%	935.3	12.8%	236.8	3.2%	**1,848.1**	**25.2%**
Off TEN-T	209.8	2.9%	446.4	6.1%	125.5	1.7%	**781.8**	**10.7%**
Total	**4,561.0**	**62.2%**	**2,175.0**	**29.7%**	**594.0**	**8.1%**	**7,330.0**	**100.0%**

Source: Contractor based on consultation with the Infrastructure Managers

The RFC NS-B in 2018 primarily consisted of principal lines (62.2%) and core network lines (64.1%): 3,675.2 km of corridor lines, corresponding to half of the whole RFC NS-B, is made up of principal/expected principal lines belonging to the TEN-T core network. As part of the comprehensive network lines, the diversionary ones cover the highest share (12.8%), followed by the principal lines (9.2%) and the connecting lines (3.2%). The same applies to the lines not belonging to the TEN-T network, as the share of diversionary lines (6.1%) is higher than the one of the principal lines (2.9%) and connecting lines (1.7%). Overall, the diversionary lines represent a relevant share of the corridor (29.7%), most of which (12.8%) is classified as comprehensive network. The connecting lines of the RFC NS-B result to be equally distributed between the core and the comprehensive network (3.2% each), whilst only 1.7% do not belong to the TEN-T network. Referring to the corridor lines in the Member States involved in the study it is noticeable that over 80% of the RFC NS-B crossed Germany and Poland. The Polish corridor lines in particular, represented over 45% of the corridor length, most of which belonging to the core network.

To the purpose of the study and aimed at analysing and describing the technical maximum train length and related capacity constraints of the RFC NS-B lines, the corridor network in each Member State was divided into a number of lines as detailed in Chapters 4 to 9 below. Table 3-3 overleaf summarises the outcome of this analysis for the year 2018.

Table 3-3 – Technical maximum train length and related capacity constraints in 2018

Line	Technical maximum train length and related capacity constraints in 2018
Netherlands	
Principal line from Amsterdam Westhaven to the NL/DE border near Bad Bentheim (Line 1-NL)	740 m Amsterdam > Amersfoort 720 m Amersfoort > Amsterdam (length restriction waiting track) 740 m Amersfoort – Bad Bentheim (limited number of paths available for 740 m trains) Border agreement NL/DE standard train length = 590 m
Principal line from Maasvlakte to the NL/DE border near Emmerich (Line 2-NL)	740 m Maasvlakte West – Zevenaar Border - Length limitations apply on the Harbour SY Maasvlakte Oost, Botlek, Pernis and Waalhaven Zuid. Border agreement NL/DE standard train length = 690 m
Diversionary line from Weesp via Rotterdam to Kijfhoek (Line 3-NL)	660 m Kijfhoek > Weesp (length restriction waiting track) 740 m Weesp < Kijfhoek
Connecting line from Amersfoort via Utrecht, 's Hertogenbosch to the NL/BE border near Roosendaal (Line 4-NL)	630 m Amersfoort - Meteren (length restriction waiting track) 740 m Meteren – Roosendaal (limited number of paths for 740 m trains available)
Connecting line from Beverwijk to Amsterdam (Line 5-NL)	740 m at most times of the day
Expected principal line ("Iron Rhine") from the BE/NL border via Roermond to the NL/DE border near Weert (Line 6-NL)	550 m
Belgium	
All corridor lines	740 m trains were allowed outside peak hours
Germany	
All corridor lines	For the German corridor network a train length up to 740 m was basically possible. Capacity constraints during peak hours existed on some sections of line 1 [Hamm - Löhne (Strecke 2990); Minden - Haste; Groß Gleidingen – Magdeburg; Magdeburg - Saarmund; Berlin-Wuhlheide - Frankfurt (O) - Border DE/PL], line 3 [Border NL/DE - Bad Bentheim – Osnabrück] and line 6 [Riesa - Bad Schandau - Border CZ/DE]. Restrictions due to timetabling and operational specific situations might also result in a temporary reduction of the train length on the corridor lines
Poland	
Principal line starting at the PL/DE border near Rzepin continuing via Poznan Franowo, Lowicz, Skierniewice, Pilawa and Łuków to Terespol (close to the PL/BY border) (Line 1-PL). However, the section between Poznan Franowo and Lowicz is an expected principal line	Most of this line allowed for the operation of 740 meter long trains. There are however several sections At the Poznań railway node (Poznań bypass) which allowed for the operation of 650 meter long trains only; The section from Kunowice (Border DE/PL) to Rzepin limited train length for cross-border trains from Germany to 630 m
Principal line starting at the PL/LT border near Trakiszki to Elk (Line 2-PL)	600 m
Principal line starting at the PL/DE border near Bielawa Dolna continuing via Wroclaw Brochów,	On section Bielawa Dolna - Wrocław Muchobór 740 meter long trains were possible to be operated. On the remaining sections the prevailing train length was 600 m

Line	Technical maximum train length and related capacity constraints in 2018
Jelcz, Opole, Gliwice and Długoszyn to Jaworzno Szczakowa (Line 3-PL). This line also includes the "triangular connection" starting at Długoszyn via Sosnowiec Maczki to Jaworzno Szczakowa	
Diversionary line starting at Rzepin continuing via Ostrów Wielkopolski, Skierniewice and Warszawa before re-joining Line 1-PL in Łuków (Line 4-PL)	On part of the corridor between Gajewnik and Skierniewice as well as on sections Łowicz-Warszawa-Łuków (except on some lines in Warsaw railway node), 740 meter long trains are possible to be operated. On the remaining of the line the prevailing train length was 620 m
Diversionary line starting at Elk continuing via Gniewkowo and Poznan Franowo before re-joining Line 4-PL in Ostrów Wielkopolski (Line 5-PL)	640 m
Diversionary line starting at Wroclaw Brochów to Opole, via Brzeg (Line 6-PL)	650 m
Expected principal line starting from Pilawa to Elk via Tluszcz (Line 7-PL)	620 m
Expected diversionary line starting from Lowicz to Tluszcz via Warszawa (Line 8-PL). However, the short section between Warszawa Główna Towarowa and Warszawa Praga is already a diversionary line (part of Line 4-PL)	Most of this line allowed for the operation of 740m long trains. Capacity constraint exists on section between Legionowo and Krusze, where 650 m long trains can operate
Czech Republic	
Principal line starting at the CZ/DE border near Děčín Prostřední Žleb, continuing to Praha Libeň (Line 1-CZ)	680 m on the two sections from Praha Bubeneč via Praha Holešovice to Praha Libeň
Diversionary line branching out of Line 1-CZ in Děčín Prostřední Žleb, continuing via Lysá n/Labem and meeting Line 1-CZ again in Praha Libeň (Line 2-CZ)	650 m on the section from Děčín východ d.n. to Děčín Prostřední Žleb; otherwise 680 m
Connecting line starting in Praha Uhříněves and meeting lines 1-CZ and 2-CZ also in Praha Libeň (Line 3-CZ)	680 m on the section from Praha Hostivař - Praha Uhříněves; otherwise 710 m
Lithuania	
Principal line starting at the LT/PL border near Mockava, continuing north to Kaunas (Line 1-LT)	The section with the lowest possible train length from Šeštokai to Kazlų Rūda already allowed operating 740 m long trains. If the carrier wished to form longer trains than those specified, and this request did not exceed the capacity allocated to it and, upon approval by the manager, that formation complied with the characteristics of the public railway infrastructure, the manager should have ensured the organisation and management of traffic for such trains

Source: Contractor based on consultation with the Infrastructure Managers; Notes: the description for the Netherlands and Belgium refers to the daytime period

Based on the analysis of the status of the possibility to operate 740 meter long trains along the RFC NS-B in 2018, and focussing on the relations involving at least one corridor Border Crossing Point (BCP), the following considerations apply:

- 740 meter long trains in 2018 were generally possible to be operated between the Netherlands, Belgium, Germany and Wrocław in Poland, across the Horka – Węgliniec BCP, with the following restrictions:
  - In the Netherlands limitations existed on waiting tracks on the diversionary and connecting lines. Limited paths were available in the daytime between Amersfoort and Bad Bentheim. Train length was also reduced for trains stopping at the intermodal shunting yards Botlek (Bot), Pernis (Ps), Waalhaven Zuid (Whz). The "Iron Rhine" did not technically allow operating 740 meter long trains;
  - At the BCPs between the Netherlands and Germany operational restrictions were in place on the Dutch side that allowed the transit of 740 meter long trains only based on ad hoc requests;
  - In Belgium 740 meter long trains were generally possible to be operated but only outside peak hours;
  - In Germany 740 meter long trains were also generally possible to be operated. Capacity constraints during peak hours existed on some sections of line 1 [Hamm - Löhne (Strecke 2990); Minden - Haste; Groß Gleidingen – Magdeburg; Magdeburg - Saarmund; Berlin-Wuhlheide - Frankfurt (O) - Border DE/PL], line 3 [Border NL/DE - Bad Bentheim – Osnabrück] and line 6 [Riesa - Bad Schandau - Border CZ/DE]. Restrictions due to timetabling and operational specific situations might also result in a temporary reduction of the train length on other corridor lines;
- 740 meter long trains operations were also possible on national O/Ds of the RFC NS-B at the same conditions described for cross-border trains (except for limitations at the BCPs), as well as along several national corridor stretches in Poland and on the RFC NS-B lines in Lithuania;
- No 740 meter long trains were possible to be operated along the RFC NS-B to/from the Czech Republic and within this Member State.

Table 3-4 and Table 3-5 overleaf summarise the status of the operability of 740 meter long trains along the RFC NS-B in 2018 with reference to: 1) the type of lines, i.e. principal (including expected principal), diversionary (including expected diversionary) and connecting lines; and 2) the type of network, i.e. TEN-T core, TEN-T comprehensive, off TEN-T. More details about the technical/capacity conditions of the RFC NS-B lines are provided in the Chapters dedicated to each corridor Member State.

Table 3-4 – 740 meter long trains operability in 2018 by type of line

State of art	Principal		Diversionary		Connecting		Total	
Even and Odd direction - 2018	**Nr. of sections**	**Length [%]**	**Nr. of sections**	**Length [%]**	**Nr. of sections**	**Length [%]**	**Nr. of sections**	**Length [km]**
Operation of 740 m long trains possible	91	56.7%	36	38.8%	19	39.3%	146	3,661.4
Operation of 740 m long trains possible with capacity constraints	23	16.9%	1	0.7%	13	29.9%	37	965.0
Operation of 740 m long trains not possible	56	26.4%	36	60.5%	19	30.8%	111	2,703.7
Total	*170*	*4,561.0 km*	*73*	*2,175.0 km*	*51*	*594.0 km*	*294*	*7,330.0*
Even direction - 2018	**Nr. of sections**	**Length [%]**	**Nr. of sections**	**Length [%]**	**Nr. of sections**	**Length [%]**	**Nr. of sections**	**Length [km]**
Operation of 740 m long trains possible	91	56.7%	33	38.6%	19	39.3%	143	3,653.3
Operation of 740 m long trains possible with capacity constraints	26	17.8%	1	0.7%	13	29.9%	40	1,006.0
Operation of 740 m long trains not possible	53	25.5%	36	60.7%	19	30.8%	108	2,662.6
Total	*170*	*4,561.0 km*	*70*	*2,166.9 km*	*51*	*594.0 km*	*291*	*7,321.9*
Odd direction - 2018	**Nr. of sections**	**Length [%]**	**Nr. of sections**	**Length [%]**	**Nr. of sections**	**Length [%]**	**Nr. of sections**	**Length [km]**
Operation of 740 m long trains possible	91	56.7%	32	38.6%	19	39.3%	142	3,653.5
Operation of 740 m long trains possible with capacity constraints	23	16.9%	5	3.3%	13	29.9%	41	1,021.6
Operation of 740 m long trains not possible	56	26.4%	32	58.1%	19	30.8%	107	2,647.0
Total	*170*	*4,561.0 km*	*69*	*2,167.1 km*	*51*	*594.0 km*	*290*	*7,322.1*

Source: Contractor based on consultation with the Infrastructure Managers

Table 3-5 – 740 meter long trains operability in 2018 by type of network

State of art	Core		Comprehensive		Off TEN-T		Total	
Type of network - 2018	**Nr. of sections**	**Length [%]**	**Nr. of sections**	**Length [%]**	**Nr. of sections**	**Length [%]**	**Nr. of sections**	**Length [km]**
Operation of 740 m long trains possible	102	55.7%	31	39.7%	13	39.7%	146	3,661.4
Operation of 740 m long trains possible with capacity constraints	22	16.1%	11	9.1%	4	5.1%	37	965.0
Operation of 740 m long trains not possible	59	28.2%	24	51.2%	28	55.2%	111	2,703.7
Total	183	4,700.1 km	66	1,848.1 km	45	781.8 km	294	7,330.0

Source: Contractor based on consultation with the Infrastructure Managers

The main considerations from the analysis of the corridor status in 2018 are as follow:

- On 50.0% of the total corridor lines (3,661.4 km) it was possible operating 740 meter long trains in 2018, without any capacity constraints affecting the corridor performance; whereas on 50.0% of the RFC NS-B lines technical/capacity issues were present limiting the operation of 740 meter long trains in specific periods of the day, with 36.9% of the corridor presenting technical characteristics not allowing the operation of long trains;
- Referring to the type of lines:
  - On 56.7% of the principal lines (totalling 62.2% of the RFC NS-B length) it was possible operating 740 meter long trains already in 2018. On 16.9% of the principal lines capacity problems existed, which hampered the operation of long trains in specific periods of the day and on 26.4% of the principal lines it was not possible to operate 740 meter long trains;
  - 60.7% of the diversionary lines (29.7% of the total corridor length) were affected by capacity issues in 2018. Furthermore, most of them (i.e. 60.5%) presented technical characteristics not allowing the operation of 740 meter long trains in 2018;
  - On 39.3% of the connecting lines (corresponding to 8.1% of the RFC NS-B length) it was possible operating 740 meter long trains in 2018, whereas on 60.7% of the remaining connecting lines problems existed that affected the possibility to operate 740 meter long trains both under the technical stand point or due to capacity limitations;
- Referring to the type of network:
  - On 55.7% of the total length of the RFC NS-B core network sections (corresponding to 64.1% of the RFC NS-B length) it was already possible operating 740 meter long trains in 2018, whereas on the remaining 44.3% of the core network lines issues were present limiting the operation of 740 meter long trains to specific periods of the day or not allowing their operation at all; concerning the corridor sections belonging to the comprehensive network (totalling 25.2% of the RFC NS-B length), 60.3% of their length presented either capacity or technical problems hampering the operation of 740 meter long trains in 2018, whereas on 39.7% of this type of network it was possible to operate long trains without capacity constraints;
  - Concerning the other RFC NS-B sections not belonging to the TEN-T network (corresponding to 10.7% of the corridor length), on most of them, i.e. 60.3%, it was not possible to operate 740 meter long trains due to technical/capacity limitations, whereas on the remaining 39.7% of this type of network 740 meter long trains were already possible to be operated.

Finally, details are provided in Table 3-8 overleaf for the whole corridor and by Member State, for the extent of the corridor that was affected in 2018 by technical and/or capacity constraints hampering the operability of 740 meter long trains along the RFC NS-B:

- 259.2 km of the corridor lines in the Netherlands (over 1/3 of the RFC NS-B in this Member State, corresponding to the 3.5% of the whole corridor length) were affected by either technical or capacity constraints; most of these lines belong to the comprehensive network (i.e. 194.4 km). Limitations were related to both restrictions at waiting tracks on the principal, diversionary and connecting lines as well as limited available paths on principal/core network corridor lines;
- In Belgium there were no lines where 740 meter long trains could not be accommodated, whilst the whole corridor network was potentially affected by capacity problems;
- Similar to Belgium, in Germany there were no lines where the operation of 740 meter long trains was not possible, whereas capacity limitations involved principal lines along the core network only, covering 7.1% of the whole corridor length, specified that restrictions due to timetabling and operational specific situations might also result in a temporary reduction of the train length on other corridor lines;
- On 2,248.2 km of corridor lines in Poland, representing 30.7% of the whole RFC NS-B length, 740 meter long trains could not be operated in 2018. Problems affected in particular principal and diversionary lines and the TEN-T comprehensive network;
- In the Czech Republic, technical constraints were present along the whole corridor, i.e. 307.5 km of lines, corresponding to 4.2% of the total length of the RFC NS-B;
- Finally, neither capacity nor technical constraints existed in the part of the corridor alignment located in Lithuania.

Table 3-6 – Corridor extent affected by technical/capacity contrains to operate 740 meter long trains in 2018

Member State	Total length [km]	2018					
		Corridor extent affected by technical/capacity constraints to operate 740 m long trains		Operation of 740 m long trains possible with capacity constraints		Operation of 740 m long trains not possible	
Whole corridor		**km**	**%**	**km**	**%**	**km**	**%**
NL	634.8	259.2	3.5%	111.3	1.5%	147.9	2.0%
BE	332.2	332.2	4.5%	332.2	4.5%	0.0	0.0%
DE	2,508.3	521.5	7.1%	521.5	7.1%	0.0	0.0%
PL	3,431.7	2,248.2	30.7%	0.0	0.0%	2,248.2	30.7%
CZ	307.5	307.5	4.2%	0.0	0.0%	307.5	4.2%
LT	115.5	0.0	0.0%	0.0	0.0%	0.0	0.0%
Total	7,330.0	3,668.6	50.0%	965.0	13.2%	2703.7	36.9%
Principal lines		**km**	**%**	**km**	**%**	**km**	**%**
NL	367.4	55.6	1.2%	14.5	0.3%	41.1	0.9%
BE	235.7	235.7	5.2%	235.7	5.2%	0.0	0.0%
DE	1,921.0	521.5	11.4%	521.5	11.4%	0.0	0.0%
PL	1,778.8	1,021.5	22.4%	0.0	0.0%	1,021.5	22.4%
CZ	142.6	142.6	3.1%	0.0	0.0%	142.6	3.1%
LT	115.5	0.0	0.0%	0.0	0.0%	0.0	0.0%
Total	4,561.0	1,976.9	43.3%	771.7	16.9%	1205.2	26.4%
Diversionary lines		**km**	**%**	**km**	**%**	**km**	**%**
NL	96.5	56.7	2.6%	0.0	0.0%	56.7	2.6%
BE	15.8	15.8	0.7%	15.8	0.7%	0.0	0.0%
DE	386.3	0.0	0.0%	0.0	0.0%	0.0	0.0%
PL	1,524.0	1,106.3	50.9%	0.0	0.0%	1,106.3	50.9%
CZ	152.4	152.4	7.0%	0.0	0.0%	152.4	7.0%
LT	0.0	0.0	0.0%	0.0	0.0%	0.0	0.0%
Total	2,175.0	1,331.1	61.2%	15.8	0.7%	1315.3	60.5%
Connecting lines		**km**	**%**	**km**	**%**	**km**	**%**
NL	170.8	146.9	24.7%	96.7	16.3%	50.2	8.5%
BE	80.7	80.7	13.6%	80.7	13.6%	0.0	0.0%
DE	201.0	0.0	0.0%	0.0	0.0%	0.0	0.0%
PL	128.9	120.4	20.3%	0.0	0.0%	120.4	20.3%
CZ	12.6	12.6	2.1%	0.0	0.0%	12.6	2.1%
LT	0.0	0.0	0.0%	0.0	0.0%	0.0	0.0%
Total	594.0	360.6	60.7%	177.4	29.9%	183.2	30.8%

Member State	Total length [km]	2018					
		Corridor extent affected by technical/capacity constraints to operate 740 m long trains		Operation of 740 m long trains possible with capacity constraints		Operation of 740 m long trains not possible	
Core network lines		**km**	**%**	**km**	**%**	**km**	**%**
NL	393.7	64.8	1.4%	16.5	0.4%	48.3	1.0%
BE	218.7	218.7	4.7%	218.7	4.7%	0.0	0.0%
DE	1,705.9	521.5	11.1%	521.5	11.1%	0.0	0.0%
PL	2,172.0	1,104.3	23.5%	0.0	0.0%	1,104.3	23.5%
CZ	173.0	173.0	3.7%	0.0	0.0%	173.0	3.7%
LT	36.8	0.0	0.0%	0.0	0.0%	0.0	0.0%
Total	4,700.1	2,082.2	44.3%	756.7	16.1%	1325.6	28.2%
Comprehensive network lines		**km**	**%**	**km**	**%**	**km**	**%**
NL	241.0	194.4	10.5%	94.8	5.1%	99.6	5.4%
BE	73.7	73.7	4.0%	73.7	4.0%	0.0	0.0%
DE	557.4	0.0	0.0%	0.0	0.0%	0.0	0.0%
PL	762.7	712.1	38.5%	0.0	0.0%	712.1	38.5%
CZ	134.5	134.5	7.3%	0.0	0.0%	134.5	7.3%
LT	78.8	0.0	0.0%	0.0	0.0%	0.0	0.0%
Total	1,848.1	1,114.7	60.3%	168.5	9.1%	946.2	51.2%
Off TEN-T network lines		**km**	**%**	**km**	**%**	**km**	**%**
NL	0.0	0.0	0.0%	0.0	0.0%	0.0	0.0%
BE	39.8	39.8	5.1%	39.8	5.1%	0.0	0.0%
DE	245.0	0.0	0.0%	0.0	0.0%	0.0	0.0%
PL	497.0	431.9	55.2%	0.0	0.0%	431.9	55.2%
CZ	0.0	0.0	0.0%	0.0	0.0%	0.0	0.0%
LT	0.0	0.0	0.0%	0.0	0.0%	0.0	0.0%
Total	781.8	471.7	60.3%	39.8	5.1%	431.9	55.2%

Source: Contractor based on consultation with the Infrastructure Managers

In addition to the analysis of the suitability of the RFC NS-B to operate 740 meter long trains, a review of the characteristics of the corridor network with reference to the electrification of the corridor lines was performed as part of the study. Table 3-7 provides the list of non-electrified corridor sections in 2018.

Table 3-7 – Non-electrified corridor lines in 2018

MS	Corridor lines	Length in km	Type of line	Type of network
BE	Y. Rooierweg - Genk Goederen	13.8	Connecting	Off TEN-T
BE	Y. Rooierweg - Genk Zuid	8.0	Connecting	Off TEN-T
BE	Mol - Hamont border	41.1	Expected principal	Comprehensive
DE	Wilhelmshaven - Sande	15.4	Principal	Core
DE	Sande - Oldenburg	45.0	Principal	Core
DE	Cottbus - Horka	74.6	Diversionary	Comprehensive
DE	Berlin-Moabit - Berlin-Hamburger und Lehrter Bf	2.3	Connecting	Off TEN-T
PL	Ełk - Olecko	28.5	Principal	Core
PL	Olecko - (Gw)	16.5	Principal	Core
PL	(Gw) - Papiernia	20.7	Principal	Core
PL	Papiernia - Suwałki	5.7	Principal	Core
PL	Suwałki - Trakiszki	25.7	Principal	Core
PL	Trakiszki - Trakiszki (Border PL/LT)	3.4	Principal	Core
PL	Głogów - Leszno	46.8	Diversionary	Off TEN-T
PL	Leszno - Kąkolewo	11.9	Diversionary	Off TEN-T
PL	Kąkolewo - Osusz	56.3	Diversionary	Off TEN-T
PL	Osusz - Durzyn	5.3	Diversionary	Off TEN-T
PL	Ełk - Korsze	98.8	Diversionary	Comprehensive
LT	Trakiszki (Border PL/LT) - Mockava	14.3	Principal	Comprehensive
LT	Mockava - Šeštokai	7.5	Principal	Comprehensive
LT	Šeštokai - Kazlų Rūda	57.0	Principal	Comprehensive
LT	Kazlų Rūda - Kaunas	36.8	Principal	Core
	Total	**635.3**		

Source: Contractor based on consultation with the Infrastructure Managers

The analysis shows that in 2018, 635.3 km of RFC NS-B lines were not electrified, including 317.6 km of principal and expected principal corridor sections and in particular all the RFC NS-B lines in Lithuania.

3.2.2. Handover stations

A total of 89 handover stations/marshalling yards/waiting-buffer locations were assessed as part of this study. Table 3-8 provides the list of 33 handover stations/marshalling yards/waiting-buffer locations along the alignment of the RFC NS-B where 740 meter long trains could not be operated in 2018. In the remaining 56 handover stations/marshalling yards/waiting-buffer locations of the RFC NS-B no technical/capacity problems were experienced at that time.

Table 3-8 – Handover stations/marshalling yards/waiting-buffer locations presenting 740 meter long trains operability issues in 2018

Country	Handover station and waiting/buffer locations	Type of network
NL	Maasvlakte (Oost)	Core
NL	Europoort	Core
NL	Botlek	Core
NL	Pernis	Core
NL	Waalhaven Zuid	Core
NL	Amersfoort (car terminal)	Core
NL	Almelo	Core
NL	Roosendaal	Core
NL	Tilburg Goederen	Comprehensive
NL	Geldermelden/Meteren	Core
NL	Amersfoort (waiting- buffer track)	Core
NL	Rotterdam Noord Goederen	Comprehensive
NL	Almelo buffer track	Core
NL	Kijfhoek	Core
NL	Crailoo	Comprehensive
NL	's-Hertogenbosch	Comprehensive
BE	Antwerpen Haven - Bundel B3	Off TEN-T
BE	Antwerpen Haven - Bundel Oorderen	Off TEN-T
BE	Antwerpen Haven - Bundel Angola	Off TEN-T
DE	Duisburg Ruhrort Hafen	Off TEN-T
DE	Duisburg Hafen	Off TEN-T
DE	Duisburg-Hochfeld Süd	Core
DE	Braunschweig Rbf	Core
DE	Magdeburg-Rothensee	Core
DE	Berlin Hamburger und Lehrter Bf	Off TEN-T
DE	Frankfurt (Oder) Pbf	Core
PL	Gliwice (port)	Off TEN-T
PL	Sosnowiec Południowy	Core
PL	Brzeg Dolny	Comprehensive
CZ	Ústí nad Labem	Comprehensive
CZ	Děčín	Comprehensive
LT	Mockava	Comprehensive
LT	Kaunas	Core

Source: Contractor based on consultation with the Infrastructure Managers

Further to 740 meter long trains operability issues the 13 following handover stations/marshalling yards/waiting-buffer locations also represented a barrier in terms of lack of electrification: Crailoo, Antwerpen Haven - Bundel Berendrecht, Antwerpen Haven - Bundel Buitenschoor, Antwerpen Haven - Bundel Oudendijk 1, Antwerpen Haven - Bundel Oorderen, Antwerpen Haven - Bundel Angola, Wilhelmshaven, Duisburg Hafen, Duisburg-Hochfeld Süd, Berlin Hamburger und Lehrter Bf, Mockava, Šeštokai, Kaunas.

3.2.3. Terminals

A total of 160 terminals is in operation along the RFC NS-B. These are listed in Annex A to this report. Table 3-9 below provides the distribution of these terminals by Member State, as well as the number of terminals that responded to the SCI survey referred to at Section 2.2.1 above.

Table 3-9 – Terminals along the RFC NS-B and Terminals that responded to the SCI survey

Member State	Number of contacted terminals	Number of terminals that responded to the survey
NL	76	0
BE	19	1
DE	41	8
PL	16	8
CZ	5	0
LT	3	3
Total	**160**	**20**

Source: Contractor

20 terminal operators/managers responded to the SCI survey. The characteristics of these terminals in 2018 are summarised in Table 3-10 overleaf.

The analysis of the characteristics of the RFC NS-B terminals that responded to the SCI survey shows that in 2018 740 meter long trains were not possible to be operated at the following logistics nodes: MSC Gate Bremerhaven, KV-Drehscheibe Rhein/Ruhr (Megahub Duisburg), Ubf Großbeeren, Hannover Linden (until go life of KV Drehscheibe Lehrte), Terminal Brzeg Dolny (PCC Intermodal S.A.), Terminal Dąbrowa Górnicza (Metrans), Terminal Gądki (Metrans), Terminal Gliwice (port) (PCC Intermodal S.A.), Terminal Kąty Wrocławskie (Shavemaker Logistics & Transport), Pruszków (Metrans), Terminal Kutno (PCC Intermodal S.A.), Kaunas intermodal terminal, Mockava.

Electrified train terminal accessibility was furthermore not possible at the following terminals: NV Haven Genk, CT Wilhelmshaven (CTW), Terminal Brzeg Dolny (PCC Intermodal S.A.), Terminal Dąbrowa Górnicza (Metrans), Terminal Gądki (Metrans), Terminal Gliwice (port) (PCC Intermodal S.A.), Pruszków (Metrans), Terminal Kutno (PCC Intermodal S.A.), Kaunas intermodal terminal, Mockava terminal, Šeštokai railway station. Finally, electrified accessibility at loading/unloading track(s), was not feasible at the following logistics nodes: NV Haven Genk, CTB Bremerhaven, MSC Gate Bremerhaven, CT Wilhelmshaven (CTW), Terminal Brzeg Dolny (PCC Intermodal S.A.), Terminal Dąbrowa Górnicza (Metrans), Terminal Gądki (Metrans), Terminal Gliwice (port) (PCC Intermodal S.A.), Terminal Kąty Wrocławskie (Shavemaker Logistics & Transport), Pruszków (Metrans), Terminal Kutno (PCC Intermodal S.A.), Kaunas intermodal terminal, Mockava terminal, Šeštokai railway station.

Table 3-10 – Characteristics of the terminals that responded to the SCI survey in 2018

Country	Terminal	Handover station	Type of node	Electrified accessibility at terminal	Electrified accessibility at loading/unloading track(s)	Max train length (m)
BE	NV Haven Genk	Genk Goederen	Off TEN-T	No	No	>=740
DE	CTB Bremerhaven	Bremerhaven - Speckenbüttel	Core	Yes	No	>=740
DE	NTB Bremerhaven	Bremerhaven - Speckenbüttel	Core	Yes	Yes	>=740
DE	MSC Gate Bremerhaven	Bremerhaven - Speckenbüttel	Core	Yes	No	<740
DE	Bahnhof Duisburg Ruhrort Hafen	Duisburg Ruhrort Hafen	Off TEN-T	Yes	Yes	>=740
DE	KV-Drehscheibe Rhein/Ruhr (Megahub Duisburg)	Duisburg Ruhrort Hafen	Off TEN-T	Yes	Yes	<740
DE	Ubf Großbeeren	Großbeeren	Core	Yes	Yes	<740
DE	Hannover Linden (until go life of KV Drehscheibe Lehrte)	Hannover - Linden	Core	Yes	Yes	<740
DE	CT Wilhelmshaven (CTW)	Wilhelmshaven	Core	No	No	>=740
PL	Terminal Brzeg Dolny (PCC Intermodal S.A.)	Brzeg Dolny	Comprehensive	No	No	<740
PL	Terminal Dąbrowa Górnicza (Metrans)	Dąbrowa Górnicza Towarowa	Off TEN-T	No	No	<740
PL	Terminal Gądki (Metrans)	Gądki	Off TEN-T	No	No	<740
PL	Terminal Gliwice (port) (PCC Intermodal S.A.)	Gliwice (port)	Off TEN-T	No	No	<740
PL	Terminal Kąty Wrocławskie (Shavemaker Logistics & Transport)	Kąty Wrocławskie	Off TEN-T	Yes	No	<740
PL	Pruszków (Metrans)	Pruszków	Core	No	No	<740
PL	Terminal Kutno (PCC Intermodal S.A.)	Stara Wieś k. Kutna	Core	No	No	<740
PL	Terminal Swarzędz (CLIP Logistics Sp. z.o.o.)	Swarzędz	Core	Yes	Yes	>=740
LT	Kaunas intermodal terminal	Kaunas	Core	No	No	<740
LT	Mockava terminal	Mockava	Comprehensive	No	No	<740
LT	Šeštokai railway station	Šeštokai	Comprehensive	No	No	>=740

Source: Contractor based on SCI survey results

3.3. Expected corridor infrastructure and operational characteristics by 2030 and persisting gaps

A review of the ongoing and planned investments and initiatives affecting the operation of 740 meter long trains along the RFC NS-B was performed as part of the study aimed at analysing the technical and operational conditions of long trains along the corridor by 2030. The details of this analysis are provided in Chapters 4 to 9 below for each RFC NS-B Member State involved in the study. The sections below summarise the analysis presented in these chapters providing an overview of the expected technical and operational characteristics of the RFC NS-B by 2030, also highlighting the persisting barriers that would still hamper the smooth and seamless operation of long trains along the corridor by this time horizon, upon completion of the ongoing/planned initiatives (i.e. gap analysis).

It is worth to notice that as more specifically commented in Chapter 8 below, reporting on the study analysis on the RFC NS-B infrastructure in Poland, several projects related to the modernisation of the corridor sections in this Member State are still to be fully defined in terms of project costs and/or implementation schedule. Furthermore some of them are in the reserve list of the national railway plan and accordingly state funding is not secured for these initiatives. These maturity issues are apparently affecting the reconstruction/modernisation of about 700 km of corridor lines in Poland, half of these related to the core network, which is in any case assumed to be fully modernised and upgraded to the standards required in the Regulation (EU) 1315/2013 by 2030. For the initiatives currently affected by maturity issues a general risk of possible delays in their completion by 2030 may exist, particularly for those relating to the modernisation of the lines not belonging to the core network. On the other hand it is not possible at present to exactly identify which projects may be affected by implementation issues, if any will materialise. Accordingly the gap analysis performed as part of this study focussed on those corridor lines that are currently not covered by the scope of any ongoing/planned investments.

3.3.1. Railway lines

Table 3-11 provides a summary of the technical maximum train length and related capacity constraints along the RFC NS-B lines as described in Chapters 4 to 9 below for the year 2030.

Table 3-11 – Technical maximum train length and related capacity constraints along the RFC NS-B lines by 2030

Line	Technical maximum train length and related capacity constraints
Netherlands	
Principal line from Amsterdam Westhaven to the NL/DE border near Bad Bentheim (Line 1-NL)	740 m Amsterdam Westhaven – Bad Bentheim (limited number of path available for 740 m trains) Border agreement NL/DE standard train length = 590 m
Principal line from Maasvlakte to the NL/DE border near Emmerich (Line 2-NL)	740 m Maasvlakte West – Zevenaar Border Length limitations apply on the Harbour SY Botlek, Pernis and Maasvlakte Oost. Border agreement NL/DE standard train length = 690 m
Diversionary line from Weesp via Rotterdam to Kijfhoek (Line 3-NL)	660 m Kijfhoek > Weesp (length restriction waiting track) 740 m Weesp < Kijfhoek
Connecting line from Amersfoort via Utrecht, 's Hertogenbosch to the NL/BE border near Roosendaal (Line 4-NL)	740 m Amersfoort - Meteren – Roosendaal (limited number of paths for 740 m trains available)
Connecting line from Beverwijk to Amsterdam (Line 5-NL)	740 m at most times of the day
Expected principal line ("Iron Rhine") from the BE/NL border via Roermond to the NL/DE border near Weert (Line 6-NL)	Will depend upon realisation of the "Iron Rhine Project"
Belgium	
All corridor lines	740 m trains would be allowed outside peak hours
Germany	
All corridor lines	For the German corridor network a train length up to 740 m will be basically possible. Restrictions due to timetabling and operational specific situations may result in temporary reductions of the train length
Poland	
Principal line starting at the PL/DE border near Rzepin continuing via Poznan Franowo, Lowicz, Skierniewice, Pilawa and Łuków to Terespol (close to the PL/BY border) (Line 1-PL). However, the section between Poznan Franowo and Lowicz is an expected principal line	The planned upgrades will increase the train length up to the required standard. With reference to the first two sections, from Kunowice (Border DE/PL) to Chlastawa via Rzepin, even though no plans for an upgrade are yet in place it is assumed that by 2030 also this cross-border section will allow operating 740 m long trains
Principal line starting at the PL/LT border near Trakiszki to Elk (Line 2-PL)	Upgrades will increase the train length up to 740 m
Principal line starting at the PL/DE border near Bielawa Dolna continuing via Wroclaw Brochów, Jelcz, Opole, Gliwice and Długoszyn to Jaworzno	Improvements are expected on the line, resulting in 740 m long trains to be operated on almost entire line including section Opole Groszowice – Gliwice – Chorzów Stary as well as Chorzów Stary – Mysłowice – Szabelnia, in addition to section Bielawa Dolna - Wrocław Muchobór, where 740 m

Line	Technical maximum train length and related capacity constraints
Szczakowa (Line 3-PL). This line also includes the "triangular connection" starting at Długoszyn via Sosnowiec Maczki to Jaworzno Szczakowa	long trains were already available. On the remaining few sections restrictions to operate 740 m long trains may persist
Diversionary line starting at Rzepin continuing via Ostrów Wielkopolski, Skierniewice and Warszawa before re-joining Line 1-PL in Łuków (Line 4-PL)	Some improvements are expected on section Głogów – Ostrów Wielkopolski – Gajewniki, which in addition to the part of the corridor between Gajewnik and Skierniewice as well as on sections Łowicz-Warszawa-Łuków (except on some km in Warsaw) already at standard, will result in substantial part of the line available for 740 meter long trains with approximately 120 km available for train length of 620 m
Diversionary line starting at Elk continuing via Gniewkowo and Poznan Franowo before re-joining Line 4-PL in Ostrów Wielkopolski (Line 5-PL)	Ełk - Korsze section will be modernized allowing operating 740 m long trains. The line will be also electrified. On the section Kobylnica – Mogilno the maximum train length is expected to remain up 650 m
Diversionary line starting at Wroclaw Brochów to Opole, via Brzeg (Line 6-PL)	The prevailing train length is 650 m, because the relevant sections are not expected to be upgraded
Expected principal line starting from Pilawa to Elk via Tluszcz (Line 7-PL)	The planned upgrades are expected to increase the train length up to the required standard on the entire section, except on section Krusze - Tłuszcz, where the maximum train length will be 650 m
Expected diversionary line starting from Lowicz to Tluszcz via Warszawa (Line 8-PL). However, the short section between Warszawa Główna Towarowa and Warszawa Praga is already a diversionary line (part of Line 4-PL)	No upgrades are expected on this section, therefore section between Legionowo and Krusze will remain at 650 m
Czech Republic	
All corridor lines	Operation of 740 m trains on the whole corridor possible at most times of the day
Lithuania	
Principal line starting at the LT/PL border near Mockava, continuing north to Kaunas (Line 1-LT)	The section with the lowest possible train length from Šeštokai to Kazlų Rūda already allows for 740 m long trains. If the carrier wishes to form longer trains than those specified, and this request does not exceed the capacity allocated to it and, upon approval by the manager, that formation complies with the characteristics of the public railway infrastructure, the manager shall ensure the organisation and management of traffic for such trains

Source: Contractor based on consultation with the Infrastructure Managers; Notes: the description for the Netherlands and Belgium refers to the daytime period

Based on the analysis of the planned investments and their impact on the possibility to operate 740 meter long trains along the RFC NS-B by 2030, and focussing on the relations involving at least one corridor Border Crossing Point (BCP), the following considerations apply:

- The operation of 740 meter long trains by 2030 is generally expected to be possible along the corridor principal and core network corridor lines between the Netherlands, Belgium, Germany, the Czech Republic and most destinations in Poland, as well as between these countries and Belarus via Terespol; and between Tłuszcz/Sokolka in Poland and Kaunas in Lithuania via Bialystok/Ełk, as well as between Mogilno in Poland and Kaunas in Lithuania, via Ełk. Restrictions will however be present, which are described below:
  - In the Netherlands limited paths will be available in the daytime between Amersfoort and Bad Bentheim, as well as between Amersfoort, Meteren and Roosendaal. Issues will also exist on waiting tracks on the diversionary line between Kijfhoek and Weesp. Train length will furthermore be restricted for trains stopping at the intermodal shunting yards Botlek (Bot), Pernis (Ps), Waalhaven Zuid (Whz). Possibility to operate 740 meter long trains along the "Iron Rhine" will finally depend on the implementation of the "Iron Rhine Project";
  - At the BCPs between the Netherlands and Germany operational limitations on the Dutch side will be in place that will allow the transit of 740 meter long trains only based on ad hoc requests;
  - In Belgium the operation of 740 meter long trains will be generally possible, but only outside peak hours;
  - In Germany the operation of 740 meter long trains will also be generally feasible, with possible temporary limitations due to timetabling and operational specific circumstances;
  - In the Czech Republic capacity issues may be experienced, particularly in the daytime;
- The operation of 740 meter long trains along the RFC NS-B to/from Lithuania would be affected by persisting technical constraints on the following segments of the expected principal, diversionary/expected diversionary lines interconnecting the Polish with the Lithuanian networks along the RFC NS-B routes: Krusze - Tłuszcz (4.1 km long, expected principal/Off TEN-T line), Legionowo - Krusze (32.7 km long, expected diversionary/ Off TEN-T line) and Kobylnica - Mogilno (63.9 km long, diversionary/ TEN-T comprehensive line);
- Operating 740 meter long trains to/from Ukraine via Medyka towards most corridor destinations might be also affected by persisting technical problems at the short sections belonging to the "triangular connection" starting at Długoszyn via Sosnowiec Maczki to Jaworzno Szczakowa (6.9 km long, principal/Off TEN-T line – including the very short 1.9 km long

segment Jaworzno Szczakowa - Długoszyn), close to the border between Poland and Ukraine;

- The operation of 740 meter long trains along national O/Ds of the RFC NS-B will be generally possible at the same conditions described above and affecting international long distance trains (except from those problems applying only to trains crossing the BCPs between the Netherlands and Germany). In addition to the above described conditions, problems are expected to persist in Poland on the diversionary/Off TEN-T lines between (Poznań Gł.) P. Starołęka Psk - Franklinów - Stary Staw (91.8 km) along the itinerary Poznań - Stary Staw and between Głogów - Ostrów Wielkopolski - Gajewniki (242.8 km) along the itinerary Rzepin - Skierniewice; as well as on the connecting/Off TEN-T line Sosnowiec Maczki - Dąbrowa Górnicza Towarowa (14.9 km).

Table 3-12 and Table 3-13 overleaf summarise the status of the operability of 740 meter long trains along the RFC NS-B by 2030 with reference to: 1) the type of lines, i.e. principal (including expected principal), diversionary (including expected diversionary) and connecting lines; and 2) the type of network, i.e. TEN-T core, TEN-T comprehensive, off TEN-T. The main considerations are as follow:

- On 82.2% of the corridor lines (6,024.2 km) it will be possible operating 740 meter long trains, without capacity constraints affecting the corridor performance; 17.8% of the RFC NS-B lines will be affected by technical/capacity problems limiting the operation of 740 meter long trains in specific periods of the day, with 7.0% of the lines still presenting technical characteristics not allowing the operation of long trains;
- Referring to the type of lines:
    - On 90.2% of the principal lines it will be possible to operate 740 meter long trains by 2030. On 9.5% of the principal lines, capacity problems are expected to exist which will hamper the operation of long trains in specific periods of the day and on only 0.3% of the principal lines it will not be possible to operate 740 meter long trains;
    - 30.2% of the diversionary lines will be affected by technical/capacity issues, whereas on 69.8% of these lines it will be possible operating 740 meter long trains;
    - On 65.5% of the connecting lines it will be possible to operate 740 meter long trains by 2030, whereas 34.5% of the remaining connecting lines will still present problems hampering the operation of 740 meter long trains, primarily due to capacity restrictions;

Table 3-12 – 740 meter long trains operability by 2030 by type of line

Base scenario	Principal		Diversionary		Connecting		Total	
Even and odd direction - 2030	**Nr. of sections**	**Length [%]**	**Nr. of sections**	**Length [%]**	**Nr. of sections**	**Length [%]**	**Nr. of sections**	**Length [km]**
Operation of 740 m long trains possible	139	90.2%	48	69.8%	33	65.5%	220	6,024.2
Operation of 740 m long trains possible with capacity constraints	26	9.5%	7	7.7%	16	32.0%	49	792.0
Operation of 740 m long trains not possible	5	0.3%	18	22.4%	2	2.5%	25	513.7
Total	170	4,561.0 km	73	2,175.0 km	51	594.0 km	294	7,330.0
Even direction - 2030	**Nr. of sections**	**Length [%]**	**Nr. of sections**	**Length [%]**	**Nr. of sections**	**Length [%]**	**Nr. of sections**	**Length [km]**
Operation of 740 m long trains possible	139	90.2%	45	69.7%	33	65.5%	217	6,016.1
Operation of 740 m long trains possible with capacity constraints	26	9.5%	7	7.8%	16	32.0%	49	792.0
Operation of 740 m long trains not possible	5	0.3%	18	22.5%	2	2.5%	25	513.7
Total	170	4,561.0 km	70	2,166.9 km	51	594.0 km	291	7,321.9
Odd direction - 2030	**Nr. of sections**	**Length [%]**	**Nr. of sections**	**Length [%]**	**Nr. of sections**	**Length [%]**	**Nr. of sections**	**Length [km]**
Operation of 740 m long trains possible	139	90.2%	44	69.7%	33	65.5%	216	6,016.4
Operation of 740 m long trains possible with capacity constraints	26	9.5%	11	10.4%	16	32.0%	53	848.7
Operation of 740 m long trains not possible	5	0.3%	14	19.9%	2	2.5%	21	457.1
Total	170	4,561.0 km	69	2,167.1 km	51	594.0 km	290	7,322.1

Source: Contractor based on consultation with the Infrastructure Managers

Table 3-13 – 740 meter long trains operability by 2030 by type of network

Base scenario	Core		Comprehensive		Off TEN-T		Total	
Type of network - 2030	**Nr. of sections**	**Length [%]**	**Nr. of sections**	**Length [%]**	**Nr. of sections**	**Length [%]**	**Nr. of sections**	**Length [km]**
Operation of 740 m long trains possible	159	91.3%	40	74.9%	21	44.6%	220	6,024.2
Operation of 740 m long trains possible with capacity constraints	24	8.7%	21	18.6%	4	5.1%	49	792.0
Operation of 740 m long trains not possible	0	0.0%	5	6.5%	20	50.3%	25	513.7
Total	183	4,700.1 km	66	1,848.1 km	45	781.8 km	294	7,330.0

Source: Contractor based on consultation with the Infrastructure Managers

- Referring to the type of network:
  - On 91.3% of the total length of the RFC NS-B core network sections it will be possible operating 740 meter long trains by 2030, whereas on the remaining 8.7% of the core network lines issues will be present, limiting the operation of 740 meter long trains to specific periods of the day;
  - Concerning the corridor sections belonging to the comprehensive network, on most of them, i.e. 74.9%, it will be possible operating long trains without capacity constraints, whereas 25.1% of this type of network will present either capacity or technical issues hindering the operation of 740 meter long trains by 2030;
  - Finally, concerning the other RFC NS-B sections not belonging to the TEN-T network, on 44.6% of their length long trains will be possible to be operated. On the remaining 55.4% of this type of network the operation of 740 meter long trains will still be affected by technical/capacity problems.

Finally, details are provided in Table 3-14 overleaf for the whole corridor and by Member State, for the extent of the RFC NS-B that by 2030 is still expected to present technical and/or capacity issues limiting the operability of 740 meter long trains:

- 209 km of corridor lines in the Netherlands will be affected by both technical and capacity constraints, particularly on the lines belonging to the comprehensive network (i.e. 194.4 km). Whereas the extent of the corridor affected by technical issues will decrease, the length of the lines subject to capacity restrictions will increase, particularly in the daytime. As further commented in the following sections, investments will be required to accommodate 740 meter long trains at the following handover stations/marshalling yards/waiting-buffer locations: Maasvlakte Oost, Botlek, Pernis, Waalhaven Zuid, Kijfhoek, Amersfoort, Rotterdam Noord Goederen, Almelo. Furthermore solutions to improve stability/punctuality will be needed at the Crailoo, 's Hertogenbosch and Tilburg Goederen waiting/buffer locations;
- In Belgium the situation will substantially remain unchanged, compared to 2018: 740 meter long trains will be possible to be operated on the RFC NS-B lines, whereas the whole corridor lines will be potentially affected by capacity limitations, particularly in the peak hours. Due to the increasing traffic, solutions are currently under investigation to improve the existing capacity/operational conditions by 2030;
- The capacity limitations affecting the corridor lines in Germany in 2018 will be addressed and solved, although additional interventions may be required to further improve capacity in view of traffic increase;

Table 3-14 – Corridor extent affected by technical/capacity contrains to operate 740 meter long trains by 2030

Member State	Total length [km]	2030					
		Corridor extent affected by technical/capacity constraints to operate 740 m long trains		Operation of 740 m long trains possible with capacity constraints		Operation of 740 m long trains not possible	
Whole corridor		**km**	**%**	**km**	**%**	**km**	**%**
NL	634.8	209.0	2.9%	152.3	2.1%	56.7	0.8%
BE	332.2	332.2	4.5%	332.2	4.5%	0.0	0.0%
DE	2,508.3	0.0	0.0%	0.0	0.0%	0.0	0.0%
PL	3,431.7	457.1	6.2%	0.0	0.0%	457.2	6.2%
CZ	307.5	307.5	4.2%	307.5	4.2%	0.0	0.0%
LT	115.5	0.0	0.0%	0.0	0.0%	0.0	0.0%
Total	7,330.0	1,305.8	17.8%	792.0	10.8%	513.7	7.0%
Principal lines		**km**	**%**	**km**	**%**	**km**	**%**
NL	367.4	55.6	1.2%	55.6	1.2%	0.0	0.0%
BE	235.7	235.7	5.2%	235.7	5.2%	0.0	0.0%
DE	1,921.0	0.0	0.0%	0.0	0.0%	0.0	0.0%
PL	1,778.8	10.9	0.2%	0.0	0.0%	10.9	0.2%
CZ	142.6	142.6	3.1%	142.6	3.1%	0.0	0.0%
LT	115.5	0.0	0.0%	0.0	0.0%	0.0	0.0%
Total	4,561.0	444.8	9.8%	433.9	9.5%	10.9	0.2%
Diversionary lines		**km**	**%**	**km**	**%**	**km**	**%**
NL	96.5	56.7	2.6%	0.0	0.0%	56.7	2.6%
BE	15.8	15.8	0.7%	15.8	0.7%	0.0	0.0%
DE	386.3	0.0	0.0%	0.0	0.0%	0.0	0.0%
PL	1,524.0	431.2	19.8%	0.0	0.0%	431.2	19.8%
CZ	152.4	152.4	7.0%	152.4	7.0%	0.0	0.0%
LT	0.0	0.0	0.0%	0.0	0.0%	0.0	0.0%
Total	2,175.0	656.1	30.2%	168.2	7.7%	487.9	22.4%
Connecting lines		**km**	**%**	**km**	**%**	**km**	**%**
NL	170.8	96.7	16.3%	96.7	16.3%	0.0	0.0%
BE	80.7	80.7	13.6%	80.7	13.6%	0.0	0.0%
DE	201.0	0.0	0.0%	0.0	0.0%	0.0	0.0%
PL	128.9	14.9	2.5%	0.0	0.0%	14.9	2.5%
CZ	12.6	12.6	2.1%	12.6	2.1%	0.0	0.0%
LT	0.0	0.0	0.0%	0.0	0.0%	0.0	0.0%
Total	594.0	204.9	34.5%	190.0	32.0%	14.9	2.5%

		2030					
Member State	**Total length [km]**	**Corridor extent affected by technical/capacity constraints to operate 740 m long trains**		**Operation of 740 m long trains possible with capacity constraints**		**Operation of 740 m long trains not possible**	
Core network lines		**km**	**%**	**km**	**%**	**km**	**%**
NL	393.7	16.5	0.4%	16.5	0.4%	0.0	0.0%
BE	218.7	218.7	4.7%	218.7	4.7%	0.0	0.0%
DE	1,705.9	0.0	0.0%	0.0	0.0%	0.0	0.0%
PL	2,172.0	0.0	0.0%	0.0	0.0%	0.0	0.0%
CZ	173.0	173.0	3.7%	173.0	3.7%	0.0	0.0%
LT	36.8	0.0	0.0%	0.0	0.0%	0.0	0.0%
Total	4,700.1	408.2	8.7%	408.2	8.7%	0.0	0.0%
Comprehensive network lines		**km**	**%**	**km**	**%**	**km**	**%**
NL	241.0	192.5	10.4%	135.8	7.3%	56.7	3.1%
BE	73.7	73.7	4.0%	73.7	4.0%	0.0	0.0%
DE	557.4	0.0	0.0%	0.0	0.0%	0.0	0.0%
PL	762.7	63.9	3.5%	0.0	0.0%	63.9	3.5%
CZ	134.5	134.5	7.3%	134.5	7.3%	0.0	0.0%
LT	78.8	0.0	0.0%	0.0	0.0%	0.0	0.0%
Total	1,848.1	464.6	25.1%	344.0	18.6%	120.6	6.5%
Off TEN-T network lines		**km**	**%**	**km**	**%**	**km**	**%**
NL	0.0	0.0	0.0%	0.0	0.0%	0.0	0.0%
BE	39.8	39.8	5.1%	39.8	5.1%	0.0	0.0%
DE	245.0	0.0	0.0%	0.0	0.0%	0.0	0.0%
PL	497.0	393.2	50.3%	0.0	0.0%	393.2	50.3%
CZ	0.0	0.0	0.0%	0.0	0.0%	0.0	0.0%
LT	0.0	0.0	0.0%	0.0	0.0%	0.0	0.0%
Total	781.8	433.0	55.4%	39.8	5.1%	393.2	50.3%

Source: Contractor based on consultation with the Infrastructure Managers

- In Poland, the total length of the lines affected by technical constraints will drop to 457.2 km (6.2% of the whole corridor length) by 2030. This part of the corridor will mainly concern diversionary lines and the lines not belonging to the TEN-T, whereas issues will still hamper operating 740 meter long trains to/from Lithuania as well as to/from Ukraine via Medyka;
- In the Czech Republic, the whole RFC NS-B will be capable of handling 740 meter long trains, provided that capacity constraints could potentially affect all the lines, particularly in the daytime;
- All the lines in Lithuania were already at standard in 2018, specified that investments related to capacity improvements may be required to optimise the operation of the corridor lines.

Table 3-15 provides the list of non-electrified corridor lines by 2030. The analysis shows that by 2030, the length of non-electrified corridor sections will reduce to 218.9 km. All the principal lines of the corridor will be electrified; due to the completion of the Rail Baltica Global project, that will replace the existing alignment in the Baltic States, all the corridor lines in Lithuania will be also electrified.

Table 3-15 – Non-electrified corridor lines by 2030

MS	Corridor lines	Length in km	Type of line	Type of network
BE	Y. Rooierweg - Genk Goederen	13.8	Connecting	Off TEN-T
BE	Y. Rooierweg - Genk Zuid	8.0	Connecting	Off TEN-T
DE	Cottbus - Horka	74.6	Diversionary	Comprehensive
DE	Berlin-Moabit - Berlin-Hamburger und Lehrter Bf	2.3	Connecting	Off TEN-T
PL	Głogów - Leszno	46.8	Diversionary	Off TEN-T
PL	Leszno - Kąkolewo	11.9	Diversionary	Off TEN-T
PL	Kąkolewo - Osusz	56.3	Diversionary	Off TEN-T
PL	Osusz - Durzyn	5.3	Diversionary	Off TEN-T
	Total	**218.9**		

Source: Contractor based on consultation with the Infrastructure Managers

3.3.2. Handover stations

Table 3-16 provides the list of 27 handover stations/marshalling yards/waiting-buffer locations on the alignment of the RFC NS-B, where issues affecting the operation of 740 meter long trains are expected to persist by 2030, upon completion of the ongoing and planned investments.

Table 3-16 – Handover stations/marshalling yards/waiting-buffer locations presenting 740 meter long trains operability issues by 2030

Country	Handover station and waiting/buffer locations	Type of network
NL	Maasvlakte (Oost)	Core
NL	Europoort	Core
NL	Botlek	Core
NL	Pernis	Core
NL	Waalhaven Zuid	Core
NL	Amersfoort (car terminal)	Core
NL	Almelo	Core

Country	Handover station and waiting/buffer locations	Type of network
NL	Roosendaal	Core
NL	Tilburg Goederen	Comprehensive
NL	Amersfoort (waiting- buffer track)	Core
NL	Rotterdam Noord Goederen	Comprehensive
NL	Almelo buffer track	Core
NL	Kijfhoek	Core
NL	Crailoo	Comprehensive
NL	's-Hertogenbosch	Comprehensive
BE	Antwerpen Haven - Bundel B3	Off TEN-T
BE	Antwerpen Haven - Bundel Oorderen	Off TEN-T
BE	Antwerpen Haven - Bundel Angola	Off TEN-T
DE	Duisburg Ruhrort Hafen	Off TEN-T
DE	Duisburg Hafen	Off TEN-T
DE	Duisburg-Hochfeld Süd	Core
DE	Braunschweig Rbf	Core
DE	Magdeburg-Rothensee	Core
DE	Berlin Hamburger und Lehrter Bf	Off TEN-T
DE	Frankfurt (Oder) Pbf	Core
LT	Mockava	Comprehensive
LT	Kaunas	Core

Source: Contractor based on consultation with the Infrastructure Managers

Further to 740 meter long trains operability issues, lack of electrification is also expected to persist at the following 9 handover stations/marshalling yards/waiting-buffer locations by 2030: Crailoo, Antwerpen Haven - Bundel Berendrecht, Antwerpen Haven - Bundel Buitenschoor, Antwerpen Haven - Bundel Oudendijk 1, Antwerpen Haven - Bundel Oorderen, Antwerpen Haven - Bundel Angola, Duisburg Hafen, Duisburg-Hochfeld Süd, Berlin Hamburger und Lehrter Bf.

3.3.3. Terminals

The characteristics of the 20 terminals that responded to the SCI survey by 2030 are summarised in Table 3-17 overleaf , showing that 740 meter long trains operability issues are still expected to persist at the following logistics nodes: MSC Gate Bremerhaven, KV-Drehscheibe Rhein/Ruhr (Megahub Duisburg), Hannover Linden (until go life of KV Drehscheibe Lehrte), Terminal Brzeg Dolny (PCC Intermodal S.A.), Terminal Dąbrowa Górnicza (Metrans), Terminal Gądki (Metrans), Terminal Gliwice (port) (PCC Intermodal S.A.), Pruszków (Metrans), Kaunas intermodal terminal, Mockava.

Electrified train terminal accessibility is also expected to be unavailable at terminals Dąbrowa Górnicza (Metrans) and Pruszków (Metrans), whereas electrified accessibility at loading/unloading track(s), is expected to remain not possible at the following logistics nodes: CTB Bremerhaven, MSC Gate Bremerhaven, CT Wilhelmshaven (CTW), Terminal Brzeg Dolny (PCC Intermodal S.A.), Terminal Dąbrowa Górnicza (Metrans), Terminal Gliwice (port) (PCC Intermodal S.A.), Terminal Kąty Wrocławskie (Shavemaker Logistics & Transport), Pruszków (Metrans), Terminal Kutno (PCC Intermodal S.A.).

Table 3-17 – Characteristics of the terminals that responded to the SCI survey by 2030

Country	Terminal	Handover station	Type of node	Electrified accessibility at terminal	Electrified accessibility at loading/unloading track(s)	Max train length (m)
BE	NV Haven Genk	Genk Goederen	Off TEN-T	Yes	Yes	>=740
DE	CTB Bremerhaven	Bremerhaven - Speckenbüttel	Core	Yes	No	>=740
DE	NTB Bremerhaven	Bremerhaven - Speckenbüttel	Core	Yes	Yes	>=740
DE	MSC Gate Bremerhaven	Bremerhaven - Speckenbüttel	Core	Yes	No	<740
DE	Bahnhof Duisburg Ruhrort Hafen	Duisburg Ruhrort Hafen	Off TEN-T	Yes	Yes	>=740
DE	KV-Drehscheibe Rhein/Ruhr (Megahub Duisburg)	Duisburg Ruhrort Hafen	Off TEN-T	Yes	Yes	<740
DE	Ubf Großbeeren	Großbeeren	Core	Yes	Yes	>=740
DE	Hannover Linden (until go life of KV Drehscheibe Lehrte)	Hannover - Linden	Core	Yes	Yes	<740
DE	CT Wilhelmshaven (CTW)	Wilhelmshaven	Core	Yes	No	>=740
PL	Terminal Brzeg Dolny (PCC Intermodal S.A.)	Brzeg Dolny	Comprehensive	Yes	No	<740
PL	Terminal Dąbrowa Górnicza (Metrans)	Dąbrowa Górnicza Towarowa	Off TEN-T	No	No	<740
PL	Terminal Gądki (Metrans)	Gądki	Off TEN-T	Yes	Yes	<740
PL	Terminal Gliwice (port) (PCC Intermodal S.A.)	Gliwice (port)	Off TEN-T	Yes	No	<740
PL	Terminal Kąty Wrocławskie (Shavemaker Logistics & Transport)	Kąty Wrocławskie	Off TEN-T	Yes	No	>=740
PL	Pruszków (Metrans)	Pruszków	Core	No	No	<740
PL	Terminal Kutno (PCC Intermodal S.A.)	Stara Wieś k. Kutna	Core	Yes	No	>=740
PL	Terminal Swarzędz (CLIP Logistics Sp. z.o.o.)	Swarzędz	Core	Yes	Yes	>=740
LT	Kaunas intermodal terminal	Kaunas	Core	Yes	Yes	<740
LT	Mockava terminal	Mockava	Comprehensive	Yes	Yes	<740
LT	Šeštokai railway station	Šeštokai	Comprehensive	Yes	Yes	>=740

Source: Contractor based on SCI survey results

3.4. Technical and capacity improvement measures to further enhance operation of 740 meter long trains

Based on the analysis of the expected technical and operational conditions of the RFC NS-B by 2030 conducted on the basis of the review of the planned investments and discussion with the infrastructure managers concerned by this study, a set of technical and capacity improvement measures was identified that in addition to the ongoing and foreseen initiatives will further enhance operation of 740 meter long trains along the corridor.

Table 3-18 provides a summary of the gap analysis and additional identified initiatives/measures that would still be required to allow smooth and seamless operation of 740 meter long trains by 2030 along the RFC NS-B.

Table 3-18 – Summary of gap analysis and identified initiatives/measures to further improve the operation of 740 meter long trains along the RFC NS-B

Member State	Persisting gaps by 2030 and additional identified initiatives/measures
NL	Capacity constraints affecting the operation of 740 meter long trains along the RFC NS-B in the Netherlands are expected to be present by 2030, which will not be solved by the ongoing and planned investments. In line with analyses recently completed by the concerned infrastructure manager, works were identified as part of this study that will be required to accommodate 740 meter long trains and achieve operational flexibility at the following handover stations/marshalling yards/waiting-buffer locations: Botlek, Pernis, Amersfoort, Almelo, Maasvlakte Oost, Europoort, Waalhaven Zuid, Kijfhoek, Crailoo, Rotterdam Noord Goederen, Rosendaal, Tilburg Goederen and 's-Hertogenbosch. In greater detail investments will be required to accommodate 740 meter long trains at Maasvlakte Oost, Botlek, Pernis, Waalhaven Zuid, Kijfhoek, Amersfoort, Rotterdam Noord Goederen, Almelo, whereas solutions to improve stability/punctuality will be needed at Crailoo, 's Hertogenbosch and Tilburg Goederen. These interventions are deemed of priority in solving current and future capacity issues along the RFC NS-B lines, also considering the results of the recently completed Transport Market Study, showing that the Netherlands is involved in all the most relevant trade/transport as well as train traffic O/D relations along the RFC NS-B. Notwithstanding the implementation of the additional investments identified in the study by the Dutch infrastructure manager, technical constraints may be present after 2030 at some Rotterdam Harbour handover stations and at the Amersfoort handover station. Capacity and time limitations may also exist at the Rotterdam Harbour handover stations and along the Kijfhoek - Weesp and Roosendaal - Bad Bentheim routes
BE	In addition to the ongoing and planned investments, studies for the further improvement of the technical and operational conditions of 740 meter long trains in Belgium are under elaboration, that are foreseen for completion during 2020. Accordingly, investments have not been identified as part of this study for the corridor lines. On the other hand gaps may still persist by 2030 concerning the following handover stations/marshalling yards, where 740 meter long trains are not possible to be operated: Antwerpen Haven - Bundel B3, Antwerpen Haven - Bundel Oorderen, Antwerpen Haven - Bundel Angola. Given that the ongoing and planned projects and analyses do not seem to include in their scope the upgrading of this infrastructure, such additional measures were proposed in this study and their costs were estimated

Member State	Persisting gaps by 2030 and additional identified initiatives/measures
DE	Further to the ongoing and planned investments foreseen in the Bundesverkehrswegeplan (Federal Transport Infrastructure Plan), additional initiatives will be considered to ensure adequate operational conditions of 740 meter long trains in Germany. Accordingly investments have not been identified as part of this study for the corridor lines. Gaps appear however to exist concerning the following handover stations/marshalling yards, were 740 meter long trains are not possible to be operated: Duisburg Ruhrort Hafen, Duisburg Hafen, Duisburg Hochfeld Süd, Braunschweig, Magdeburg, Berlin Hamburger und Lehrter Bf, Frankfurt (Oder) Pbf. As no investments are currently foreseen for the upgrading of this infrastructure, solutions were proposed in this study for these handover stations/marshalling yards, to allow the operation of 740 meter long trains by 2030. Costs were accordingly estimated for these measures
PL	An ambitious modernisation programme of the Polish railway lines is currently ongoing that will significantly improve the RFC NS-B lines. Investments are either ongoing, planned and/or under definition that are expected to allow achieving the standards set in the Regulation (EU) 1315/2013 on the whole core network infrastructure belonging to the RFC NS-B by 2030, including 740 meter train length. Investments are also ongoing, planned and/or under definition that relate to the comprehensive network and lines outside the TEN-T network along the RFC NS-B. These measures will contribute to the improvement of the technical and capacity conditions of the corridor by 2030, with significant benefits also with reference to the operation of 740 meter long trains. Based on the review of the current plans, it is envisaged that additional investments would be needed by 2030 for the modernisation/upgrading of about 457.2 km of corridor lines, where technical limitations may still persist to operate 740 meter long trains. These include 11.0 km of principal lines, 431.3 km of diversionary lines and 14.9 km of connecting lines. In consideration of the need to modernise these sections and the stations located therein further to upgrading them to 740 meter train length operability, solutions were identified in this study that concern the modernisation of these lines. Costs were estimated accordingly. Among the additional measures identified in this study, the ones relating to the modernisation of the following sections are of particular relevance to solve 740 meter long train operational bottlenecks towards Lithuania and Ukraine: Krusze - Tłuszcz (4.1 km long, expected principal/Off TEN-T line), Legionowo - Krusze (32.7 km long, expected diversionary/ Off TEN-T line) and Kobylnica - Mogilno (63.9 km long, diversionary/ TEN-T comprehensive line), as well as the "triangular connection" starting at Długoszyn via Sosnowiec Maczki to Jaworzno Szczakowa (6.9 km long, principal/Off TEN-T line – including the 1.9 km long section Jaworzno Szczakowa - Długoszyn). The modernisation of the 14.9 km long connecting line Sosnowiec Maczki - Dąbrowa Górnicza Towarowa might be also relevant to provide adequate connection to the intermodal terminals located along this line. No measures were identified in this study relating to the improvement of the parameters of handover stations/marshalling yards in Poland as this infrastructure will be upgraded/modernised by 2030 as part of the planned investments
CZ	In addition to the ongoing and planned investments, a study is planned to be conducted in 2020 to identify measures to further enhance the operational capacity of 740 meter long trains particularly in the Prague area. Depending on the cost/benefit ratio of the identified solutions, this study may identify additional investment needs and a range of potential accompanying operational measures not currently envisaged for implementation. Accordingly investments were not proposed as part of this analysis for the corridor lines in the Czech Republic. No gaps were identified which relate to handover stations/marshalling yards
LT	The ongoing and planned investments expected to be completed before 2030 are foreseen to further enhance operations of freight trains on the RFC NS-B along the corridor lines in Lithuania. Moreover the concerned

Member State	Persisting gaps by 2030 and additional identified initiatives/measures
	infrastructure manager is currently preparing a project – *Unified Interlockings at Lithuanian Railways* – regarding improvements on the existing standard gauge line. Foreseen to be implemented between 2030-2036, this initiative and the related costs are considered in this study to further increase the capacity of the existing RFC NS-B infrastructure in Lithuania. Measures to solve capacity limitations at the existing handover stations/marshalling yards and terminals at Kaunas and Mockava were also identified as part of the study, and the related costs estimated

Source: Contractor based on consultation with the Infrastructure Managers;

Due to the low responsiveness of the terminal managers/operators to the SCI survey, it was not possible to elaborate a representative estimate of the measures and costs associated with the upgrading/expansion of the existing terminal infrastructure of the RFC NS-B as part of this study.

Table 3-19 below provides the cost estimates for the additional measures identified in the previous table to further enhance operation of 740 meter long trains on the RFC NS-B.

Table 3-19 – Total additional investment needed on RFC NS-B (€ million excluding VAT)

Member State	Additional investments
NL	**€ 355-660 million** to accommodate 740 meter long trains and improve capacity at handover stations/marshalling yards/waiting-buffer locations. Such investments will also improve operability of 740 meter long trains on the corridor lines
BE	**€ 1 million** to accommodate 740 meter long trains at handover stations; Studies are ongoing by the concerned IM that may result in the identification of capacity improvement measures on the corridor lines; additional investments are not official yet
DE	**€ 13 million** to accommodate 740 meter long trains at handover stations
PL	**€ 2,342 million** to modernise 457.2 km of corridor railway lines and the handover stations located therein, which will allow accommodating 740 meter long trains
CZ	Studies are under consideration by the concerned IM that may result in the identification of capacity improvement measures on the corridor lines; additional investments are not official yet
LT	**€ 44 million** to improve capacity of the existing corridor lines and handover stations
RFC NS-B	**€ 2,755-3,060 million** to accommodate 740 meter long trains and improve capacity at handover stations/marshalling yards/waiting-buffer locations in NL, BE, DE, PL and LT. In BE and CZ studies are also ongoing/under consideration by the concerned IMs that may result in the identification of capacity improvement measures on the corridor lines and additional investments are not official yet

Source: Contractor based on consultation with the Infrastructure Managers; Note: figures rounded to the million unit

The costs related to the corridor railway lines, amounting to about € 2.4 billion, concern the modernisation of 457.2 km of lines in Poland, to allow operation of 740 meter long trains along the whole RCF NS-B by 2030 under the technical point of view, as well as infrastructure improvement measures in Lithuania. Up to € 680 million would furthermore be required to improve operational conditions of 740 meter long trains along the corridor by 2030, removing technical barriers

and capacity bottlenecks at 27 handover stations/marshalling yards/waiting-buffer locations in the Netherlands, Belgium, Germany, and Lithuania.

Among the additional measures identified in this study further to the planned investments by the study concerned infrastructure managers, the following ones are deemed particularly relevant to further improve operation of 740 meter long trains along the RFC NS-B, whose total cost ranges between € 1,1-1,4 billion:

- The modernisation of one or more of the following sections interconnecting the RFC NS-B with Lithuania: Krusze - Tłuszcz (4.1 km long, expected principal/Off TEN-T line), Legionowo - Krusze (32.7 km long, expected diversionary/ Off TEN-T line) and Kobylnica - Mogilno (63.9 km long, diversionary/ TEN-T comprehensive line), whose estimated investment costs equal respectively € 153 million, € 233 million, € 221 million, for a total cost of the three lines of € 607 million;
- The modernisation of the "triangular connection" starting at Długoszyn via Sosnowiec Maczki to Jaworzno Szczakowa (6.9 km long, principal/Off TEN-T line) and particularly the 1.9 km long section Jaworzno Szczakowa – Długoszyn, interconnecting the RFC NS-B with Ukraine, of total cost equal to € 163 million;
- The modernisation of the 14.9 km long connecting line Sosnowiec Maczki - Dąbrowa Górnicza Towarowa to provide adequate connection to the intermodal terminals located along this line, whose modernisation costs amount to € 116 million;
- The capacity expansion investments at the handover stations/marshalling yards/waiting-buffer locations in the Netherlands, Belgium, Germany, and Lithuania, whose total costs are estimated in a range of € 373-678 million. Among these ones the initiatives in the Netherlands are deemed of specific relevance to ensure adequate operation of 740 meter long trains along the RFC NS-B lines, also considering that based on the results of the recently completed Transport Market Study, the corridor lines of this Member State are involved in the most relevant trade/transport relations along the RFC NS-B. In this regard it is also noticed that due consideration shall be given to the removal of the conditions currently limiting the transit of 740 meter long trains across the borders between the Netherlands and Germany only subject to ad hoc requests.

The total cost of the measures identified as part of this study and amounting up to about € 3.1 billion represents a conservative estimate as it does not include the costs of potential additional measures relating to:

- Solutions to solve technical restrictions in the Netherlands at some Rotterdam Harbour handover stations and at the Amersfoort handover station, as well as capacity and time limitations at the Rotterdam Harbour handover stations and along the Kijfhoek - Weesp and Roosendaal - Bad Bentheim routes;

- Capacity improvement measures to be possibly implemented in Belgium and in the Czech Republic upon completion of the ongoing studies;
- Upgrading of the RFC NS-B terminals as due to the limited responsiveness of the terminal operators/managers to the SCI survey it was decided not to identify measures for the improvement/expansion of this corridor infrastructure and estimate their associated costs as part of this study.

3.5. Operational measures to further enhance operation of 740 meter long trains

Operational measures are described and analysed in this study referring to a sample methodology clarifying and providing indications about general requirements for their adoption, also considering their impacts and effectiveness under the operational, infrastructure and financial/economic points of view. Chapters 4 to 9 below discuss the applicability of these measures on the corridor lines of the RFC NS-B Member States concerned by this study, also commenting on existing practices.

3.5.1. Operational measures

Three measures can be identified to allow the operation of 740 meter long trains on not equipped infrastructure:

- Measure 1: Scheduling and timetable planning;
- Measure 2: Blocking the use of stations with short tracks;
- Measure 3: Detouring.

Starting with measure 1, in normal operation the use of shorter station tracks for 740 meter long trains is prohibited. However, with timetabling adjustments, a freight train can be scheduled not to use any shorter station tracks. The train does not stop on this section. It needs to be secured, that the train does not stop on this section and if a dangerous situation occurs, the train stops in a safe area.

In the timetable planning process, the scheduling of overtaking manoeuvres can be made according to the available infrastructure. In operation however, delays and dispatching can create massive disruption and even deadlocks in stations. The timetable planning is therefore a very risky solution.

Measure 2 is very similar to the measure 1, but with a more flexible approach. The traffic control is informed about 740 meter long trains and the available infrastructure. If not all station tracks are suitable for 740 meter long trains, the use of those is prohibited. All other tracks (for example continuous main tracks) can be used for stopping of trains. The operational challenges related to a stopping of a 740 meter long train must be known to all involved parties. Again, a good information management is required to pre-empt dangerous situations.

The measures 1 & 2 only work on low frequency lines with significant capacity reserves.

Measure 3 requires a suitable alternative route, which can accommodate additional trains.

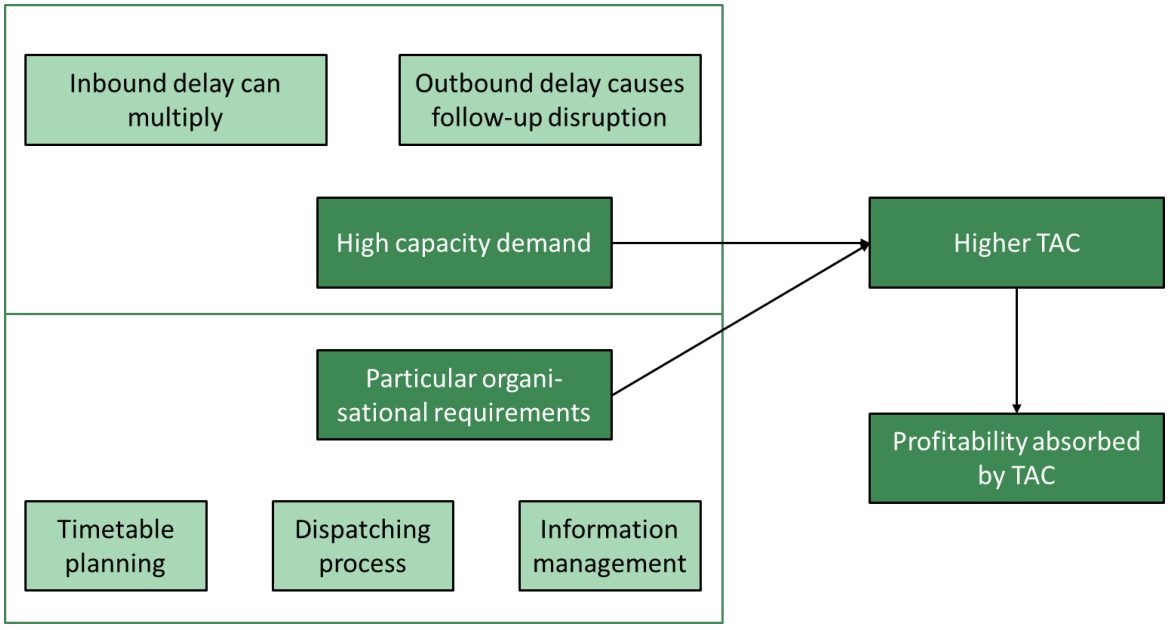
A virtual example (along with a theoretical timetable) concerning the applicability of the above measures and their effects and operational consequences is provided in Annex C to this report for the railway line Frankfurt (Oder) – Poznan, focussing on the section between Frankfurt-Oderbrücke (border station) and Zbąszyń. The example shows that the above operational measures loose in effectiveness with the increase of traffic along the line and reduction of the available capacity. In these situations measures related to the expansion of the existing infrastructure would be more appropriate as also further commented in the following section below.

3.5.2. Economic problems affecting 740 meter long train operations

The use of the above described operational measures, especially on sections with moderate to high traffic density and used by both passenger and freight trains, shall be carefully considered in light of their effectiveness and efficiency for the railway undertakings and end users.

The consumption of capacity and the problems related to dispatching usually result in higher costs for infrastructure usage. This relates to higher Track Access Charges (TAC) for 740 meter long trains. It is often the case, that the profitability generated by additional load on the train is absorbed by the higher TAC to pay for the railway undertaking.

Figure 3-1 – Economic effects of 740 meter train operation



Source: Contractor

The same effect applies to detoured trains if the alternative route is significantly longer than the original one. The high-level cost estimation in Table 3-20 overleaf shows that the increase in the cost per TEU for a 740 meter long train would be 5% higher. Negative effects on turnaround times, etc. should furthermore be added to these increased costs, further reducing the efficiency of this operational measure in the described conditions.

Table 3-20 – Cost estimation for route alternatives

Route	Route length	Route costs	TEU per train (theoretical capacity)	Costs per TEU	Average speed	Journey time
Magdeburg – Frankfurt (Oder) - Poznan	431.6 km	EUR 15,000	96 TEU	EUR 156/TEU	57 km/h	7.5 h
Magdeburg – Horka – Wroclaw - Poznan	564.8 km	EUR 18,000	110 TEU	EUR 164/TEU	51 km/h	11 h
For container trains (route length ca. 600 km) costs are ca. EUR 24/km ➔ Additional costs of more than EUR 3,000				The average speed and journey time depend on various factors and cannot be generally determined. These are approximations		

Source: Contractor

In conclusion an operation of 740 meter long trains on infrastructure not equipped for 740 meter long trains is generally not recommended. On particularly selected sections, where the traffic volume is very low and the timetable has significant capacity reserves, an operation of 740 meter long trains is possible. However, the operation of trains with overlength poses a high risk to the general railway operation. It requires effort to maintain the safety level and makes the enforcement of new operational rules necessary. It needs to be questioned, if the economic effects of higher train loads will exceed the costs to enable their operation.

4. THE NETHERLANDS

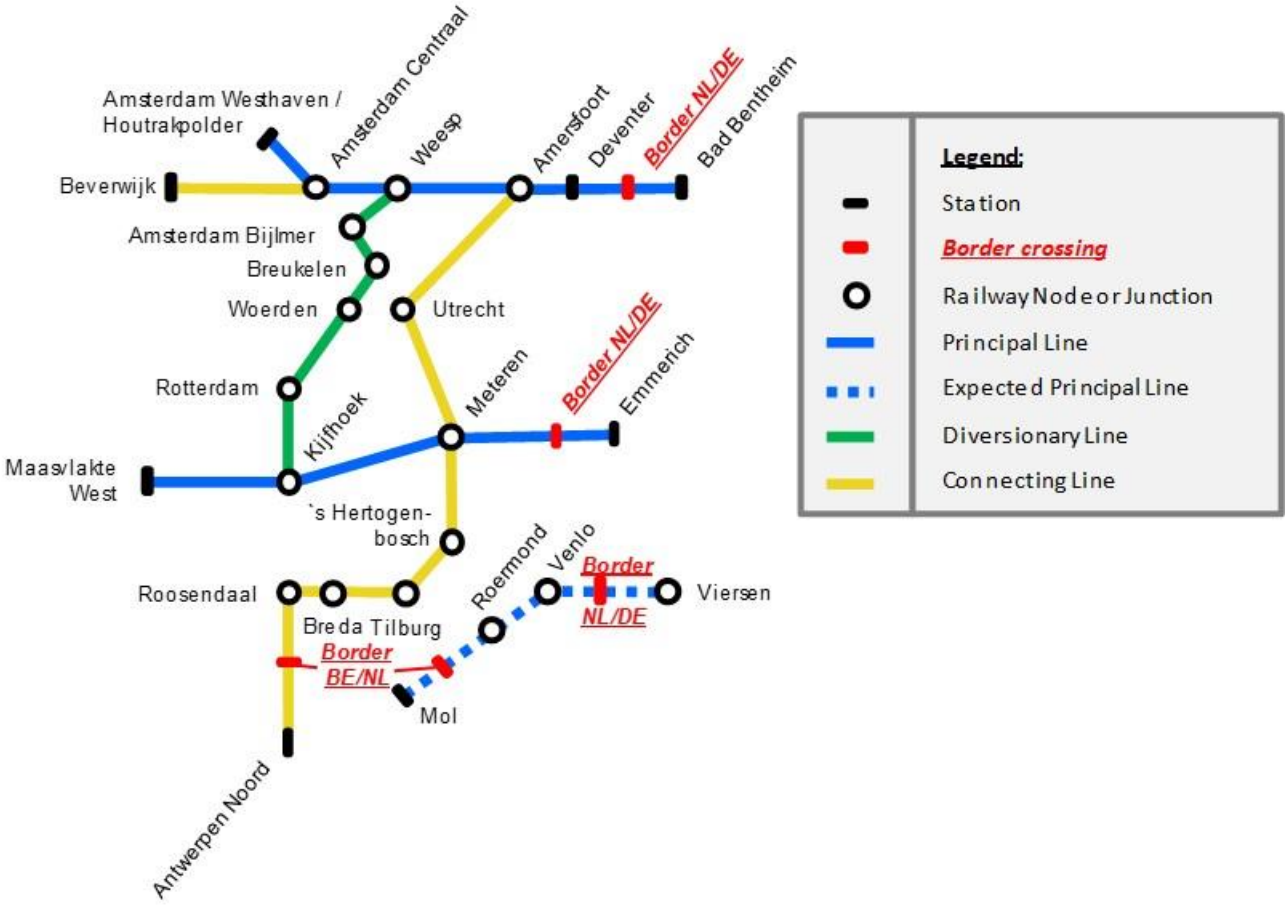
4.1. Corridor infrastructure and operational characteristics in 2018

This section provides an overview of the main characteristics of the RFC NS-B infrastructure in 2018, with a focus on the analysis of the technical maximum train length and possible related capacity constraints.

4.1.1. Railway lines

Figure 4-1 represents the alignment of the RFC NS-B in the Netherlands.

Figure 4-1 – Corridor infrastrucure in NL in 2018



Source: Contractor based on consultation with the Infrastructure Managers

The length of the RFC NS-B in the Netherlands is 634.8 km. To the purposes of the description of the characteristics of the RFC NS-B within the scope of this study the following six lines were identified:

- A **principal** line from Amsterdam Westhaven to the NL/DE border near Bad Bentheim (Line 1-NL);
- A **principal** line from Maasvlakte to the NL/DE border near Emmerich (Line 2-NL);
- A **diversionary** line from Weesp via Rotterdam to Kijfhoek (Line 3-NL);
- A **connecting** line from Amersfoort via Utrecht, 's Hertogenbosch to the NL/BE border near Roosendaal (Line 4-NL);
- A **connecting** line from Beverwijk to Amsterdam (Line 5-NL);
- And an **expected principal** line ("Iron Rhine") from the BE/NL border via Roermond to the NL/DE border near Weert (Line 6-NL).

The basic characteristics of the principal lines are summarised in Table 4-1 below.

Table 4-1 – Infrastrucure characteristics in NL (principal lines) in 2018

General information on **principal** lines	▪ Tracks with UIC gauge (1,435 mm) ▪ All lines are part of the TEN-T core or comprehensive network; ▪ Mainly 2 tracks per line, except for a section with 3 tracks on Line 2-NL near the border with DE ▪ Both lines are electrified; electrification in NL is in general DC 1.5 kV; exception is Line 2-NL ("Betuwe line") with AC 25 kV – 50 Hz except for some short sections around Kijfhoek

Source: Contractor based on consultation with the Infrastructure Managers

Focussing on long train operability with reference to the 740 meter long train standard adopted by TEN-T Regulation (EU) 1315/2013 and possibly associated capacity constraints, Table 4-2 provides an overview of the status of the RFC NS-B in the Netherlands in 2018, referring to the above mentioned corridor lines, during the daytime.

Table 4-2 – Technical maximum train length for NL and related capacity constraints in 2018 (daytime)

Line	Technical maximum train length and related capacity constraints
1-NL	740 m Amsterdam > Amersfoort 720 m Amersfoort > Amsterdam 740 m Amersfoort – Bad Bentheim (limited number of paths available for 740 m trains) Border agreement NL/DE standard train length = 590 m
2-NL	740 m Maasvlakte West – Zevenaar Border - Length limitations apply on the Harbour SY Maasvlakte Oost, Botlek, Pernis and Waalhaven Zuid. Border agreement NL/DE standard train length = 690 m
3-NL	660 m Kijfhoek > Weesp (length restriction waiting track). 740 m Weesp < Kijfhoek
4-NL	630 m Amersfoort - Meteren (length restriction waiting track) 740 m Meteren – Roosendaal (limited number of paths for 740 m trains available)
5-NL	740 m at most times of the day
6-NL	550 m

Source: Contractor based on consultation with the Infrastructure Managers

According to the corridor infrastructure and operational characteristics in 2018 740 meter technical/capacity improvement related issues existed, particularly

during the daytime, along the principal line interconnecting Amsterdam Westhaven to the NL/DE border near Bad Bentheim, on the connecting line from Amersfoort via Utrecht, 's Hertogenbosch to the NL/BE border near Roosendaal, on the diversionary line from Weesp via Rotterdam to Kijfhoek. Issues would also affect the expected principal "Iron Rhine" line, currently not in operation.

4.1.2. Handover stations

Table 4-3 provides the list of handover stations/marshalling yards that are located on the alignment of the RFC NS-B in the Netherlands, and the related technical characteristics in 2018.

Table 4-3 – Summary of the technical characteristics of the handover stations/marshalling yards in NL in 2018

Handover station	Type of network	Traction	Max train length (m)
Maasvlakte West + West West	Core	E	>=740
Maasvlakte (Oost)	Core	E	>=740*
Europoort	Core	E	>=740*
Botlek	Core	E	<740
Pernis	Core	E	<740
Waalhaven Zuid	Core	E	>=740*
Beverwijk	Comprehensive	E	>=740
Amsterdam Houtrakpolder	Core	E	>=740
Amsterdam Westhaven	Core	E	>=740
Amersfoort (car terminal)	Core	E	<740
Almelo	Core	E	<740
Waiting/buffer locations	**Type of network**	**Traction**	**Max train length (m)**
Roosendaal	Core	E	>=740*
Breda	Comprehensive	E	>=740
Tilburg Goederen	Comprehensive	E	<740
Geldermelden/Meteren	Core	E	<740
Amersfoort (waiting- buffer track)	Core	E	<740
Rotterdam Noord Goederen	Comprehensive	E	<740
Rotterdam Central	Comprehensive	E	>=740
Stroe	Core	E	>=740
Deventer Goederen	Core	E	>=740
Almelo buffer track	Core	E	<740
Oldenzaal	Core	E	>=740
Kijfhoek	Core	E	>=740*
Crailoo	Comprehensive	D	>=740
's-Hertogenbosch	Comprehensive	E	<740

*Source: Contractor based on consultation with the Infrastructure Managers; Notes: *capacity constraints limiting the operation of 740 meter long trains*

According to the information collected from the concerned infrastructure manager, issues affecting technical/capacity limitations existed at the following handover stations/marshalling yards/waiting, buffer locations, generally impacting on the capacity of the corridor lines:

- Maasvlakte Oost;
- Europoort;
- Waalhaven Zuid;
- Roosendaal;

- Botlek;
- Pernis;
- Amersfoort;
- Tilburg Goederen;
- Geldermelden/Meteren;
- Rotterdam Noord Goederen;
- Almelo;
- Kijfhoek;
- Crailoo;
- 's-Hertogenbosch.

Furthermore, the Crailoo waiting/buffer location resulted to be non-electrified in 2018.

4.1.3. Terminals

The list of the terminals and the related handover stations that are located on the alignment of the RFC NS-B in the Netherlands is shown in Table 4-4.

Table 4-4 – List of terminals in NL in 2018

Terminal	Handover station
Defensie	Almelo
Grindhandel Dollegoor	Almelo
Openbare Laad- en losplaats (public loading and unloading facilities)	Almelo (track 14)
Van Merksteijn	Almelo
Kolb (Delden)	Bad Bentheim
PON Leusden	Amersfoort
AVI West	Amsterdam Houtrakpolder
De Rietlanden (Afrikahaven)	Amsterdam Houtrakpolder
De Rietlanden (Amerikahaven)	Amsterdam Houtrakpolder
Ter Haak	Amsterdam Houtrakpolder
Cotterel (Vlothaven)	Amsterdam Westhaven
EuroTank Amsterdam	Amsterdam Westhaven
Igma Cargill	Amsterdam Westhaven
Koopman Car Terminal	Amsterdam Westhaven
Noord-Europees Wijnopslag Bedrijf (NWB)	Amsterdam Westhaven
Openbare Laad- en losplaats (public loading and unloading facilities)	Amsterdam Westhaven
Overslagbedrijf Amsterdam (OBA)	Amsterdam Westhaven
Rotim	Amsterdam Westhaven
Steinweg	Amsterdam Westhaven
VCK Scandia Terminal	Amsterdam Westhaven
Vopak Petroleumhaven	Amsterdam Westhaven
Waterland Terminal	Amsterdam Westhaven
Tata-Steel	Beverwijk (track 77 + 78)
Akzo-Nobel	Botlek
Bertschi Terminal Rotterdam	Botlek
Biopetrol	Botlek
Borax	Botlek
C.RO	Botlek
Broekman Distriport	Botlek
Kemira	Botlek
LBC	Botlek
LyondellBasell	Botlek
Koole tankstorage Botlek	Botlek
Rubis	Botlek

Terminal	Handover station
Steinweg Botlekterminal	Botlek
Vopak Chemiehaven	Botlek
Vopak TTR	Botlek
Vopak Terminal Botlek	Botlek
Vopak Terminal RCC	Botlek
Abengoa	Europoort
ADM	Europoort
Broekman Logistics Europoort	Europoort
Caldic	Europoort
Ertsoverslagbedrijf Europoort CV	Europoort
Euro Tank Terminal	Europoort
European Bulk Services	Europoort
BP Raffinaderij Rotterdam B.V.	Europoort
P&O Ferries	Europoort
Steinweg	Europoort
EMO	Maasvlakte
Rotterdam Container Terminal (Kramer)	Maasvlakte West
Steinweg Hartel Terminal	Maasvlakte
APM Terminal	Maasvlakte West
Hutchison Ports ECT Delta	Maasvlakte West
Hutchison Ports ECT Euromax	Maasvlakte West
RTW-ECT Rail Terminal West	Maasvlakte West
RWG (Rotterdam World Gateway)	Maasvlakte West
Lyondell Basell	Maasvlakte West
Rhenus Logistics	Maasvlakte West
Cerexagri / Arkema	Pernis
Interforest	Pernis
Koole	Pernis
Rotterdam RTT	Pernis
CTT Rotterdam	Pernis
Shell (diverse poorten)	Pernis
Metaal Transport	Waalhaven Zuid
Metaaltransport / Meijers	Waalhaven Zuid
Openbare Laad- en losplaats (public loading and unloading facilities)	Waalhaven Zuid
RET Metro-depot	Waalhaven Zuid
Rhenus Logistics	Waalhaven Zuid
Rotterdams Havenbedrijf	Waalhaven Zuid
Shunter (A. Plesmanweg)	Waalhaven Zuid
Shunter (Blindeweg)	Waalhaven Zuid
Steinweg Beatrixhaven	Waalhaven Zuid
Steinweg Dodewaardstaart	Waalhaven Zuid
Uniport	Waalhaven Zuid
Rail Service Center Rotterdam BV (RSC)	Waalhaven Zuid

Source: Contractor based on consultation with the Infrastructure Managers

None of the terminal operators/infrastructure managers responded to the SCI survey and accordingly their characteristics are not described in this study. Based on Contractor's knowledge, 740 meter long trains seemed to be possible to be operated at most intermodal terminals, whereas limitations apparently exist at coal, iron-ore and wet bulk terminals.

4.2. Expected corridor infrastructure and operational characteristics by 2030 and persisting gaps

This section summarises the main ongoing and planned investments along the RFC NS-B infrastructure for the period 2018-2030 and provides an overview of the corridor infrastructure by 2030, with a focus on the analysis of the technical

maximum train length and possible related capacity constraints that would still persist at this time horizon, upon completion of these initiatives.

4.2.1. Review of the ongoing and planned investments

An analysis of the planned investments on infrastructure upgrades with an expected finalisation date until 2030 was carried out based on publicly available sources. Measures without information on their completion date have been anyway considered in the analysis.

As detailed information on the technical scope of the bundle of upgrading measures considered in the study was not consistently available for all the projects, the study assumes that the following parameters will be anyway improved, as appropriate:

- Construction of new tracks;
- Length of tracks;
- Change of signal position or new signal;
- Conversion of railheads at stations.

For the Netherlands, seven measures in total were identified, which are listed in Table 4-5 below.

Table 4-5 – Infrastrucure upgrades in NL

N°	Project	Section or node involved	End date	Total costs € million (excl. VAT)
1)	Redesign Geldermalsen (PHS) and 3rd track Geldermalsen - Geldermalsen aansl (Restrictions to operate 740 meter long trains between Amersfoort and Meteren will be removed in both directions by sept 2020)	Utrecht - Den Bosch	12/2021	n.a.
2)	Increasing the capacity of the Sophiatunnel	Betuweroute, Kijfhoek – Sliedrecht section	unknown	n.a.
3)	PHS Amsterdam CS	Amsterdam	12/2026	n.a.
4)	Amersfoort section upgrade	Amersfoort	01/2024	n.a.
5)	Elevated railway track along the Theemsweg" (Removing rail traffic operational constraints due to Calandbridge openings related interruptions)	Harbourline Maasvlakte – Kijfhoek	12/2021	n.a.
6)	Redevelopment Waalhaven Zuid freight yard (Increasing capacity and track length to operate 740 meter long trains)	Habourline Maasvlakte – Kijfhoek	12/2025	n.a.

Source: Contractor based on consultation with the Infrastructure Managers

The geographical distribution of the above listed projects is shown in the map in Figure 4-2 below, also including a brief description of these investments.

Figure 4-2 – Location of infrastrucure upgrades in NL

Source: Contractor

4.2.2. Railway lines

Based on the expected impact of the ongoing and planned investments illustrated above, Table 4-6 provides an overview of the foreseen maximum train length operability on the RFC NS-B in the Netherlands by 2030, referring to the corridor lines listed at Section 4.1.1, during the daytime.

Table 4-6 – Technical maximum train length for NL and related capacity constraints by 2030 (daytime)

Line	Technical maximum train length and related capacity constraints
1-NL	740 m Amsterdam Westhaven – Bad Bentheim (limited number of path available for 740 m trains) Border agreement NL/DE standard train length = 590 m
2-NL	740 m Maasvlakte West – Zevenaar Border - Length limitations apply on the Harbour SY Botlek, Pernis and Maasvlakte Oost. Border agreement NL/DE standard train length = 690 m
3-NL	660 m Kijfhoek > Weesp (length restriction waiting track) 740 m Weesp < Kijfhoek
4-NL	740 m Amersfoort - Meteren - Roosendaal (limited number of paths for 740 m trains available)
5-NL	740 m at most times of the day
6-NL	Will depend upon realisation of the "Iron Rhine Project"

Source: Contractor based on consultation with the Infrastructure Managers

Notwithstanding the planned improvements, strict capacity limitations to the number of 740 meter long trains are expected to persist and even increase by 2030 and afterwards, at least during daytime. The number of slots for freight trains will be limited to 2 or 4 per hour on main lines during passenger trains operating times, which extend up to a period of 20 hours between 5 in the morning and 1 in the night. Density of passenger services by 2030 and afterwards will be higher than in 2020 with the further increase of high-frequency intercity services. The number of 740 meter long trains which can be operated will accordingly be subject to limitations due to an insufficient number of station and siding tracks which can handle 740 meter long trains on some sections, especially in the Amsterdam, Rotterdam and Brabant regions. Of the

current 2-4 slots per hour, only 1-2, if any, will remain for the whole day which can be used for the operation of 740 meter long trains. This reduces both the potential number of slots and flexibility of operations, likely resulting in delays and perturbations.

4.2.3. Handover stations

Table 4-7 provides the list of handover stations/marshalling yards that are located on the alignment of the RFC NS-B in the Netherlands, and the related technical characteristics by 2030.

Table 4-7 – Summary of the technical characteristics of the handover stations/marshalling yards in NL by 2030

Handover station	Type of network	Traction	Max train length (m)
Maasvlakte West + West	Core	E	>=740
Maasvlakte (Oost)	Core	E	>=740*
Europoort	Core	E	>=740*
Botlek	Core	E	<740
Pernis	Core	E	<740
Waalhaven Zuid	Core	E	>=740*
Beverwijk	Comprehensive	E	>=740
Amsterdam Houtrakpolder	Core	E	>=740
Amsterdam Westhaven	Core	E	>=740
Amersfoort (car terminal)	Core	E	<740
Almelo	Core	E	<740
Waiting/buffer locations	**Type of network**	**Traction**	**Max train length (m)**
Roosendaal	Core	E	>=740*
Breda	Comprehensive	E	>=740
Tilburg Goederen	Comprehensive	E	<740
Geldermelden/Meteren	Core	E	>=740
Amersfoort (waiting- buffer track)	Core	E	<740
Rotterdam Noord Goederen	Comprehensive	E	<740
Rotterdam Central	Comprehensive	E	>=740
Stroe	Core	E	>=740
Deventer Goederen	Core	E	>=740
Almelo buffer track	Core	E	<740
Oldenzaal	Core	E	>=740
Kijfhoek	Core	E	>=740*
Crailoo	Comprehensive	D	>=740
's-Hertogenbosch	Comprehensive	E	<740

*Source: Contractor based on consultation with the Infrastructure Managers; Notes: *capacity constraints limiting the operation of 740 meter long trains*

According to the information collected from the concerned infrastructure manager, issues affecting technical/capacity limitations will persist at the following handover stations/marshalling yards/waiting-buffer locations, upon completion of the ongoing and planned investments:

- Maasvlakte Oost;
- Europoort;
- Waalhaven Zuid;
- Roosendaal;
- Botlek;
- Pernis;
- Amersfoort;
- Tilburg Goederen;
- Rotterdam Noord Goederen;
- Almelo;
- Kijfhoek;
- Crailoo;
- s-Hertongebosch.

The technical and especially the capacity limitations at the above listed handover stations/marshalling yards/waiting, buffer locations, will significantly hamper the operational conditions of 740 meter long trains along the RFC NS-B in the Netherlands by 2030 and afterwards, as also summarised in section 4.2.2 above.

Furthermore, the Crailoo waiting/buffer location is also expected to remain non-electrified by 2030.

4.2.4. Terminals

None of the terminal operators/infrastructure managers responded to the SCI survey and accordingly their likely future characteristics are not described in this study. Based on Contractor's knowledge, 740 meter long trains will be possible to be operated in most intermodal terminals, whereas limitations may still exist at coal, iron-ore and wet bulk terminals.

4.3. Technical and capacity improvement measures to further enhance operation of 740 meter long trains

This section identifies the measures that would still be required by 2030 and afterwards to remove infrastructure obstacles and allow a smooth and seamless operation of 740 meter long trains along the RFC NS-B, notwithstanding the completion of the ongoing and planned investments described at Section 4.2 above.

Further to the infrastructure improvements described in this section, measures applicable at the RFC NS-B level to increase the operational capacity and quality of operations along the corridor are described at Section 3.5 above.

4.3.1. Railway lines

The set of ongoing and planned investments presented at Section 4.2.1 above will already allow achieving several improvements of the existing technical and operational conditions, specified that additional investments are needed to solve the existing and future capacity constraints at the handover stations/marshalling yards/waiting-buffer locations as detailed in the following section. This will generally result in an improved capacity of the corridor lines and quality in the operation of freight as well as passenger traffic.

4.3.2. Handover stations

Particularly aimed at solving the capacity constraints affecting the operation of 740 meter long trains along the RFC NS-B in the Netherlands, the concerned infrastructure manager has drafted plans to improve capacity and flexibility of train operations including investments of up to € 155 million involving the handover stations of Botlek, Pernis, Amersfoort and Almelo to accommodate 740 meter long trains and up to € 510 million to achieve operational flexibility in the stations of Maasvlakte Oost, Europoort, Waalhaven Zuid, Kijfhoek, Crailoo, Rotterdam Noord Goederen, Rosendaal, Tilburg Goederen and 's-Hertogenbosch (see Table 4-8 overleaf).

The existing structure and density of the network in the Netherlands will not allow for more reasonable deviations or overtaking of freight trains than at present. Accordingly, the investments foreseen in the programme elaborated by the Dutch infrastructure manager are appropriate to allow a market-oriented quality operation of 740 meter long trains on the corridor, particularly on the itineraries interconnecting to the ports.

Based on analyses and estimates elaborated by the concerned infrastructure manager additional investments ranging between € 355 to 660 million are needed to fully upgrade the RFC NS-B principal and diversionary lines to allow operating 740 meter long trains.

Notwithstanding the implementation of the additional investments identified in the study by the Dutch infrastructure manager, technical limitations may be present after 2030 at some Rotterdam Harbour handover stations and at the Amersfoort handover station. Capacity and time limitations may also exist at the Rotterdam Harbour handover stations and along the Kijfhoek - Weesp and Roosendaal - Bad Bentheim routes.

4.3.3. Terminals

None of the terminal operators/infrastructure managers responded to the SCI survey. Due to the low responsiveness of the terminal managers/operators to the SCI survey, it was not possible to elaborate a representative estimate of the measures and costs associated with the upgrading/expansion of the existing terminal infrastructure of the RFC NS-B as part of this study.

Table 4-8 – Costs of infrastructure measures in handover stations/marshalling yards/waiting-buffer locations in NL (€ million)

Corridor section	Additional investments to allow operating 740 meter long trains			Additional investments to remove capacity/operational constraints to operate 740 meter long trains -		
		Minimum and maximum cost estimates			*Minimum and maximum cost estimates*	
Maasvlakte West - Emmerich	Expansion of the infrastructure at handover stations Botlek and Pernis	55	105	Expansion of the infrastructure at handover stations Maasvlakte Oost, Europoort, Waalhaven Zuid and Kijfhoek	220	410
Amsterdam Westhaven - Oldenzaal Grens	Expansion of the infrastructure at handover stations Amersfoort and Almelo	25	45	Electrification of side-tracks at Crailoo	15	25
Kijfhoek - Gouda - Weesp	-			Expansion of side-tracks in Rotterdam Noord Goederen	10	15
Roosendaal - Tilburg - Utrecht	-			Expansion of the infrastructure Border station Roosendaal and side-tracks Tilburg Goederen + side track's Hertogenbosch	30	60
Total		**80**	**150**		**275**	**510**

Source: Contractor based on consultation with the Infrastructure Managers; Notes: Costs are rounded to the nearest ten and are net of VAT

5. BELGIUM

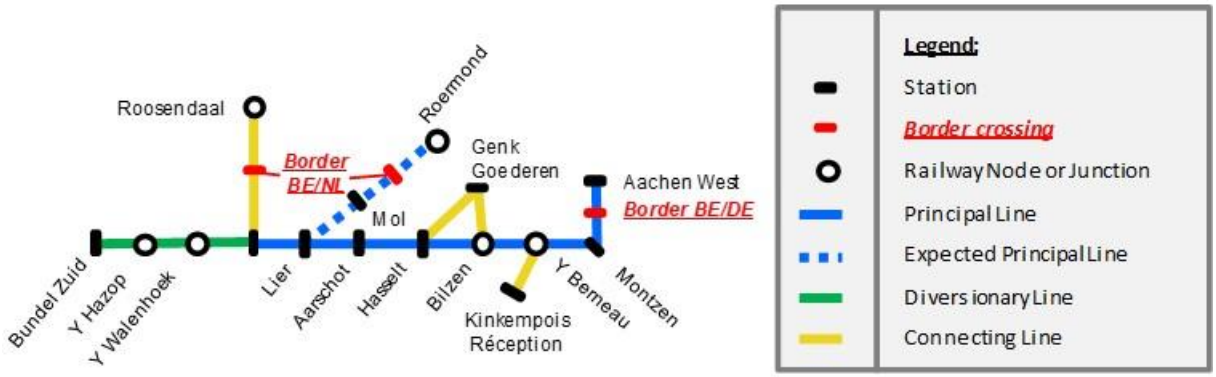
5.1. Corridor infrastructure and operational characteristics in 2018

This section provides an overview of the main characteristics of the RFC NS-B infrastructure in 2018, with a focus on the analysis of the technical maximum train length and possible related capacity constraints.

5.1.1. Railway lines

Figure 5-1 represents the alignment of the RFC NS-B in Belgium.

Figure 5-1 – Corridor infrastrucure in BE in 2018



Source: Contractor based on consultation with the Infrastructure Managers

The length of the RFC NS-B in Belgium is 332.2 km. To the purposes of the description of the characteristics of the RFC NS-B within the scope of this study the following lines were identified:

- A **principal** line from Antwerpen Noord to the BE/DE border near Gemmenich (Line 1-BE);
- A **diversionary** line from Bundel Zuid to Antwerpen Noord (Line 2-BE);
- A **connecting** line from Antwerpen Noord to the BE/NL border near Roosendaal (Line 3-BE);
- Several **connecting** lines linking Genk Goederen and Kinkempois Réception to Line 1-BE;
- And an **expected principal** line ("Iron Rhine") from Lier to the BE/NL border near Weert (Line 4-BE).

The basic characteristics of the principal line are summarised in Table 5-1 below.

Table 5-1 – Infrastructure characteristics in BE (principal lines) in 2018

General information on **principal** line	▪ Tracks with UIC gauge (1,435 mm) ▪ The line is part of the TEN-T core network ▪ Always 2 tracks ▪ The line is electrified (electrification in BE is generally DC 3.0 kV; between Montzen and the border with DE voltage is 15 kV)

Source: Contractor based on consultation with the Infrastructure Managers

Focussing on long train operability with reference to the 740 meter long train standard adopted by TEN-T Regulation (EU) 1315/2013 and possibly associated capacity constraints, Table 5-2 provides an overview of the status of the RFC NS-B in Belgium in 2018, referring to the above mentioned corridor lines, during the daytime.

Table 5-2 – Technical maximum train length for BE and related capacity constraints in 2018 (daytime)

Line	Technical maximum train length and related capacity constraints
1-BE–4-BE	740 m trains were allowed outside peak hours

Source: Contractor based on consultation with the Infrastructure Managers

In Belgium 740 meter long trains were allowed to operate on all lines outside peak hours.

In addition to the analysis of the suitability of the RFC NS-B to operate 740 meter long trains, a review of the characteristics of the corridor lines with reference to the electrification of the RFC NS-B was performed as part of the study. Table 5-3 provides the list of non-electrified corridor lines in 2018.

Table 5-3 – Non-electrified corridor lines in 2018

Corridor lines	Length in km	Type of line	Type of network
Y. Rooierweg - Genk Goederen	13.8	Connecting	Off TEN-T
Y. Rooierweg - Genk Zuid	8.0	Connecting	Off TEN-T
Mol - Hamont border	41.1	Expected principal	Comprehensive

Source: Contractor based on consultation with the Infrastructure Managers

The analysis shows that in 2018, 23.8 km of RFC NS-B lines were not electrified.

5.1.2. Handover stations

Table 5-4 provides the list of handover stations/marshalling yards that are located on the alignment of the RFC NS-B in Belgium, and the related technical characteristics in 2018.

Table 5-4 – Summary of the technical characteristics of the handover stations/marshalling yards in BE in 2018

Handover station	Type of network	Traction	Max train length (m)
Antwerpen Marshalling Yard	-	-	-
Antwerpen Haven - Bundel A1	Off TEN-T	E	>=740
Antwerpen Haven - Bundel B3	Off TEN-T	E	<740
Antwerpen Haven – Bundel Berendrecht	Off TEN-T	D	>=740
Antwerpen Haven - Bundel Buitenschoor	Off TEN-T	D	>=740
Antwerpen Haven - Bundel Oudendijk 1	Off TEN-T	D	>=740
Antwerpen Haven - Bundel Oorderen	Off TEN-T	D	<740
Antwerpen Haven - Bundel Angola	Off TEN-T	D	<740
Antwerpen Bundel Zuid	Off TEN-T	E	>=740
Antwerpen-Schijnpoort Bundel Q	Off TEN-T	E	>=740
Genk Goederen	Off TEN-T	E	>=740
Kinkempois-Réception	Off TEN-T	E	>=740
Bressoux	Off TEN-T	E	>=740

Source: Contractor based on consultation with the Infrastructure Managers

According to the information collected from the concerned infrastructure manager, issues affecting technical/capacity limitations existed in 2018 in the following handover stations:

- Antwerpen Haven - Bundel B3;
- Antwerpen Haven - Bundel Oorderen;
- Antwerpen Haven - Bundel Angola.

Furthermore, the following handover stations resulted to be non-electrified in 2018:

- Antwerpen Haven - Bundel Berendrecht;
- Antwerpen Haven - Bundel Buitenschoor;
- Antwerpen Haven - Bundel Oudendijk 1;
- Antwerpen Haven - Bundel Angola.

5.1.3. Terminals

The list of the terminals and the related handover stations that are located on the alignment of the RFC NS-B in Belgium is shown in Table 5-5.

Table 5-5 – List of terminals in BE in 2018

Terminal	Handover station
DP World Antwerp Gateway	Antwerpen Haven+B84:B101 - Bundel Oorderen
SHIPIT	Antwerpen Bundel Zuid
MSC/PSA European Terminal	Antwerpen Bundel Zuid
Hupac Terminal Antwerpen	Antwerpen Haven - Bundel Oorderen
Antwerpen Mainhub Terminal	Antwerpen Haven – Bundel A1
Antwerp Zomerweg Terminal	Antwerpen Haven – Bundel Angola
Antwerpen ATO	Antwerpen Haven – Bundel Angola
Trilogiport	Bressoux
Euroterminal Genk Exploitatie	Genk Goederen
NV Haven Genk	Genk Goederen
Liège Container Terminal	Kinkempois-Réception
Liège Logistics Intermodal	Kinkempois-Réception
Kinkempois	Kinkempois-Réception
n/a	Antwerpen Schijnpoort Bundel Q
Antwerpen Cirkeldyck	Antwerpen Haven - Bundel Berendrecht
PSA Noordzee Terminal	Antwerpen Haven - Bundel Buitenschoor
PSA Europa Terminal	Antwerpen Haven - Bundel Oudendijk 1
Combinant	Antwerpen Haven - Bundel B3
Delwaide Dock Terminal	Antwerpen Haven+B84:B101 - Bundel Berendrecht

Source: Contractor based on consultation with the Infrastructure Managers

One terminal operator/manager responded to the SCI survey. The characteristics of this terminal in 2018 are summarised in Table 5-6, showing that 740 meter long trains were already possible to be operated at this logistics node.

Table 5-6 – Characteristics of the terminals that responded to the SCI survey in BE in 2018

Terminal	Handover station	Electrified accessibility at terminal	Electrified accessibility at loading/unloading track(s)	Max train length (m)
NV Haven Genk	Genk Goederen	No	No	>=740

Source: Contractor based on SCI survey results

The operators/infrastructure managers of other terminals did not respond to the SCI survey and accordingly the characteristics of the logistics nodes other than the one above are not described in this study.

5.2. Expected corridor infrastructure and operational characteristics by 2030 and persisting gaps

5.2.1. Review of the ongoing and planned investments

An analysis of the planned investments on infrastructure upgrades with an expected finalisation date until 2030 was carried out based on publicly available sources.

For Belgium, projects were identified relating to technological upgrading along the corridor and capacity improvements to the Port of Antwerp and on the "Iron Rhine" line, which has the current status of "expected principal line" of the RFC NS-B. These are listed in Table 5-7 below.

Table 5-7 – Infrastrucure projects in BE

N°	Project	Section or node involved	End date	Total costs € million (excl. VAT)
1)	Equipment of the Belgian part of the RFC NS-B with ETCS	Belgian part of RFC NS-B	2025	n.a.
2)	Construction of the Oude Landen junction to improve accessibility to the Port of Antwerp	Antwerp	2025	80.1
3)	Electrification of the Iron Rhine between Mol and the border with the Netherlands	Mol – Hamont Border	2020	46.3
4)	Instalment of signalling equipment on several lines on the right bank of the port of Antwerp	Antwerp	2022	16.99
5)	Construction of the second track along the Iron Rhine between Neerpelt and Balen Werkplaats	Iron Rhine	2025	43.8
6)	Extension of the sidings at Kinkempois	Kinkempois	2020	19.96

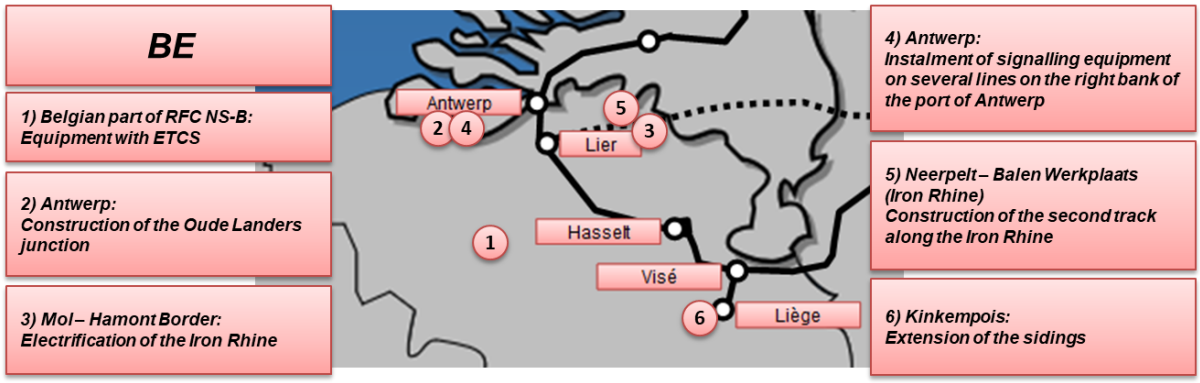
Source: Contractor based on consultation with the Infrastructure Managers

The geographical location of these projects is represented in the map in Figure 5-2, also including a brief description of these investments.

Further to the above listed investments the following studies are also worth mentioning which are related to the improvement of accessibility to the Port of Antwerp:

- Study for the construction of a new line between Antwerp North and Lier to improve accessibility to the Port of Antwerp;
- Studies for the expansion and renewal works on the right and left banks of the port of Antwerp.

Figure 5-2 – Location of infrastrucure upgrades in BE



Source: Contractor

5.2.2. Railway lines

Based on the expected impact of the ongoing and planned investments illustrated above, Table 5-8 provides an overview of the foreseen maximum train length operability on the RFC NS-B in Belgium by 2030, referring to the corridor lines listed at Section 5.1.1, during the daytime.

Table 5-8 – Technical maximum train length for BE and related capacity constraints by 2030 (daytime)

Line	Technical maximum train length and related capacity constraints
1-BE–4-BE	740 m trains would be allowed outside peak hours

Source: Contractor based on consultation with the Infrastructure Managers

Similarly to the conditions in 2018 it will be technically feasible to operate 740 meter long trains in Belgium by 2030, outside the rush hours period.

Both in the present and likely future operational conditions, there is no guarantee for an applicant to be offered a stable 740 meter long train path. The 740 meter long train path may or may not be allocated, with negative implications from the market-quality standpoint of rail freight transport in Belgium along the RFC NS-B.

Table 5-9 provides the list of non-electrified corridor lines by 2030. The analysis shows that by 2030, the length of non-electrified corridor lines will reduce to 21.8 km.

Table 5-9 – Non-electrified corridor lines by 2030

Corridor lines	Length in km	Type of line	Type of network
Y. Rooierweg - Genk Goederen	13.8	Connecting	Off TEN-T
Y. Rooierweg - Genk Zuid	8.0	Connecting	Off TEN-T

Source: Contractor based on consultation with the Infrastructure Managers

5.2.3. Handover stations

Table 5-10 provides the list of handover stations/marshalling yards that are located on the alignment of the RFC NS-B in Belgium, and the related technical characteristics by 2030.

Table 5-10 – Summary of the technical characteristics of the handover stations/marshalling yards in BE by 2030

Handover station	Type of network	Traction	Max train length (m)
Antwerpen Marshalling Yard	-	-	-
Antwerpen Haven - Bundel A1	Off TEN-T	E	>=740
Antwerpen Haven - Bundel B3	Off TEN-T	E	<740
Antwerpen Haven – Bundel Berendrecht	Off TEN-T	D	>=740
Antwerpen Haven - Bundel Buitenschoor	Off TEN-T	D	>=740
Antwerpen Haven - Bundel Oudendijk 1	Off TEN-T	D	>=740
Antwerpen Haven - Bundel Oorderen	Off TEN-T	D	<740
Antwerpen Haven - Bundel Angola	Off TEN-T	D	<740
Antwerpen Bundel Zuid	Off TEN-T	E	>=740
Antwerpen-Schijnpoort Bundel Q	Off TEN-T	E	>=740
Genk Goederen	Off TEN-T	E	>=740
Kinkempois-Réception	Off TEN-T	E	>=740
Bressoux	Off TEN-T	E	>=740

Source: Contractor based on consultation with the Infrastructure Managers

According to the information collected from the concerned infrastructure manager, issues affecting technical/capacity limitations will still persist at the following handover stations, upon completion of the ongoing and planned investments:

- Antwerpen Haven - Bundel B3;
- Antwerpen Haven - Bundel Oorderen;
- Antwerpen Haven - Bundel Angola.

Furthermore, no handover stations will be electrified by 2030 compared to the 2018 situation.

5.2.4. Terminals

One terminal operator/manager responded to the SCI survey. The characteristics of this terminal by 2030 are summarised in Table 5-11, showing that 740 meter long trains are already possible to be operated at this logistics node, as in any case this terminal already allowed operation of long trains in 2018. It is also worth noticing that the electrification of reception/departure tracks is expected to be possible at this logistics node by 2030.

Table 5-11 – Characteristics of the terminals that responded to the SCI survey in BE by 2030

Terminal	Handover station	Electrified accessibility at terminal	Electrified accessibility at loading/unloading track(s)	Max train length (m)
NV Haven Genk	Genk Goederen	Yes	Yes	>=740

Source: Contractor based on SCI survey

The operators/infrastructure managers of other terminals did not respond to the SCI survey and accordingly the characteristics of the logistics nodes other than the one above are not described in this study.

5.3. Technical and capacity improvement measures to further enhance operation of 740 meter long trains

5.3.1. Railway lines

As commented in previous sections above, it was already technically feasible to operate 740 meter long trains in Belgium in 2018. However, capacity restrictions already limited the operation of 740 meter long trains in certain periods of the day and capacity constraints are likely to become more severe in the future. Based on such conditions and in consideration of the growing freight traffic on the corridor lines, especially to/from the Port of Antwerp, the concerned infrastructure manager is currently preparing and conducting studies for the improvement of the technical and operational conditions of 740 meter long trains. These analyses are foreseen for completion during 2020 and are not possible to be consulted as part of this study. Two projects are also ongoing to improve the access to the port in general, i.e. the junction at Oude Landen and the study for second access to the port. Furthermore, one initiative is also ongoing aimed at improving capacity along the Iron Rhine line between Neerpelt and Balen Werkplaats.

As the structure and density of the network does not allow for more deviations or overtaking possibilities for freight trains than today, extra investments are seen as crucial to allow an adequate market-oriented quality operation of 740 meter long trains.

In consideration of the ongoing and planned initiatives, no additional measures were agreed to be identified as part of this study.

5.3.2. Handover stations

In line with the analysis performed as part of this study, the following handover stations/marshalling yards will not be capable of handling 740 meter long trains by 2030:

- Antwerpen Haven - Bundel B3;
- Antwerpen Haven - Bundel Oorderen;
- Antwerpen Haven - Bundel Angola.

Given that no investments are currently ongoing and planned for the upgrading of this infrastructure of the RFC NS-B, costs have been estimated for the infrastructure works required to allow the operation of 740 meter long trains at these three handover stations/marshalling yards. These are reported in Table 5-12. The total cost amounts to about € 1.4 million.

Table 5-12 – Costs of infrastructure measures in handover stations in BE (€)

	Antwerpen Haven - Bundel B3	Antwerpen Haven - Bundel Oorderen	Antwerpen Haven - Bundel Angola
Tracks			
New track	80,000	80,000	80,000
Switches	**-**	**-**	**-**
New switches	-	-	-
Moving of switches to other locations	250,000	250,000	250,000
Electrification	**-**	**-**	**-**
Electrification	75,200	75,200	75,200
Signalling	**-**	**-**	**-**
ETCS system	48,000	48,000	48,000
Interlocking/ETCS adjustments	18,000	18,000	18,000
Total cost per handover station	**471,200**	**471,200**	**471,200**

Source: Contractor

5.3.3. Terminals

None of the terminal operators/infrastructure managers responded to the SCI survey except for the NV Haven Genk logistics facility that do not require investments to allow/improve operation of 740 meter long trains. Due to the low responsiveness of the terminal managers/operators to the SCI survey, it was not possible to elaborate a representative estimate of the measures and costs associated with the upgrading/expansion of the existing terminal infrastructure of the RFC NS-B as part of this study.

6. GERMANY

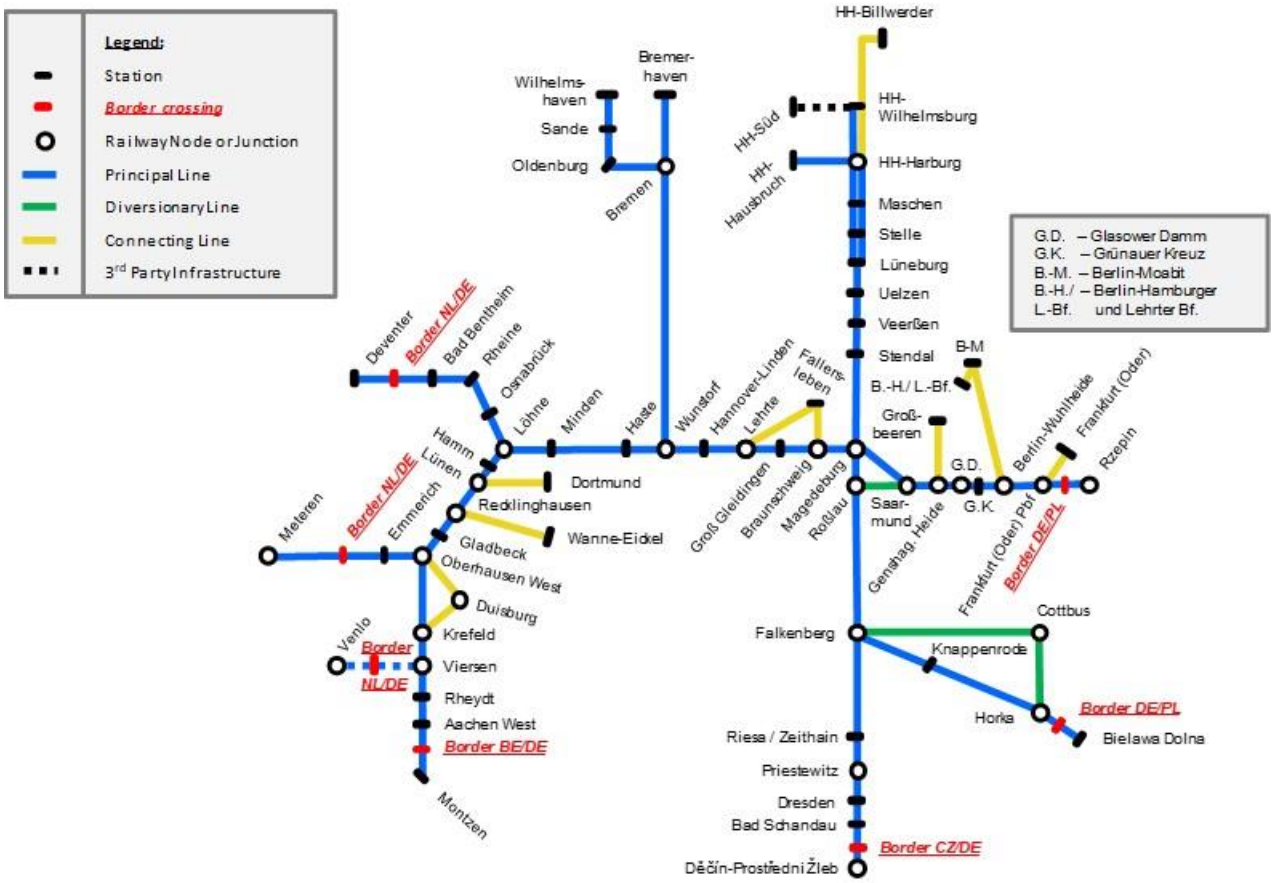
6.1. Corridor infrastructure and operational characteristics in 2018

This section provides an overview of the main characteristics of the RFC NS-B infrastructure in 2018, with a focus on the analysis of the technical maximum train length and possible related capacity constraints.

6.1.1. Railway lines

Figure 6-1 represents the alignment of the RFC NS-B in Germany.

Figure 6-1 – Corridor infrastrucure in Germany in 2018



Source: Contractor based on consultation with the Infrastructure Managers

The length of the RFC NS-B in Germany is 2,508.3 km. To the purposes of the description of the characteristics of the RFC NS-B within the scope of this study several lines have been considered among which 9 principal and diversionary lines:

- A **principal** line starting at the DE/BE border near Aachen West, continuing via Oberhausen West, Löhne, Wunstorf, Magdeburg to the DE/PL border near Frankfurt/Oder (Line 1-DE);

- A **principal** line starting at the DE/NL border near Emmerich connecting in Oberhausen West to Line 1-DE (Line 2-DE);
- A **principal** line starting at the DE/NL border near Bad Bentheim connecting in Löhne to Line 1-DE (Line 3-DE);
- A **principal** line starting at the North Sea harbours in Wilhelmshaven and Bremerhaven, joining in Bremen and connecting in Wunstorf to Line 1-DE (Line 4-DE);
- A **principal** line starting in Hamburg-Hausbruch and Hamburg-Wilhelmsburg, joining in Hamburg-Harburg and connecting in Magdeburg to Line 1-DE (Line 5-DE);
- A **principal** line branching out of Line 1 in Magdeburg to the DE/CZ border near Bad Schandau (Line 6-DE);
- A **principal** line branching out of Line 6 in Falkenberg to the DE/PL border near Horka (Line 7-DE);
- A **diversionary** line from Roßlau to Saarmund (Line 8-DE);
- A **diversionary** line from Falkenberg via Cottbus to Horka (Line 9-DE);

Further to the above, the RFC NS-B lines subject of this study in Germany also include several connecting lines along Lines 1-DE and 5-DE.

The basic characteristics of the principal lines are summarised in Table 6-1 below.

Table 6-1 – Infrastructure characteristics in DE (principal lines) in 2018

General information on **principal** lines	▪ Tracks with UIC gauge (1,435 mm) ▪ All lines are part of the TEN-T core or comprehensive network ▪ Mainly 2 tracks per line; exceptions are: o the section on Line 4-DE between Wilhelmshaven and Sande has 1 track; o there are several sections on Line 1-DE providing 1 or 2 parallel tracks (e.g. Hamburg-Wilhelmsburg to Lüneburg ▪ Most of the lines are electrified, electrification from Wilhelmshaven to Oldeburg (Line 4-DE) is currently under construction; electrification in DE is AC 15 kV – 16.7 Hz

Source: Contractor

Focussing on long train operability with reference to the 740 meter long train standard adopted by TEN-T Regulation (EU) 1315/2013 and possibly associated capacity constraints, Table 6-2 provides an overview of the status of the RFC NS-B in Germany in 2018, referring to the above mentioned corridor lines.

Table 6-2 – Technical maximum train length for DE and related capacity constraints in 2018

Line	Technical maximum train length and related capacity constraints
1-DE–9-DE	740 m trains were basically possible to be operated. Capacity constraints during peak hours existed on some sections of line 1 [Hamm - Löhne (Strecke 2990); Minden - Haste; Groß Gleidingen – Magdeburg; Magdeburg - Saarmund; Berlin-Wuhlheide - Frankfurt (O) - Border DE/PL], line 3 [Border NL/DE - Bad Bentheim – Osnabrück] and line 6 [Riesa - Bad Schandau - Border CZ/DE]. Restrictions due to timetabling and operational specific situations might also result in a temporary reduction of the train length on the corridor lines

Source: Contractor based on consultation with the Infrastructure Managers

In Germany it was generally possible to operate 740 meter long trains along the RFC NS-B in 2018, specified that restrictions during peak hours existed on some sections of corridor lines 1, 3 and 6 and that limitations due to timetabling and specific operational situations could temporary influence the corridor capacity. Furthermore, technological upgrading works were required to remove and reconstruct signalling equipment along the corridor lines that also affected the smooth and seamless operation of 740 meter long trains in this Member State.

In addition to the analysis of the suitability of the RFC NS-B to operate 740 meter long trains, a review of the characteristics of the corridor lines with reference to electrification was performed as part of the study. Table 6-3 provides the list of non-electrified corridor lines in 2018.

Table 6-3 – Non-electrified corridor lines in 2018

Corridor lines	Length in km	Type of line	Type of network
Wilhelmshaven - Sande	15.4	Principal	Core
Sande - Oldenburg	45.0	Principal	Core
Cottbus - Horka	74.6	Diversionary	Comprehensive
Berlin-Moabit - Berlin-Hamburger und Lehrter Bf	2.3	Connecting	Off TEN-T
Total	137.3		

Source: Contractor based on consultation with the Infrastructure Managers

The analysis shows that in 2018, 137.3 km of RFC NS-B lines were not electrified, including 60.4 km of principal corridor sections.

6.1.2. Handover stations

Table 6-4 provides the list of handover stations/marshalling yards that are located on the alignment of the RFC NS-B in Germany, and the related technical characteristics in 2018.

Table 6-4 – Summary of the technical characteristics of the handover stations/marshalling yards in DE in 2018

Handover station	Type of network	Traction	Max train length (m)
Wilhelmshaven	Core	D	>=740
Maschen Rbf	Core	E	>=740
Hamburg Süd	Third party infrastructure		>=740
Bremerhaven - Speckenbüttel	Core	E	>=740
Bremen Rbf	Core	E	>=740
Oberhausen-Osterfeld Süd	Comprehensive	E	>=740
Oberhausen West	Core	E	>=740
Duisburg Ruhrort Hafen	Off TEN-T	E	>=740*
Duisburg Hafen	Off TEN-T	D	>=740*
Rheinhausen	Comprehensive	E	>=740
Duisburg-Hochfeld Süd	Core	D	>=740*
Krefeld-Uerdingen	Comprehensive	E	>=740
Wanne-Eickel	Core	E	>=740
Dortmund-Obereving	Core	E	>=740
Seelze Rbf	Core	E	>=740
Hannover-Linden	Core	E	>=740
Lehrte	Core	E	>=740

Handover station	Type of network	Traction	Max train length (m)
Fallersleben	Core	E	>=740
Braunschweig Rbf	Core	E	<740
Beddingen	Off TEN-T	E	>=740
Magdeburg-Rothensee	Core	E	<740
Magdeburg-Sudenburg	Core	E	>=740
Großbeeren	Comprehensive	E	>=740
Seddin	Comprehensive	E	>=740
Dresden - Friedrichstadt	Core	E	>=740
Berlin Hamburger und Lehrter Bf	Off TEN-T	D	>=740*
Frankfurt (Oder) Pbf	Core	E	<740

*Source: Contractor based on consultation with the Infrastructure Managers; Notes: *capacity constraints limiting the operation of 740 meter long trains*

According to the information collected from the concerned infrastructure manager, issues affecting technical/capacity limitations existed at the following handover stations/marshalling yards:

- Duisburg Ruhrort Hafen;
- Duisburg Hafen;
- Duisburg Hochfeld Süd;
- Braunschweig;
- Magdeburg;
- Berlin Hamburger und Lehrter Bf;
- Frankfurt (Oder) Pbf.

Furthermore, the following handover stations/marshalling yards resulted to be non-electrified in 2018:

- Wilhelmshaven;
- Duisburg Hafen;
- Duisburg-Hochfeld Süd;
- Berlin Hamburger und Lehrter Bf.

6.1.3. Terminals

The list of the terminals and the related handover stations that are located on the alignment of the RFC NS-B in Germany is shown in Table 6-5.

Table 6-5 – List of terminals in DE in 2018

Terminal	Handover station
Berlin - Westhafen	Berlin Hamburger und Lehrter Bf
Braunschweig Container terminal	Braunschweig
Bremen Roland	Bremen
Bahnhof Bremen Rbf	Bremen
CTB Bremerhaven	Bremerhaven - Speckenbüttel
NTB Bremerhaven	Bremerhaven - Speckenbüttel
MSC Gate Bremerhaven	Bremerhaven - Speckenbüttel
Container Terminal Dortmund	Dortmund - Obereving
Ubf Dresden	Dresden - Friedrichstadt
Dresden GVZ	Dresden - Friedrichstadt
Duisburg RRT (Rhein-Ruhr Terminal)	Duisburg Hafen
Logport II Gateway West	Duisburg Hochfeld Süd
Bahnhof Duisburg Ruhrort Hafen	Duisburg Ruhrort Hafen
DeCeTe Duisburg	Duisburg Ruhrort Hafen
PKV Duisburg	Duisburg Ruhrort Hafen
KV-Drehscheibe Rhein/Ruhr (Megahub Duisburg)	Duisburg Ruhrort Hafen

Terminal	Handover station
Wolfsburg GVZ	Fallersleben
Frankfurt (Oder)	Frankfurt (Oder) Pbf
Ubf Großbeeren	Großbeeren
Hamburg – Container Terminal Tollerort (CTT)	Hamburg Süd
Hamburg - BUSS Hansa	Hamburg Süd
Hannover Linden (until go life of KV Drehscheibe Lehrte)	Hannover - Linden
Logport III	Krefeld - Hohenbudberg
KV Drehscheibe Lehrte (coming up)	Lehrte
Magdeburg Rothensee	Magdeburg
Ubf Hamburg Billwerder	Maschen
Hamburg – Container Terminal Altenwerder (CTA)	Maschen
Hamburg – Container Terminal Burchardkai (CTB)	Maschen
Hamburg - Waltershof	Maschen
Maschen Rbf	Maschen
Bahnhof Oberhausen Osterfeld	Oberhausen Osterfeld
Bahnhof Oberhausen West	Oberhausen West
Logport I Duisburg DIT	Rheinhausen
Logport I Duisburg Kombiterminal (DKT)	Rheinhausen
Logport I Duisburg Trimodal Terminal (D3T)	Rheinhausen
Salzgitter GVZ - KLV Terminal	Salzgitter - Beddingen
Bahnhof Seddin Rbf	Seddin
Bahnhof Seelze Rbf	Seelze
Bahnhof Wanne-Eickel	Wanne-Eickel
Container Terminal Herne	Wanne-Eickel
CT Wilhelmshaven (CTW)	Wilhelmshaven

Source: Contractor based on consultation with the Infrastructure Managers

Eight terminal operators/managers responded to the SCI survey. The characteristics of these terminals in 2018 are summarised in Table 6-6, showing that 740 meter long trains were already possible to be operated at these logistics nodes, except at MSC Gate Bremerhaven, KV-Drehscheibe Rhein/Ruhr (Megahub Duisburg), Ubf Großbeeren and Hannover Linden (to be replaced by KV Drehscheibe Lehrte). Furthermore, electrified accessibility was not possible at CT Wilhelmshaven (CTW) and electrified access at loading/unloading tracks was not feasible at CTB Bremerhaven, MSC Gate Bremerhaven and CT Wilhelmshaven (CTW).

Table 6-6 – Characteristics of the terminals that responded to the SCI survey in DE in 2018

Terminal	Handover station	Type of node	Electrified accessibility at terminal	Electrified accessibility at loading/unloading track(s)	Max train length (m)
CTB Bremerhaven	Bremerhaven - Speckenbüttel	Core	Yes	No	>=740
NTB Bremerhaven	Bremerhaven - Speckenbüttel	Core	Yes	Yes	>=740
MSC Gate Bremerhaven	Bremerhaven - Speckenbüttel	Core	Yes	No	<740
Bahnhof Duisburg Ruhrort Hafen	Duisburg Ruhrort Hafen	Off TEN-T	Yes	Yes	>=740
KV-Drehscheibe Rhein/Ruhr (Megahub Duisburg)	Duisburg Ruhrort Hafen	Off TEN-T	Yes	Yes	<740
Ubf Großbeeren	Großbeeren	Core	Yes	Yes	<740

Terminal	Handover station	Type of node	Electrified accessibility at terminal	Electrified accessibility at loading/unloading track(s)	Max train length (m)
Hannover Linden (to be replaced by KV Drehscheibe Lehrte)	Hannover - Linden	Core	Yes	Yes	<740
CT Wilhelmshaven (CTW)	Wilhelmshaven	Core	No	No	>=740

Source: Contractor based on SCI survey results

The operators/infrastructure managers of other terminals did not respond to the SCI survey and accordingly the characteristics of the logistics nodes other than the ones listed above are not described in this study.

6.2. Expected corridor infrastructure and operational characteristics by 2030 and persisting gaps

6.2.1. Review of the ongoing and planned investments

An analysis of the planned investments on infrastructure upgrades with an expected finalisation date until 2030 was carried out based on publicly available sources.

For Germany, 21 measures on infrastructure upgrades were identified, which are listed in Table 6-7 below.

Table 6-7 – Infrastrucure upgrades in DE

N°	Project	Section or node involved	End date	Total costs € million (excl. VAT)
1)	Prolongation of sidings for 740 meter long trains om NS-B corridor	Arios locations	2020 - 2028	95.77 (estimated)
2)	Hamburg node, elimination of bottlenecks	Hamburg node	12/2030	1,800.00
3)	Hannover node	Hannover node	12/2030	610.00
4)	NBS/ABS Hamburg/Bremen-Hannover (Optimised Alpha E)	Hamburg/Bremen - Hannover	12/2030	3,891.00
5)	"Upgraded line (ABS) (Amsterdam) - DE/NL border - Emmerich - Oberhausen (1. Phase)	Zevenaar - Oberhausen	12/2030	2,262.52
6)	ABS Grenze DE/NL-Emmerich-Oberhausen (1. Baustufe)"	Hannover-Bielefeld	12/2030	1,885.00
7)	ABS/NBS Hannover - Bielefeld	Oldenburg – Wilhelmshaven	12/2022	871.00
8)	ABS Oldenburg - Wilhelmshaven/Langwedel - Uelzen	Hamburg node	12/2030	545.00

Nº	Project	Section or node involved	End date	Total costs € million (excl. VAT)
9)	Hamburg node	Hannover - Wolfsburg	12/2030	532.00
10)	NBS Lehrte/Hameln - Braunschweig - Magdeburg - Roßlau (I)	Lehrte - Braunschweig - Magdeburg - Roßlau	12/2030	359.00
11)	NBS Lehrte/Hameln - Braunschweig - Magdeburg - Roßlau (II)	Stelle - Lüneburg	12/2019	356.00
12)	ABS Stelle - Lüneburg	Oebisfelde – Staaken (Regular route "Stammstrecke")	12/2030	293.00
13)	Upgrade of regular line (Stammstrecke) Oebisfelde – Staaken (NV 08) DE	Rotenburg - Verden	12/2030	194.00
14)	ABS Bremerhaven - Bremervörde - Rotenburg - Verden	Hamburg	12/2019	136.00
15)	"Rail Corridor Wilhelmsburg /	Emmerich - Oberhausen	12/2019	67.48
16)	Reallocation Wilhelmsburger Reichsstrasse"	Berlin-Dresden	12/2030	802.00
17)	Upgraded line (ABS) (Amsterdam) - DE/NL border - Emmerich - Oberhausen	Berlin – Frankfurt (Oder) – Border DE/PL (ABS)	12/2026	730.00
18)	Upgrading railway line Berlin - Dresden (first and second phase)	Berlin	12/2025	646.00
19)	ABS Berlin – Frankfurt (Oder) – Border (DE/PL)	Berlin	12/2018	167.00
20)	Reconstruction of railway line Südkreuz - Blankenfelde	Berlin	12/2020	178.00
21)	Reconstruction of Ostkreuz railway junction	Urban Node Berlin-Brandenburg	12/2017	unknown

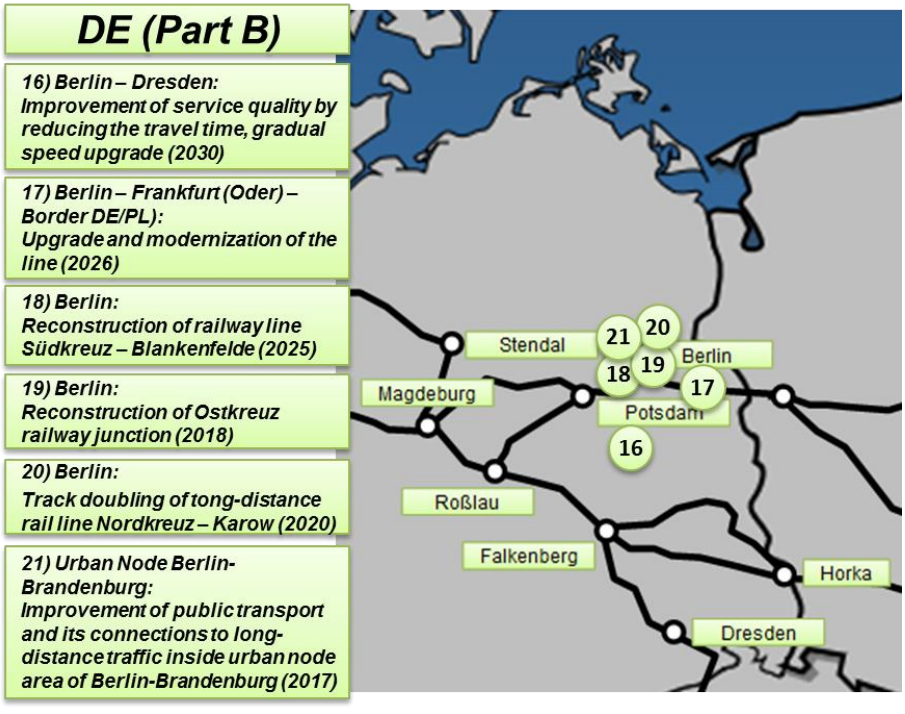
Source: Contractor based on consultation with the Infrastructure Managers

The geographical location of the above projects, also including a brief description of these investments is represented in Figure 6-2 and Figure 6-3 overleaf.

Figure 6-2 – Location of infrastrucure upgrades in DE (Part A)

Source: Contractor

Figure 6-3 – Location of infrastrucure upgrades in DE (Part B)



Source: Contractor

Specifically concerning 740 meter long train operations in Germany, works are foreseen to be completed by 2030 that will particularly focus on the removal or new construction of signalling equipment. Such works are planned to be located at the following locations:

- Bad Bentheim;
- Hamm RBf;
- Kirchhorsten;
- Rehren;
- Schandelah;
- Wusterwitz;
- Fangschleuse;
- Berkenbrück (Track 3);
- Berkenbrück (Track 4);
- Kurort Rathen.

Estimates by the concerned infrastructure manager indicate that the value of these works on the RFC NS-B will amount to about € 84 million.

6.2.2. Railway lines

Based on the expected impact of the ongoing and planned investments illustrated above, Table 6-8 provides an overview of the foreseen maximum train length operability on the RFC NS-B in Germany by 2030, referring to the corridor lines listed at Section 6.1.1.

Table 6-8 – Technical maximum train length for DE and related capacity constraints by 2030

Line	Technical maximum train length and related capacity constraints
1-DE– 9-DE	740 m trains will basically be possible to be operated. Restrictions due to timetabling and operational specific situations may result in temporary reductions of the train length

Source: Contractor based on consultation with the Infrastructure Managers

Overall the planned investments are expected to further enhance the possibility to operate 740 meter long trains along the corridor, whereas capacity limitations due to timetabling and operational conditions may still be present on limited sections of the RFC NS-B due to increase in traffic.

Table 6-9 provides the list of non-electrified corridor lines by 2030. The analysis shows that by 2030, the length of non-electrified corridor lines will reduce to 76.9 km. All the principal lines of the RFC NS-B will be electrified by this time horizon in Germany.

Table 6-9 – Non-electrified corridor lines by 2030

Corridor lines	Length in km	Type of line	Type of network
Cottbus - Horka	74.6	Diversionary	Comprehensive
Berlin-Moabit - Berlin-Hamburger und Lehrter Bf	2.3	Connecting	Off TEN-T

Source: Contractor based on consultation with the Infrastructure Managers

6.2.3. Handover stations

Table 6-10 provides the list of handover stations/marshalling yards that are located on the alignment of the RFC NS-B in Germany, and the related technical characteristics by 2030.

Table 6-10 – Summary of the technical characteristics of the handover stations/marshalling yards in DE by 2030

Handover station	Type of network	Traction	Max train length (m)
Wilhelmshaven	Core	E	>=740
Maschen Rbf	Core	E	>=740
Hamburg Süd	Off TEN-T		>=740
Bremerhaven - Speckenbüttel	Core	E	>=740
Bremen Rbf	Core	E	>=740
Oberhausen-Osterfeld Süd	Comprehensive	E	>=740
Oberhausen West	Core	E	>=740
Duisburg Ruhrort Hafen	Off TEN-T	E	>=740*
Duisburg Hafen	Off TEN-T	D	>=740*
Rheinhausen	Comprehensive	E	>=740
Duisburg-Hochfeld Süd	Core	D	>=740*
Krefeld-Uerdingen	Comprehensive	E	>=740
Wanne-Eickel	Core	E	>=740
Dortmund-Obereving	Core	E	>=740
Seelze Rbf	Core	E	>=740
Hannover-Linden	Core	E	>=740
Lehrte	Core	E	>=740
Fallersleben	Core	E	>=740
Braunschweig Rbf	Core	E	<740
Beddingen	Off TEN-T	E	>=740
Magdeburg-Rothensee	Core	E	<740
Magdeburg-Sudenburg	Core	E	>=740
Großbeeren	Comprehensive	E	>=740
Seddin	Comprehensive	E	>=740
Dresden - Friedrichstadt	Core	E	>=740
Berlin Hamburger und Lehrter Bf	Off TEN-T	D	>=740*
Frankfurt (Oder) Pbf	Core	E	<740

*Source: Contractor based on consultation with the Infrastructure Managers; Notes: *capacity constraints limiting the operation of 740 meter long trains*

According to the information collected from the concerned infrastructure manager, issues affecting technical/capacity limitations will still affect handling of 740 meter long trains by 2030 at the following handover stations/marshalling yards, upon completion of the planned investments:

- Duisburg Ruhrort Hafen;
- Duisburg Hafen;
- Duisburg Hochfeld Süd;
- Braunschweig;
- Magdeburg;
- Berlin Hamburger und Lehrter Bf;
- Frankfurt (Oder) Pbf.

Furthermore, the following handover station/marshalling yard will still be non-electrified by 2030:

- Duisburg Hafen
- Duisburg-Hochfeld Süd
- Berlin Hamburger und Lehrter Bf.

6.2.4. Terminals

Eight terminal operators/managers responded to the SCI survey. The characteristics of these terminals by 2030 are summarised in Table 6-11.

Table 6-11 – Characteristics of the terminals that responded to the SCI survey in DE by 2030

Terminal	Handover station	Electrified accessibility at terminal	Electrified accessibility at loading/unloading track(s)	Max train length (m)
CTB Bremerhaven	Bremerhaven - Speckenbüttel	Yes	No	>=740
NTB Bremerhaven	Bremerhaven - Speckenbüttel	Yes	Yes	>=740
MSC Gate Bremerhaven	Bremerhaven - Speckenbüttel	Yes	No	<740
Bahnhof Duisburg Ruhrort Hafen	Duisburg Ruhrort Hafen	Yes	Yes	>=740
KV-Drehscheibe Rhein/Ruhr (Megahub Duisburg)	Duisburg Ruhrort Hafen	Yes	Yes	<740
Ubf Großbeeren	Großbeeren	Yes	Yes	>=740
Hannover Linden (to be replaced by KV Drehscheibe Lehrte)	Hannover - Linden	Yes	Yes	<740
CT Wilhelmshaven (CTW)	Wilhelmshaven	Yes	No	>=740

Source: Contractor based on SCI survey results

According to the information collected as part of the SCI survey, issues affecting limitations to operate 740 meter long trains at the RFC NS-B terminals in Germany will still persist by 2030 at MSC Gate Bremerhaven, KV-Drehscheibe Rhein/Ruhr (Megahub Duisburg) and Hannover Linden (to be replaced by KV Drehscheibe Lehrte), whereas they are foreseen to be solved at Ubf Großbeeren.

Furthermore, no additional terminal will allow electrified accessibility at loading/unloading tracks by 2030 compared to the 2018 situation.

The operators/infrastructure managers of other terminals did not respond to the SCI survey and accordingly the characteristics of the logistics nodes other than the ones listed above are not described in this study.

6.3. Technical and capacity improvement measures to further enhance operation of 740 meter long trains

6.3.1. Railway lines

The German infrastructure manager is developing and implementing an extensive investment program to allow the flexible operation of 740 meter long trains along the RFC NS-B on high-quality levels. This is aimed at supporting both passenger and freight traffic increase all over Germany, which might potentially result in possible conflicts in the allocation of capacity between long distance passenger operators, local and regional transit operators and national and international freight operators. A number of projects to minimize these potential conflicts are being prepared within the scope of the Bundesverkehrswegeplan (Federal Transport Infrastructure Plan), and in addition to it.

Also, operational issues like accelerated implementation of ETCS and the flexible DB Netze "Click-and-Ride" application for the allocation of reliable short-term slots will increase the capacity for freight. "Click-and-Ride" (https://www1.deutschebahn.com/clickandride#) allows Railway Undertakings to apply for ad-hoc slots between 48 hours and 45 minutes before departure. It leads to a better use of short-term capacity and provides reliable timetables also for ad-hoc-trains. The allocation is based on correct train information. So it is essential to make sure that the features of train dynamics of 740 meter long trains are fully included in all these measures to keep the possibility of a high-quality operation of long trains also when the number of trains will be increased significantly.

The structure and density of the network may allow for some reasonable deviations or overtaking of freight trains on a very limited scale only, so all planned investments and measures will be essential to allow a market oriented quality and number of 740 meter long trains.

In consideration of the ongoing and planned investments and initiatives, no additional measures were agreed to be identified as part of this study.

6.3.2. Handover stations

Based on information received from the concerned infrastructure manager, technical and capacity constraints will still affect handling of 740 meter long trains by 2030 at the following handover stations/marshalling yards, upon completion of the planned investments:

- Duisburg Ruhrort Hafen;
- Duisburg Hafen;
- Duisburg Hochfeld Süd;
- Braunschweig;
- Magdeburg;
- Berlin Hamburger und Lehrter Bf;
- Frankfurt (Oder) Pbf.

Given that investments at these handover stations/marshalling yards are not planned, costs have been estimated for the works required to upgrade these corridor infrastructure, which are provided in Table 6-12. The total estimated costs associated with the works at these handover stations/marshalling yards amount to about € 12.8 million.

Table 6-12 – Costs of infrastructure measures in handover stations in DE (€)

	Duisburg Ruhrort Hafen	Duisburg Hafen	Duisburg Hochfeld Süd
Tracks			
New track	60,000	860,000	780,000
Switches			
New switches	-	-	-
Moving of switches to other locations	120,000	240,000	240,000
Electrification			
Electrification	70,200	1,731,600	912,600
Signalling			
ETCS system	15,600	223,600	202,800
Interlocking/ETCS adjustments	4,480	8,960	8,960
Total cost per handover station	**270,280**	**3,064,160**	**2,144,360**

	Braunschweig	Magdeburg	Berlin Hamburger und Lehrter Bf	Frankfurt (Oder) Pbf
Tracks				
New track	300,000	890,000	780,000	220,000
Switches				
New switches	-	150,000	-	-
Moving of switches to other locations	240,000	120,000	240,000	240,000
Electrification				
Electrification	351,000	1,041,300	1,731,600	257,400
Signalling				
ETCS system	78,000	231,400	202,800	57,200
Interlocking/ETCS adjustments	8,960	4,480	8,960	8,960
Total cost per handover station	**977,960**	**2,591,180**	**2,963,360**	**783,560**

Source: Contractor

6.3.3. Terminals

Based on the results of the SCI survey, technical issues to operate 740 meter long trains will be present by 2030 at least at the following terminals: MSC Gate Bremerhaven, KV-Drehscheibe Rhein/Ruhr (Megahub Duisburg) and Hannover Linden (to be replaced by KV Drehscheibe Lehrte). Due to the low responsiveness of the terminal managers/operators to the SCI survey, it was not possible to elaborate a representative estimate of the measures and costs associated with the upgrading/expansion of the existing terminal infrastructure of the RFC NS-B as part of this study.

7. POLAND

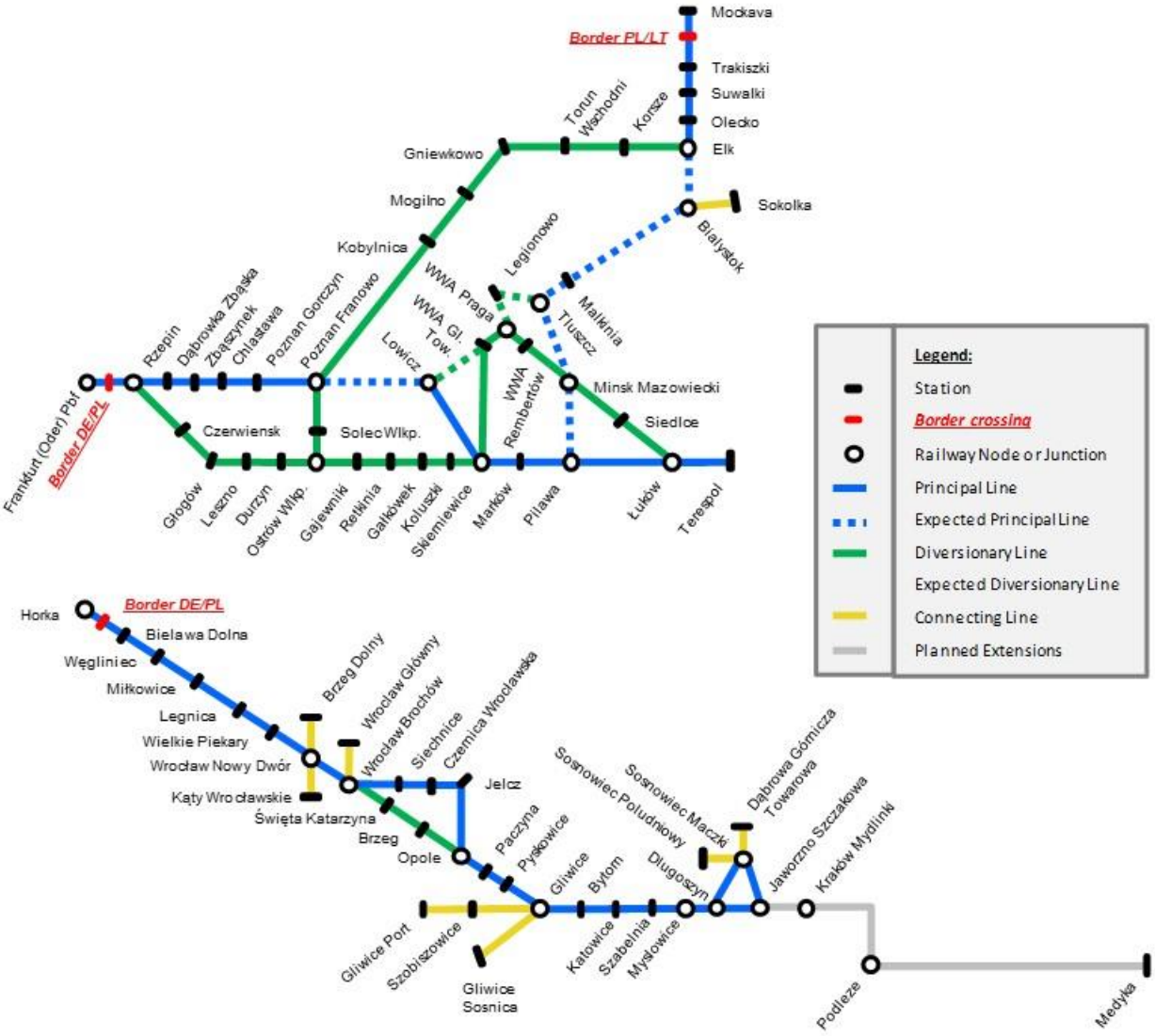
7.1. Corridor infrastructure and operational characteristics in 2018

This section provides an overview of the main characteristics of the RFC NS-B infrastructure in 2018, with a focus on the analysis of the technical maximum train length and possible related capacity constraints.

7.1.1. Railway lines

Figure 7-1 represents the alignment of the RFC NS-B in Poland.

Figure 7-1 – Corridor infrastrucure in PL in 2018



Source: Contractor based on consultation with the Infrastructure Managers

The length of the RFC NS-B in Poland is 3,431.7 km. To the purposes of the description of the characteristics of the RFC NS-B within the scope of this study the following nine lines were identified:

Table 7-1 – Infrastructure characteristics in PL (principal lines) in 2018

Line N°	Description
Line 1-PL	A **principal** line starting at the PL/DE border near Rzepin continuing via Poznan Franowo, Lowicz, Skierniewice, Pilawa and Łuków to Terespol (close to the PL/BY border). However, the section between Poznan Franowo and Lowicz is an **expected principal** line
Line 2-PL	A **principal** line starting at the PL/LT border near Trakiszki to Elk
Line 3-PL	A **principal** line starting at the PL/DE border near Bielawa Dolna continuing via Wroclaw Brochów, Jelcz, Opole, Gliwice and Długoszyn to Jaworzno Szczakowa. This line also includes the "triangular connection" starting at Długoszyn via Sosnowiec Maczki to Jaworzno Szczakowa
Line 4-PL	A **diversionary** line starting at Rzepin continuing via Ostrów Wielkopolski, Skierniewice and Warszawa before re-joining Line 1-PL in Łuków
Line 5-PL	A **diversionary** line starting at Elk continuing via Gniewkowo and Poznan Franowo before re-joining Line 4-PL in Ostrów Wielkopolski
Line 6-PL	A **diversionary** line starting at Wroclaw Brochów to Opole, via Brzeg
Line 7-PL	An **expected principal** line starting from Pilawa to Elk via Tluszcz
Line 8-PL	An **expected diversionary** line starting from Lowicz to Tluszcz via Warszawa. However, the short section between Warszawa Główna Towarowa and Warszawa Praga is already a diversionary line (part of Line 4-PL)
Line 9-PL	A **planned extension** of Line 3-PL starting at Jaworzno Szczakowa and continuing around Kraków to Medyka (close to the PL/UA border)

Source: Contractor

Further to the lines listed in the table above, the RFC NS-B lines subject of study in Poland also include several **connecting** lines along Lines 3-PL and 7-PL.

The basic characteristics of the principal lines are summarised in Table 7-2 below.

Table 7-2 – Infrastructure characteristics in PL (principal lines) in 2018

General information on **principal** lines	▪ Tracks with UIC gauge (1,435 mm);
	▪ All lines are part of the TEN-T core network;
	▪ On Lines 1-PL and 3-PL there are mainly 2 tracks per line; exceptions are on Line 3-PL:
	  ○ The section between Siechnica and Czernica and Wrocławska has 1 track;
	  ○ The section between Szabelnia and Katowice Szopienice Północne has 1 track;
	  ○ The sections of the "triangle" starting at Długoszyn via Sosnowiec Maczki and Jaworzno Szczakowa back to Długoszyn all have 1 track;
	▪ All sections of Line 2-PL have 1 track;
	▪ Lines 1-PL and 3-PL are electrified, Line 2-PL is not electrified; electrification in PL is DC 3 kV.

Source: Contractor

Focussing on long train operability with reference to the 740 meter long train standard adopted by TEN-T Regulation (EU) 1315/2013 and possibly associated capacity constraints, Table 7-3 provides an overview of the status of the RFC NS-B in Poland in 2018, referring to the above mentioned principal, expected principal and diversionary corridor lines.

Table 7-3 – Technical maximum train length for PL and related capacity constraints in 2018

Line	Technical maximum train length and related capacity constraints
1-PL	Most of this line allowed for the operation of 740 meter long trains. There are however several sections at the Poznań railway node (Poznań bypass) which allowed for the operation of 650 meter long trains only; The section from Kunowice (Border DE/PL) to Rzepin limited train length for cross-border trains from Germany to 630 m
2-PL	600 m
3-PL	On section Bielawa Dolna - Wrocław Muchobór 740 meter long trains were possible to be operated. On the remaining sections the prevailing train length was 600 m
4-PL	On part of the corridor between Gajewnik and Skierniewice as well as on sections Łowicz-Warszawa-Łuków (except on some lines in Warsaw railway node), 740 meter long trains are possible to be operated. On the remaining of the line the prevailing train length was 620 m
5-PL	640 m
6-PL	650 m
7-PL	620 m

Source: Contractor based on consultation with the Infrastructure Managers

The possibility to operate long freight trains in Poland in 2018 depended upon the level of infrastructure development achieved. Therefore, the situation varied from line to line. The sections starting in Warszawa Rembertów to Łuków (part of Line 4-PL) could be used as example for the maximum technical train length of 800 meters. On the other hand, the shortest trains on the corridor lines in Poland operated northwards from Elk to Papiernia (part of Line 4-PL) with a maximum technical train length of 597 meters.

The corridor lines in Poland faced only very limited capacity issues in 2018, most of the issues concentrated on lines with high passenger traffic (in particular the area of urban agglomerations). Other than in the Netherlands or Belgium, the mixture of traffic between freight and passenger was more balanced and less dense, and it is expected to persist after 2030, which also opens up more opportunities to apply the measures as described in Section 3.5.1. Those measures were also in use in 2018 in planning and dispatching of trains longer than the technical standards allowed in certain sidings and stations. The application nevertheless was however limited to lines of low traffic density.

In addition to the analysis of the suitability of the RFC NS-B to operate 740 meter long trains, a review of the characteristics of the corridor lines with reference to electrification was performed as part of the study. Table 7-4 provides the list of non-electrified corridor lines in 2018.

Table 7-4 – Non-electrified corridor lines in 2018

Corridor lines	Length in km	Type of line	Type of network
Ełk - Olecko	28.5	Principal	Core
Olecko - (Gw)	16.5	Principal	Core
(Gw) - Papiernia	20.7	Principal	Core
Papiernia - Suwałki	5.7	Principal	Core
Suwałki - Trakiszki	25.7	Principal	Core

Corridor lines	Length in km	Type of line	Type of network
Trakiszki - Trakiszki (Border PL/LT)	3.4	Principal	Core
Głogów - Leszno	46.8	Diversionary	Off TEN-T
Leszno - Kąkolewo	11.9	Diversionary	Off TEN-T
Kąkolewo - Osusz	56.3	Diversionary	Off TEN-T
Osusz - Durzyn	5.3	Diversionary	Off TEN-T
Ełk - Korsze	98.8	Diversionary	Comprehensive

Source: Contractor based on consultation with the Infrastructure Managers

The analysis shows that in 2018, 319.6 km of RFC NS-B lines were not electrified, comprising 100.5 km of principal corridor sections.

7.1.2. Handover stations

Table 7-5 provides the list of handover stations/marshalling yards that are located on the alignment of the RFC NS-B in Poland, and the related technical characteristics in 2018.

Table 7-5 – Summary of the technical characteristics of the handover stations/marshalling yards in CZ in 2018

Handover station	Type of network	Traction	Max train length (m)
Jaworzno Szczakowa	Core	E	>=740
Gądki	Core	E	>=740
Gliwice	Core	E	>=740
Gliwice (port)	Off TEN-T	E	<740
Kąty Wrocławskie	Off TEN-T	E	>=740
Stara Wieś k. Kutna	Core	E	>=740
Pruszków	Core	E	>=740
Sosnowiec Południowy	Core	E	<740
Warszawa Główna Towarowa	Off TEN-T	E	>=740
Łódź Olechów	Core	E	>=740
Małaszewicze Południe	Core	E	>=740
Sokółka	Comprehensive	E	>=740
Poznań Franowo	Core	E	>=740
Swarzędz	Core	E	>=740
Brzeg Dolny	Comprehensive	E	<740
Dąbrowa Górnicza Towarowa	Off TEN-T	E	>=740

Source: Contractor based on consultation with the Infrastructure Managers

According to the information collected from the concerned infrastructure manager, issues affecting technical/capacity limitations existed at the following handover stations/marshalling yards:

- Gliwice (port);
- Sosnowiec Południowy;
- Brzeg Dolny.

All the listed handover stations/marshalling yards resulted to be electrified in 2018, thus allowing electrified access of trains from the corridor lines to the related terminals.

7.1.3. Terminals

The list of the terminals and the related handover stations that are located on the alignment of the RFC NS-B in Poland is shown in Table 7-6.

Table 7-6 – List of terminals in PL in 2018

Terminal	Handover station
Terminal Brzeg Dolny (PCC Intermodal S.A.)	Brzeg Dolny
Terminal Dąbrowa Górnicza (Metrans)	Dąbrowa Górnicza Towarowa
Terminal Gądki (Metrans)	Gądki
Terminal Gliwice (PKP Cargo)	Gliwice
Terminal Gliwice (port) (PCC Intermodal S.A.)	Gliwice (port)
Euroterminal Sławków (Euroterminal Sławków)	Jaworzno Szczakowa
Terminal Kąty Wrocławskie (Shavemaker Logistics & Transport)	Kąty Wrocławskie
Terminal Łódź Olechów (Spedycja Polska Spedcont Sp. z o.o.)	Łódź Olechów
Centrum Logistyczne Małaszewicze (PKP Cargo)	Małaszewicze Południe
Terminal Poznań Franowo (PKP Cargo)	Poznań Franowo
Pruszków (Metrans)	Pruszków
Centrum Logistyczne Łososna (Centrum Logistyczne w Łososnej)	Sokółka
Terminal Sosnowiec Południowy (Spedycja Polska Spedcont Sp. z o.o.)	Sosnowiec Południowy
Terminal Kutno (PCC Intermodal S.A.)	Stara Wieś k. Kutna
Terminal Swarzędz (CLIP Logistics Sp. z.o.o.)	Swarzędz
Terminal Warszawa Główna Towarowa (Spedycja Polska Spedcont Sp. z o.o.)	Warszawa Główna Towarowa

Source: Contractor based on consultation with the Infrastructure Managers

Eight terminal operators/managers responded to the SCI survey. The characteristics of these terminals in 2018 are summarised in Table 7-7, showing that 740 meter long trains were not possible to be operated at these logistics nodes, except than at Terminal Swarzędz (CLIP Logistics Sp. z.o.o.). Furthermore, electrified accessibility was possible only at Kąty Wrocławskie (Shavemaker Logistics & Transport) and Swarzędz (CLIP Logistics Sp. z.o.o.) and only at the latter electrified accessibility at loading/unloading track(s) was allowed.

Table 7-7 – Characteristics of the terminals that responded to the SCI survey in PL in 2018

Terminal	Handover station	Electrified accessibility at terminal	Electrified accessibility at loading/unloading track(s)	Max train length (m)
Terminal Brzeg Dolny (PCC Intermodal S.A.)	Brzeg Dolny	No	No	<740
Terminal Dąbrowa Górnicza (Metrans)	Dąbrowa Górnicza Towarowa	No	No	<740
Terminal Gądki (Metrans)	Gądki	No	No	<740
Terminal Gliwice (port) (PCC Intermodal S.A.)	Gliwice (port)	No	No	<740
Terminal Kąty Wrocławskie	Kąty Wrocławskie	Yes	No	<740

Terminal	Handover station	Electrified accessibility at terminal	Electrified accessibility at loading/unloading track(s)	Max train length (m)
(Shavemaker Logistics & Transport)				
Pruszków (Metrans)	Pruszków	No	No	<740
Terminal Kutno (PCC Intermodal S.A.)	Stara Wieś k. Kutna	No	No	<740
Terminal Swarzędz (CLIP Logistics Sp. z.o.o.)	Swarzędz	Yes	Yes	>=740

Source: Contractor based on SCI survey results

The operators/infrastructure managers of other terminals did not respond to the SCI survey and accordingly the characteristics of the logistics nodes other than the ones listed above are not described in this study.

7.2. Expected corridor infrastructure and operational characteristics by 2030 and persisting gaps

7.2.1. Review of the ongoing and planned investments

An analysis of the planned investments on infrastructure upgrades with an expected finalisation date until 2030 was carried out based on publicly available sources, in particular the National Railway Program until 2023. Table 7-8 below provides the list of main infrastructure investments ongoing along the RFC NS-B in Poland.

Table 7-8 – Infrastrucure upgrades in PL

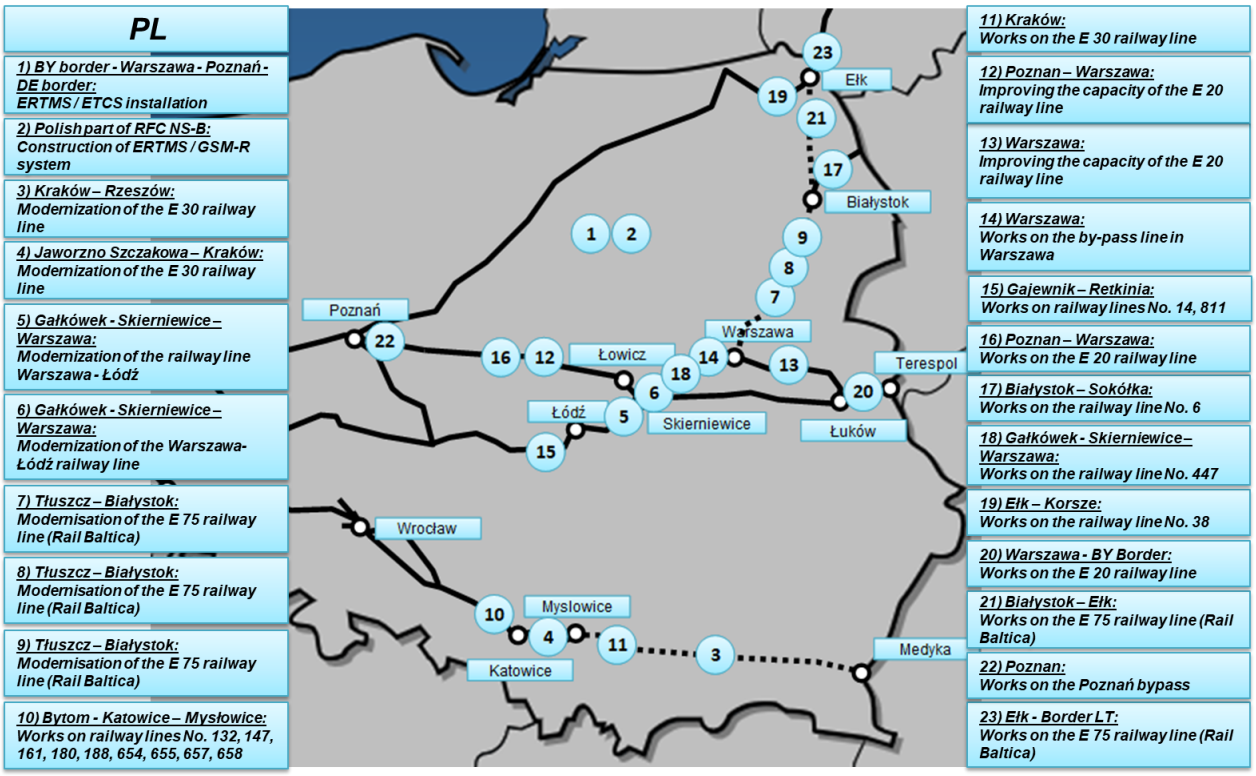
Nº	Project	Section or node involved	End date	Total costs € million (excl. VAT)
1)	ERTMS / ETCS installation on the TEN-T core network lines	BY border - Warszawa - Poznań - DE border	2023	21.8
2)	Construction of ERTMS / GSM-R system infrastructure on PKP Polskie Linie Kolejowe S.A. railway lines as part of NPW ERTMS	Horizontal	2023	53.3
3)	Modernization of the E 30 railway line, section Kraków - Rzeszów, stage III - Phase II	Kraków - Rzeszów	2020	13.6
4)	Modernization of the E 30 railway line, section Zabrze - Katowice - Kraków, stage Iib	Jaworzno Szczakowa - Kraków	2021	42.4
5)	Modernization of the railway line Warszawa - Łódź, stage II, Lot A - section Warszawa Zachodnia - Miedniewice (Skierniewice), Phase II	Gałkówek - Skierniewice - Warszawa	2021	2.7
6)	Modernization of the Warszawa-Łódź railway line, stage II, Lot C - other works, Phase II	Gałkówek - Skierniewice - Warszawa	2021	4.4

Nº	Project	Section or node involved	End date	Total costs € million (excl. VAT)
7)	Modernization of the E 75 Rail Baltica Warszawa - Białystok - border with Lithuania, stage I, section Warszawa Rembertów - Zielonka - Tłuszcz (Sadowne) Phase II	Tłuszcz - Białystok	2021	12.3
8)	Works on line E 75, section Sadowne – Czyżew and remaining works on section Warszawa Rembertów – Sadowne	Tłuszcz - Białystok	2021	24.6
9)	Works on railway line E 75, section Czyżew - Bialystok	Tłuszcz - Białystok	2023	91.6
10)	Works on railway lines No. 132, 147, 161, 180, 188, 654, 655, 657, 658, on the sections Gliwice - Bytom, Chorzów Stary - Mysłowice and Dorota - Mysłowice Brzezinka	Bytom - Katowice - Mysłowice	2022	9.0
11)	Works on the E 30 railway line on the Kraków Główny Towarowy - Rudzice section along with the extension of the agglomeration line	Kraków	2021	24.4
12)	Improving the capacity of the E 20 railway line on the Warszawa - Kutno section, stage I: Works on railway line No. 3 on the section Warszawa - border of LCS Łowicz	Poznań - Warszawa	2021	2.5
13)	Improving the capacity of the E 20 railway line on the Warszawa - Mińsk Mazowiecki section, stage I	Warszawa	2020	3.3
14)	Works on the by-pass line in Warszawa (section Warszawa Gołąbki / Warszawa Zachodnia - Warszawa Gdańska)	Warszawa	2020	5.5
15)	Works on railway lines No. 14, 811 on the section Łódź Kaliska - Zduńska Wola - Ostrów Wlkp., Stage I: Łódź Kaliska - Zduńska Wola	Gajewnik - Retkinia	2020	7.8
16)	Works on the E 20 railway line, Warszawa – Poznań section - remaining works on sub-section Sochaczew - Swarzedz	Poznań - Warszawa	2021	51.0
17)	Works on the railway line No. 6 on the section Białystok - Sokółka - Kuźnica Białostocka (state border)	Białystok - Sokółka	-	2.0
18)	Works on the Warszawa Włochy - Grodzisk Mazowiecki railway line (line no. 447)	Gałkówek - Skierniewice - Warszawa	2020	7.2
19)	Works on the railway line No. 38 on the Ełk - Korsze section with electrification	Ełk - Korsze	2023	14.7
20)	Works on the E 20 railway line, section Siedlce-Terespol, stage III - LCS Terespol	Warszawa - BY Border	2022	15.5
21)	Works on the E 75 railway line, Białystok – Suwałki – Trakiszki (state border) section, Stage I Białystok - Ełk section, Phase I	Białystok - Ełk	2022	17.2
22)	Works on the Poznań bypass	Poznań	-	21.0
23)	Works on the E 75 railway line, section Białystok - Suwałki - Trakiszki (state border), stage II section Ełk - Trakiszki (state border) - project documentation	Ełk - Border LT	-	4.3

Source: Contractor based on consultation with the Infrastructure Managers

The geographical location of the above listed projects also including a brief description of these investments, is represented in Figure 7-2 overleaf.

Figure 7-2 – Location of infrastrucure upgrades in PL



Source: Contractor

The above referred investments are part of an ambitious modernisation programme of the Polish railway lines that will significantly affect the RFC NS-B lines. Investments are either ongoing, planned and/or under definition that are expected to allow achieving the standards set in the Regulation (EU) 1315/2013 on the whole core network infrastructure belonging to the RFC NS-B by 2030, including 740 meter train length and electrification. Investments are also ongoing, planned and/or under definition that relate to the comprehensive network and lines outside the TEN-T network along the RFC NS-B; these will contribute to the improvement of the technical and capacity conditions of the corridor by 2030 with reference to both 740 meter long train operation and electrification.

Based on the review of current plans for the 2014-2020 and subsequent 2021-2027 Multiannual Financial Frameworks, lack of financing may affect the modernisation/upgrading of the corridor sections listed in Table 7-9, where the operation of 740 meter long trains may not be possible by 2030.

Table 7-9 – RFC NS-B lines at risk of non modernisation/upgrading by 2030 due to lack of financial resources

Corridor lines	Length in km	Type of line	Type of network
Jaworzno Szczakowa - Długoszyn Podg/ Sosnowiec Maczki	6.9	Principal	Off TEN-T
Krusze – Tłuszcz	4.1	Expected principal	Off TEN-T
Total	***11.00***	***Principal***	***Off TEN-T***
(Poznań Gł.) P. Starołęka Psk - Franklinów	90.4	Diversionary	Off TEN-T
Franklinów - Stary Staw	1.5	Diversionary	Off TEN-T
Kobylnica - Mogilno	63.9	Diversionary	Comprehensive
Głogów - Ostrów Wielkopolski	146.5	Diversionary	Off TEN-T
Ostrów Wielkopolski - Gajewniki	96.3	Diversionary	Off TEN-T
Legionowo - Krusze	32.7	Expected diversionary	Off TEN-T
Total	***431.3***	***Diversionary***	***Off TEN-T/ Comprehensive***
Sosnowiec Maczki - Dąbrowa Górnicza Towarowa	14.9	Connecting	Off TEN-T
Total	***14.9***	***Connecting***	***Off TEN-T***
Total	**457.2**	**Principal/ Diversionary/ Connecting**	**Off TEN-T/ Comprehensive**

Source: Contractor based on consultation with the Infrastructure Managers

Particularly regarding the diversionary lines listed in the table above, despite the maintenance activities undertaken and planned by the infrastructure manager, modernisation works of the existing tracks at the stations on these lines would still be required to ensure adequate operation of 740 meter long trains.

As part of the ongoing investment planning and implementation process for the 2014 - 2020 and 2021-2027 periods, several projects are still to be fully defined in their scope and costs (this requiring the implementation and completion of feasibility studies and works related designs). Furthermore approval of the list of investments is required at the Government level, to secure adequate funding and financing for the investments to be implemented in the 2021-2027 period.

Table 7-10 provides the list of corridor lines subject of modernisation projects, for which preparatory activities need to be undertaken/finalised to start construction works.

Table 7-10 – Corridor lines where 740 meter long trains upgrading works are under definition as part of project preparation activities/studies

Corridor lines	Length in km	Type of line	Type of network
	Core		
Kunowice (Border DE/PL) - Chlastawa	95.6	Principal	Core
Poznań Górczyn - Poznań Franowo – Swarzędz	17.1	Principal	Core
Białystok - Ełk	103.4	Principal	Core
Ełk – Suwałki - Trakiszki (Border PL/LT)	100.5	Principal	Core
Opole Groszowice - Pyskowice	56.2	Principal	Core
Pyskowice - Gliwice Łabędy	6.1	Principal	Core
Wrocław Muchobór - Wrocław Brochów	11.4	Principal	Core
Wrocław Brochów - Opole Groszowice	90.2	Principal	Core
Kraków Mydlniki - Podłęże	33.2	Expected principal	Core
Podłęże - Medyka Gr.P.	239.9	Expected principal	Core
Gliwice - Bytom - Chorzów Stary	26.7	Principal	Core
Gliwice Łabędy - Gliwice	5.3	Principal	Core
Gliwice - Gliwice Port	2.7	Connecting	Off TEN-T
Gliwice - Gliwice Sośnica	0.9	Connecting	Off TEN-T
Warszawa Gdańska - Warszawa Praga	4.0	Diversionary	Core
Warszawa Michałów - Warszawa Wschodnia Tow. - Warszawa Rembertów	5.5	Diversionary	Core
Święta Katarzyna - Brzeg - Opole Groszowice	75.2	Diversionary	Core
Total	**873.9**		
	Other lines		
Ełk - Korsze	98.8	Diversionary	Comprehensive
Rzepin - Głogów	124.1	Diversionary	Comprehensive
Toruń Wschód - Korsze	353.0	Diversionary	Comprehensive
Białystok - Sokółka	41.2	Connecting	Comprehensive
Wrocław Gądów - Brzeg Dolny	24.9	Connecting	Off TEN-T
Wrocław Gądów - Kąty Wrocławskie	20.6	Connecting	Off TEN-T
Total	***662.6***		
Total	**1,536.5**		

Source: Contractor based on consultation with the Infrastructure Managers

Notwithstanding the progresses in the preparation of the investment pipeline for the modernisation of the RFC NS-B corridor infrastructure, a general risk of possible delays in the completion of the foreseen investments by 2030 may exist, particularly for those sections not belonging to the core network. On the other hand it is not possible at present to exactly identify which projects may be affected by implementation issues, if any will materialise. Accordingly the gap analysis performed as part of this study focusses on those corridor lines listed in

Table 7-9, that are currently not covered by the scope of any ongoing/planned initiative.

7.2.2. Railway lines

Based on the expected impact of the ongoing and planned investments illustrated above, Table 7-11 provides an overview of the foreseen maximum train length operability on the RFC NS-B in Poland by 2030, referring to the principal, expected principal and diversionary corridor lines listed at Section 7.1.1.

Table 7-11 – Technical maximum train length for PL and related capacity constraints by 2030

Line	Technical maximum train length and related capacity constraints
1-PL	The planned upgrades will increase the train length up to the required standard. With reference to the first two sections, from Kunowice (Border DE/PL) to Chlastawa via Rzepin, even though no plans for an upgrade are yet in place it is assumed that by 2030 also this cross-border section will allow operating 740 m long trains
2-PL	Upgrades will increase the train length
3-PL	Improvements are expected on the line, resulting in 740 m long trains to be operated on almost entire line including section Opole Groszowice – Gliwice – Chorzów Stary as well as Chorzów Stary – Mysłowice – Szabelnia, in addition to section Bielawa Dolna - Wrocław Muchobór, where 740 m long trains were already available. On the remaining few sections restrictions to operate 740 m long trains may persist
4-PL	Some improvements are expected on section Głogów – Ostrów Wielkopolski – Gajewniki, which in addition to the part of the corridor between Gajewnik and Skierniewice as well as on sections Łowicz-Warszawa-Łuków (except on some km in Warsaw) already at standard, will result in substantial part of the line available for 740 meter long trains with approximately 120 km available for train length of 620 m
5-PL	Ełk - Korsze section will be modernized allowing operating 740 m long trains. The line will be also electrified. On the rest of the line the prevailing train length is expected to be 640 m
6-PL	The prevailing train length is 650 m, because the relevant sections are not expected to be upgraded
7-PL	The planned upgrades are expected to increase the train length up to the required standard on the entire section

Source: Contractor based on consultation with the Infrastructure Managers

Thanks to the completion of the above listed investments and additional initiatives, the TEN-T core lines belonging to the RFC NS-B are currently assumed to accommodate 740 meter long trains by 2030. An investment gap for about 457.2 km of corridor principal, diversionary and connecting lines not belonging to the core network was identified, due the unavailability at present of the financial resources required for their modernisation. Provided that the Polish network belonging to the RFC NS-B may be used to operate 740 meter long trains by means of a careful application of the operational measures described at Section 3.5.1, also used today on the low traffic density lines, these measures would however be hardly applicable to the core network and principal lines of the RFC NS-B after 2030, especially in case of increased train operations.

In line with the assumptions concerning the modernisation of the corridor railway lines, it is considered that the RFC NS-B sections will be all electrified by 2030 in Poland. Notwithstanding possible implementation risks associated with some of the projects related to the modernisation of the corridor railway lines, investments are indeed already foreseen which relate to the electrification of the corridor lines in Poland.

Table 7-13 provides the list of non-electrified corridor lines by 2030. The analysis shows that by 2030, the length of non-electrified corridor lines will reduce to 120.3 km. All the principal lines of the RFC NS-B will be electrified by this time horizon in Poland.

Table 7-12 – Non-electrified corridor lines by 2030

MS	Corridor lines	Length in km	Type of line	Type of network
PL	Głogów - Leszno	46.8	Diversionary	Off TEN-T
PL	Leszno - Kąkolewo	11.9	Diversionary	Off TEN-T
PL	Kąkolewo - Osusz	56.3	Diversionary	Off TEN-T
PL	Osusz - Durzyn	5.3	Diversionary	Off TEN-T

Source: Contractor based on consultation with the Infrastructure Managers

7.2.3. Handover stations

Table 7-13 provides the list of handover stations/marshalling yards that are located on the alignment of the RFC NS-B in Poland, and the related technical characteristics by 2030.

Table 7-13 – Summary of the technical characteristics of the handover stations/marshalling yards in PL by 2030

Handover station	Type of network	Traction	Max train length (m)
Jaworzno Szczakowa	Core	E	>=740
Gądki	Core	E	>=740
Gliwice	Core	E	>=740
Gliwice (port)	Off TEN-T	E	>=740
Kąty Wrocławskie	Off TEN-T	E	>=740
Stara Wieś k. Kutna	Core	E	>=740
Pruszków	Core	E	>=740
Sosnowiec Południowy	Core	E	>=740
Warszawa Główna Towarowa	Off TEN-T	E	>=740
Łódź Olechów	Core	E	>=740
Małaszewicze Południe	Core	E	>=740
Sokółka	Comprehensive	E	>=740
Poznań Franowo	Core	E	>=740
Swarzędz	Core	E	>=740
Brzeg Dolny	Comprehensive	E	>=740
Dąbrowa Górnicza Towarowa	Off TEN-T	E	>=740

Source: Contractor based on consultation with the Infrastructure Managers

According to the information collected from the concerned infrastructure manager, issues affecting technical/capacity limitations at the following

handover stations/marshalling yards will be removed by 2030 upon completion of the planned investments.

7.2.4. Terminals

Eight terminal operators/managers responded to the SCI survey. The characteristics of these terminals by 2030 are summarised in Table 7-14.

Table 7-14 – Characteristics of the terminals that responded to the SCI survey in PL by 2030

Terminal	Handover station	Electrified accessibility at terminal	Electrified accessibility at loading/unloading track(s)	Max train length (m)
Terminal Brzeg Dolny (PCC Intermodal S.A.)	Brzeg Dolny	Yes	No	<740
Terminal Dąbrowa Górnicza (Metrans)	Dąbrowa Górnicza Towarowa	No	No	<740
Terminal Gądki (Metrans)	Gądki	Yes	Yes	<740
Terminal Gliwice (port) (PCC Intermodal S.A.)	Gliwice (port)	Yes	No	<740
Terminal Kąty Wrocławskie (Shavemaker Logistics & Transport)	Kąty Wrocławskie	Yes	No	>=740
Pruszków (Metrans)	Pruszków	No	No	<740
Terminal Kutno (PCC Intermodal S.A.)	Stara Wieś k. Kutna	Yes	No	>=740
Terminal Swarzędz (CLIP Logistics Sp. z.o.o.)	Swarzędz	Yes	Yes	>=740

Source: Contractor based on SCI survey results

According to the information collected as part of the SCI survey, issues affecting limitations to operate 740 meter long trains at the RFC NS-B terminals in Poland will still persist by 2030 at the following logistics nodes, upon completion of the planned investments:

- Terminal Brzeg Dolny (PCC; Intermodal S.A.);
- Terminal Dąbrowa Górnicza (Metrans);
- Terminal Gądki (Metrans);
- Terminal Gliwice (port) (PCC Intermodal S.A.);
- Pruszków (Metrans).

The operators/infrastructure managers of other terminals did not respond to the SCI survey and accordingly the characteristics of the logistics nodes other than the ones listed above are not described in this study.

7.3. Technical and capacity improvement measures to further enhance operation of 740 meter long trains

7.3.1. Railway lines

According to the review of the planned investments and their impact as described in the previous section, due to unavailability of financial resources the implementation of the projects for the modernisation/upgrading of the RFC NS-B sections listed in Table 7-15 by 2030 to accommodate 740 meter long trains may be at risk.

Table 7-15 – RFC NS-B lines at risk of non modernisation/upgrading by 2030 due to lack of financial resources – Investment costs

Corridor lines	Length in km	Type of line	Type of network	Estimated Investment Costs*
Jaworzno Szczakowa - Długoszyn Podg/ Sosnowiec Maczki	6.90	Principal	Off TEN-T	PLN 700 million / € 163 million
Krusze – Tłuszcz	4.10	Expected principal	Off TEN-T	PLN 650 million / € 153 million As part of works on railway line no. 13 and 513 Krusze/Tłuszcz - Pilawa
Total	***11.00***	***Principal***	***Off TEN-T***	***PLN 1,350 million / € 314 million***
(Poznań Gł.) P. Starołęka Psk - Franklinów	90.40	Diversionary	Off TEN-T	PLN 1,170 million / € 272 million
Franklinów - Stary Staw	1.50	Diversionary	Off TEN-T	
Kobylnica - Mogilno	63.9	Diversionary	Comprehensive	PLN 950 million / € 221 million
Głogów - Ostrów Wielkopolski	146.50	Diversionary	Off TEN-T	PLN 3,136 million / € 729 million
Ostrów Wielkopolski - Gajewniki	96.30	Diversionary	Off TEN-T	PLN 1,965 million / € 457 million
Legionowo - Krusze	32.7	Expected diversionary	Off TEN-T	PLN 1,000 million / € 233 million
Total	***431.30***	***Diversionary***	***Off TEN-T/ Comprehensive***	***PLN 8,221 million / € 1,912 million***
Sosnowiec Maczki - Dąbrowa Górnicza Towarowa	14.90	Connecting	Off TEN-T	PLN 500 million / € 116 million
Total	***14.90***	***Connecting***	***Off TEN-T***	***PLN 500 million / € 116 million***
Total	**457.20**	**Principal/ Diversionary/ Connecting**	**Off TEN-T/ Comprehensive**	**PLN 10,071 million / € 2,342 million**

Source: Contractor based on consultation with the Infrastructure Managers

Actually the sections listed above will not just require upgrading with reference to the 740 meter train length parameter, but they are generally in need of undergoing reconstruction/modernisation works either along the lines and/or at the stations. Accordingly, and based on discussions with the concerned

infrastructure manager, estimates for the investments required to improve the conditions of these lines to allow the operation of 740 meter long trains on the RFC NS-B were assumed to be associated with the modernisation of the corridor infrastructure.

Based on the estimates elaborated as part of this study, a total cost of € 2.3 billion would be required to modernise the 457.2 km of RFC NS-B railway lines, currently not assumed to be reconstructed/upgraded as part of the ongoing/planned investments. Out of this total, about € 314 million would be required to modernise 11 km of principal lines (and stations located along these sections), € 1.9 billion would be needed to modernise diversionary lines and about € 116 million would be necessary to modernise the connecting lines.

As described at Section 7.2.1 above, as part of the ongoing investment planning and implementation process for the 2014 - 2020 and 2021-2027 periods, several projects are still to be fully defined in their scope and costs (this requiring the implementation and completion of feasibility studies and works related designs). Furthermore, approval of the list of investments is required at the Government level, to secure adequate funding and financing for the investments to be implemented in the 2021-2027 period. Table 7-16 provides the list of corridor lines subject of modernisation projects, for which preparatory activities need to be undertaken/finalised to start construction works. The table also includes the cost estimates for the projects related to the modernisation of these lines.

Table 7-16 – Corridor lines where 740 meter long trains upgrading works are under definition as part of project preparation activities/studies – Investment costs

Corridor lines	Length in km	Type of line	Type of network	Investment Costs*
Core				
Kunowice (Border DE/PL) - Chlastawa	95.6	Principal	Core	PLN 600 million / € 140 million
Poznań Górczyn - Poznań Franowo – Swarzędz	17.1	Principal	Core	Project planned to be launched under the National Railway Program. The necessary cost to be incurred will be defined after splitting the project. (estimated value of the whole project PLN 905 million / € 210 million)
Białystok - Ełk	103.4	Principal	Core	The project started under the National Railway Program. (other estimated costs PLN 2,411.3 million / € 561 million)
Ełk – Suwałki - Trakiszki (Border PL/LT)	100.5	Principal	Core	project undergoing feasibility study. Planned start of design work under the National Railway Program. (estimated value of the project PLN 4,800 million / € 1116 million)
Opole Groszowice - Pyskowice	56.2	Principal	Core	PLN 780 million / € 181 million

Corridor lines	Length in km	Type of line	Type of network	Investment Costs*
Pyskowice - Gliwice Łabędy	6.1	Principal	Core	PLN 300 million / € 70 million
Wrocław Muchobór - Wrocław Brochów	11.4	Principal	Core	PLN 1,800 million / € 419 million
Wrocław Brochów - Opole Groszowice	90.2	Principal	Core	PLN 1,500 million / € 349 million)
Kraków Mydlniki - Podłęże	33.2	Expected principal	Core	PLN 900 million / € 209 million
Podłęże - Medyka Gr.P.	239.9	Expected principal	Core	PLN 3,000 million / € 698 million
Gliwice - Bytom - Chorzów Stary	26.7	Principal	Core	PLN 600 million / € 140 million
Gliwice Łabędy - Gliwice	5.3	Principal	Core	PLN 900 million / € 209 million
Gliwice - Gliwice Port	2.7	Connecting	Off TEN-T	
Gliwice - Gliwice Sośnica	0.9	Connecting	Off TEN-T	
Warszawa Gdańska - Warszawa Praga	4.0	Diversionary	Core	PLN 350 million / € 81 million
Warszawa Michałów - Warszawa Wschodnia Tow. - Warszawa Rembertów	5.5	Diversionary	Core	PLN 700 million / € 163 million
Święta Katarzyna - Brzeg - Opole Groszowice	75.2	Diversionary	Core	PLN 400 million / € 93 million
Total	***873.9***			***PLN 19,946 million / € 4,639 million***
Other lines				
Ełk - Korsze	98.8	Diversionary	Comprehensive	The project started under the National Railway Program. (other estimated costs PLN 700 million / € 163 million)
Rzepin - Głogów	124.1	Diversionary	Comprehensive	PLN 1,500 million / € 349 million
Toruń Wschód - Korsze	353.0	Diversionary	Comprehensive	PLN 1,800 million /€ 419 million
Białystok - Sokółka	41.2	Connecting	Comprehensive	PLN 1,400 million / € 326 million
Wrocław Gądów - Brzeg Dolny	24.9	Connecting	Off TEN-T	PLN 900 million / € 209 million
Wrocław Gądów - Kąty Wrocławskie	20.6	Connecting	Off TEN-T	PLN 300 million / € 70 million
Total	***662.6***			***PLN 6,600 million / € 1,535 million***
Total	**1,536.5**			**PLN 26,546 million / € 6,174 million**

*Source: Contractor based on consultation with the Infrastructure Managers; Notes: *For some lines, the estimated costs include a longer section of the line*

Specified that it is not possible at present to exactly identify which projects may be affected by implementation issues, if any will materialise, the gap analysis performed as part of this study was limited to the corridor lines listed in Table 7-15. Adopting more pessimistic assumptions, the lines not belonging to the core network listed in the previous table above and expected to be modernised as part of projects currently affected by low maturity may not be ready to

accommodate 740 meter long trains by 2030. Under such a pessimistic scenario the gap analysis would also cover these initiatives and the costs required to allow operation of 740 meter long trains in Poland would increase by € 1.5 billion. Concerning the sections belonging to the core network, in line with discussions with the concerned infrastructure manager, it was deemed not appropriate to consider the non-implementation of the modernisation works on these lines by 2030 even as part of a pessimistic scenario.

7.3.2. Handover stations

Based on information received from the concerned infrastructure manager, investments are planned that will allow handover stations/marshalling yards in Poland to operate 740 meter long trains by 2030. Therefore, no further investments were identified as part of this study.

7.3.3. Terminals

Based on the results of the SCI survey, technical issues to operate 740 meter long trains will be present by 2030 at least at the following terminals: Brzeg Dolny (PCC; Intermodal S.A.), Dąbrowa Górnicza (Metrans), Gądki (Metrans), Gliwice (port) (PCC Intermodal S.A.) and Pruszków (Metrans). Due to the low responsiveness of the terminal managers/operators to the SCI survey, it was not possible to elaborate a representative estimate of the measures and costs associated with the upgrading/expansion of the existing terminal infrastructure of the RFC NS-B as part of this study.

8. THE CZECH REPUBLIC

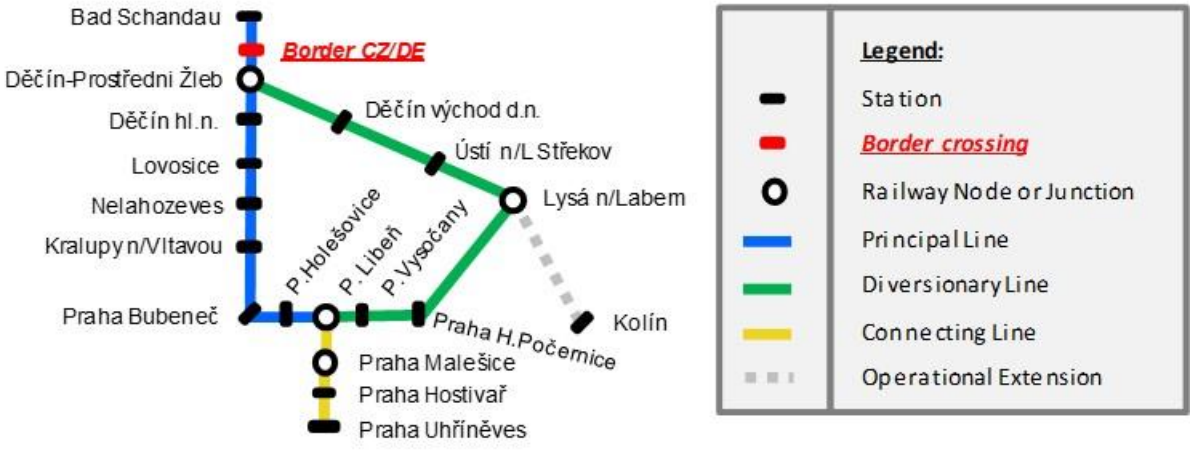
8.1. Corridor infrastructure and operational characteristics in 2018

This section provides an overview of the main characteristics of the RFC NS-B infrastructure in 2018, with a focus on the analysis of the technical maximum train length and possible related capacity constraints.

8.1.1. Railway lines

Figure 8-1 represents the alignment of the RFC NS-B in the Czech Republic.

Figure 8-1 – Corridor infrastrucure in CZ in 2018



Source: Contractor based on consultation with the Infrastructure Managers

The length of the RFC NS-B in the Czech Republic is 307.5 km. To the purposes of the description of the characteristics of the RFC NS-B within the scope of this study the following three lines were identified:

- A **principal** line starting at the CZ/DE border near Děčín Prostřední Žleb, continuing to Praha Libeň (Line 1-CZ);
- A **diversionary** line branching out of Line 1-CZ in Děčín Prostřední Žleb, continuing via Lysá n/Labem and meeting Line 1-CZ again in Praha Libeň (Line 2-CZ);
- A **connecting** line starting in Praha Uhříněves and meeting lines 1-CZ and 2-CZ also in Praha Libeň (Line 3-CZ).

Further to the above, the RFC NS-B lines subject of this study in the Czech Republic also include an **operational** extension starting in Kolín and joining Line 2-CZ in Lysá n/Labem.

The basic characteristics of the principal line are summarised in Table 8-1 below.

Table 8-1 – Infrastructure characteristics in CZ (principal lines) in 2018

General information on **principal** line	▪ Tracks with UIC gauge (1,435 mm) ▪ The line is part of the TEN-T core or comprehensive network ▪ Always 2 tracks ▪ The line is electrified; electrification in CZ is DC 3.0 kV

Source: Contractor based on consultation with the Infrastructure Managers

Focussing on long train operability with reference to the 740 meter long train standard adopted by TEN-T Regulation (EU) 1315/2013 and possibly associated capacity constraints, Table 8-2 provides an overview of the status of the RFC NS-B in the Czech Republic in 2018, referring to the above mentioned corridor lines.

Table 8-2 – Technical maximum train length for CZ and related capacity constraints in 2018

Line	Technical maximum train length and related capacity constraints
1-CZ	680 m on the two sections from Praha Bubeneč via Praha Holešovice to Praha Libeň
2-CZ	650 m on the section from Děčín východ d.n. to Děčín Prostřední Žleb; otherwise 680 m
3-CZ	680 m on the section from Praha Hostivař - Praha Uhříněves; otherwise 710 m

Source: Contractor based on consultation with the Infrastructure Managers

Based on the characteristics of the RFC NS-B lines in the Czech republic, technical limitations existed in 2018 which did not allow the operation of 740 meter long trains. In greater detail, freight trains could operate up to a length of 650 meters and on the sections starting at the CZ/DE border to Děčín hl.n. up to 700 meters.

Concerning electrification, all the corridor lines in the Czech Republic were already electrified in 2018.

8.1.2. Handover stations

Table 8-3 provides the list of handover stations/marshalling yards that are located on the alignment of the RFC NS-B in the Czech Republic, and the related technical characteristics in 2018.

Table 8-3 – Summary of the technical characteristics of the handover stations/marshalling yards in CZ in 2018

Handover station	Type of network	Traction	Max train length (m)
Praha-Uhříněves	Core	E	>=740
Lovosice	Comprehensive	E	>=740
Ústí nad Labem	Comprehensive	E	<740
Děčín	Comprehensive	E	<740
Mělník	Core	E	>=740

Source: Contractor based on consultation with the Infrastructure Managers

According to the information collected from the concerned infrastructure manager, issues affecting technical/capacity limitations existed at the following handover stations/marshalling yards:

- Ústí nad Labem;
- Děčín.

Furthermore, all the listed handover stations/marshalling yards resulted to be electrified in 2018.

8.1.3. Terminals

The list of the terminals and the related handover stations that are located on the alignment of the RFC NS-B in the Czech Republic is shown in Table 8-5.

Table 8-4 – List of terminals in CZ in 2018

Terminal	Handover station
Děčín	Děčín
Lovosice	Lovosice
Mělník	Mělník
Praha-Uhříněves	Praha-Uhříněves
Ústí nad Labem	Ústí nad Labem

Source: Contractor based on consultation with the Infrastructure Managers

None of the terminal operators/infrastructure managers responded to the SCI survey and accordingly their characteristics are not described in this study.

8.2. Expected corridor infrastructure and operational characteristics by 2030 and persisting gaps

This section summarises the main ongoing and planned investments along the RFC NS-B infrastructure for the period 2018-2030 and provides an overview of the corridor infrastructure by 2030, with a focus on the analysis of the technical maximum train length and possible related capacity constraints that would still persist at this time horizon, upon completion of these initiatives.

8.2.1. Review of the ongoing and planned investments

An analysis of the planned investments on infrastructure upgrades with an expected finalisation date until 2030 was carried out based on publicly available sources. Measures without information on their completion date have been anyway considered in the analysis.

For the Czech Republic eleven projects on infrastructure upgrades were identified, which are listed in Table 8-5 below.

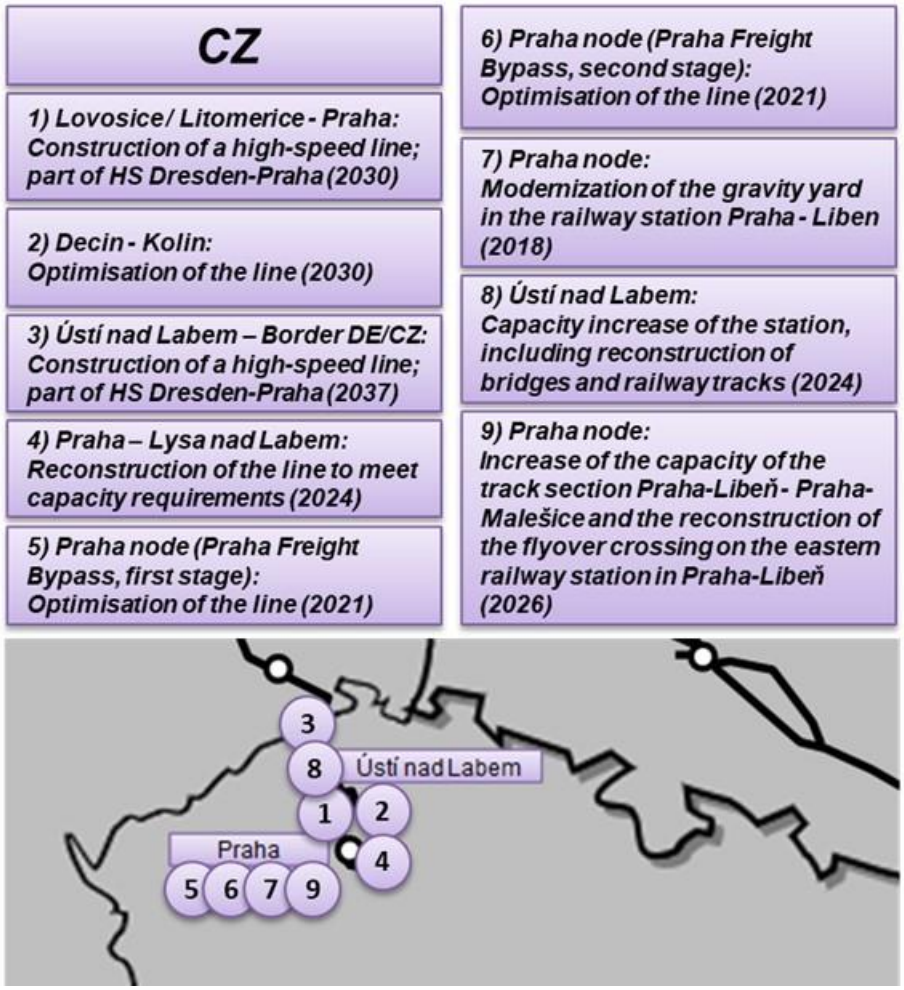
Table 8-5 – Infrastrucure upgrades in CZ

Nº	Project	Section or node involved	End date	Total costs € million (excl. VAT)
1)	HSR Dresden - Praha (part Lovosice / Litomerice - Praha)	Lovosice / Litomerice - Praha	12/2030	2,000.00
2)	Optimization of the line Děčín - Vsetaty - Lysa nad Labem – Kolín	Děčín - Kolín	12/2030	1,306.70
3)	HSR Dresden - Praha (part border - Ústí nad Labem)	Ústí nad Labem - State Border DE/CZ	12/2037	2,500.00
4)	Optimization of the line Praha Vysocany-Lysa nad Labem, 2nd construction phase (Praha Freight Bypass)	Praha <--> Lysa n. Labem	06/2024	394.50
5)	Optimization of the line Praha Hostivar - Praha hl.n., 1st part (Praha Freight Bypass)	Praha node	06/2021	44.97
6)	Optimization of the line Praha Hostivar - Praha hl.n., 2nd part - Praha Hostivar - Praha hl.n.	Praha node	10/2021	135.97
7)	Modernization of the gravity yard in the railway station Praha - Libeň including noise barriers	Praha node	11/2018	92.21
8)	Capacity increasing of Ústí nad Labem station	Ústí nad Labem	01/2024	49.48
9)	Increasing capacity of the Freight line Praha-Libeň – Praha-Malešice – Praha-Hostivař / Praha-Vršovice (Praha Freight Bypass)	Praha Node	09/2026	50.44

Source: Contractor based on consultation with the Infrastructure Managers

The geographical location of these projects is represented in the map in Figure 8-2, also including a brief description of these investments.

Figure 8-2 – Location of infrastrucure upgrades in CZ



Source: Contractor

8.2.2. Railway lines

Based on the expected impact of the ongoing and planned investments illustrated above, Table 8-6 provides an overview of the foreseen maximum train length operability on the RFC NS-B in the Czech Republic by 2030, referring to the corridor lines listed at Section 8.1.1.

Table 8-6 – Technical maximum train length for CZ and related capacity constraints by 2030

Line	Technical maximum train length and related capacity constraints
1-CZ– 3-CZ	Operation of 740 m trains on the corridor lines possible at most times of the day

Source: Contractor based on consultation with the Infrastructure Managers

The operation of 740 meter long trains in the Czech Republic will be technically possible by 2030 but will face capacity restrictions. The Ministry of Transport has conducted a study in 2015 on the expected capacity for 740 meter long trains under current plans and conditions – *Implementace nařízení Evropského parlamentu a Rady č. 1315/2013 o hlavních směrech Unie pro rozvoj*

transevropské dopravní sítě a interakce s TSI - Infrastruktura (Studie pro Ministerstvo dopravy, 2015). The scope of this study also covers all sections of RFC NS-B. Measures include deviations and specific slots for 740 meter long trains as described in Section 3.5.1.

The outcome of this study demonstrates that 1 slot per hour during daytime, and 2 per hour in the night can be allocated to 740 meter long trains, without negatively affecting the operation of other services on the overall network.

This capacity would be sufficient for the demand of 740 meter long trains as expected today for 2030 and afterwards by the Czech Authorities. Some more slots on the Praha – Lovosice (- Germany) section will furthermore be available, if and when the planned Praha – Dresden High Speed Line will open.

Unsolved capacity issues by 2030, according to 2020 projections might however arise in the Prague area, and particularly on the following lines:

- Praha Libeň - Praha Vysočany;
- Praha Vysočany - Praha H. Počernice;
- Praha H. Počernice - Lysá n/Labem.

8.2.3. Handover stations

Table 8-7 provides the list of handover stations/marshalling yards that are located on the alignment of the RFC NS-B in the Czech Republic, and the related technical characteristics by 2030.

Table 8-7 – Summary of the technical characteristics of the handover stations/marshalling yards in CZ by 2030

Handover station	Type of network	Traction	Max train length (m)
Praha-Uhříněves	Core	E	>=740
Lovosice	Comprehensive	E	>=740
Ústí nad Labem	Comprehensive	E	>=740
Děčín	Comprehensive	E	>=740
Mělník	Core	E	>=740

Source: Contractor based on consultation with the Infrastructure Managers

According to the information collected from the concerned infrastructure manager, issues affecting technical/capacity limitations at the following handover stations/marshalling yards will be removed by 2030 upon completion of the planned investments.

8.2.4. Terminals

None of the terminal operators/infrastructure managers responded to the SCI survey and accordingly their likely future characteristics are not described in this study.

8.3. Technical and capacity improvement measures to further enhance operation of 740 meter long trains

8.3.1. Railway lines

Investments are planned that will allow the technical operation of 740 meter long trains in the Czech Republic by 2030. According to analysis performed by the Czech Authorities the operational conditions of 740 meter long trains by 2030 should also be sufficient to accommodate the expected demand, specified that available slots will be limited to 1 per hour during the daytime and 2 per hour over the night. Some more restrictions may also be experienced in the Prague area.

Other than in the Netherlands or Belgium, the mixture of traffic between freight and passenger is more balanced and less dense, and will be still after 2030, which opens up more opportunities to apply the measures as described in Section 3.5.1.

A study on measures and their related costs and benefits to further enhance capacity for 740 meter long trains, also in the Prague area, is planned to be undertaken in 2020. This may result in the identification of additional investment needs and a range of potential accompanying operational measures not currently envisaged.

In consideration of the ongoing and planned initiatives no additional measures were agreed to be identified as part of this study.

8.3.2. Handover stations

Based on information received from the concerned infrastructure manager, investments are planned that will allow handover stations/marshalling yards in the Czech Republic to operate 740 meter long trains by 2030. Therefore, no further investments were identified as part of this study.

8.3.3. Terminals

None of the terminal operators/infrastructure managers responded to the SCI survey. Due to the low responsiveness of the terminal managers/operators to the SCI survey, it was not possible to elaborate a representative estimate of the measures and costs associated with the upgrading/expansion of the existing terminal infrastructure of the RFC NS-B as part of this study.

9. LITHUANIA

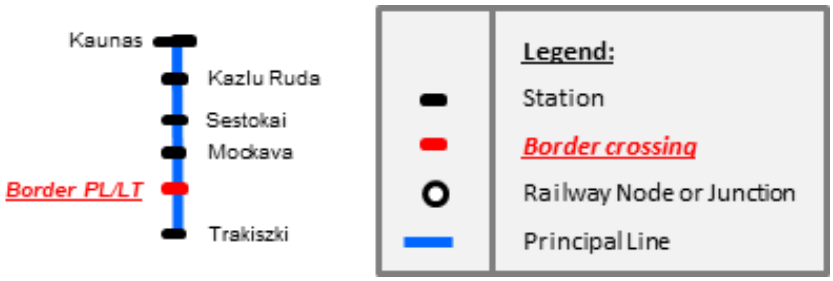
9.1. Corridor infrastructure and operational characteristics in 2018

This section provides an overview of the main characteristics of the RFC NS-B infrastructure in 2018, with a focus on the analysis of the technical maximum train length and possible related capacity constraints.

9.1.1. Railway lines

Figure 9-1 represents the alignment of the RFC NS-B in Lithuania.

Figure 9-1 – Corridor infrastrucure in LT in 2018



Source: Contractor based on consultation with the Infrastructure Managers

The length of the RFC NS-B in Lithuania is 115.5 km. To the purposes of the description of the characteristics of the RFC NS-B within the scope of this study the following line was identified:

- A **principal** line starting at the LT/PL border near Mockava, continuing north to Kaunas (Line 1-LT).

The basic characteristics of this principal line are summarised in Table 9-1 below.

Table 9-1 – Infrastructure characteristics in LT in 2018

General information on **principal** line	▪ Tracks with UIC gauge (1,435 mm) ▪ The lines are part of the TEN-T core or comprehensive network ▪ The line has one track ▪ The line is not electrified

Source: Contractor

Focussing on long train operability with reference to the 740 meter long train standard adopted by TEN-T Regulation (EU) 1315/2013 and possibly associated capacity constraints,

Table 9-2 provides an overview of the status of the RFC NS-B in Lithuania in 2018, referring to the abovementioned corridor line.

Table 9-2 – Technical maximum train length for LT and related capacity constraints in 2018

Line	Technical maximum train length and related capacity constraints
1-LT	The section with the lowest possible train length from Šeštokai to Kazlų Rūda already allowed operating 740 m long trains. If the carrier wished to form longer trains than those specified, and this request did not exceed the capacity allocated to it and, upon approval by the manager, that formation complied with the characteristics of the public railway infrastructure, the manager should have ensured the organisation and management of traffic for such trains

Source: Contractor based on consultation with the Infrastructure Managers

In Lithuania 740 meter long trains were possible to be operated without specific capacity constraints in 2018. As already mentioned above, the whole RFC NS-B was however not electrified.

9.1.2. Handover stations

Table 9-3 provides the list of handover stations/marshalling yards that are located on the alignment of the RFC NS-B in the Lithuania, and the related technical characteristics in 2018.

Table 9-3 – Summary of the technical characteristics of the handover stations/marshalling yards in LT in 2018

Handover station	Type of network	Traction	Max train length (m)
Mockava	Comprehensive	D	>=740*
Šeštokai	Comprehensive	D	>=740
Kaunas	Core	D	>=740*

*Source: Contractor based on consultation with the Infrastructure Managers; Notes: *capacity constraints limiting the operation of 740 meter long trains*

Based on the existing technical conditions of the RFC NS-B infrastructure in Lithuania, 740 meter long trains were already possible to be operated at the handover stations/marshalling yards in Lithuania. However, capacity limitations hamper the operability of 740 meter long trains at Mockava and Kaunas. In line with the characteristics of the corridor lines, the three handover stations/marshalling yards listed in Table 9-3 above were not electrified in 2018.

9.1.3. Terminals

The list of the terminals and the related handover stations that are located on the alignment of the RFC NS-B in Lithuania is shown in Table 9-4.

Table 9-4 – List of terminals in LT in 2018

Terminal	Handover station
Kaunas intermodal terminal	Kaunas
Mockava terminal	Mockava
Šeštokai railway station	Šeštokai

Source: Contractor based on consultation with the Infrastructure Managers

The three terminal operators/managers responded to the SCI survey. The characteristics of the three terminals in 2018 are summarised in Table 9-5, showing that 740 meter long trains were possible to be operated only at the Šeštokai railway station.

Table 9-5 – Characteristics of the terminals that responded to the SCI survey in LT in 2018

Terminal	Handover station	Electrified accessibility at terminal	Electrified accessibility at loading/unloading track(s)	Max train length (m)
Kaunas intermodal terminal	Kaunas	No	No	<740
Mockava terminal	Mockava	No	No	<740
Šeštokai railway station	Šeštokai	No	No	>=740

Source: Contractor based on SCI survey results

According to the information collected as part of the survey none of the terminals were electrified in 2018.

9.2. Expected corridor infrastructure and operational characteristics by 2030 and persisting gaps

This section summarises the main ongoing and planned investments along the RFC NS-B infrastructure for the period 2018-2030 and provides an overview of the corridor infrastructure by 2030, with a focus on the analysis of the technical maximum train length and possible related capacity constraints that would still persist at this time horizon, upon completion of these initiatives.

9.2.1. Review of the ongoing and planned investments

An analysis of the planned investments on infrastructure upgrades with an expected finalisation date until 2030 was carried out based on publicly available sources. Measures without information on their completion date have been anyway considered in the analysis. For Lithuania, two projects were identified that are currently at the planning stage, which are listed in Table 9-6 below.

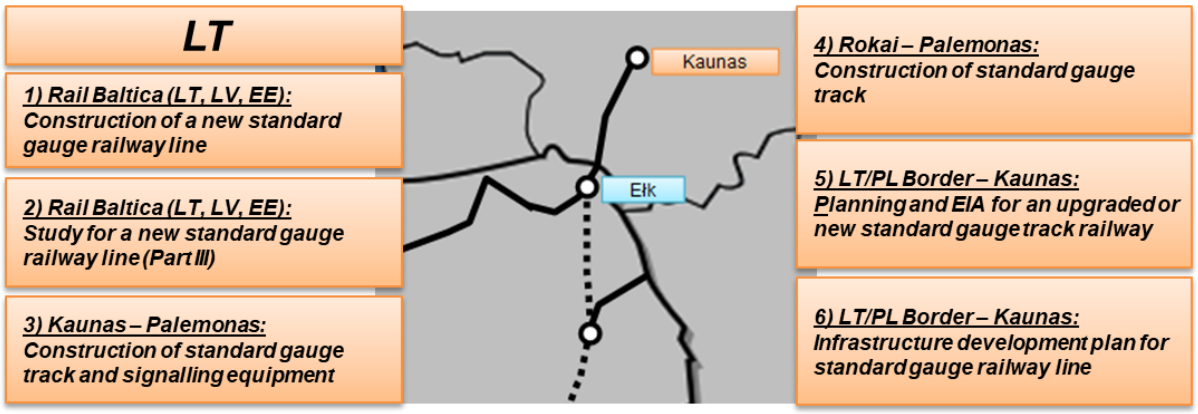
Table 9-6 – Infrastrucure upgrades in LT

N°	Project	Section or node involved	End date	Total costs € million (excl. VAT)
1)	Rail Baltica - Development of a 240 km/h design speed 1,435 mm standard gauge fully interoperable electrified railway line for mixed passenger and freight traffic	Rail Baltica section PL/LT border - Kaunas (LT) - Riga (LV) - Tallinn (EE)	12/2025	5,788.10
2)	Rail Baltica – Study 1,435 mm standard gauge railway line development in Estonia, Latvia and Lithuania (Part III)	Tallinn - Riga - Kaunas - Warszawa	12/2023	129.97

Source: Contractor

The geographical distribution of the above listed projects is represented in the map in Figure 9-2 below, including a brief description of these investments.

Figure 9-2 – Location of infrastrucure upgrades in LT



Source: Contractor

Further to the above planned initiatives some investments are also ongoing that are foreseen to be completed by 2026 to upgrade the existing infrastructure to dual-gauge lines, which are summarised in Table 9-7 below. The geographical distribution of these projects is also represented in the map in Figure 9-2 above.

Table 9-7 – Planned measure on dual-gauge lines in Lithuania

N°	Project	Section or node involved	End date	Total costs € million (excl. VAT)
3)	Construction of the 1435 mm railway track and modernization of signalling equipment from Kaunas to Palemonas	Kaunas - Palemonas	2020/2021	61.8
4)	Railway line reconstruction on section Rokai - Palemonas by building a new 1435 mm gauge double track	Rokai - Palemonas	2020-2026	n.a.
5)	Territorial planning and EIA for an upgraded or new 1435 mm double track railway line	Lithuanian/Poland state border - Kaunas	2022	n.a.
6)	European-standard railway line from Poland/Lithuania border to Kaunas infrastructure development plan	Lithuanian/Poland state border - Kaunas	2024	n.a.

Source: Contractor based on consultation with the Infrastructure Managers

9.2.2. Railway lines

Based on the expected impact of the ongoing and planned investments illustrated above, Table 9-8 provides an overview of the foreseen maximum train length operability on the RFC NS-B in Lithuania by 2030, referring to the corridor line identified at Section 9.1.1.

Table 9-8 – Technical maximum train length for LT and related capacity constraints by 2030

Line	Technical maximum train length and related capacity constraints
1-LT	The section with the lowest possible train length from Šeštokai to Kazlų Rūda already allows for 740 m long trains. If the carrier wishes to form longer trains than those specified, and this request does not exceed the capacity allocated to it and, upon approval by the manager, that formation complies with the characteristics of the public railway infrastructure, the manager shall ensure the organisation and management of traffic for such trains

Source: Contractor based on consultation with the Infrastructure Managers

In Lithuania 740 meter long trains are already possible to be operated without specific capacity constraints. The ongoing and planned investments, by means of modernisation and expansion of the existing infrastructure will further enhance operation of freight traffic between the Baltic States and central and Western Europe as well as across the European Union. Furthermore, these initiatives will contribute to the electrification of the whole RFC NS-B in this Member State.

9.2.3. Handover stations

Table 9-9 provides the list of handover stations/marshalling yards that are located on the alignment of the RFC NS-B in Lithuania and the related technical characteristics by 2030.

Table 9-9 – Summary of the technical characteristics of the handover stations/marshalling yards in LT by 2030

Handover station	Type of network	Traction	Max train length (m)
Mockava	Comprehensive	E	>=740*
Šeštokai	Comprehensive	E	>=740
Kaunas	Core	E	>=740*

*Source: Contractor based on consultation with the Infrastructure Managers; Notes: *capacity constraints limiting the operation of 740 meter long trains*

As already commented in previous sections above, 740 meter long trains were already possible to be operated at the handover stations/marshalling yards in Lithuania in 2018, however capacity limitations existed that hampered the operability of 740 meter long trains at Mockava and Kaunas. Based on the review of the scope of the planned investments these limitations are still expected to persist by 2030. The handover stations/marshalling yards along the RFC NS-B in Lithuania are expected to be electrified as part of the works related to the implementation of the Rail Baltica Global Project.

9.2.4. Terminals

Three terminal operators/managers responded to the SCI survey. The characteristics of these terminals by 2030 are summarised in Table 9-10, showing that 740 meter long trains will still be possible to be operated only at Šeštokai railway station.

Table 9-10 – Characteristics of the terminals that responded to the SCI survey in LT by 2030

Terminal	Handover station	Electrified accessibility at terminal	Electrified accessibility at loading/unloading track(s)	Max train length (m)
Kaunas intermodal terminal	Kaunas	Yes	Yes	<740
Mockava terminal	Mockava	Yes	Yes	<740
Šeštokai railway station	Šeštokai	Yes	Yes	>=740

Source: Contractor based on SCI survey

It is expected that thanks to the completion of the Rail Baltica Global Project these terminals will be also electrified by 2030.

9.3. Technical and capacity improvement measures to further enhance operation of 740 meter long trains

9.3.1. Railway lines

740 meter long trains are already possible to be operated in Lithuania. With distances and travel times in the network being very limited in the RFC NS-B, there should be no operational measures required to be implemented now and after 2030. An exception maybe the planning and dispatching of 740 meter long trains to and from Poland if trains use specific 740-m-slots in the Polish sections. As these slots require more punctuality and reliability when entering the slot, planning on the Lithuanian side may require a special focus on reliability of planned border times to Poland.

The ongoing and planned investments are expected to further enhance operations of freight trains on the RC NS-B along the corridor lines in Lithuania and in addition to the projects illustrated at Section 9.2.1 above the concerned infrastructure manager is currently preparing a project – *Unified Interlockings at Lithuanian Railways* – aimed at improving the capacity of the existing standard gauge line. These investments, totalling € 40 million, are currently foreseen to be implemented between 2030 – 2036, and in line with discussions with the concerned infrastructure manager, they have been included in the costs of the additional measures required to further increase the capacity of the existing RFC NS-B infrastructure in Lithuania.

9.3.2. Handover stations

740 meter long trains are already possible to be operated at the RFC NS-B handover stations/marshalling yards in Lithuania. Nonetheless capacity constraints exist at Kaunas and Mockava, where extension of the existing tracks is required.

Given that investments at these handover stations/marshalling yards are not planned, costs have been estimated for the works required to upgrade these corridor infrastructure, which are provided in Table 9-11. The total estimated costs associated with the works at these handover stations/marshalling yards amount to about € 4.2 million.

Table 9-11 – Costs of infrastructure measures in handover stations in LT (€)

	Kaunas	Mockava
Tracks		
New track	1,333,750	1,393,750
Switches		
New switches	-	-
Moving of switches to other locations	100,000	100,000
Electrification		
Electrification	277,420	289,900
Signalling		
ETCS system	314,765	328,925
Interlocking/ETCS adjustments	9,400	9,400
Total cost per handover station	**2,035,335**	**2,121,975**

Source: Contractor

9.3.3. Terminals

Based on the results of the SCI survey, technical issues to operate 740 meter long trains will be present by 2030 at Kaunas intermodal and Mockava terminals. At Kaunas intermodal terminal it will be necessary to construct a new track and extend one of the existing tracks, whereas at Mockava two tracks will needed to be extended. The total cost for the implementation of this infrastructure will amount to about € 3 million.

10. CONCLUDING CONSIDERATIONS

10.1. Summary of the characteristics of the RFC NS-B in 2018 and by 2030

Table 10-1 summarises the composition of the RFC NS-B in 2018 with reference to the type of line and type of network. Data are provided for the whole corridor and the corridor lines within the individual Member States. Percentages are also indicated referring to the entire length of the RFC NS-B in 2018, i.e. 7,330 km.

Table 10-1 – RFC NS-B composition by type of line and network in 2018

Member State	Total corridor length		Type of line					
			Principal / Expected principal		Diversionary / Expected diversionary		Connecting	
	km	%	km	%	km	%	km	%
NL	634.8	8.7%	367.4	5.0%	96.5	1.3%	170.8	2.3%
BE	332.2	4.5%	235.7	3.2%	15.8	0.2%	80.7	1.1%
DE	2,508.3	34.2%	1,921.0	26.2%	386.3	5.3%	201.0	2.7%
PL	3,431.7	46.8%	1,778.8	24.3%	1,524.0	20.8%	128.9	1.8%
CZ	307.5	4.2%	142.6	1.9%	152.4	2.1%	12.6	0.2%
LT	115.5	1.6%	115.5	1.6%	0.0	0.0%	0.0	0.0%
Total	**7,330.0**	**100.0%**	**4,561.0**	**62.2%**	**2,175.0**	**29.7%**	**594.0**	**8.1%**
Member State	**Total corridor length**		**Type of network**					
			Core		**Comprehensive**		**Off TEN-T**	
	km	**%**	**km**	**%**	**km**	**%**	**km**	**%**
NL	634.8	8.7%	393.7	5.4%	241.0	3.3%	0.0	0.0%
BE	332.2	4.5%	218.7	3.0%	73.7	1.0%	39.8	0.5%
DE	2,508.3	34.2%	1,705.9	23.3%	557.4	7.6%	245.0	3.3%
PL	3,431.7	46.8%	2,172.0	29.6%	762.7	10.4%	497.0	6.8%
CZ	307.5	4.2%	173.0	2.4%	134.5	1.8%	0.0	0.0%
LT	115.5	1.6%	36.8	0.5%	78.8	1.1%	0.0	0.0%
Total	**7,330.0**	**100.0%**	**4,700.1**	**64.1%**	**1,848.1**	**25.2%**	**781.8**	**10.7%**

Source: Contractor based on consultation with the Infrastructure Managers

Table 10-2 below provides a matrix of the composition of the RFC NS-B with reference to the type of line and network, for the entire corridor.

Table 10-2 – Characterisation of the RFC NS-B by type of line and network in 2018

Type of line	Principal / Expected principal		Diversionary / Expected diversionary		Connecting		Total	
Type of network	**Km**	**%**	**km**	**%**	**km**	**%**	**km**	**%**
Core	3,675.2	50.1%	793.2	10.8%	231.7	3.2%	**4,700.1**	**64.1%**
Comprehensive	676.0	9.2%	935.3	12.8%	236.8	3.2%	**1,848.1**	**25.2%**
Off TEN-T	209.8	2.9%	446.4	6.1%	125.5	1.7%	**781.8**	**10.7%**
Total	**4,561.0**	**62.2%**	**2,175.0**	**29.7%**	**594.0**	**8.1%**	**7,330.0**	**100.0%**

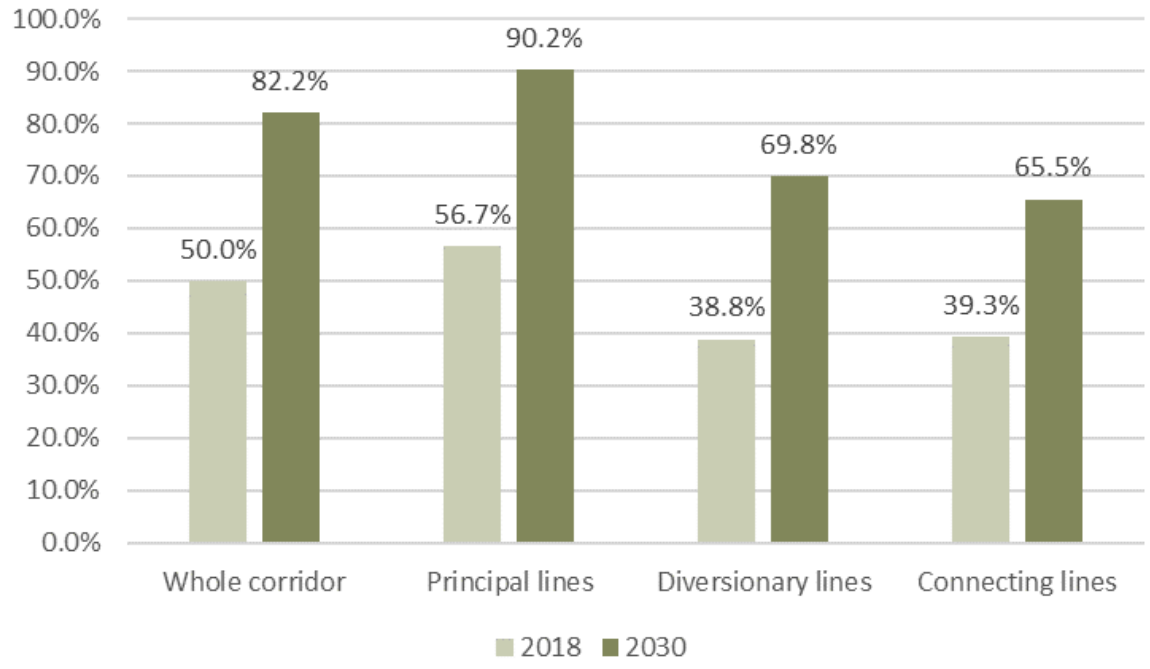
Source: Contractor based on consultation with the Infrastructure Managers

The RFC NS-B in 2018 primarily consisted of principal lines (62.2%) and core network lines (64.1%): 3,675.2 km of corridor lines, corresponding to half of the whole RFC NS-B, was made up of principal/expected principal lines belonging to

the TEN-T core network. As part of the comprehensive network lines, the diversionary ones covered the highest share (12.8%), followed by principal lines (9.2%) and connecting lines (3.2%). The same applies to the lines not belonging to the TEN-T network, as the share of diversionary lines (6.1%) was higher than the one of the principal lines (2.9%) and connecting lines (1.7%). Overall, the diversionary lines represented a relevant share of the corridor (29.7%), most of which (12.8%) belonging to the TEN-T comprehensive network. The connecting lines of the RFC NS-B were equally distributed between the core and the comprehensive networks (3.2% each), whilst only 1.7% of these lines did not belong to the TEN-T network. Referring to the corridor lines in the Member States involved in the study it is noticeable that over 80% of the RFC NS-B crossed Germany and Poland. The corridor lines in Poland in particular, represented over 45% of the total RFC NS-B length, most of them belonging to the core network.

Figure 10-1 and Figure 10-2 summarise the characteristics of the RFC NS-B railway lines in 2018 and by 2030 with reference to the possibility to operate 740 meter long trains. Details are provided for the whole corridor, for the types of lines and for the type of network. The characteristics of the corridor by 2030 reflect the impact of the ongoing and planned investments, but exclude the effects of the additional measures identified as part of this study.

Figure 10-1 – 740 meter long trains operability in 2018 and by 2030 by type of line

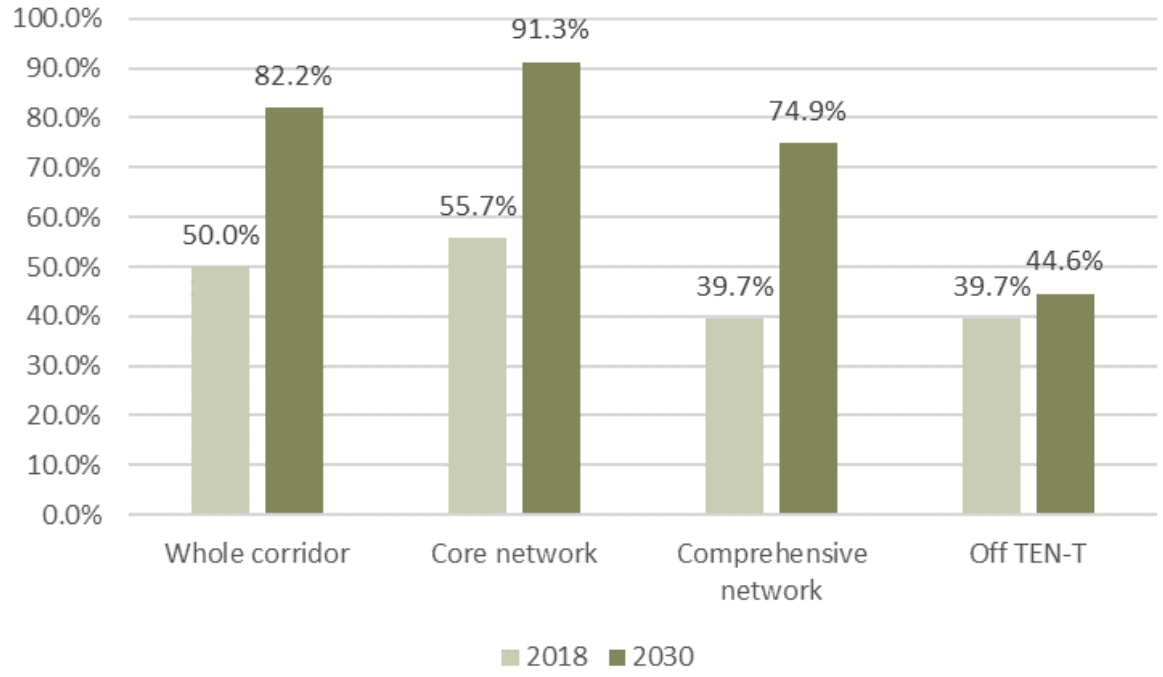


Source: Contractor based on consultation with the Infrastructure Managers

The analysis shows that compared to the situation in 2018 when technical and capacity constraints existed on 50% of the corridor lines, issues will reduce by

2030 to less than 20% of the corridor sections. Focussing on the type of lines, the ongoing and planned investments are expected to contribute significantly to the improvement of the technical and operational conditions of the corridor, with 90.2% of the principal lines (corresponding to 62.2% of the RFC NS-B length) expected to accommodate 740 meter long trains by 2030, without capacity constraints. The same condition will characterise nearly 70% of the diversionary sections and about 65% of the connecting lines of the RFC NS-B.

Figure 10-2 – 740 meter long trains operability in 2018 and by 2030 by type of network



Source: Contractor based on consultation with the Infrastructure Managers

The review of the characteristics of the corridor in 2018 and by 2030 with reference to the type of network shows that significant improvements will be achieved on the core network lines. On over 90% of this type of network (corresponding to 64.1% of the RFC NS-B length) it will be possible to operate 740 meter long trains without capacity constraints. The same condition will apply to nearly 75% of the comprehensive network and to about 45% of the lines not belonging to the TEN-T.

Table 10-3 overleaf provides detailed figures on the corridor extent affected by technical or capacity limitations in 2018 and by 2030. Overall the issues limiting or impeding the operation of 740 meter long trains will decrease meaningfully, with the total affected corridor length dropping from 3,668.6 km (50.0%) to 1,305.8 km (17.8%).

Table 10-3 – Corridor extent affected by technical/capacity constraints to operate 740 m long trains in 2018 and by 2030

	2018		2030	
	km	%	km	%
Corridor lines affected by technical constraints	2,707.4	36.9%	513.5	7.0%
Corridor lines affected by capacity constraints	961.2	13.1%	792.3	10.8%
Corridor lines affected by technical or capacity constraints	**3,668.6**	**50.0%**	**1,305.8**	**17.8%**

Source: Contractor based on consultation with the Infrastructure Managers

Referring to the RFC NS-B Member States, Table 10-4 provides an indication on the presence of technical and capacity constraints to operate 740 meter long trains on the RFC NS-B in 2018 and by 2030.

Table 10-4 – Technical/capacity constraints to operate 740 m long trains on the RFC NS-B in 2018 and by 2030 by Member State

Member State	Technical constraints		Capacity constraints	
	2018	2030	2018	2030
Netherlands	x	x	x	x
Belgium			x	x
Germany			x	
Poland	x	x		
Czech Republic	x			x
Lithuania				

Source: Contractor based on consultation with the Infrastructure Managers

According to the analysis, technical limitations existed in 2018 on 37% of the corridor lines in the Netherlands as well as on all corridor lines in the Czech Republic and in most of the corridor lines in Poland. Capacity restrictions applied to 13% of the corridor lines in the Netherlands, Belgium and Germany. Focussing on the operation of 740 meter long trains across at least one BCP, the most severe technical/capacity issues existed in the Netherlands, affecting the interconnection between this country and the other countries along the RFC NS-B, via Germany; in the Czech Republic, hindering the interconnection between this country and the other countries on the corridor; in Poland, hampering the interconnection between this country and the other countries along the RFC NS-B, as well as between Lithuania and the other countries on the RFC NS-B. Limitations in Poland also affected the operation of 740 meter long trains between the RFC NS-B countries and the border stations of Terespol and Medyka, towards Belarus and Ukraine, along the itineraries of the Eurasia Land Bridge.

Based on the review of the planned investments and analysis of their impact on the possibility to operate 740 meter long trains along the RFC NS-B by 2030, it is envisaged that technical restrictions will reduce to 7% of the total corridor length in the Netherlands and Poland, whereas capacity and time limitations will

be present on 11% of the RFC NS-B in the Netherlands, Belgium and in the Czech Republic. Referring to the operation of 740 meter long trains across at least one BCP, issues will still be present in the Netherlands, affecting the interconnection between this country and the other countries on the RFC NS-B, via Germany; and in Poland, hampering the interconnection between Lithuania and the other countries along the RFC NS-B, as well as between the RFC NS-B and Ukraine. In greater detail:

- The operation of 740 meter long trains by 2030 is generally expected to be possible along the corridor principal and core network corridor lines between the Netherlands, Belgium, Germany, the Czech Republic and most destinations in Poland, as well as between these countries and Belarus via Terespol; and between Tłuszcz/Sokolka in Poland and Kaunas in Lithuania via Bialystok/Ełk, as well as between Mogilno in Poland and Kaunas in Lithuania, via Ełk. Restrictions will however be present, which are described below:
    - In the Netherlands limited paths will be available in the daytime between Amersfoort and Bad Bentheim, as well as between Amersfoort, Meteren and Roosendaal. Issues will also exist on waiting tracks on the diversionary line between Kijfhoek and Weesp. Train length will furthermore be restricted for trains stopping at the intermodal shunting yards Botlek (Bot), Pernis (Ps), Waalhaven Zuid (Whz). Possibility to operate 740 meter long trains along the "Iron Rhine" will finally depend on the implementation of the "Iron Rhine Project";
    - At the BCPs between the Netherlands and Germany operational limitations on the Dutch side will be in place that will allow the transit of 740 meter long trains only based on ad hoc requests;
    - In Belgium the operation of 740 meter long trains will be generally possible, but only outside peak hours;
    - In Germany the operation of 740 meter long trains will also be generally feasible, with possible temporary limitations due to timetabling and operational specific circumstances;
    - In the Czech Republic capacity issues may be experienced, particularly in the daytime;
- The operation of 740 meter long trains along the RFC NS-B to/from Lithuania would be affected by persisting technical constraints on the following segments of the expected principal, diversionary/expected diversionary lines interconnecting the Polish with the Lithuanian networks along the RFC NS-B routes: Krusze - Tłuszcz (4.1 km long, expected principal/Off TEN-T line), Legionowo - Krusze (32.7 km long, expected diversionary/ Off TEN-T line) and Kobylnica - Mogilno (63.9 km long, diversionary/ TEN-T comprehensive line);
- Operating 740 meter long trains to/from Ukraine via Medyka towards most corridor destinations might be also affected by persisting technical problems at the short sections belonging to the "triangular connection"

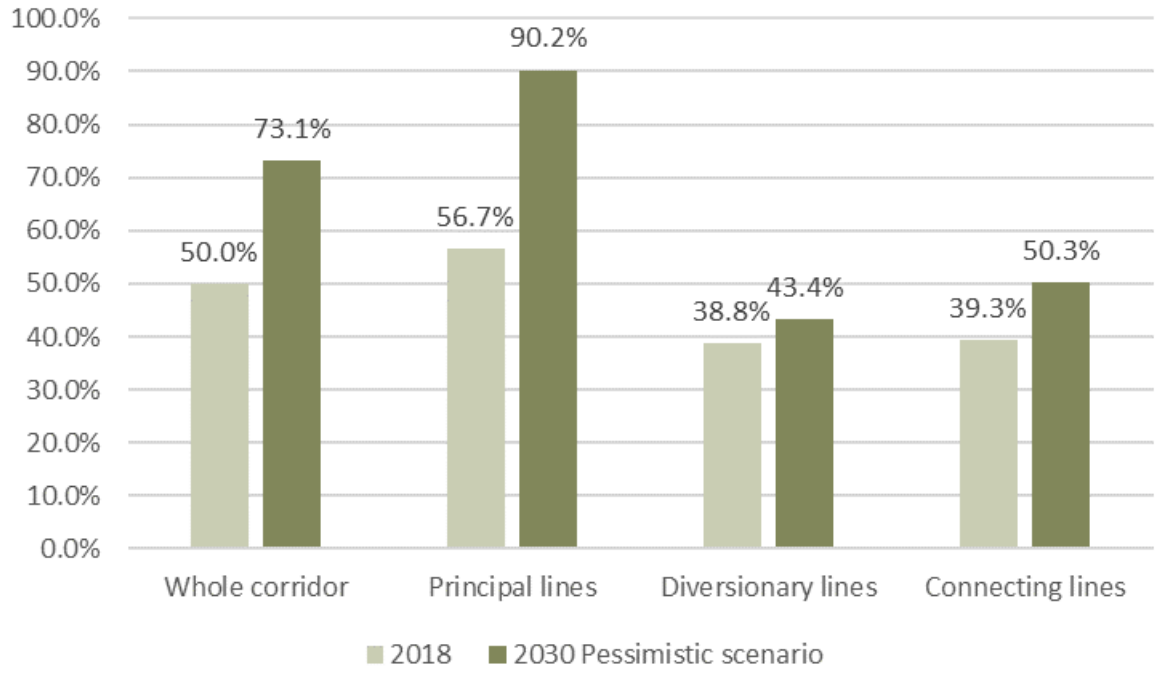
starting at Długoszyn via Sosnowiec Maczki to Jaworzno Szczakowa (6.9 km long, principal/Off TEN-T line – including the very short 1.9 km long segment Jaworzno Szczakowa - Długoszyn), close to the border between Poland and Ukraine;

- The operation of 740 meter long trains along national O/Ds of the RFC NS-B Member States will be generally possible at the same conditions described above and affecting international long distance trains (except from those problems applying only to trains crossing the BCPs between the Netherlands and Germany). In addition to the above described conditions, problems are expected to persist in Poland on the diversionary/Off TEN-T lines between (Poznań Gł.) P. Starołęka Psk - Franklinów - Stary Staw (91.8 km) along the itinerary Poznań - Stary Staw and between Głogów - Ostrów Wielkopolski - Gajewniki (242.8 km) along the itinerary Rzepin - Skierniewice and between; and the connecting/Off TEN-T line Sosnowiec Maczki - Dąbrowa Górnicza Towarowa (14.9 km).

It is worth to notice that as more specifically commented in Chapter 8, reporting on the study analysis on the RFC NS-B infrastructure in Poland, several projects related to the modernisation of the corridor sections in this Member State are still to be fully defined in terms of scope, project costs and/or implementation schedule. Furthermore, some of them are in the reserve list of the national railway plan and accordingly state funding is not secured for these initiatives. These maturity issues are apparently affecting about 700 km of corridor lines in Poland, half of these related to the core network, which is in any case assumed to be fully modernised and upgraded to the standards required in the Regulation (EU) 1315/2013 by 2030. For the initiatives currently affected by maturity issues a general risk of possible delays in their completion by 2030 may exist, particularly for those relating to the modernisation of the lines not belonging to the core network.

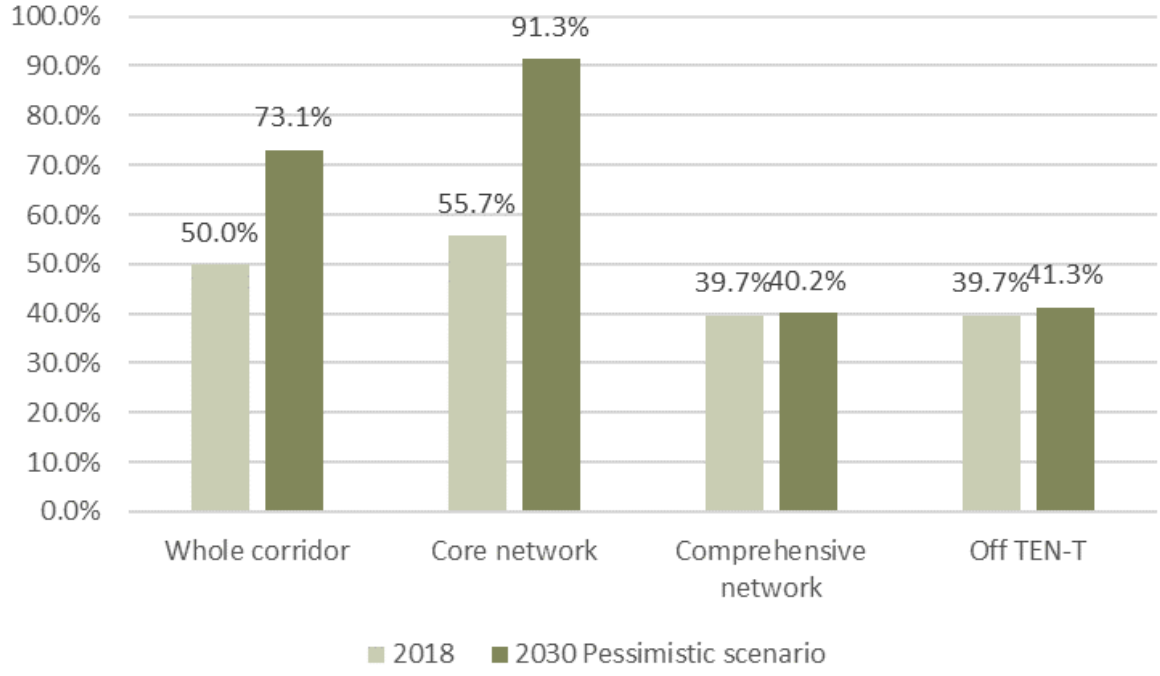
An exercise was thus performed as part of the study aimed at assessing the impact of the possible non implementation and/or delay in the completion of those projects affected by maturity issues at present and not related to the modernisation of the core network lines (i.e. about 352 km of diversionary lines and a short segment of an expected principal line). The results of the simulation of such a pessimistic scenario are illustrated in Figure 10-3 and Figure 10-4. The analysis shows that the non implementation of these projects or the delay in their completion by 2030 would particularly impact on the operability of 740 meter long trains along the diversionary and connecting lines not belonging to the core network.

Figure 10-3 – 740 meter long trains operability in 2018 and by 2030 by type of line – pessimistic scenario



Source: Contractor based on consultation with the Infrastructure Managers

Figure 10-4 – 740 meter long trains operability in 2018 and by 2030 by type of network – pessimistic scenario



Source: Contractor based on consultation with the Infrastructure Managers

Whereas this exercise demonstrates the relevance of maximising efforts towards the elaboration of a mature pipeline of projects (also applicable to the core network lines not currently subject of defined initiatives), the gap analysis performed as part of this study for the corridor lines refers to the 2030 scenario summarised in Figure 10-1 and Figure 10-2 above, excluding for Poland only those corridor lines that are currently not covered by the scope of any ongoing/planned investments. This approach was deemed more appropriate based on the consideration that it is not possible at present to exactly identify for which projects implementation issues will effectively materialise.

Concerning handover stations/marshalling yards, in 2018, 740 meter long trains could not be operated at 33 out of the 89 handover stations/marshalling yards/waiting-buffer locations subject of study. This figure will reduce to 27 by 2030 thanks to the completion of the ongoing and planned investments.

Further to the analysis of the train length interoperability standard, the study also assessed the current status and future outlook of the corridor infrastructure with reference to the electrification parameter. The analysis shows that in 2018, 635.3 km of RFC NS-B lines in Belgium, Germany, Poland and Lithuania were not electrified, comprising 317.6 km of principal and expected principal corridor sections and in particular all the corridor lines in Lithuania. By 2030, the length of non-electrified corridor lines will reduce to 218.9 km, upon completion of the ongoing and planned investments. More importantly all the principal lines of the RFC NS-B will be electrified. 13 out of the 89 investigated handover stations/marshalling yards/waiting-buffer locations were not electrified in 2018 in the Netherlands, Belgium, Germany and Lithuania. This figure will reduce to 9 by 2030 in the Netherlands, Belgium and Germany. The assessment of the RFC NS-B characteristics with reference to electrification was however limited to the description of the corridor infrastructure in 2018 and by 2030 and no measures and costs were identified and estimated to address gaps specifically related to this parameter.

10.2. Improvement measures

10.2.1. Gap analysis and additional improvement measures

The review of the ongoing and planned initiatives shows that due consideration is given by the concerned infrastructure managers to the solution of the obstacles hampering the smooth and seamless operation of 740 meter long trains along the RFC NS-B. In this regard investments are ongoing and planned in the RFC NS-B Member States and studies have been recently completed or are currently under completion/consideration to solve existing and future technical and capacity issues. Nonetheless, as also depicted in the above described corridor outlook by 2030, problems are envisaged to persist by this time horizon upon completion of the ongoing and planned investments. In order to solve these gaps a set of initiatives/measures was discussed with the concerned infrastructure managers as part of the study. For each RFC NS-B

Member State, Table 10-5 provides a summary of the gap analysis and of the initiatives/measures identified as part of the study.

Table 10-5 – Summary of gap analysis and identified initiatives/measures to further improve the operation of 740 meter long trains along the RFC NS-B

Member State	Persisting gaps by 2030 and additional identified initiatives/measures
NL	Capacity constraints affecting the operation of 740 meter long trains along the RFC NS-B in the Netherlands are expected to be present by 2030, which will not be solved by the ongoing and planned investments. In line with analyses recently completed by the concerned infrastructure manager, works were identified as part of this study that will be required to accommodate 740 meter long trains and achieve operational flexibility at the following handover stations/marshalling yards/waiting-buffer locations: Botlek, Pernis, Amersfoort, Almelo, Maasvlakte Oost, Europoort, Waalhaven Zuid, Kijfhoek, Crailoo, Rotterdam Noord Goederen, Rosendaal, Tilburg Goederen and 's-Hertogenbosch. In greater detail investments will be required to accommodate 740 meter long trains at Maasvlakte Oost, Botlek, Pernis, Waalhaven Zuid, Kijfhoek, Amersfoort, Rotterdam Noord Goederen, Almelo, whereas solutions to improve stability/punctuality will be needed at Crailoo, 's Hertogenbosch and Tilburg Goederen. These interventions are deemed of priority in solving current and future capacity issues along the RFC NS-B lines, also considering the results of the recently completed Transport Market Study, showing that the Netherlands is involved in all the most relevant trade/transport as well as train traffic O/D relations along the RFC NS-B. Notwithstanding the implementation of the additional investments identified in the study by the Dutch infrastructure manager, technical constraints may be present after 2030 at some Rotterdam Harbour handover stations and at the Amersfoort handover station. Capacity and time limitations may also exist at the Rotterdam Harbour handover stations and along the Kijfhoek - Weesp and Roosendaal - Bad Bentheim routes
BE	In addition to the ongoing and planned investments, studies for the further improvement of the technical and operational conditions of 740 meter long trains in Belgium are under elaboration, that are foreseen for completion during 2020. Accordingly, investments have not been identified as part of this study for the corridor lines. On the other hand gaps may still persist by 2030 concerning the following handover stations/marshalling yards, where 740 meter long trains are not possible to be operated: Antwerpen Haven - Bundel B3, Antwerpen Haven - Bundel Oorderen, Antwerpen Haven - Bundel Angola. Given that the ongoing and planned projects and analyses do not seem to include in their scope the upgrading of this infrastructure, such additional measures were proposed in this study and their costs were estimated
DE	Further to the ongoing and planned investments foreseen in the Bundesverkehrswegeplan (Federal Transport Infrastructure Plan), additional initiatives will be considered to ensure adequate operational conditions of 740 meter long trains in Germany. Accordingly investments have not been identified as part of this study for the corridor lines. Gaps appear however to exist concerning the following handover stations/marshalling yards, were 740 meter long trains are not possible to be operated: Duisburg Ruhrort Hafen, Duisburg Hafen, Duisburg Hochfeld Süd, Braunschweig, Magdeburg, Berlin Hamburger und Lehrter Bf, Frankfurt (Oder) Pbf. As no investments are currently foreseen for the upgrading of this infrastructure, solutions were proposed in this study for these handover stations/marshalling yards, to allow the operation of 740 meter long trains by 2030. Costs were accordingly estimated for these measures
PL	An ambitious modernisation programme of the Polish railway lines is currently ongoing that will significantly improve the RFC NS-B lines.

Member State	Persisting gaps by 2030 and additional identified initiatives/measures
	Investments are either ongoing, planned and/or under definition that are expected to allow achieving the standards set in the Regulation (EU) 1315/2013 on the whole core network infrastructure belonging to the RFC NS-B by 2030, including 740 meter train length. Investments are also ongoing, planned and/or under definition that relate to the comprehensive network and lines outside the TEN-T network along the RFC NS-B. These measures will contribute to the improvement of the technical and capacity conditions of the corridor by 2030, with significant benefits also with reference to the operation of 740 meter long trains. Based on the review of the current plans, it is envisaged that additional investments would be needed by 2030 for the modernisation/upgrading of about 457.2 km of corridor lines, where technical limitations may still persist to operate 740 meter long trains. These include 11.0 km of principal lines, 431.3 km of diversionary lines and 14.9 km of connecting lines. In consideration of the need to modernise these sections and the stations located therein further to upgrading them to 740 meter train length operability, solutions were identified in this study that concern the modernisation of these lines. Costs were estimated accordingly. Among the additional measures identified in this study, the ones relating to the modernisation of the following sections are of particular relevance to solve 740 meter long train operational bottlenecks towards Lithuania and Ukraine: Krusze - Tłuszcz (4.1 km long, expected principal/Off TEN-T line), Legionowo - Krusze (32.7 km long, expected diversionary/ Off TEN-T line) and Kobylnica - Mogilno (63.9 km long, diversionary/ TEN-T comprehensive line), as well as the "triangular connection" starting at Długoszyn via Sosnowiec Maczki to Jaworzno Szczakowa (6.9 km long, principal/Off TEN-T line – including the 1.9 km long section Jaworzno Szczakowa - Długoszyn). The modernisation of the 14.9 km long connecting line Sosnowiec Maczki - Dąbrowa Górnicza Towarowa might be also relevant to provide adequate connection to the intermodal terminals located along this line. No measures were identified in this study relating to the improvement of the parameters of handover stations/marshalling yards in Poland as this infrastructure will be upgraded/modernised by 2030 as part of the planned investments
CZ	In addition to the ongoing and planned investments, a study is planned to be conducted in 2020 to identify measures to further enhance the operational capacity of 740 meter long trains particularly in the Prague area. Depending on the cost/benefit ratio of the identified solutions, this study may identify additional investment needs and a range of potential accompanying operational measures not currently envisaged for implementation. Accordingly investments were not proposed as part of this analysis for the corridor lines in the Czech Republic. No gaps were identified which relate to handover stations/marshalling yards
LT	The ongoing and planned investments expected to be completed before 2030 are foreseen to further enhance operations of freight trains on the RFC NS-B along the corridor lines in Lithuania. Moreover the concerned infrastructure manager is currently preparing a project – *Unified Interlockings at Lithuanian Railways* – regarding improvements on the existing standard gauge line. Foreseen to be implemented between 2030-2036, this initiative and the related costs are considered in this study to further increase the capacity of the existing RFC NS-B infrastructure in Lithuania. Measures to solve capacity limitations at the existing handover stations/marshalling yards and terminals at Kaunas and Mockava were also identified as part of the study, and the related costs estimated

Source: Contractor based on consultation with the Infrastructure Managers

Table 10-6 below summarises the cost estimates for the additional measures identified in the previous table to further enhance the operation of 740 meter long trains along the RFC NS-B by 2030.

Table 10-6 – Total additional investment needed on RFC NS-B € million

Member State	Additional investments
NL	**€ 355-660 million** to accommodate 740 meter long trains and improve capacity at handover stations/marshalling yards/waiting-buffer locations. Such investments will also improve operability of 740 meter long trains on the corridor lines
BE	**€ 1 million** to accommodate 740 meter long trains at handover stations; Studies are ongoing by the concerned IM that may result in the identification of capacity improvement measures on the corridor lines; additional investments are not official yet
DE	**€ 13 million** to accommodate 740 meter long trains at handover stations
PL	**€ 2,342 million** to modernise 457.2 km of corridor railway lines and the handover stations located therein, which will allow accommodating 740 meter long trains
CZ	Studies are under consideration by the concerned IM that may result in the identification of capacity improvement measures on the corridor lines; additional investments are not official yet
LT	**€ 44 million** to improve capacity of the existing corridor lines and handover stations
RFC NS-B	**€ 2,755-3,060 million** to accommodate 740 meter long trains and improve capacity at handover stations/marshalling yards/waiting-buffer locations in NL, BE, DE, PL and LT. In BE and CZ studies are also ongoing/under consideration by the concerned IMs that may result in the identification of capacity improvement measures on the corridor lines and additional investments are not official yet

Source: Contractor based on consultation with the Infrastructure Managers; Note: figures rounded to the million unit

The costs related to the corridor railway lines, amounting to about € 2.4 billion, concern the modernisation of 457.2 km of lines in Poland, to allow operation of 740 meter long trains along the whole RCF NS-B by 2030 under the technical point of view, as well as infrastructure improvement measures in Lithuania. Up to € 680 million would furthermore be required to improve operational conditions of 740 meter long trains along the corridor by 2030, removing technical barriers and capacity bottlenecks at 27 handover stations/marshalling yards/waiting-buffer locations in the Netherlands, Belgium, Germany, and Lithuania.

The total cost of the identified measures, amounting up to about € 3.1 billion represents a conservative estimate as it does not include the costs of potential additional measures relating to:

- Measures to solve technical restrictions in the Netherlands at some Rotterdam Harbour handover stations and at the Amersfoort handover station, as well as capacity and time limitations at the Rotterdam Harbour handover stations and along the Kijfhoek - Weesp and Roosendaal - Bad Bentheim routes;
- Capacity improvement measures to be possibly implemented in Belgium and in the Czech Republic upon completion of the ongoing and foreseen studies;
- Upgrading of the RFC NS-B terminals, as due to the limited responsiveness of the terminal operators/managers to the SCI survey no measures were identified in this study for the upgrading of this corridor infrastructure.

10.2.2. Relevant improvement measures

Among the additional measures identified in this study the following ones are deemed particularly relevant to further improve operation of 740 meter long trains along the RFC NS-B:

- *Solutions to technically allow operating 740 meter long trains along international relations of the RFC NS-B by 2030:*
  - The modernisation of one or more of the following sections interconnecting the RFC NS-B with Lithuania: Krusze - Tłuszcz (4.1 km long, expected principal/Off TEN-T line), Legionowo - Krusze (32.7 km long, expected diversionary/ Off TEN-T line) and Kobylnica - Mogilno (63.9 km long, diversionary/ TEN-T comprehensive line), whose estimated investment costs equal respectively € 153 million, € 233 million, € 221 million, for a total cost for the modernisation of the three lines of € 607 million;
  - The modernisation of the "triangular connection" starting at Długoszyn via Sosnowiec Maczki to Jaworzno Szczakowa (6.9 km long, principal/Off TEN-T line) and particularly the 1.9 km long section Jaworzno Szczakowa – Długoszyn, interconnecting the RFC NS-B with Ukraine, of total cost equal to € 163 million;
- *Measures to technically allow 740 meter long trains accessibility to intermodal terminals along the RFC NS-B by 2030:*
  - The modernisation of the 14.9 km long connecting line Sosnowiec Maczki - Dąbrowa Górnicza Towarowa, to provide adequate connection to the intermodal terminals located along this line, whose modernisation costs amount to € 116 million;
- *Solutions to improve the capacity of the existing infrastructure to operate 740 meter long trains along the RFC NS-B by 2030:*
  - Investments at the handover stations/marshalling yards/waiting-buffer locations in the Netherlands, Belgium, Germany, and Lithuania, whose total costs are estimated in a range of € 373-678 million. Among these ones, the initiatives in the Netherlands are deemed of specific relevance to ensure adequate operation of 740 meter long trains along the RFC NS-B lines, also considering that based on the results of the recently completed Transport Market Study, the corridor lines of this Member State are involved in the most relevant trade/transport relations along the RFC NS-B. In this regard it is also noticed that due consideration shall be given to the removal of the conditions that limit the transit of 740 meter long trains across the borders between the Netherlands and Germany only subject to ad hoc requests.

The total cost of the above listed relevant measures ranges between € 1,1-1,4 billion. Whereas the first set of solutions in Poland are of specific importance to ensure the development of a homogeneous corridor infrastructure (conforming

to the 740 meter maximum train length requirement), the investments to allow accessibility at intermodal terminals and expand capacity at the handover stations along the corridor are crucial under the market point of view.

10.3. Concluding remarks

The infrastructure measures identified within the scope of this study together with the ones already ongoing and planned by the concerned infrastructure managers are expected to technically allow the operation of 740 meter long trains on all lines of the RFC NS-B by 2030, specified that some technical issues may still exist at some Rotterdam Harbour handover stations and at the Amersfoort handover station.

Capacity and time limitations may exist by 2030 at some Rotterdam Harbour handover stations and along the Kijfhoek - Weesp and Roosendaal - Bad Bentheim routes. Constraints may also be experienced particularly in the daytime and peak hours on sections used by passenger and freight traffic and/or located in urban agglomerations in Belgium and in the Czech Republic, where studies are ongoing/planned to assess the extent of such problems, also based on expected traffic projections, which were not elaborated as part of this study.

The ambitious modernisation programme of the railway lines in Poland, including significant investments on the RFC NS-B, might be affected by implementation delays, also considering the different status of the technical/financial maturity of the projects required to modernise the Polish corridor lines. Unavailability of funds and delays in the completion of the infrastructure measures considered in this study to modernise/upgrade the existing infrastructure in this Member State, may result in technical/capacity restrictions towards the operation of 740 meter long trains along the RFC NS-B in this country by 2030. This emphasises the opportunity to financially and administratively support the development of a stable and mature pipeline of projects in Poland.

The implementation of the infrastructure initiatives/measures identified as part of this study to solve existing and future technical and capacity problems along the RFC NS-B with reference to the 740 meter train length standard might be also integrated/accompanied during the period up to 2030 and afterwards, with a set of operational measures, related to scheduling and timetable planning, blocking the use of stations with short tracks and/or detouring. These solutions, that according to this study are already adopted/considered for use by the concerned infrastructure managers, are particularly useful to allow the temporary operation of 740 meter long trains along the corridor, especially in low density traffic conditions. The study demonstrates that the effectiveness and cost-benefit ratio of the applicability of these measures reduce with an increasing density of traffic on the lines and mixed use of the corridor sections by passenger and freight transport. For a market-oriented quality approach and in light of an increased use of the corridor lines, solutions to allow technical operability and capacity improvement are ultimately more effective and efficient.

ANNEX A SCI – INFRASTRUCTURE DATABASE

Tables A-1, A-2 and A-3 in this annex respectively list the i) the corridor lines, ii) handover stations/marshalling yards/waiting-buffer locations, and iii) terminals subject of study and provide relevant information on this infrastructure for the years 2018 and 2030. Data were provided by the concerned infrastructure managers for the corridor lines and handover stations/marshalling yards/waiting-buffer locations. The database also includes the information collected for the terminals as part of the SCI survey.

Tables A-1 and A-3 are provided in A3 format.

Table A-1 Line sections of the RFC NS-B in 2018 and their characteristics in 2018 and by 2030 based on information provided by the infrastructure managers

Member State	Line section 2018 (1435 mm)	Issues at waiting- or buffer locations in 2018	Issues at waiting- or buffer locations by 2030	Length of section 2018 (km)	Type of line 2018	Type of network 2018	Number of tracks 2018	Expected changes in the n. of tracks by 2030	Traction 2018	Expected Traction by 2030	Max train length (m) 2018		Max train length (m) 2030		Capacity constraints limiting 740 meters train operations in 2018	Capacity constraints limiting 740 meters train operations by 2030
											Even direction	Odd direction	Even direction	Odd direction		
NL	Maasvlakte / Maasvlakte West - Zevenaar grens															
NL	Maasvlakte aansl. - Maasvlakte West	Nonstop trainpaths Buffertracks at 1) Waalhaven Zuid 2) Kijfhoek 3) Meteren Betuweroute 4) CUP Valburg (2x) All designed for 740 m trains	Nonstop trainpaths Buffertracks at 1) Waalhaven Zuid 2) Kijfhoek 3) Meteren Betuweroute 4) CUP Valburg (2x) All designed for 740 m trains	2.0	Principal	Core	2	Non-stop trainpaths No plans for changes in the number of tracks.	E	E	>=740	>=740	>=740	>=740	No	No
NL	Maasvlakte aansl. - Maasvlakte			1.6	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	No	No
NL	Maasvlakte aansl. - Europoort West			5.5	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	No	No
NL	Europoort West - Europoort			6.5	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	No	No
NL	Europoort - Botlek			10.3	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	No	No
NL	Botlek - Pernis			4.9	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	No	No
NL	Botlek - Botlek Tunnel			1.6	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	No	No
NL	Botlek Tunnel - Pernis			3.3	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	No	No
NL	Pernis - Rail Service Center Waalhaven aansl.			0.7	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	No	No
NL	Rail Service Center Waalhaven aansl. - Waalhaven Zuid			3.2	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	No	No
NL	Waalhaven Zuid - Waalhaven Zuid aansl. Noord			4.3	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	No	No
NL	Waalhaven Zuid aansl. Noord - Barendrecht Vork			2.0	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	No	No
NL	Barendrecht Vork - Barendrecht Aansl.			2.5	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	No	No
NL	Barendrecht Aansl. - Kijfhoek aansluiting noord			2.0	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	No	No
NL	Kijfhoek aansluiting noord - Betuwe Route Papendrecht			11.4	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	No	No
NL	Kijfhoek aansluiting noord - Kijfhoek Noord			1.3	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	No	No
NL	Kijfhoek Noord - Kijfhoek zuid			2.2	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	No	No
NL	Kijfhoek zuid - Betuwe Route Papendrecht			7.8	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	No	No
NL	Betuwe Route Papendrecht - Betuweroute Meteren			40.9	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	No	No
NL	Betuweroute Meteren - Betuweroute Valburg aansl. West			36.2	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	No	No
NL	Betuweroute Valburg aansl. West - Betuweroute Centraal Uitwisselpunt Valburg			2.3	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	No	No
NL	Betuweroute Centraal Uitwisselpunt Valburg - Betuweroute Valburg aansl. Oost			2.4	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	No	No
NL	Betuweroute Valburg aansl. West - Betuweroute Valburg aansl. Oost			4.7	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	No	No
NL	Betuweroute Valburg aansl. Oost - Zevenaar Betuweroute Aansl.			18.9	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	No	No
NL	Zevenaar Betuweroute Aansl. - Zevenaar grens			3.3	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	No	No
NL	Beverwijk - Oldenzaal grens															
NL	Beverwijk - Noordelijke splitsing (Haarlem)	Reverse track to Tata Steel (740 m)	Reverse track to Tata Steel (740 m)	10.2	Connecting	Comprehensive	2		E	E	>=740	>=740	>=740	>=740	At most times of the day	At most times of the day
NL	Noordelijke splitsing (Haarlem) - Radarweg aansl.			14.5	Connecting	Comprehensive	2		E	E	>=740	>=740	>=740	>=740	At most times of the day	At most times of the day
NL	Houtrakpolder (Amsterdam) - Radarweg aansl.			2.1	Principal	Comprehensive	2		E	E	>=740	>=740	>=740	>=740	At most times of the day	At most times of the day
NL	Radarweg aansl. - Amsterdam Sloterdijk			1.0	Principal	Comprehensive	2		E	E	>=740	>=740	>=740	>=740	At most times of the day	At most times of the day
NL	Amsterdam Sloterdijk - Overbrakerpolder aansl.			1.9	Principal	Comprehensive	2	Complete new layout for Amsterdam Central. New waiting track at Dijksgracht Westzijde for 740 m Cargo trains from Haarlem <> Utrecht.	E	E	>=740	>=740	>=740	>=740	At most times of the day	At most times of the day
NL	Overbrakerpolder aansl. - Singelgracht aansl.			1.1	Principal	Comprehensive	2		E	E	>=740	>=740	>=740	>=740	At most times of the day	At most times of the day
NL	Amsterdam Westhaven - Singelgracht aansl.			3.4	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	At most times of the day	At most times of the day
NL	Amsterdam Centraal - Singelgracht aansl.			1.6	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	At most times of the day	At most times of the day
NL	Amsterdam Centraal - Dijksgracht Westzijde (Amsterdam)			1.1	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	At most times of the day	At most times of the day
NL	Dijksgracht Westzijde (Amsterdam) - Amsterdam Muiderpoort West	Nonstop through A'dam Central	Waitingtrack Dijksgracht (740 m) (Beverwijk <> Utrecht)	2.3	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	At most times of the day	At most times of the day
NL	Amsterdam Muiderpoort West - Gaasperdammerweg aansl. (Amsterdam)			6.3	Principal	Comprehensive	2		E	E	>=740	<740	>=740	>=740	At most times of the day	At most times of the day
NL	Gaasperdammerweg aansl. (Amsterdam) - Hilversum			18.6	Principal	Comprehensive	2		E	E	>=740	<740	>=740	>=740	At most times of the day	At most times of the day

Member State	Line section 2018 (1435 mm)	Issues at waiting- or buffer locations in 2018	Issues at waiting- or buffer locations by 2030	Length of section 2018 (km)	Type of line 2018	Type of network 2018	Number of tracks 2018	Expected changes in the n. of tracks by 2030	Traction 2018	Expected Traction by 2030	Max train length (m) 2018		Max train length (m) 2030		Capacity constraints limiting 740 meters train operations in 2018	Capacity constraints limiting 740 meters train operations by 2030
											Even direction	Odd direction	Even direction	Odd direction		
NL	Hilversum - Amersfoort	To A'dam waitingtrack at Amersfoort (max 720 m)	To A'dam waitingtrack at Amersfoort (740 m)	16.2	Principal	Comprehensive	2		E	E	>=740	<740	>=740	>=740	At most times of the day	At most times of the day
NL	Amersfoort - Apeldoorn			43.7	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	No	No
NL	Deventer - Apeldoorn	To Oldenzaal Waitingtrack at Stroe (740 m)	To Oldenzaal Waitingtrack at Stroe (740 m)	14.8	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	No	No
NL	Deventer - Almelo			38.7	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	No	No
NL	Hengelo - Almelo	Bufferlocations at Almelo (680 m) and Oldenzaal (740m)		14.6	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	No	No
NL	Hengelo - Oldenzaal Grens			18.2	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	No	No
NL	Barendrecht Vork / Barendrecht aansl. - Gaasperdammerweg aansl. (Amsterdam)															
NL	Barendrecht Vork - Barendrecht Vork Aansl			2.3	Diversionary	Comprehensive	1	Kijfhoek > Gouda/A'dam	E	E	>=740		>=740		No	No
NL	Barendrecht Vork Aansl - Rotterdam Lombardijen			0.9	Diversionary	Comprehensive	1		E	E	>=740		>=740		No	No
NL	Rotterdam Lombardijen - Rotterdam Zuid			2.9	Diversionary	Comprehensive	1		E	E	>=740		>=740		No	No
NL	IJsselmonde aansl. - Barendrecht Vork			2.5	Diversionary	Comprehensive	1	Gouda/A'dam > Kijfhoek	E	E		>=740		>=740	No	No
NL	Rotterdam Zuid - IJsselmonde aansl.			3.1	Diversionary	Comprehensive	1		E	E		>=740		>=740	No	No
NL	Barendrecht aansl. - Barendrecht Vork Aansl			1.8	Diversionary	Comprehensive	1	Kijfhoek > Gouda/A'dam	E	E	>=740		>=740		No	No
NL	IJsselmonde aansl. - Barendrecht aansl.			2.4	Diversionary	Comprehensive	1	Gouda/A'dam > Kijfhoek	E	E		>=740		>=740	No	No
NL	Rotterdam Westelijke Splitsing - Rotterdam Zuid			6.0	Diversionary	Comprehensive	2		E	E	<740	>=740	<740	>=740	At most times of the day	At most times of the day
NL	Gouda - Rotterdam Westelijke Splitsing	To Gouda/A'dam waitingtrack Rtng (664 m)	To Gouda/A'dam waitingtrack Rtng (664 m)	22.1	Diversionary	Comprehensive	2		E	E	<740	>=740	<740	>=740	At most times of the day	At most times of the day
NL	Harmelen aansl. - Gouda			20.3	Diversionary	Comprehensive	2		E	E	<740	>=740	<740	>=740	At most times of the day	At most times of the day
NL	Breukelen aansluiting - Harmelen aansl.			8.3	Diversionary	Comprehensive	2		E	E	<740	>=740	<740	>=740	At most times of the day	At most times of the day
NL	Amsterdam Bijlmer - Breukelen aansluiting			17.1	Diversionary	Core	4		E	E	>=740	>=740	>=740	>=740	No	No
NL	Amsterdam Bijlmer - Gaasperdammerweg aansl. (Amsterdam)			6.8	Diversionary	Comprehensive	2		E	E	>=740	>=740	>=740	>=740	No	No
NL	Roosendaal grens - 's Hertogenbosch - Utrecht – Amersfoort															
NL	Roosendaal grens - Roosendaal	Buffer + waitingtracks Roosendaal	Buffer + waitingtracks Roosendaal	8.1	Connecting	Core	2		E	E	>=740	>=740	>=740	>=740	At most times of the day	At most times of the day
NL	Roosendaal - Breda aansl.			21.5	Connecting	Comprehensive	2		E	E	>=740	>=740	>=740	>=740	At most times of the day	At most times of the day
NL	Breda aansl. - Tilburg aansl.	Buffer Tilburg Goederen	Buffer Tilburg Goederen	25.0	Connecting	Comprehensive	2		E	E	>=740	>=740	>=740	>=740	At most times of the day	At most times of the day
NL	Tilburg aansl. - Vught aansl.			17.4	Connecting	Comprehensive	2		E	E	>=740	>=740	>=740	>=740	At most times of the day	At most times of the day
NL	Vught aansl. - 's-Hertogenbosch Diezebrug aansl.			4.2	Connecting	Comprehensive	2		E	E	>=740	>=740	>=740	>=740	No	No
NL	's-Hertogenbosch Diezebrug aansl. - Meteren Betuweroute aansluiting Zuid		To Utrecht/Amersfoort Waitingtrack Meteren track 93	17.8	Connecting	Comprehensive	2		E	E	>=740	>=740	>=740	>=740	No	No
NL	Betuweroute Meteren - Meteren Betuweroute aansluiting Zuid			1.8	Connecting	Comprehensive	2		E	E	>=740	>=740	>=740	>=740	No	No
NL	Meteren Betuweroute aansluiting Zuid - Meteren Betuweroute aansluiting Noord			1.9	Connecting	Comprehensive	2	2022-2024 new waitingtracks at Geldermalsen/Meteren	E	E	<740	<740	>=740	>=740	No	No
NL	Utrecht Centraal - Meteren Betuweroute aansluiting Noord	Waitingtrack Geldermalsen	Waitingtrack Geldermalsen/Meteren	27.4	Connecting	Core	2		E	E	<740	<740	>=740	>=740	No	No
NL	Amersfoort - Utrecht Centraal			20.8	Connecting	Core	2		E	E	<740	<740	>=740	>=740	No	No
BE	Antwerpen Noord- Montzen Border															
BE	Antwerpen Noord - Lier *			26.0	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	Partially during peak hours	Partially during peak hours
BE	Lier - Aarschot *			29.0	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	Partially during peak hours	Partially during peak hours
BE	Aarschot - Hasselt *			36.0	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	Partially during peak hours	Partially during peak hours

Member State	Line section 2018 (1435 mm)	Issues at waiting- or buffer locations in 2018	Issues at waiting- or buffer locations by 2030	Length of section 2018 (km)	Type of line 2018	Type of network 2018	Number of tracks 2018	Expected changes in the n. of tracks by 2030	Traction 2018	Expected Traction by 2030	Max train length (m) 2018		Max train length (m) 2030		Capacity constraints limiting 740 meters train operations in 2018	Capacity constraints limiting 740 meters train operations by 2030
											Even direction	Odd direction	Even direction	Odd direction		
BE	Hasselt - Montzen *			64.0	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	Partially during peak hours	Partially during peak hours
BE	Montzen - Montzen Border *			7.0	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	Partially during peak hours	Partially during peak hours
BE	Antwerpen Noord - Essen Border															
BE	Antwerpen Noord - Essen Border *			21.3	Connecting	Core	2		E	E	>=740	>=740	>=740	>=740	Partially during peak hours	Partially during peak hours
BE	Liefkenshoek rail link															
BE	Antwerpen Noord - Bundel Zuid *			15.8	Diversionary	Core	2		E	E	>=740	>=740	>=740	>=740	Partially during peak hours	Partially during peak hours
BE	Hasselt - Genk Goederen															
BE	Y West Driehoek Hasselt -Genk Goederen *			16.0	Connecting	Off TEN-T	2		E	E	>=740	>=740	>=740	>=740	Partially during peak hours	Partially during peak hours
BE	Y. Rooierweg - Genk Goederen															
BE	Y. Rooierweg - Genk Goederen *			13.8	Connecting	Off TEN-T	1		D	D	>=740	>=740	>=740	>=740	Partially during peak hours	Partially during peak hours
BE	Y. Rooierweg - Genk Zuid *			8.0	Connecting	Off TEN-T	1		D	D	>=740	>=740	>=740	>=740	Partially during peak hours	Partially during peak hours
BE	Y Berneau – Kinkempois															
BE	Y Berneau - Visé *			3.6	Connecting	Core	2		E	E	>=740	>=740	>=740	>=740	Partially during peak hours	Partially during peak hours
BE	Visé - Froidmont *			16.0	Connecting	Core	2		E	E	>=740	>=740	>=740	>=740	Partially during peak hours	Partially during peak hours
BE	Froidmont - Kinkempois formation *			2.0	Connecting	Off TEN-T	2		E	E	>=740	>=740	>=740	>=740	Partially during peak hours	Partially during peak hours
BE	Lier - BE/NL border															
BE	Lier - Mol *			32.6	Expected principal	Comprehensive	2		E	E	>=740	>=740	>=740	>=740	Partially during peak hours	Partially during peak hours
BE	Mol- Hamont border *			41.1	Expected principal	Comprehensive	1		D	E	>=740	>=740	>=740	>=740	Partially during peak hours	Partially during peak hours
DE	Aachen Border BE/DE - Oberhausen West															
DE	Aachen Border BE/DE - Aachen West			5.4	Principal	Comprehensive	2		E	E	>=740	>=740	>=740	>=740	No	No
DE	Aachen West - Rheydt			51.5	Principal	Comprehensive	2		E	E	>=740	>=740	>=740	>=740	No	No
DE	Rheydt - Viersen (Strecke 2550)			16.4	Principal	Comprehensive	2		E	E	>=740	>=740	>=740	>=740	No	No
DE	Rheydt (Gbf) - Viersen-Helenabrunn (Strecke 2522)			11.7	Connecting	Off TEN-T	1		E	E	>=740	>=740	>=740	>=740	No	No
DE	Viersen - Krefeld			15.5	Principal	Comprehensive	2		E	E	>=740	>=740	>=740	>=740	No	No
DE	Krefeld - Meerbeck - Oberhausen West			37.6	Principal	Off TEN-T	2		E	E	>=740	>=740	>=740	>=740	No	No
DE	Krefeld - Duisburg - Oberhausen West			37.5	Connecting	Comprehensive	2		E	E	>=740	>=740	>=740	>=740	No	No
DE	Border NL/DE - Emmerich - Oberhausen West / Oberh. Osterfeld															
DE	Border NL/DE - Emmerich - Oberhausen West / Oberh. Osterfeld			73.6	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	No	No
DE	Oberhausen West – Löhne															
DE	Oberhausen West - Gladbeck			14.4	Principal	Comprehensive	2		E	E	>=740	>=740	>=740	>=740	No	No
DE	Gladbeck - Recklinghausen			18.5	Principal	Comprehensive	2		E	E	>=740	>=740	>=740	>=740	No	No
DE	Recklinghausen - Wanne-Eickel			7.9	Connecting	Off TEN-T	1		E	E	>=740	>=740	>=740	>=740	No	No
DE	Recklinghausen - Hamm			45.6	Principal	Comprehensive	2		E	E	>=740	>=740	>=740	>=740	No	No
DE	Lünen - Dortmund			8.9	Connecting	Core	2		E	E	>=740	>=740	>=740	>=740	No	No
DE	Hamm - Löhne (Strecke 2990)			92.2	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	Partially during peak hours	No
DE	Hamm - Löhne (Strecke 1700)			91.0	Diversionary	Core	2		E	E	>=740	>=740	>=740	>=740	No	No
DE	Border NL/DE - Bad Bentheim – Löhne															
DE	Border NL/DE - Bad Bentheim - Osnabrück			77.0	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	Partially during peak hours	No
DE	Osnabrück - Löhne			47.2	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	No	No
DE	Löhne – Wunstorf															
DE	Löhne - Minden (Strecke 2990)			21.0	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	No	No
DE	Löhne - Minden (Strecke 1700)			20.9	Diversionary	Core	2		E	E	>=740	>=740	>=740	>=740	No	No
DE	Minden - Haste			36.1	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	Partially during peak hours	No

Member State	Line section 2018 (1435 mm)	Issues at waiting- or buffer locations in 2018	Issues at waiting- or buffer locations by 2030	Length of section 2018 (km)	Type of line 2018	Type of network 2018	Number of tracks 2018	Expected changes in the n. of tracks by 2030	Traction 2018	Expected Traction by 2030	Max train length (m) 2018		Max train length (m) 2030		Capacity constraints limiting 740 meters train operations in 2018	Capacity constraints limiting 740 meters train operations by 2030
											Even direction	Odd direction	Even direction	Odd direction		
DE	Haste - Wunstorf			6.9	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	Partially during peak hours	No
DE	Wilhelmshaven – Bremen															
DE	Wilhelmshaven - Sande			15.4	Principal	Core	1		D	E	>=740	>=740	>=740	>=740	No	No
DE	Sande - Oldenburg			45.0	Principal	Core	2		D	E	>=740	>=740	>=740	>=740	No	No
DE	Oldenburg - Bremen			44.4	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	No	No
DE	Bremerhaven - Bremen – Wunstorf															
DE	Bremerhaven - Bremen			72.7	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	No	No
DE	Bremen - Wunstorf			100.8	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	No	No
DE	Wunstorf - Hannover-Linden/Hannover Hbf – Magdeburg															
DE	Wunstorf - Hannover-Linden (Strecke 1750)			22.8	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	No	No
DE	Hannover-Linden - Lehrte (Strecke 1750)			20.5	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	No	No
DE	Wunstorf - Hannover Hbf (Strecke 1700)			21.4	Diversionary	Core	2		E	E	>=740	>=740	>=740	>=740	No	No
DE	Hannover Hbf - Lehrte (Strecke 1730)			16.3	Diversionary	Core	2		E	E	>=740	>=740	>=740	>=740	No	No
DE	Lehrte - Groß Gleidingen			36.7	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	No	No
DE	Lehrte - Fallersleben			52.9	Connecting	Core	2		E	E	>=740	>=740	>=740	>=740	No	No
DE	Groß Gleidingen - Magdeburg			91.3	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	Partially during peak hours	No
DE	Braunschweig - Fallersleben			20.5	Connecting	Comprehensive	1		E	E	>=740	>=740	>=740	>=740	No	No
DE	Hamburg – Magdeburg															
DE	Hamburg-Hausbruch - Hamburg-Harburg (Strecke 1720)			5.7	Principal	Comprehensive	2		E	E	>=740	>=740	>=740	>=740	No	No
DE	Hamburg Süd - Hamburg-Harburg			6.9	Principal	Off TEN-T	2		E	E	>=740	>=740	>=740	>=740	No	No
DE	Hamburg-Billwerder - Hamburg-Harburg			16.5	Connecting	Core	2		E	E	>=740	>=740	>=740	>=740	No	No
DE	Hamburg-Harburg - Stelle (Strecke 1280/1284)			11.0	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	No	No
DE	Hamburg-Harburg - Stelle (Strecke 1720)			11.2	Connecting	Core	2		E	E	>=740	>=740	>=740	>=740	No	No
DE	Stelle - Uelzen (Strecke 1720)			65.3	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	No	No
DE	Stelle - Lüneburg (Strecke 1153)			24.9	Principal	Core	1		E	E	>=740	>=740	>=740	>=740	No	No
DE	Uelzen - Veerßen			3.4	Principal	Comprehensive	2		E	E	>=740	>=740	>=740	>=740	No	No
DE	Veerßen - Stendal			104.2	Principal	Comprehensive	1	2	E	E	>=740	>=740	>=740	>=740	No	No
DE	Stendal - Magdeburg			61.2	Principal	Comprehensive	2		E	E	>=740	>=740	>=740	>=740	No	No
DE	Madgeburg - Berlin-Saarmund															
DE	Magdeburg - Saarmund			113.0	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	Partially during peak hours	No
DE	Madgeburg - Roßlau – Falkenberg															
DE	Magdeburg - Roßlau			56.9	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	No	No
DE	Roßlau - Falkenberg			83.9	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	No	No
DE	Falkenberg - Knappenrode - Horka - Border DE/PL															
DE	Falkenberg - Knappenrode			81.6	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	No	No
DE	Knappenrode - Horka - Border DE/PL			54.5	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	No	No
DE	Falkenberg - Cottbus – Horka															
DE	Falkenberg - Cottbus			79.1	Diversionary	Off TEN-T	2		E	E	>=740	>=740	>=740	>=740	No	No
DE	Cottbus - Horka			74.6	Diversionary	Comprehensive	1		D	D	>=740	>=740	>=740	>=740	No	No
DE	Roßlau - Berlin - Frankfurt (Oder) - Border DE/PL															
DE	Roßlau - Saarmund			83.0	Diversionary	Comprehensive	2		E	E	>=740	>=740	>=740	>=740	No	No
DE	Saarmund - Grünauer Kreuz			31.0	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	No	No
DE	Grünauer Kreuz - Berlin-Wuhlheide			6.2	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	No	No
DE	Berlin-Genshagener Heide - Großbeeren			9.7	Connecting	Core	1		E	E	>=740	>=740	>=740	>=740	No	No
DE	Berlin-Wuhlheide - Frankfurt (O) - Border DE/PL			74.5	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	Partially during peak hours	No
DE	Falkenberg - Riesa - Bad Schandau - Border CZ/DE															
DE	Falkenberg - Riesa			97.8	Principal	Off TEN-T	2		E	E	>=740	>=740	>=740	>=740	No	No
DE	Riesa - Bad Schandau - Border CZ/DE			30.5	Principal	Core	2		E	E	>=740	>=740	>=740	>=740	Partially during peak hours	No
DE	Terminal at Frankurt (Oder)															
DE	Frankfurt (Oder) Pbf - Terminal Frankfurt (Oder)			1.7	Connecting	Off TEN-T	1		E	E	>=740	>=740	>=740	>=740	No	No
DE	Terminal at Berlin Westhafen															
DE	Berlin-Wuhlheide - Berlin-Moabit			20.2	Connecting	Core	2		E	E	>=740	>=740	>=740	>=740	No	No
DE	Berlin-Moabit - Berlin-Hamburger und Lehrter Bf			2.3	Connecting	Off TEN-T	1		D	D	>=740	>=740	>=740	>=740	No	No

Member State	Line section 2018 (1435 mm)	Issues at waiting- or buffer locations in 2018	Issues at waiting- or buffer locations by 2030	Length of section 2018 (km)	Type of line 2018	Type of network 2018	Number of tracks 2018	Expected changes in the n. of tracks by 2030	Traction 2018	Expected Traction by 2030	Max train length (m) 2018		Max train length (m) 2030		Capacity constraints limiting 740 meters train operations in 2018	Capacity constraints limiting 740 meters train operations by 2030
											Even direction	Odd direction	Even direction	Odd direction		
PL	Border DE/PL - Poznań - Terespol (Border PL/Belorussia)															
PL	Kunowice (Border DE/PL) - Rzepin			17.3	Principal	Core	2	2	E	E	<740	<740	>=740	>=740	No	No
PL	Rzepin - Chlastawa			78.3	Principal	Core	2	2	E	E	<740	<740	>=740	>=740	No	No
PL	Chlastawa - Poznań Górczyn			73.6	Principal	Core	2	2	E	E	>=740	>=740	>=740	>=740	No	No
PL	Poznań Górczyn - Poznań Starołęka PSK			2.7	Principal	Core	2	2	E	E	<740	<740	>=740	>=740	No	No
PL	Poznań Starołęka PSK - Poznań Starołęka			1.2	Principal	Core	2	2	E	E	<740	<740	>=740	>=740	No	No
PL	Poznań Starołęka - Pokrzywno			2.6	Principal	Core	2	2	E	E	<740	<740	>=740	>=740	No	No
PL	Pokrzywno - Poznań Franowo PFA			4.9	Principal	Core	2	2	E	E	<740	<740	>=740	>=740	No	No
PL	Poznań Franowo PFA - Swarzędz			5.8	Principal	Core	2	2	E	E	<740	<740	>=740	>=740	No	No
PL	Swarzędz - Łowicz Główny			211.0	Expected principal	Core	2	2	E	E	>=740	>=740	>=740	>=740	No	No
PL	Łowicz Główny - Placencja			3.5	Principal	Core	2	2	E	E	>=740	>=740	>=740	>=740	No	No
PL	Placencja - Skierniewka			1.9	Principal	Core	2	2	E	E	>=740	>=740	>=740	>=740	No	No
PL	Placencja - Skierniewka			14.7	Principal	Core	2	2	E	E	>=740	>=740	>=740	>=740	No	No
PL	Skierniewka - Skierniewice			1.6	Principal	Core	2	2	E	E	>=740	>=740	>=740	>=740	No	No
PL	Skierniewice - Marków			9.3	Principal	Core	2	2	E	E	>=740	>=740	>=740	>=740	No	No
PL	Skierniewice - Marków			15.8	Principal	Core	2	2	E	E	>=740	>=740	>=740	>=740	No	No
PL	Marków - Czachówek Zachodni			39.7	Principal	Core	2	2	E	E	>=740	>=740	>=740	>=740	No	No
PL	Czachówek Zachodni - Czachówek Wschodni			2.8	Principal	Core	2	2	E	E	>=740	>=740	>=740	>=740	No	No
PL	Czachówek Wschodni - Jaźwiny (Pilawa)			29.3	Principal	Core	1	1	E	E	>=740	>=740	>=740	>=740	No	No
PL	Pilawa - Poważe			58.4	Principal	Core	2	2	E	E	>=740	>=740	>=740	>=740	No	No
PL	Poważe - Łuków			3.4	Principal	Core	2	2	E	E	>=740	>=740	>=740	>=740	No	No
PL	Łuków - Biała Podlaska			52.4	Principal	Core	2	2	E	E	>=740	>=740	>=740	>=740	No	No
PL	Biała Podlaska - Małaszewicze			28.7	Principal	Core	2	2	E	E	>=740	>=740	>=740	>=740	No	No
PL	Małaszewicze - Terespol			7.7	Principal	Core	2	2	E	E	>=740	>=740	>=740	>=740	No	No
PL	Terespol - Terespol (Boder PL/Belorussia)			2.4	Principal	Core	2	2	E	E	>=740	>=740	>=740	>=740	No	No
PL	Pilawa - Trakiszki (Border PL/LT)															
PL	Pilawa - Krusze			56.6	Expected principal	Off TEN-T	1	1	E	E	>=740	>=740	>=740	>=740	No	No
PL	Krusze - Tłuszcz			4.1	Expected principal	Off TEN-T	1	1	E	E	<740	<740	<740	<740	No	No
PL	Tłuszcz - Białystok			139.5	Expected principal	Core	2	2	E	E	<740	<740	>=740	>=740	No	No
PL	Białystok - Ełk			103.4	Expected principal	Core	1	2	E	E	<740	<740	>=740	>=740	No	No
PL	Ełk - Olecko			28.5	Principal	Core	1	2	D	E	<740	<740	>=740	>=740	No	No
PL	Olecko - (Gw)			16.5	Principal	Core	1	2	D	E	<740	<740	>=740	>=740	No	No
PL	(Gw) - Papiernia			20.7	Principal	Core	1	2	D	E	<740	<740	>=740	>=740	No	No
PL	Papiernia - Suwałki			5.7	Principal	Core	1	2	D	E	<740	<740	>=740	>=740	No	No
PL	Suwałki - Trakiszki			25.7	Principal	Core	1	2	D	E	<740	<740	>=740	>=740	No	No
PL	Trakiszki - Trakiszki (Border PL/LT)			3.4	Principal	Core	1	2	D	E	<740	<740	>=740	>=740	No	No
PL	Poznań - Stary Staw															
PL	(Poznań Gł.) P. Starołęka Psk - Poznań Krzesiny			5.6	Diversionary	Off TEN-T	2	2	E	E	<740	<740	<740	<740	No	No
PL	Poznań Krzesiny - Kórnik			8.6	Diversionary	Off TEN-T	2	2	E	E	<740	<740	<740	<740	No	No
PL	Kórnik - Solec Wlkp.			32.8	Diversionary	Off TEN-T	2	2	E	E	<740	<740	<740	<740	No	No
PL	Solec Wlkp. - Jarocin			16.6	Diversionary	Off TEN-T	2	2	E	E	<740	<740	<740	<740	No	No
PL	Jarocin - Franklinów			26.7	Diversionary	Off TEN-T	2	2	E	E	<740	<740	<740	<740	No	No
PL	Franklinów - Stary Staw			1.5	Diversionary	Off TEN-T	1	1	E	E	<740	<740	<740	<740	No	No
PL	Rzepin – Skierniewice															
PL	Rzepin - Jerzmanice Lubuskie			6.6	Diversionary	Comprehensive	1	1	E	E	<740	<740	>=740	>=740	No	No
PL	Jerzmanice Lubuskie - Czerwieńsk			50.0	Diversionary	Comprehensive	2	2	E	E	<740	<740	>=740	>=740	No	No
PL	Czerwieńsk - Głogów			67.5	Diversionary	Comprehensive	2	2	E	E	<740	<740	>=740	>=740	No	No
PL	Głogów - Leszno			46.8	Diversionary	Off TEN-T	2	2	D	D	<740	<740	<740	<740	No	No
PL	Leszno - Kąkolewo			11.9	Diversionary	Off TEN-T	2	2	D	D	<740	<740	<740	<740	No	No
PL	Kąkolewo - Osusz			56.3	Diversionary	Off TEN-T	2	2	D	D	<740	<740	<740	<740	No	No
PL	Osusz - Durzyn			5.3	Diversionary	Off TEN-T	2	2	D	D	<740	<740	<740	<740	No	No
PL	Durzyn - Ostrów Wielkopolski			26.3	Diversionary	Off TEN-T	2	2	E	E	<740	<740	<740	<740	No	No
PL	Ostrów Wielkopolski - Gajewniki			96.3	Diversionary	Off TEN-T	2	2	E	E	<740	<740	<740	<740	No	No
PL	Gajewnik - Retkinia			37.5	Diversionary	Core	2	2	E	E	>=740	>=740	>=740	>=740	No	No
PL	Retkinia - Łódź Kaliska Towarowa			1.8	Diversionary	Core	2	2	E	E	>=740	>=740	>=740	>=740	No	No

Member State	Line section 2018 (1435 mm)	Issues at waiting- or buffer locations in 2018	Issues at waiting- or buffer locations by 2030	Length of section 2018 (km)	Type of line 2018	Type of network 2018	Number of tracks 2018	Expected changes in the n. of tracks by 2030	Traction 2018	Expected Traction by 2030	Max train length (m) 2018		Max train length (m) 2030		Capacity constraints limiting 740 meters train operations in 2018	Capacity constraints limiting 740 meters train operations by 2030
											Even direction	Odd direction	Even direction	Odd direction		
PL	Łódź Kaliska Towarowa - Łódź Chojny			5.2	Diversionary	Core	2	2	E	E	>=740	>=740	>=740	>=740	No	No
PL	Łódź Chojny - Łódź Olechów			8.0	Diversionary	Core	2	2	E	E	>=740	>=740	>=740	>=740	No	No
PL	Łódź Olechów - Gałkówek			9.3	Diversionary	Core	2	2	E	E	>=740	>=740	>=740	>=740	No	No
PL	Gałkówek - Koluszki			7.2	Diversionary	Core	2	2	E	E	>=740	>=740	>=740	>=740	No	No
PL	Koluszki - Skierniewice			39.3	Diversionary	Core	2	2	E	E	>=740	>=740	>=740	>=740	No	No
PL	Łowicz - Warszawa – Łuków															
PL	Łowicz Główny - Warszawa Gołąbki			69.9	Expected diversionary	Core	2	2	E	E	>=740	>=740	>=740	>=740	No	No
PL	Warszawa Gołąbki - Warszawa Główna Towarowa			1.4	Expected diversionary	Core	2	2	E	E	>=740	>=740	>=740	>=740	No	No
PL	Warszawa Główna Towarowa - Warszawa Gdańska			9.2	Diversionary	Core	2	2	E	E	>=740	>=740	>=740	>=740	No	No
PL	Warszawa Gdańska - Warszawa Praga			4.0	Diversionary	Core	2	2	E	E	<740	<740	>=740	>=740	No	No
PL	Warszawa Targówek - Warszawa Michałów			1.2	Diversionary	Core	2	2	E	E	>=740	>=740	>=740	>=740	No	No
PL	Warszawa Michałów - Warszawa Wschodnia Tow.			1.6	Diversionary	Core	2	2	E	E	<740	<740	>=740	>=740	No	No
PL	Warszawa Wschodnia Tow. - Warszawa Rembertów			3.9	Diversionary	Core	1	1	E	E	<740	<740	>=740	>=740	No	No
PL	Warszawa Rembertów - Stojadła			27.3	Diversionary	Core	2	2	E	E	>=740	>=740	>=740	>=740	No	No
PL	Stojadła - Mińsk Mazowiecki			1.6	Diversionary	Core	2	2	E	E	>=740	>=740	>=740	>=740	No	No
PL	Mińsk Mazowiecki - Siedlce			52.1	Diversionary	Core	2	2	E	E	>=740	>=740	>=740	>=740	No	No
PL	Siedlce - Łuków			27.8	Diversionary	Core	2	2	E	E	>=740	>=740	>=740	>=740	No	No
PL	Warszawa Praga - Krusze (Tłuszcz)															
PL	Warszawa Praga - Legionowo			15.1	Expected diversionary	Core	3	3	E	E	>=740	>=740	>=740	>=740	No	No
PL	Legionowo - Krusze			32.7	Expected diversionary	Off TEN-T	1	1	E	E	<740	<740	<740	<740	No	No
PL	Skierniewice - Warszawa Główna Towarowa															
PL	Skierniewice - Pruszków			50.0	Diversionary	Core	2	2	E	E	>=740	>=740	>=740	>=740	No	No
PL	Pruszków - Józefinów Podg			3.4	Diversionary	Core	2	2	E	E	>=740	>=740	>=740	>=740	No	No
PL	Warszawa Główna Towarowa - Józefinów			5.2	Connecting	Off TEN-T	2	2	E	E	>=740	>=740	>=740	>=740	No	No
PL	Warszawa Główna Towarowa - Warszawa Główna Towarowa			1.1	Connecting	Off TEN-T	2	2	E	E	>=740	>=740	>=740	>=740	No	No
PL	Białystok – Sokółka															
PL	Białystok - Sokółka			41.2	Connecting	Comprehensive	1	1	E	E	<740	<740	>=740	>=740	No	No
PL	Poznań – Ełk															
PL	Poznań Franowo - Kobylnica			7.9	Diversionary	Comprehensive	2	2	E	E	<740	<740	>=740	>=740	No	No
PL	Kobylnica - Mogilno			63.9	Diversionary	Comprehensive	2	2	E	E	<740	<740	<740	<740	No	No
PL	Mogilno - Gniewkowo			35.4	Diversionary	Comprehensive	2	2	E	E	>=740	>=740	>=740	>=740	No	No
PL	Gniewkowo - Toruń Wschód			15.2	Diversionary	Comprehensive	2	2	E	E	>=740	>=740	>=740	>=740	No	No
PL	Toruń Wschód - Korsze			353.0	Diversionary	Comprehensive	2	2	E	E	<740	<740	>=740	>=740	No	No
PL	Ełk - Korsze			98.8	Diversionary	Comprehensive	1	1	D	E	<740	<740	>=740	>=740	No	No
PL	Wrocław Brochów - Wrocław Główny															
PL	Wrocław Brochów - Wrocław Główny			2.4	Connecting	Core	2	2	E	E	<740	<740	>=740	>=740	No	No
PL	Bielawa Dolna (Border DE/PL) - Jaworzno Szczakowa															
PL	Bielawa Dolna (Border DE/PL) - Węgliniec			12.9	Principal	Core	2	2	E	E	>=740	>=740	>=740	>=740	No	No
PL	Węgliniec - Miłkowice			62.1	Principal	Core	2	2	E	E	>=740	>=740	>=740	>=740	No	No
PL	Miłkowice - Legnica			9.5	Principal	Core	2	2	E	E	>=740	>=740	>=740	>=740	No	No
PL	Legnica - WROCŁAW NOWY DWÓR			58.2	Principal	Core	2	2	E	E	>=740	>=740	>=740	>=740	No	No
PL	Wrocław Nowy Dwór - Wrocław Muchobór			1.9	Principal	Core	2	2	E	E	>=740	>=740	>=740	>=740	No	No
PL	Wrocław Muchobór - Wrocław Stadion			3.4	Principal	Core	2	2	E	E	<740	<740	>=740	>=740	No	No
PL	Wrocław Stadion - Wrocław Brochów			8.0	Principal	Core	2	2	E	E	<740	<740	>=740	>=740	No	No
PL	Wrocław Brochów - Siechnica			6.6	Principal	Core	2	2	E	E	<740	<740	>=740	>=740	No	No
PL	Siechnica - Czernica Wrocławska			6.9	Principal	Core	1	1	E	E	<740	<740	>=740	>=740	No	No
PL	Czernica Wrocławska - Jelcz Miłoszyce			5.2	Principal	Core	2	2	E	E	<740	<740	>=740	>=740	No	No
PL	Jelcz Miłoszyce - Biskupice Oławskie			17.3	Principal	Core	2	2	E	E	<740	<740	>=740	>=740	No	No
PL	Biskupice Oławskie - Opole Groszowice			54.3	Principal	Core	2	2	E	E	<740	<740	>=740	>=740	No	No
PL	Opole Groszowice - Strzelce Opolskie			28.8	Principal	Core	2	2	E	E	<740	<740	>=740	>=740	No	No
PL	Strzelce Opolskie - Paczyna			22.1	Principal	Core	2	2	E	E	<740	<740	>=740	>=740	No	No
PL	Paczyna - Pyskowice			5.2	Principal	Core	2	2	E	E	<740	<740	>=740	>=740	No	No
PL	Pyskowice - Gliwice Łabędy			6.1	Principal	Core	2	2	E	E	<740	<740	>=740	>=740	No	No
PL	Gliwice Łabędy - Gliwice			5.3	Principal	Core	2	2	E	E	<740	<740	>=740	>=740	No	No

Member State	Line section 2018 (1435 mm)	Issues at waiting- or buffer locations in 2018	Issues at waiting- or buffer locations by 2030	Length of section 2018 (km)	Type of line 2018	Type of network 2018	Number of tracks 2018	Expected changes in the n. of tracks by 2030	Traction 2018	Expected Traction by 2030	Max train length (m) 2018		Max train length (m) 2030		Capacity constraints limiting 740 meters train operations in 2018	Capacity constraints limiting 740 meters train operations by 2030
											Even direction	Odd direction	Even direction	Odd direction		
PL	Szobiszowice - Gliwice Port			1.8	Connecting	Off TEN-T	2	2	E	E	<740	<740	>=740	>=740	No	No
PL	Gliwice - Szobiszowice			0.9	Connecting	Off TEN-T	2	2	E	E	<740	<740	>=740	>=740	No	No
PL	Gliwice - Gliwice Sośnica			0.9	Connecting	Off TEN-T	2	2	E	E	<740	<740	>=740	>=740	No	No
PL	Gliwice - Zabrze Biskupice			13.6	Principal	Core	2	2	E	E	<740	<740	>=740	>=740	No	No
PL	Zabrze Biskupice - Bytom			6.8	Principal	Core	2	2	E	E	<740	<740	>=740	>=740	No	No
PL	Bytom - Chorzów Stary			6.3	Principal	Core	2	2	E	E	<740	<740	>=740	>=740	No	No
PL	Chorzów Stary - Katowice Szopienice Północne			12.1	Principal	Core	2	2	E	E	<740	<740	>=740	>=740	No	No
PL	Szabelnia - Katowice Szopienice Północne			1.4	Principal	Core	1	1	E	E	<740	<740	>=740	>=740	No	No
PL	Katowice Szopienice Północne - Stawiska Podg			9.7	Principal	Core	1	1	E	E	<740	<740	>=740	>=740	No	No
PL	Stawiska Podg - Stawiska Podg			0.5	Principal	Core	1	1	E	E	<740	<740	>=740	>=740	No	No
PL	Stawiska - Mysłowice			1.8	Principal	Core	1	1	E	E	<740	<740	>=740	>=740	No	No
PL	Mysłowice - Szabelnia			3.3	Principal	Core	2	2	E	E	<740	<740	>=740	>=740	No	No
PL	Mysłowice - Długoszyn			9.4	Principal	Core	2	2	E	E	<740	<740	>=740	>=740	No	No
PL	Jaworzno Szczakowa JSB - Długoszyn Podg			1.9	Principal	Off TEN-T	1	1	E	E	<740	<740	<740	<740	No	No
PL	Długoszyn Podg - Sosnowiec Maczki			1.9	Principal	Off TEN-T	1	1	E	E	<740	<740	<740	<740	No	No
PL	Sosnowiec Maczki - Sosnowiec Maczki			1.1	Principal	Off TEN-T	2	2	E	E	<740	<740	<740	<740	No	No
PL	Sosnowiec Maczki - Jaworzno Szczakowa			2.0	Principal	Off TEN-T	1	1	E	E	<740	<740	<740	<740	No	No
PL	Jaworzno Szczakowa - Kraków Mydlniki **			47.5	Expected principal	Core	2	2	E	E	<740	<740	>=740	>=740	No	No
PL	Kraków Mydlniki - Podłęże **			33.2	Expected principal	Core	2	2	E	E	<740	<740	>=740	>=740	No	No
PL	Podłęże - Medyka Gr.P. **			239.9	Expected principal	Core	2	2	E	E	<740	<740	>=740	>=740	No	No
PL	Kraków Mydlniki – Podłęże															
PL	Kraków Mydlniki - Kraków Gł. ***			7.475	Expected principal	comprehensive	2	2	E	E	<740	<740	<740	<740	No	No
PL	Kraków Gł. – Podłęże ***			18.403	Expected principal	comprehensive	2	2-4	E	E	<740	<740	<740	<740	No	No
PL	Wrocław – Opole															
PL	Wrocław Brochów - Święta Katarzyna			6.6	Diversionary	Core	2	2	E	E	<740	<740	>=740	>=740	No	No
PL	Święta Katarzyna - Brzeg			31.5	Diversionary	Core	2	2	E	E	<740	<740	>=740	>=740	No	No
PL	Brzeg - Opole Groszowice			43.7	Diversionary	Core	2	2	E	E	<740	<740	>=740	>=740	No	No
PL	Wrocław - Brzeg Dolny															
PL	Wrocław Nowy Dwór - Wrocław Gądów			1.3	Connecting	Off TEN-T	2	2	E	E	>=740	>=740	>=740	>=740	No	No
PL	Wrocław Gądów - Wrocław Kuźniki			1.8	Connecting	Off TEN-T	2	2	E	E	<740	<740	>=740	>=740	No	No
PL	Wrocław Kuźniki - Brzeg Dolny			23.1	Connecting	Comprehensive	2	2	E	E	<740	<740	>=740	>=740	No	No
PL	Wrocław - Kąty Wrocławskie															
PL	Wrocław Gądów - Wrocław Zachodni			5.4	Connecting	Off TEN-T	1	1	E	E	<740	<740	>=740	>=740	No	No
PL	Wrocław Zachodni - Kąty Wrocławskie			15.2	Connecting	Off TEN-T	2	2	E	E	<740	<740	>=740	>=740	No	No
PL	Sosnowiec Maczki - Sosnowiec Południowy															
PL	Sosnowiec Maczki - Sosnowiec Kazimierz SKZ1			3.7	Connecting	Off TEN-T	1	1	E	E	<740	<740	>=740	>=740	No	No
PL	Sosnowiec Kazimierz SKZ1 - Sosnowiec Kazimierz SKZ2			1.0	Connecting	Off TEN-T	1	1	E	E	>=740	>=740	>=740	>=740	No	No
PL	Sosnowiec Kazimierz SKZ2 - Sosnowiec Południowy			9.1	Connecting	Off TEN-T	1	1	E	E	<740	<740	>=740	>=740	No	No
PL	Sosnowiec Maczki - Dąbrowa Górnicza Towarowa															
PL	Sosnowiec Maczki - Dorota			2.6	Connecting	Off TEN-T	2	2	E	E	<740	<740	<740	<740	No	No
PL	Dorota - Dąbrowa Górnicza Towarowa			12.3	Connecting	Off TEN-T	2	2	E	E	<740	<740	<740	<740	No	No
CZ																
CZ	Praha Libeň - Praha Holešovice			5.2	Principal	Comprehensive	2	2	E	E	<740	<740	>=740	>=740	At most times of the day	At most times of the day
CZ	Praha Holešovice - Praha Bubeneč			1.5	Principal	Comprehensive	2	2	E	E	<740	<740	>=740	>=740	At most times of the day	At most times of the day
CZ	Praha Bubeneč - Kralupy n/Vltavou			22.1	Principal	Comprehensive	2	2	E	E	<740	<740	>=740	>=740	At most times of the day	At most times of the day
CZ	Kralupy n/Vltavou - Nelahozeves			5.4	Principal	Comprehensive	2	2	E	E	<740	<740	>=740	>=740	At most times of the day	At most times of the day
CZ	Nelahozeves - Lovosice			52.5	Principal	Comprehensive	2	2	E	E	<740	<740	>=740	>=740	At most times of the day	At most times of the day

Member State	Line section 2018 (1435 mm)	Issues at waiting- or buffer locations in 2018	Issues at waiting- or buffer locations by 2030	Length of section 2018 (km)	Type of line 2018	Type of network 2018	Number of tracks 2018	Expected changes in the n. of tracks by 2030	Traction 2018	Expected Traction by 2030	Max train length (m) 2018		Max train length (m) 2030		Capacity constraints limiting 740 meters train operations in 2018	Capacity constraints limiting 740 meters train operations by 2030
											Even direction	Odd direction	Even direction	Odd direction		
CZ	Lovosice - Děčín hl.n.			44.6	Principal	Comprehensive	2	2	E	E	<740	<740	>=740	>=740	At most times of the day	At most times of the day
CZ	Děčín hl.n. - Děčín Prostřední Žleb			3.3	Principal	Comprehensive	2	2	E	E	<740	<740	>=740	>=740	At most times of the day	At most times of the day
CZ	Děčín Prostřední Žleb - state border Germany			8.1	Principal	Core	2	2	E	E	<740	<740	>=740	>=740	At most times of the day	At most times of the day
CZ	Praha Libeň - Praha Vysočany			1.2	Diversionary	Core	1	1	E	E	<740	<740	>=740	>=740	Yes	Yes
CZ	Praha Vysočany - Praha H.Počernice			8.6	Diversionary	Core	2	2	E	E	<740	<740	>=740	>=740	Yes	Yes
CZ	Praha H.Počernice - Lysá n/Labem			20.5	Diversionary	Core	2	2	E	E	<740	<740	>=740	>=740	Yes	Yes
CZ	Lysá n/Labem - Ústí n/L Střekov			93.5	Diversionary	Core	2	2	E	E	<740	<740	>=740	>=740	At most times of the day	At most times of the day
CZ	Ústí n/L Střekov - Děčín východ d.n.			25.8	Diversionary	Core	2	2	E	E	<740	<740	>=740	>=740	At most times of the day	At most times of the day
CZ	Děčín východ d.n. - Děčín Prostřední Žleb			2.8	Diversionary	Core	1	1	E	E	<740	<740	>=740	>=740	At most times of the day	At most times of the day
CZ	Praha Libeň - Praha Malešice			3.9	Connecting	Core	1	1	E	E	<740	<740	>=740	>=740	At most times of the day	At most times of the day
CZ	Praha Malešice - Praha Hostivař			3.9	Connecting	Core	1	1	E	E	<740	<740	>=740	>=740	At most times of the day	At most times of the day
CZ	Praha Hostivař - Praha Uhříněves			4.8	Connecting	Core	2	2	E	E	<740	<740	>=740	>=740	At most times of the day	At most times of the day
LT																
LT	Trakiszki (Border PL/LT) - Mockava			14.3	Principal	Comprehensive	1		D	E	>=740	>=740	>=740	>=740	No	No
LT	Mockava - Šeštokai			7.5	Principal	Comprehensive	1		D	E	>=740	>=740	>=740	>=740	No	No
LT	Šeštokai - Kazlų Rūda			57.0	Principal	Comprehensive	1		D	E	>=740	>=740	>=740	>=740	No	No
LT	Kazlų Rūda - Kaunas			36.8	Principal	Core	1		D	E	>=740	>=740	>=740	>=740	No	No

*Source: Contractor based on consultation with the Infrastructure Managers: Note: * 740 m trains in Belgium are allowed outside peak hours (6-9 am / 16-19 pm) during Peak hours train length is limited to 650m; ** Albeit included in the scope of the study, the extension to Medyka was not part of the RFC NS-B in 2018; *** The expected principal lines Kraków Mydlniki – Kraków Gł. and Kraków Gł. – Podłęże are currently planned to be used for passenger traffic and accordingly they were excluded from the analysis*

Table A-2 Handover stations/marshalling yards/waiting-buffer locations of the RFC NS-B in 2018 and their characteristics in 2018 and by 2030 based on information provided by the infrastructure managers

Member State	Handover stations/marshalling yards/waiting-buffer locations	Type of network 2018	Number of tracks 2018	Traction 2018	Traction 2030	Max train length (m) 2018	Max train length (m) 2030
	Handover stations						
NL	Maasvlakte West + West	Core	36	E	E	>=740	>=740
NL	Maasvlakte (Oost)	Core	13	E	E	>=740*	>=740*
NL	Europoort	Core	4	E	E	>=740*	>=740*
NL	Botlek	Core	6	E	E	<740	<740
NL	Pernis	Core	4	E	E	<740	<740
NL	Waalhaven Zuid	Core	> 10	E	E	>=740*	>=740*
NL	Beverwijk	Comprehensive	2	E	E	>=740	>=740
NL	Amsterdam Houtrakpolder	Core	3	E	E	>=740	>=740
NL	Amsterdam Westhaven	Core	7	E	E	>=740	>=740
NL	Amersfoort (car terminal)	Core	6	E	E	>= 740/ <740 (<740 direction Amsterdam)	>= 740/ <740 (<740 direction Amsterdam)
NL	Almelo	Core	4	E	E	<740	<740
	Side tracks						
NL	Roosendaal	Core	4	E	E	>=740*	>=740*
NL	Breda	Comprehensive	1	E	E	>=740	>=740
NL	Tilburg Goederen	Comprehensive	1	E	E	<740	<740
NL	Geldermelden/Meteren	Core	2	E	E	<740	>=740
NL	Amsterfoort (waiting-buffertrack)	Core	2	E	E	>= 740/ <740 (<740 direction Amsterdam)	>= 740/ <740 (<740 direction Amsterdam)
NL	Rotterdam Noord Goederen	Comprehensive	1	E	E	<740	<740
NL	Rotterdam Central	Comprehensive	1	E	E	>=740	>=740
NL	Stroe	Core	1	E	E	>=740	>=740
NL	Deventer Goederen	Core	5	E	E	>=740	>=740
NL	Almelo buffertrack	Core	4	E	E	<740	<740
NL	Oldenzaal	Core	3	E	E	>=740	>=740
BE	Antwerpen Marhalling Yard	-	-	-	-	-	-
BE	Antwerpen Haven - Bundel A1	Off TEN-T	15	E	E	>=740	>=740
BE	Antwerpen Haven - Bundel B3	Off TEN-T	16	E	E	<740	<740
BE	Antwerpen Haven – bundel Berendrecht	Off TEN-T	21	D	D	>=740	>=740
BE	Antwerpen Haven - bundel Buitenschoor	Off TEN-T	8	D	D	>=740	>=740
BE	Antwerpen Haven - Bundel Oudendijk 1	Off TEN-T	10	D	D	>=740	>=740
BE	Antwerpen Haven - Bundel Oorderen	Off TEN-T	17	D	D	<740	<740
BE	Antwerpen Haven - Bundel Angola	Off TEN-T	14	D	D	<740	<740
BE	Antwerpen Bundel Zuid	Off TEN-T	5	E	E	>=740	>=740
BE	Antwerpen-Schijnpoort Bundel Q	Off TEN-T	10	E	E	>=740	>=740
BE	Genk Goederen	Off TEN-T	17	E	E	>=740	>=740
BE	Kinkempois-Réception	Off TEN-T	36	E	E	>=740	>=740
BE	Bressoux	Off TEN-T	36	E	E	>=740	>=740
DE	Wilhelmshaven	Core		D	E	>=740	>=740
DE	Maschen Rbf	Core	11	E	E	>=740	>=740

Member State	Handover stations/marshalling yards/waiting-buffer locations	Type of network 2018	Number of tracks 2018	Traction 2018	Traction 2030	Max train length (m) 2018	Max train length (m) 2030
DE	Hamburg Süd	Off TEN-T				>=740	>=740
DE	Bremerhaven - Speckenbüttel	Core	1	E	E	>=740	>=740
DE	Bremen Rbf	Core	3	E	E	>=740	>=740
DE	Oberhausen-Osterfeld Süd	Comprehensive	5	E	E	>=740	>=740
DE	Oberhausen West	Core	9	E	E	>=740	>=740
DE	Duisburg Ruhrort Hafen	Off TEN-T		E	E	>=740*	>=740*
DE	Duisburg Hafen	Off TEN-T		D	D	>=740*	>=740*
DE	Rheinhausen	Comprehensive	6	E	E	>=740	>=740
DE	Duisburg-Hochfeld Süd	Core	7	D	D	>=740*	>=740*
DE	Krefeld-Uerdingen	Comprehensive	3	E	E	>=740	>=740
DE	Wanne-Eickel	Core	2	E	E	>=740	>=740
DE	Dortmund-Obereving	Core	2	E	E	>=740	>=740
DE	Seelze Rbf	Core	2	E	E	>=740	>=740
DE	Hannover-Linden	Core	2	E	E	>=740	>=740
DE	Lehrte	Core	35	E	E	>=740	>=740
DE	Fallersleben	Core	3	E	E	>=740	>=740
DE	Braunschweig Rbf	Core	3	E	E	<740	<740
DE	Beddingen	Off TEN-T	2	E	E	>=740	>=740
DE	Magdeburg-Rothensee	Core	1	E	E	<740	<740
DE	Magdeburg-Sudenburg	Core	4	E	E	>=740	>=740
DE	Großbeeren	Comprehensive	1	E	E	>=740	>=740
DE	Seddin	Comprehensive	9	E	E	>=740	>=740
DE	Dresden - Friedrichstadt	Core	4	E	E	>=740	>=740
DE	Berlin Hamburger und Lehrter Bf	Off TEN-T		D	D	>=740*	>=740*
DE	Frankfurt (Oder) Pbf	Core	6	E	E	<740	<740
PL	Jaworzno Szczakowa	Core	8 (27)	E	E	>=740	>=740
PL	Gądki	Core	2 (3)	E	E	>=740	>=740
PL	Gliwice	Core	14 (24)	E	E	>=740	>=740
PL	Gliwice (port)	Off TEN-T	2 (4)	E	E	<740	>=740
PL	Kąty Wrocławskie	Off TEN-T	2 (1)	E	E	>=740	>=740
PL	Stara Wieś k. Kutna	Core	2 (3)	E	E	>=740	>=740
PL	Pruszków	Core	8 (4)	E	E	>=740	>=740
PL	Sosnowiec Południowy	Core	2 (3)	E	E	<740	>=740
PL	Warszawa Główna Towarowa	Off TEN-T	9 (17)	E	E	>=740	>=740
PL	Łódź Olechów	Core	24 (56)	E	E	>=740	>=740
PL	Małaszewicze Południe	Core	1 (4)	E	E	>=740	>=740
PL	Sokółka	Comprehensive	4 (4)	E	E	>=740	>=740
PL	Poznań Franowo	Core	8 (45)	E	E	>=740	>=740
PL	Swarzędz	Core	6 (5)	E	E	>=740	>=740
PL	Brzeg Dolny	Comprehensive	1 (1)	E	E	<740	>=740
PL	Dąbrowa Górnicza Towarowa	Off TEN-T	4 (20)	E	E	>=740	>=740
CZ	Praha-Uhříněves	Core	7	E	E	>=740	>=740
CZ	Lovosice	Comprehensive	11	E	E	>=740	>=740
CZ	Ústí nad Labem	Comprehensive	10	E	E	<740	>=740
CZ	Děčín	Comprehensive	7	E	E	<740	>=740
CZ	Mělník	Core	7	E	E	>=740	>=740
LT	Mockava	Comprehensive	7	D	E	>=740*	>=740*
LT	Šeštokai	Comprehensive	8	D	E	>=740	>=740
LT	Kaunas	Core	3	D	E	>=740*	>=740*

*Source: Contractor based on consultation with the Infrastructure Managers; Notes: * Affected by capacity constraints*

Table A-3 Terminals of the RFC NS-B in 2018 and their characteristics in 2018 and by 2030 based on the surveys performed as part of the study

Member State	Terminal	Handover station	Type of node in 2018	Number of tracks in 2018	Electrified accessibility at terminal in 2018	Electrified accessibility at terminal by 2030	Electrified accessibility at loading/unloading track(s) in 2018	Electrified accessibility at loading/unloading track(s) by 2030	Max train length [longest loading/unloading track(s) in m] in 2018	Max train length [longest loading/unloading track(s) in m] by 2030
NL	Defensie	Almelo								
NL	Grindhandel Dollegoor	Almelo								
NL	Openbare Laad- en losplaats (public loading and unloading facilities)	Almelo (track 14)								
NL	Van Merksteijn	Almelo								
NL	Kolb (Delden)	Bad Bentheim								
NL	PON Leusden	Amersfoort								
NL	AVI West	Amsterdam Houtrakpolder								
NL	De Rietlanden (Afrikahaven)	Amsterdam Houtrakpolder								
NL	De Rietlanden (Amerikahaven)	Amsterdam Houtrakpolder								
NL	Ter Haak	Amsterdam Houtrakpolder								
NL	Cotterel (Vlothaven)	Amsterdam Westhaven								
NL	EuroTank Amsterdam	Amsterdam Westhaven								
NL	Igma Cargill	Amsterdam Westhaven								
NL	Koopman Car Terminal	Amsterdam Westhaven								
NL	Noord-Europees Wijnopslag Bedrijf (NWB)	Amsterdam Westhaven								
NL	Openbare Laad- en losplaats (public loading and unloading facilities)	Amsterdam Westhaven								
NL	Overslagbedrijf Amsterdam (OBA)	Amsterdam Westhaven								
NL	Rotim	Amsterdam Westhaven								
NL	Steinweg	Amsterdam Westhaven								
NL	VCK Scandia Terminal	Amsterdam Westhaven								
NL	Vopak Petroleumhaven	Amsterdam Westhaven								
NL	Waterland Terminal	Amsterdam Westhaven								
NL	Tata-Steel	Beverwijk (track 77 + 78)								
NL	Akzo-Nobel	Botlek								
NL	Bertschi Terminal Rotterdam	Botlek								
NL	Biopetrol	Botlek								
NL	Borax	Botlek								
NL	C.RO	Botlek								
NL	Broekman Distriport	Botlek								
NL	Kemira	Botlek								
NL	LBC	Botlek								
NL	LyondellBasell	Botlek								
NL	Koole tankstorage Botlek	Botlek								
NL	Rubis	Botlek								
NL	Steinweg Botlekterminal	Botlek								
NL	Vopak Chemiehaven	Botlek								
NL	Vopak TTR	Botlek								
NL	Vopak Terminal Botlek	Botlek								
NL	Vopak Terminal RCC	Botlek								
NL	Abengoa	Europoort								
NL	ADM	Europoort								
NL	Broekman Logistics Europoort	Europoort								
NL	Caldic	Europoort								
NL	Ertsoverslagbedrijf Europoort CV	Europoort								
NL	Euro Tank Terminal	Europoort								
NL	European Bulk Services	Europoort								
NL	BP Raffinaderij Rotterdam B.V.	Europoort								
NL	P&O Ferries	Europoort								
NL	Steinweg	Europoort								
NL	EMO	Maasvlakte								
NL	Rotterdam Container Terminal (Kramer)	Maasvlakte West								
NL	Steinweg Hartel Terminal	Maasvlakte								
NL	APMT	Maasvlakte West								
NL	Hutchison Ports ECT Delta	Maasvlakte West								
NL	Hutchison Ports ECT Euromax	Maasvlakte West								
NL	RTW-ECT Rail Terminal West	Maasvlakte West								
NL	RWG (Rotterdam World Gateway)	Maasvlakte West								
NL	Lyondell Basell	Maasvlakte West								
NL	Rhenus Logistics	Maasvlakte West								

Member State	Terminal	Handover station	Type of node in 2018	Number of tracks in 2018	Electrified accessibility at terminal in 2018	Electrified accessibility at terminal by 2030	Electrified accessibility at loading/unloading track(s) in 2018	Electrified accessibility at loading/unloading track(s) by 2030	Max train length [longest loading/unloading track(s) in m] in 2018	Max train length [longest loading/unloading track(s) in m] by 2030
NL	Cerexagri / Arkema	Pernis								
NL	Interforest	Pernis								
NL	Koole	Pernis								
NL	Rotterdam RTT	Pernis								
NL	CTT Rotterdam	Pernis								
NL	Shell (diverse poorten)	Pernis								
NL	Metaal Transport	Waalhaven Zuid								
NL	Metaaltransport / Meijers	Waalhaven Zuid								
NL	RET Metro-depot	Waalhaven Zuid								
NL	Rhenus Logistics	Waalhaven Zuid								
NL	Rotterdams Havenbedrijf	Waalhaven Zuid								
NL	Shunter (A. Plesmanweg)	Waalhaven Zuid								
NL	Shunter (Blindeweg)	Waalhaven Zuid								
NL	Steinweg Beatrixhaven	Waalhaven Zuid								
NL	Steinweg Dodewaardstaart	Waalhaven Zuid								
NL	Uniport	Waalhaven Zuid								
NL	Rail Service Center Rotterdam BV (RSC)	Waalhaven Zuid								
BE	DP World Antwerp Gateway	Antwerpen Haven+B84:B101 - Bundel Oorderen								
BE	SHIPIT	Antwerpen Bundel Zuid								
BE	MSC/PSA European Terminal	Antwerpen Bundel Zuid								
BE	Hupac Terminal Antwerpen	Antwerpen Haven - Bundel Oorderen								
BE	Antwerpen Mainhub Terminal	Antwerpen Haven – Bundel A1								
BE	Antwerp Zomerweg Terminal	Antwerpen Haven – Bundel Angola								
BE	Antwerpen ATO	Antwerpen Haven – Bundel Angola								
BE	Trilogiport	Bressoux								
BE	Euroterminal Genk Exploitatie	Genk Goederen								
BE	NV Haven Genk	Genk Goederen	Off TEN-T		No	Yes	No	Yes	>=740	>=740
BE	Liège Container Terminal	Kinkempois-Réception								
BE	Liège Logistics Intermodal	Kinkempois-Réception								
BE	Kinkempois	Kinkempois-Réception								
BE	n/a	Antweprn Schijnpoort Bundel Q								
BE	Antwerpen Cirkeldyck	Antwerpen Haven - Bundel Berendrecht								
BE	PSA Noordzee Terminal	Antwerpen Haven - Bundel Buitenschoor								
BE	PSA Europa Terminal	Antwerpen Haven - Bundel Oudendijk 1								
BE	Combinant	Antwerpen Haven - Bundel B3								
BE	Delwaide Dock Terminal	Antwerpen Haven+B84:B101 - Bundel Berendrecht								
DE	Berlin - Westhafen	Berlin Hamburger und Lehrter Bf	Off TEN-T							
DE	Braunschweig Containerterminal	Braunschweig	Off TEN-T							
DE	Bremen Roland	Bremen	Core							
DE	Bahnhof Bremen Rbf	Bremen	Core							
DE	CTB Bremerhaven	Bremerhaven - Speckenbüttel	Core		Yes	Yes	No	No	>=740	>=740
DE	NTB Bremerhaven	Bremerhaven - Speckenbüttel	Core		Yes	Yes	Yes	Yes	>=740	>=740
DE	MSC Gate Bremerhaven	Bremerhaven - Speckenbüttel	Core		Yes	Yes	No	No	<740	<740
DE	Container Terminal Dortmund	Dortmund - Obereving	Core							
DE	Ubf Dresden	Dresden - Friedrichstadt	Core							
DE	Dresden GVZ	Dresden - Friedrichstadt	Core							
DE	Duisburg RRT (Rhein-Ruhr Terminal)	Duisburg Hafen	Off TEN-T							
DE	Logport II Gateway West	Duisburg Hochfeld Süd	Core							
DE	Bahnhof Duisburg Ruhrort Hafen	Duisburg Ruhrort Hafen	Off TEN-T		Yes	Yes	Yes	Yes	>=740	>=740
DE	DeCeTe Duisburg	Duisburg Ruhrort Hafen	Off TEN-T							
DE	PKV Duisburg	Duisburg Ruhrort Hafen	Off TEN-T							
DE	KV-Drehscheibe Rhein/Ruhr (Megahub Duisburg)	Duisburg Ruhrort Hafen	Off TEN-T		Yes	Yes	Yes	Yes	<740	<740
DE	Wolfsburg GVZ	Fallersleben	Core							
DE	Frankfurt (Oder)	Frankfurt (Oder) Pbf	Core							
DE	Ubf Großbeeren	Großbeeren	Core		Yes	Yes	Yes	Yes	<740	>=740
DE	Hamburg – Container Terminal Tollerort (CTT)	Hamburg Süd	Core							

Member State	Terminal	Handover station	Type of node in 2018	Number of tracks in 2018	Electrified accessibility at terminal in 2018	Electrified accessibility at terminal by 2030	Electrified accessibility at loading/unloading track(s) in 2018	Electrified accessibility at loading/unloading track(s) by 2030	Max train length [longest loading/unloading track(s) in m] in 2018	Max train length [longest loading/unloading track(s) in m] by 2030
DE	Hamburg - BUSS Hansa	Hamburg Süd	Core							
DE	Hannover Linden (until go life of KV Drehscheibe Lehrte)	Hannover - Linden	Core		Yes	Yes	Yes	Yes	<740	<740
DE	Logport III	Krefeld - Hohenbudberg	Core							
DE	KV Drehscheibe Lehrte (coming up)	Lehrte	Core							
DE	Magdeburg Rothensee	Magdeburg	Comprehensive							
DE	Ubf Hamburg Billwerder	Maschen	Core							
DE	Hamburg – Container Terminal Altenwerder (CTA)	Maschen	Comprehensive							
DE	Hamburg – Container Terminal Burchardkai (CTB)	Maschen	Comprehensive							
DE	Hamburg - Waltershof	Maschen	Comprehensive							
DE	Maschen Rbf	Maschen	Core							
DE	Bahnhof Oberhausen Osterfeld	Oberhausen Osterfeld	Comprehensive							
DE	Bahnhof Oberhausen West	Oberhausen West	Core							
DE	Logport I Duisburg DIT	Rheinhausen	Comprehensive							
DE	Logport I Duisburg Kombiterminal (DKT)	Rheinhausen	Comprehensive							
DE	Logport I Duisburg Trimodal Terminal (D3T)	Rheinhausen	Comprehensive							
DE	Salzgitter GVZ - KLV Terminal	Salzgitter - Beddingen	Off TEN-T							
DE	Bahnhof Seddin Rbf	Seddin	Comprehensive							
DE	Bahnhof Seelze Rbf	Seelze	Core							
DE	Bahnhof Wanne-Eickel	Wanne-Eickel	Core							
DE	Container Terminal Herne	Wanne-Eickel	Core							
DE	CT Wilhelmshaven (CTW)	Wilhelmshaven	Core		No	Yes	No	No	>=740	>=740
PL	Terminal Brzeg Dolny (PCC Intermodal S.A.)	Brzeg Dolny			No	Yes	No	No	<740	<740
PL	Terminal Dąbrowa Górnicza (Metrans)	Dąbrowa Górnicza Towarowa			No	No	No	No	<740	<740
PL	Terminal Gądki (Metrans)	Gądki			No	Yes	No	Yes	<740	<740
PL	Terminal Gliwice (PKP Cargo)	Gliwice								
PL	Terminal Gliwice (port) (PCC Intermodal S.A.)	Gliwice (port)			No	Yes	No	No	<740	<740
PL	Euroterminal Sławków (Euroterminal Sławków)	Jaworzno Szczakowa								
PL	Terminal Kąty Wrocławskie (Shavemaker Logistics&Transport)	Kąty Wrocławskie			Yes	Yes	No	No	<740	>=740
PL	Terminal Łódź Olechów (Spedycja Polska Spedcont Sp. z o.o.)	Łódź Olechów								
PL	Centrum Logistyczne Małaszewicze (PKP Cargo)	Małaszewicze Południe								
PL	Terminal Poznań Franowo (PKP Cargo)	Poznań Franowo								
PL	Pruszków (Metrans)	Pruszków			No	No	No	No	<740	<740
PL	Centrum Logistyczne Łososna (Centrum Logistyczne w Łososnej)	Sokółka								
PL	Terminal Sosnowiec Południowy (Spedycja Polska Spedcont Sp. z o.o.)	Sosnowiec Południowy								
PL	Terminal Kutno (PCC Intermodal S.A.)	Stara Wieś k. Kutna			No	Yes	No	No	<740	>=740
PL	Terminal Swarzędz (CLIP Logistics Sp. z .o.o.)	Swarzędz			Yes	Yes	Yes	Yes	>=740	>=740
PL	Terminal Warszawa Główna Towarowa (Spedycja Polska Spedcont Sp. z o.o.)	Warszawa Główna Towarowa								
CZ	Děčín	Děčín	Comprehensive							
CZ	Lovosice	Lovosice	Comprehensive							
CZ	Mělník	Mělník	Core							
CZ	Praha-Uhříněves	Praha-Uhříněves	Core							
CZ	Ústí nad Labem	Ústí nad Labem	Comprehensive							
LT	Kaunas intermodal terminal	Kaunas	Core	2	No	Yes	No	Yes	<740	<740
LT	Mockava terminal	Mockava	Comprehensive	7	No	Yes	No	Yes	<740	<740
LT	Šeštokai railway station	Šeštokai	Comprehensive	8	No	Yes	No	Yes	>=740	>=740

Source: Contractor based on consultation with the Infrastructure Managers

ANNEX B SCHEMATIC MAPS OF THE RFC NS-B

The schematic maps overleaf provide a graphic overview of the characteristics of the RFC NS-B in 2018 with reference to the following parameters:

- Type of line;
- Type of network;
- Number of tracks;
- Traction;
- Technical max. train length.

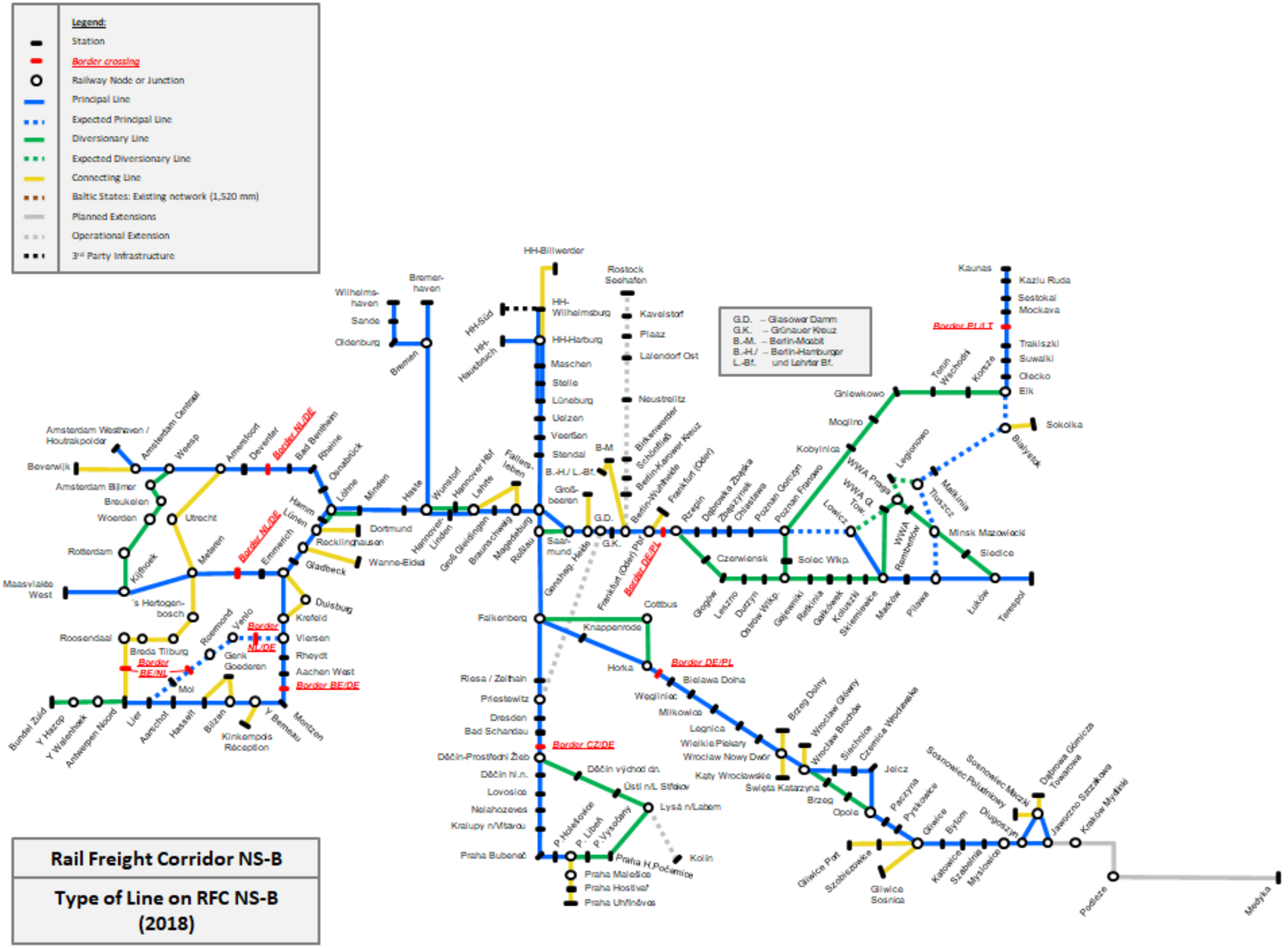
Further to these five maps outlining detailed parameters for the corridor lines, two simplified maps representing the status of the possibility to operate 740 meter long trains in 2018 and by 2030 were elaborated, which are also included in this Annex. The two maps are showing where 740 meter long trains are possible to be operated (green); where they are possible to be operated with capacity restrictions (dotted orange) and where 740 meter long trains are not possible to be operated (red).

All the maps are provided in A3 format.

With reference to the represented corridor lines it is worth to notice that:

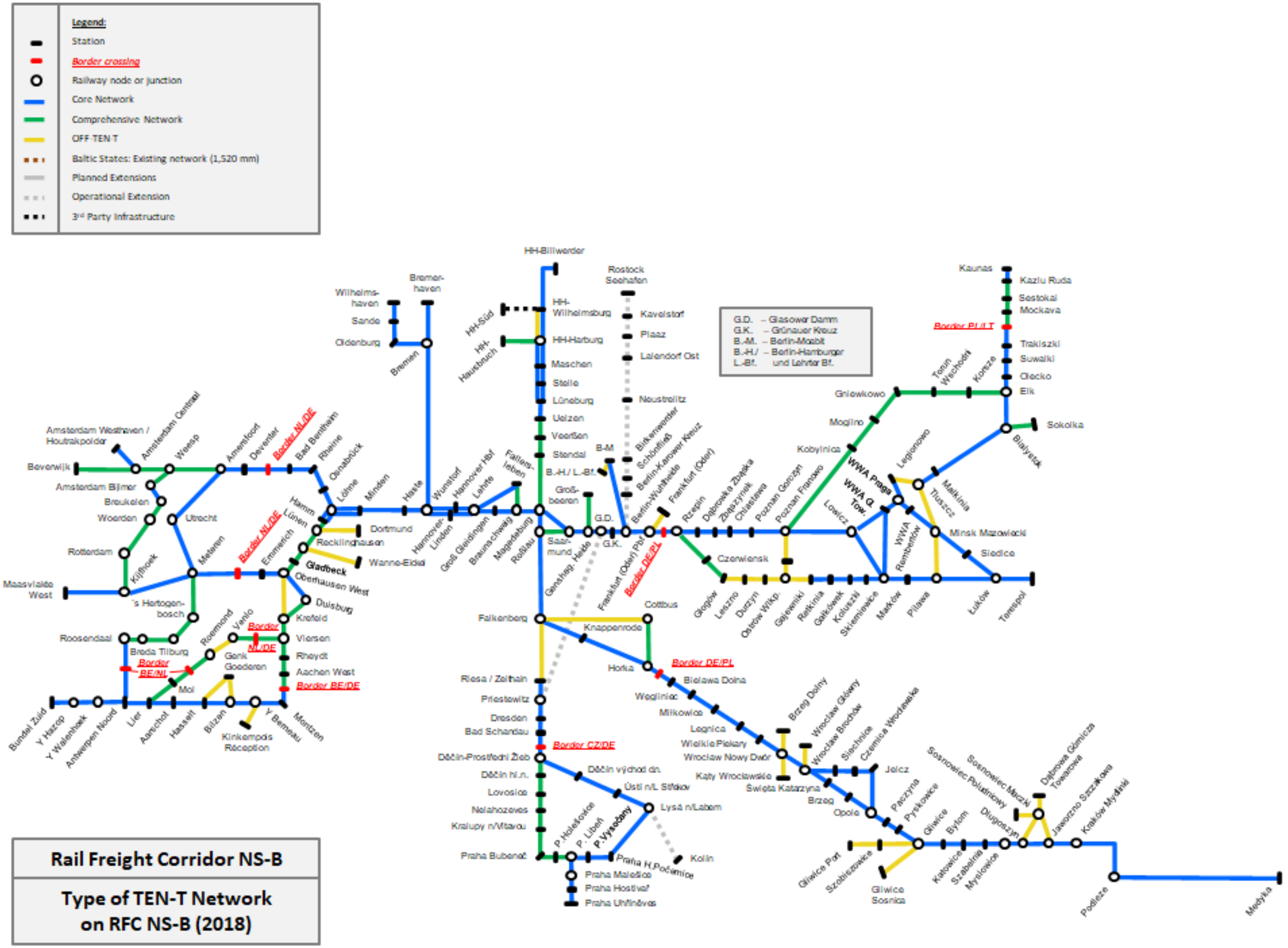
- The extension of the corridor lines to Latvia and Estonia will occur in 2020 and these lines were not represented in the maps;
- The displayed operational extensions are also part of the RFC Orient/East Med.

Figure C-1 – RFC NS-B characteristics: type of lines in 2018



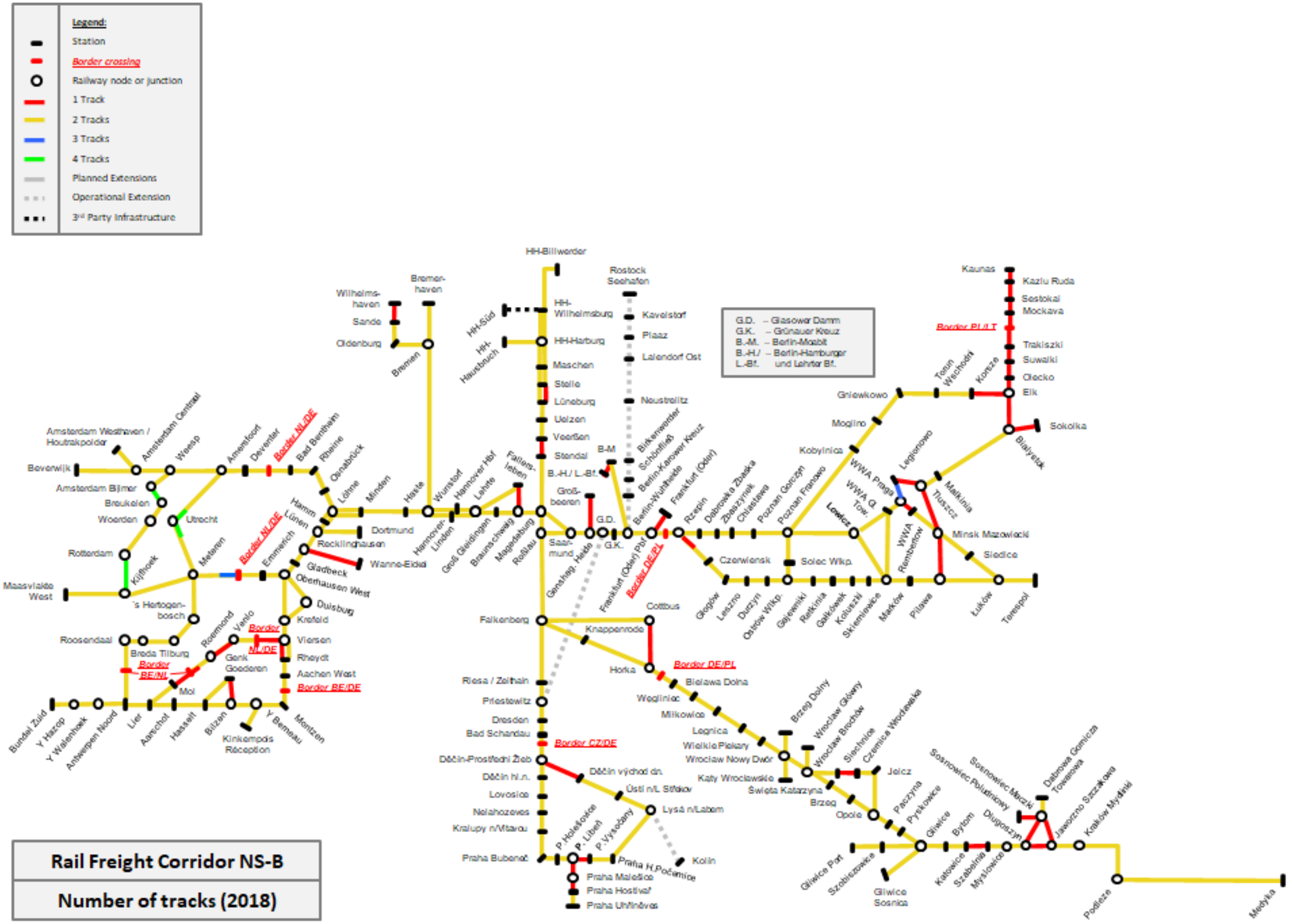
Source: Contractor based on consultation with the Infrastructure Managers; Notes: 1) the extension of the corridor lines to Latvia and Estonia will occur in 2020 and these lines were not represented in the maps; 2) the displayed operational extensions are also part of the RFC Orient/East Med

Figure C-2 – RFC NS-B characteristics: type of network in 2018



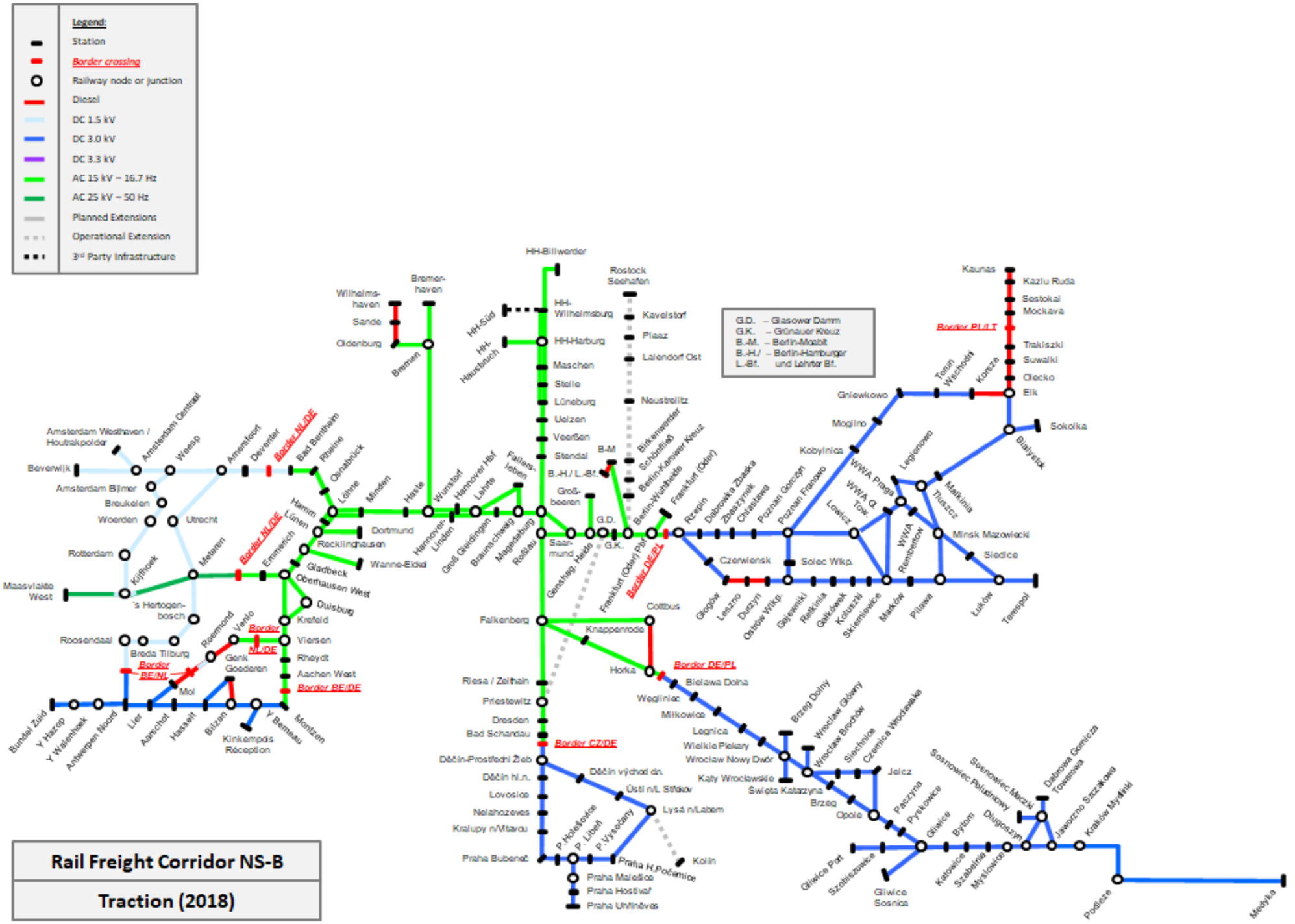
Source: Contractor based on consultation with the Infrastructure Managers; Notes: 1) the extension of the corridor lines to Latvia and Estonia will occur in 2020 and these lines were not represented in the maps; 2) the displayed operational extensions are also part of the RFC Orient/East Med

Figure C-3 – RFC NS-B characteristics: number of tracks in 2018



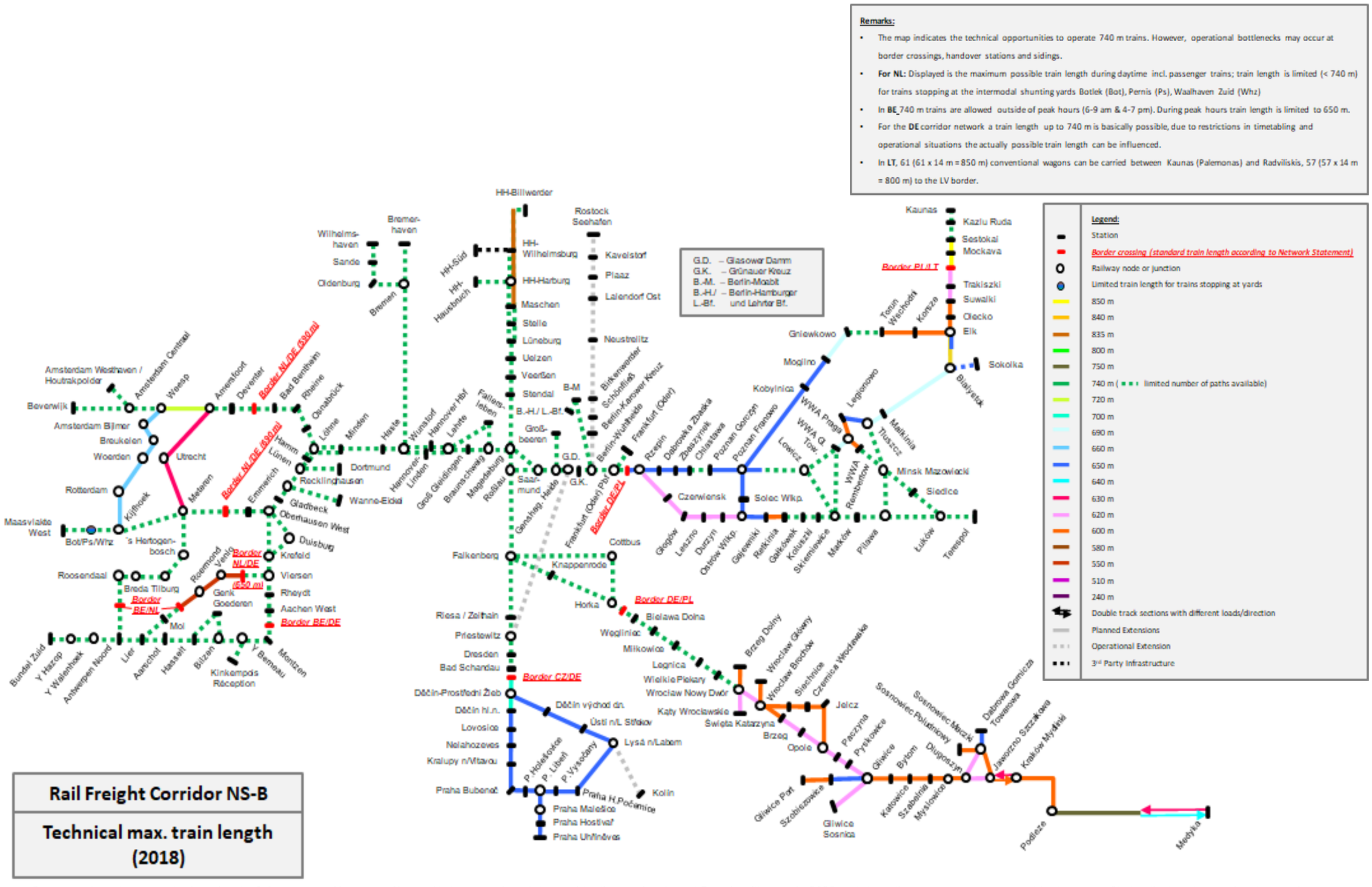
Source: Contractor based on consultation with the Infrastructure Managers; Notes: 1) the extension of the corridor lines to Latvia and Estonia will occur in 2020 and these lines were not represented in the maps; 2) the displayed operational extensions are also part of the RFC Orient/East Med

Figure C-4 – RFC NS-B characteristics: traction in 2018



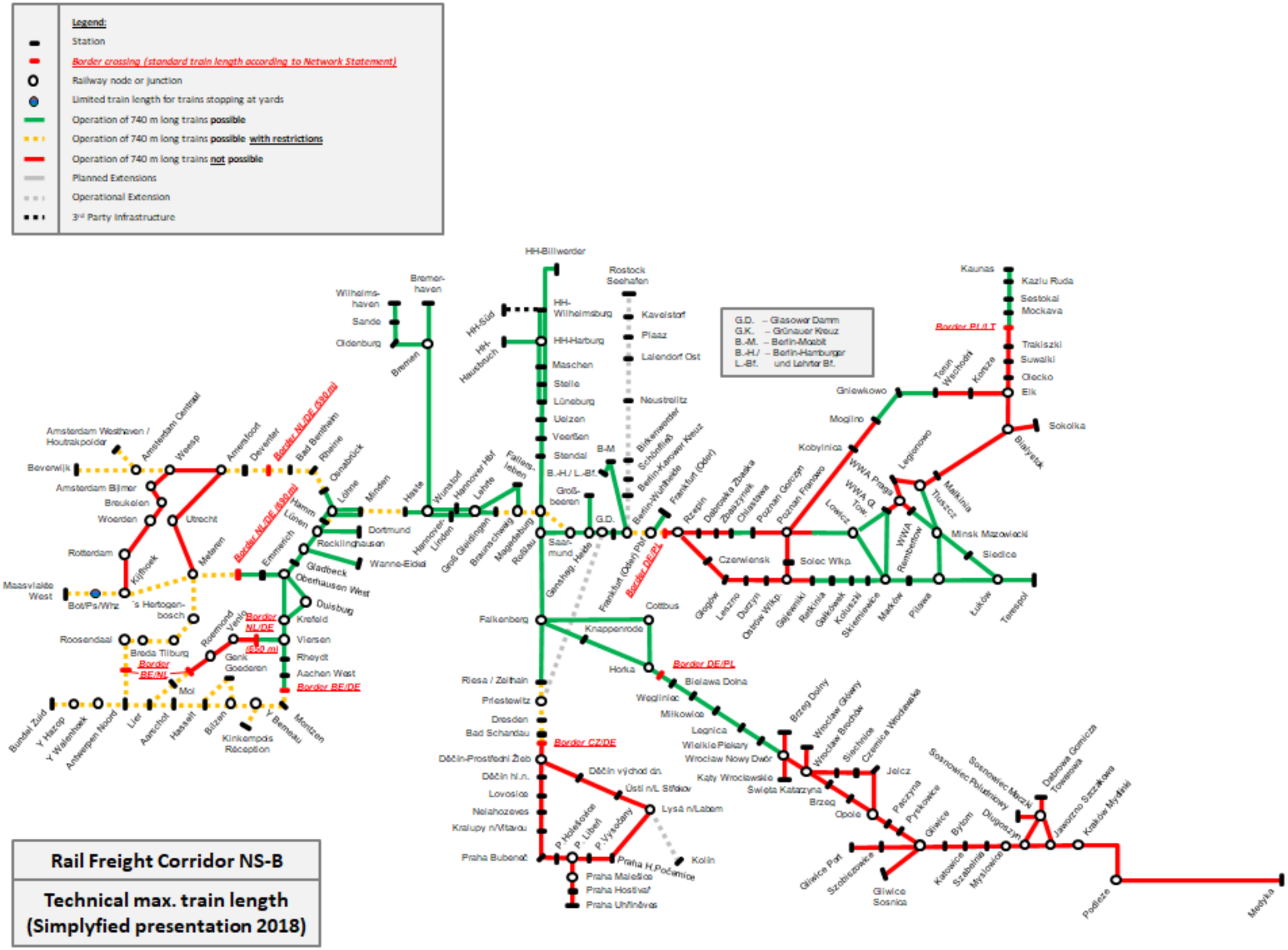
Source: Contractor based on consultation with the Infrastructure Managers; Notes: 1) the extension of the corridor lines to Latvia and Estonia will occur in 2020 and these lines were not represented in the maps; 2) the displayed operational extensions are also part of the RFC Orient/East Med

Figure C-5 – RFC NS-B characteristics: technical maximum train length in 2018



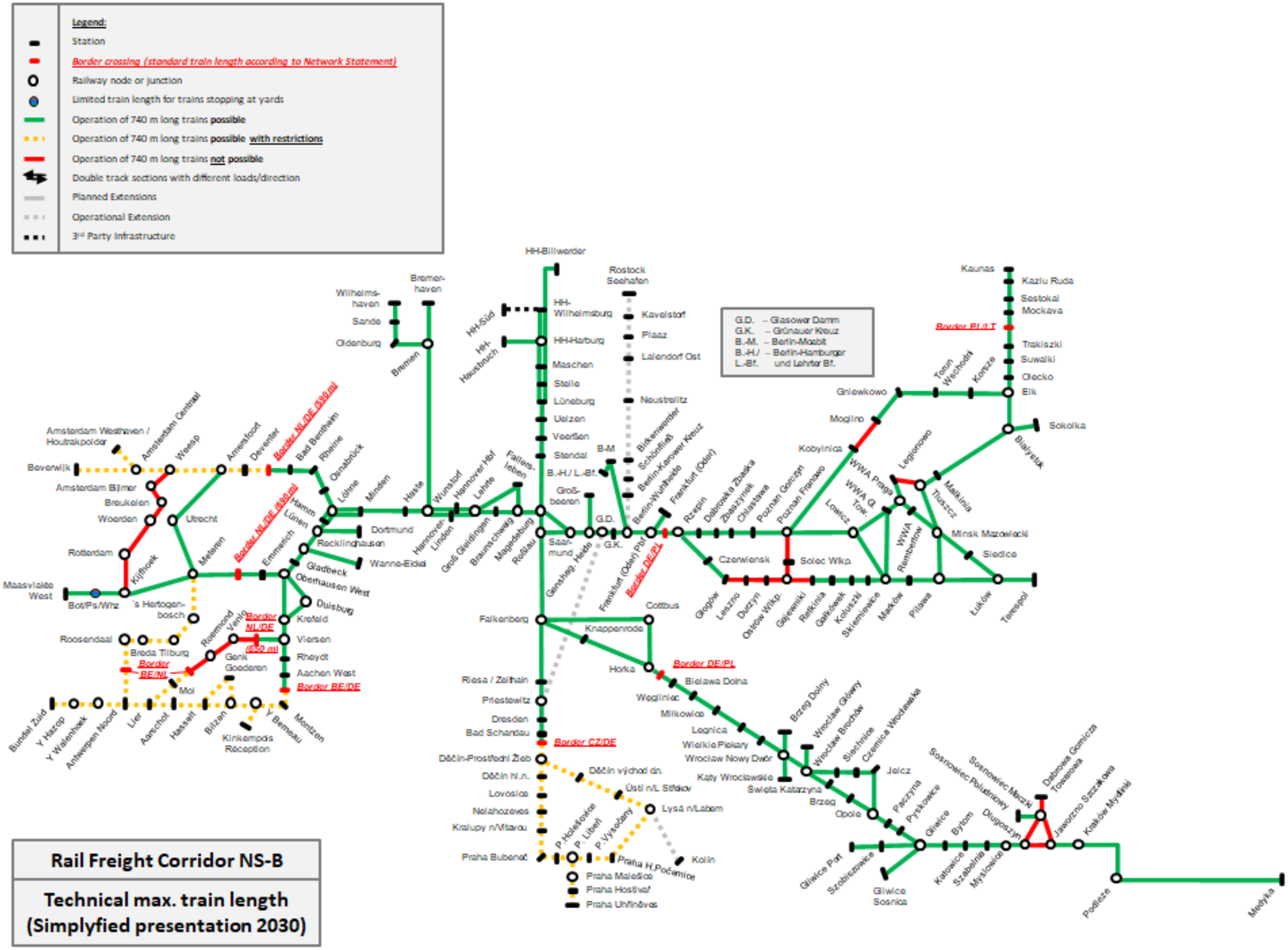
Source: Contractor based on consultation with the Infrastructure Managers; Notes: 1) the extension of the corridor lines to Latvia and Estonia will occur in 2020 and these lines were not represented in the maps; 2) the displayed operational extensions are also part of the RFC Orient/East Med

Figure C-6 – Simplified representation of the technical maximum train length along the RFC NS-B in 2018



Source: Contractor based on consultation with the Infrastructure Managers; Notes: 1) the extension of the corridor lines to Latvia and Estonia will occur in 2020 and these lines were not represented in the maps; 2) the displayed operational extensions are also part of the RFC Orient/East Med

Figure C-7 – Simplified representation of the technical maximum train length along the RFC NS-B by 2030



Source: Contractor based on consultation with the Infrastructure Managers; Notes: 1) the extension of the corridor lines to Latvia and Estonia will occur in 2020 and these lines were not represented in the maps; 2) the displayed operational extensions are also part of the RFC Orient/East Med

ANNEX C VIRTUAL EXAMPLE OF THE APPLICABILITY OF OPERATIONAL MEASURES TO ALLOW OPERATION OF 740 METER LONG TRAINS

This annex illustrates a virtual example of applicability of the operational measures described at Section 3.5.1 (along with a theoretical timetable), referring to the corridor railway line Frankfurt (Oder) – Poznan, section between Frankfurt-Oderbrücke (border station) and Zbąszyń (see Figure D-1). The line used for simulation purposes is 100 km long, it has six stations and eight stops for passenger trains, where two intermediate stations are equipped for the accommodation of 740 meter long trains and four are not. The line speed is 160 km/h, but the speed difference between the trains categories is rather low which benefits capacity. The assessment will be focused on the dispatching of delayed freight trains with 740 meter length. To the scope of this virtual example, it is assumed that the line is occupied by an hourly Intercity – IC service and a regional train, as well as two freight trains. One has overlength, the other not.

Figure D-1 – Overview of the area subject of simulation

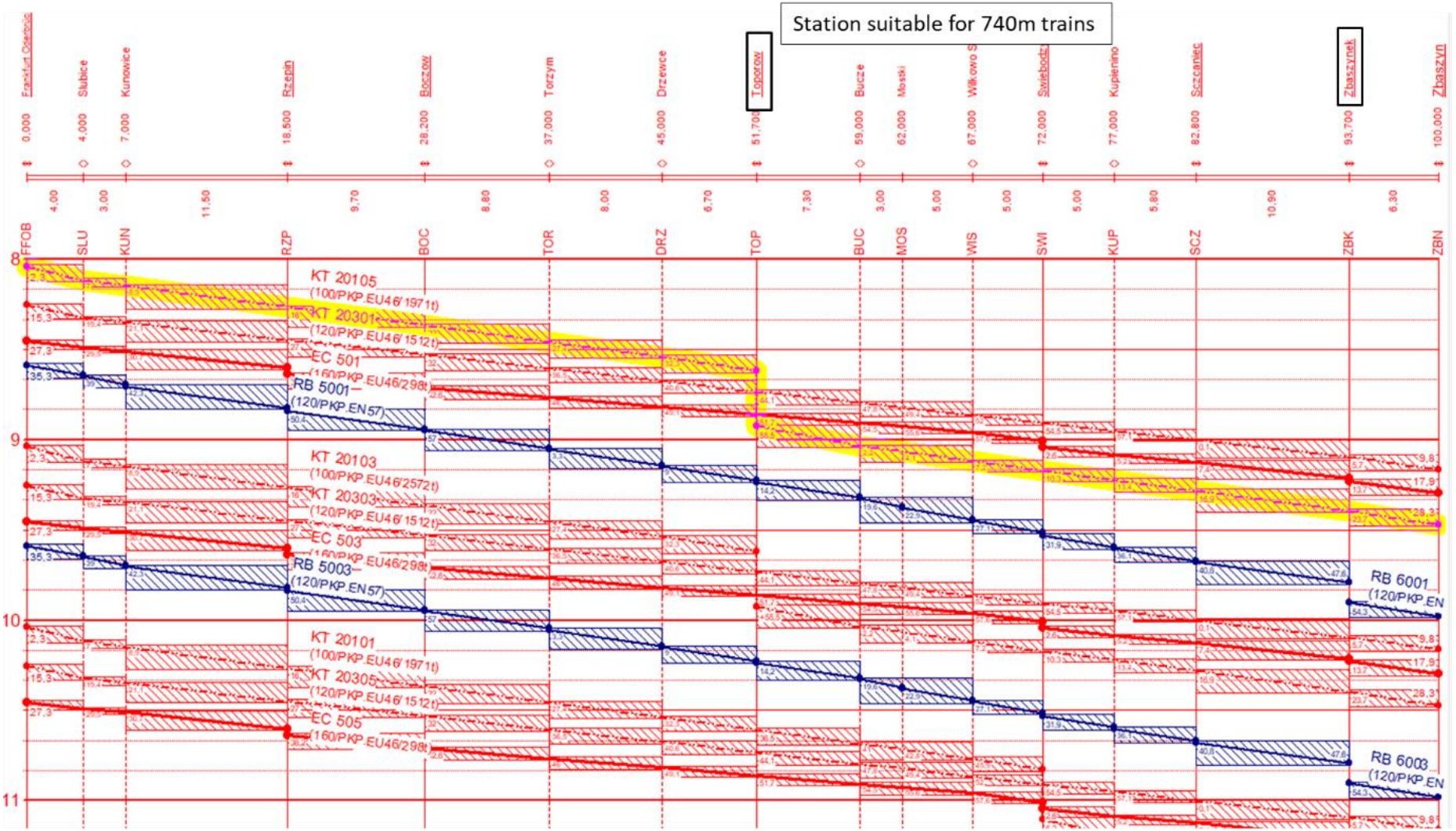
Source: Contractor

The planned timetable could look like the one represented in Figure D-2 overleaf for the West-East direction. It is worth to notice that to keep the displayed timetables comprehensible, only one direction is represented. The investigated timetable example is fictional and only serve as demonstration model.

With an inbound delay of 10 minutes for the first freight train (see Figure D-3 yellow) a total delay of 86 minutes in Zbąszyń can be measured. In total, four freight trains are delayed.

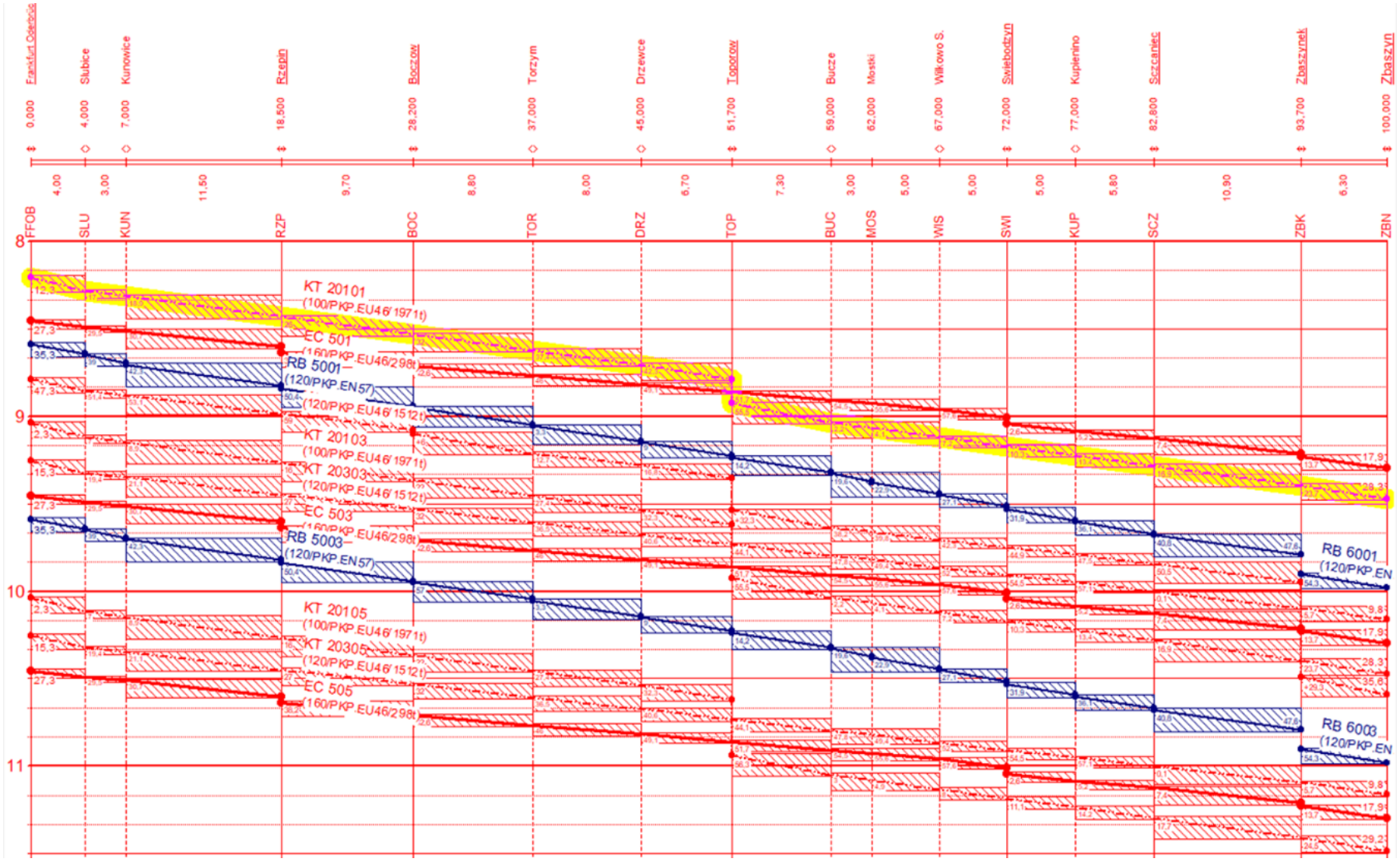
With an inbound delay of 48 minutes for the overlong freight train (see Figure D-4), an overall outbound delay of 184 minutes in the system is created. All six eight freight trains during the three-hour period are delayed. A delay of passenger trains can be possible.

Figure D-2 – Timetable planned



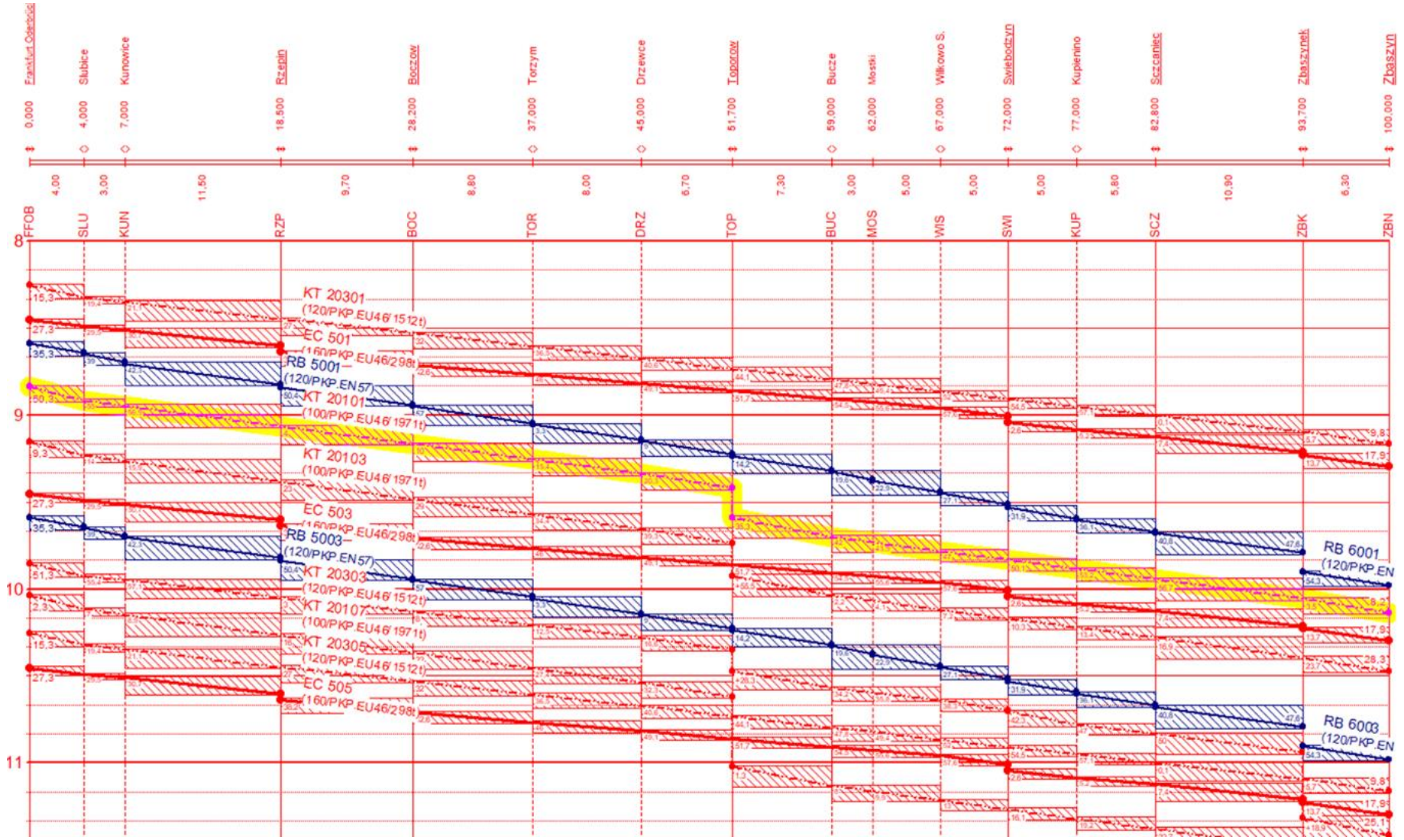
Source: Contractor

Figure D-3 – Timetable with a 10-minute delay inbound



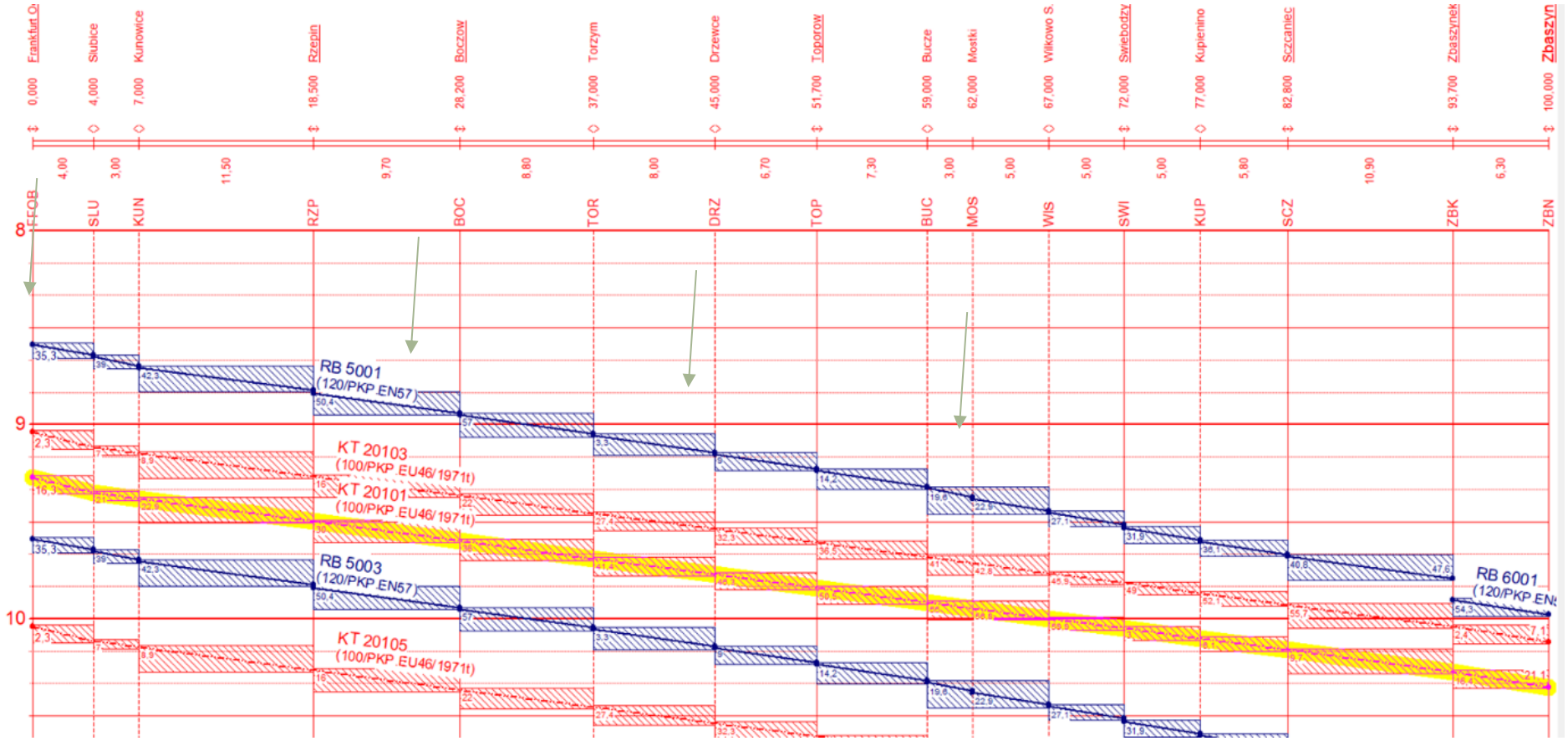
Source: Contractor

Figure D-4 – Timetable with a 48-minute delay inbound



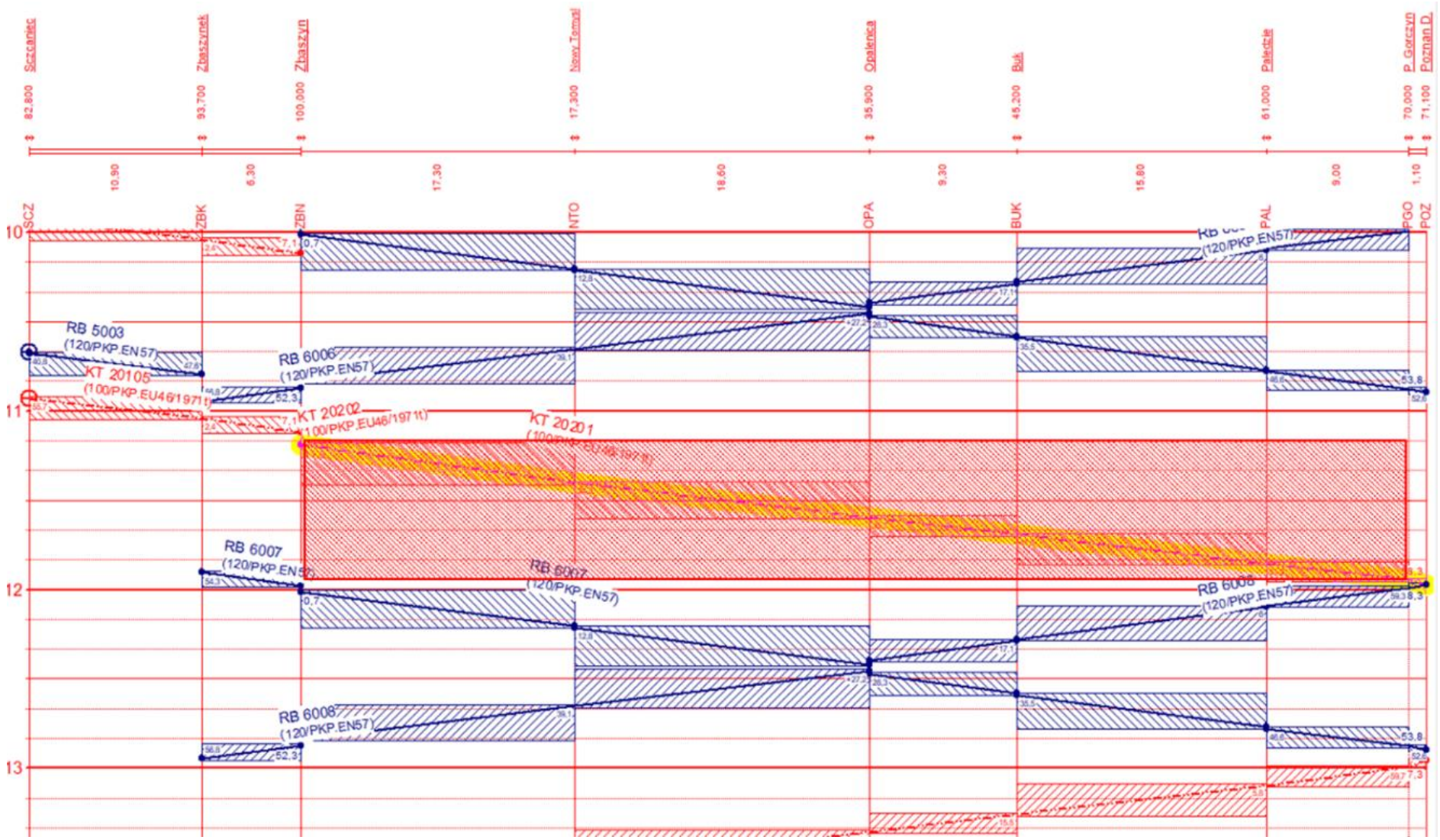
Source: Contractor

Figure D-5 – Timetable on a line with low traffic volume



Source: Contractor

Figure D-6 – Timetable on a single tracked section



Source: Contractor

The timetable on a low traffic line is much more resilient (see Figure D-5). In this case the traffic only consists of hourly regional trains and one freight train per hour. Even with an inbound delay of 74 minutes, the freight train causes no additional delay on other trains as it can occupy a free train path (slot) at a later time. This situation is used, when 740 meter freight trains are detoured on alternative routes. The alternative must have significant capacity reserves, to allow 740 meter long trains in the timetable.

In contrast, even lower traffic volumes on single tracked line (see Figure D-6) make it nearly impossible to schedule trains with overlength in cases of delays. In the example a single tracked section is observed (e.g. temporal track closure for maintenance works). The freight train is occupying the whole section. This leads to a high capacity consumption by the freight train. It is only possible for passenger trains to wait if a train crossing is needed. Dispatching is complex and leads to high follow-up delays.