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NSB CoRe

Memorandum of Understanding

on the needs and aims for the development of the Berlin-Poznań-Warsaw-Białystok Commuting Growth Corridor

Input paper

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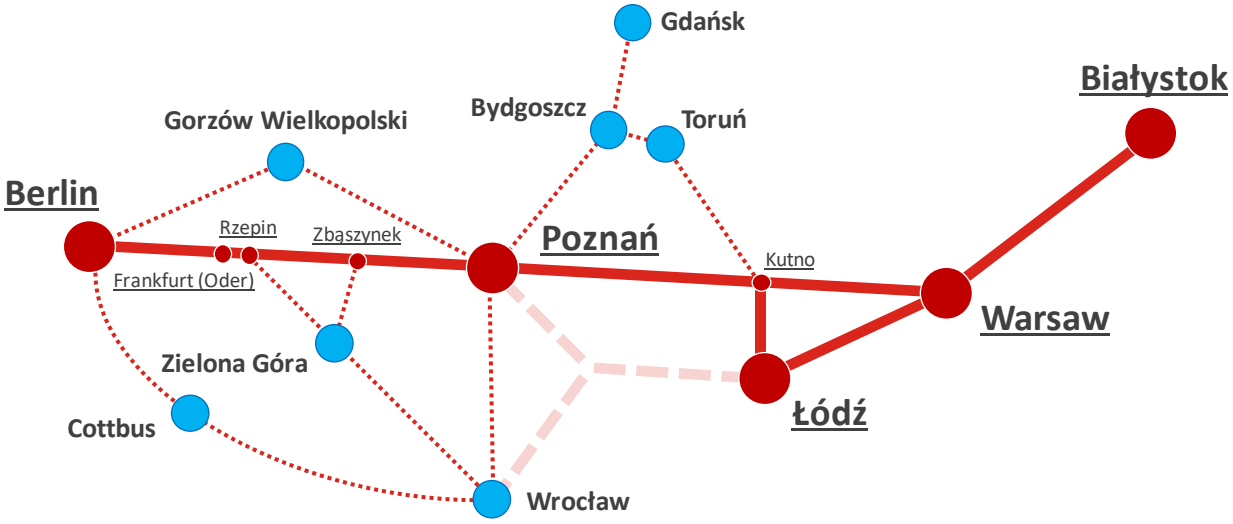
1 Introduction

The input paper for the "Memorandum of Understanding on the needs and aims for the development of the Berlin-Poznań-Warsaw-Białystok Commuting Growth Corridor" provides background knowledge on the state of development of travel offers between Berlin, Poznań, Łódź, Warsaw and Białystok.

Figure 1: Berlin-Poznań-Warsaw-Białystok Commuting Growth Corridor



It compiles the results of analyses carried out by INFRASTRUKTUR & UMWELT Professor Böhm und Partner on behalf of the Senate Department for the Environment, Transport and Climate Protection Berlin between 01/2017 and 07/2018 on the following issues:

- Infrastructure development (chapter 2)
- Connecting functions of urban nodes (chapter 3)
- Travel offers and competitiveness of railway transport (chapter 4)

The conclusions derived from these analyses have been compiled to the "Memorandum of Understanding on the needs and aims for the development of the Berlin-Poznań-Warsaw-Białystok Commuting Growth Corridor" (O 3.1). Based on the Memorandum, the Senate Department for the Environment, Transport and Climate Protection Berlin will propose a strategy paper on the future development of the Berlin-Poznań-Warsaw-Białystok Commuting Growth Corridor.

2 Infrastructure development

This section of the input paper investigates the framework conditions of infrastructure development along the Berlin-Poznań-Warsaw-Białystok Commuting Growth Corridor.

Along the Berlin-Poznań-Warsaw-Białystok Commuting Growth Corridor technical parameters, speed level and infrastructure projects have been analysed. Additionally, infrastructure projects defined in crucial national development plans and programmes have been analysed. These plans and programmes are:

- Germany: Bundesverkehrswegeplan 2030 (BVWP 2030, Federal Transport Infrastructure Plan 2030), as approved on 3 August 2016
- Poland: Krajowy Program Kolejowe do roku 2023 (KPK 2023, National Railway Programme until 2023), as approved on 15 September 2015 and revised on 23 November 2016

Besides the North Sea-Baltic Core Network Corridor, the analysis of infrastructure projects includes as well the railway links from and to Łódź, selected railway links between Germany and Poland, selected sections of the Baltic-Adriatic Core Network Corridor and the railway links from Białystok to Suwałki (via Augustów) and Grodno. Where applicable, reference to bottlenecks and aspects of interoperability is made. Additionally, the main priorities included in the project list of the Corridor study of the North Sea-Baltic Core Network Corridor have been considered.

2.1 German-Polish border area

2.1.1 Berlin – Frankfurt (Oder) – Poznań

Table 1: Technical parameters and speed level Berlin – Frankfurt (Oder) – Border D/PL

Line no.	Length (km)	Number of tracks	Electrification system	v_{max} km/h
6109 6153 6155	90,4	2	15 kV AC 16,7 Hz	100 – 160
Section			**Length (km)**	**v_{max} km/h**
Berlin Hbf - Berlin-Karlshorst			12,7	100
Berlin-Karlshorst - Berlin-Rahnsdorf (Üst)			11,4	120
Berlin-Rahnsdorf (Üst) - Frankfurt (Oder) Pbf			62,4	160
Frankfurt (Oder) Pbf - Frankfurt (Oder) Grenze			3,9	100

Source: DB Netz AG, status: 05/2017

Table 2: Infrastructure projects Berlin – Frankfurt (Oder) – Border D/PL

Project no.	Title and description	Estimated value (m EUR)	Status
L14	ABS Berlin – Frankfurt (Oder) – Border D/PL Erkner – Frankfurt (Oder) v_{max} 160 km/h	643,0	nearly finalised
L27	Berlin node Südkreuz – Blankenfelde (reconstruction of track, future connection Berlin Hbf – BER airport), v_{max} 160-200 km/h	561,0	planned; urgent need

Source: BVWP 2030

- Good level of quality, further reduction of travel time after finalisation of upgrading measures between Berlin Ostbahnhof and Erkner
- Capacity of tracks is significantly affected by a dense offer of regional trains, which shall be further increased
- Possibilities to increase capacity: Optimised track layout of smaller stations between Erkner and Frankfurt (Oder), enabling more flexible allocation of train routes, optimised track layout of the railway junction with the Berlin freight bypass (Güteraußenring)[1]
- The planned high-capacity connection to the BER airport through reconstruction of the Südkreuz – Blankenfelde section will be available at the earliest in 2023

[1] Construction of 3rd track between Berlin Stadtforst and Köpenick will be realised until 2026

- The interface between the German and Polish power system and the German and Polish security systems is located in the Oderbrücke freight station
- For passenger trains this location is a relevant bottleneck – long-distance trains have to stop to switch between security systems, and it is not possible for Polish railcars to reach Frankfurt (Oder) without German power and security systems
- Unfortunately due to outstanding high investment cost it will hardly be possible to change this situation.

Table 3: Technical parameters and speed level Border D/PL – Poznań

Line no.	Length (km)	Number of tracks	Electrification system	v_{max} km/h
3	173,4	2	3 kV DC	90 – 160

Section	Length (km)	v_{max} km/h
Granica Państwa - Rzepin	17,3	160
Rzepin - Świebodzin	53,4	160
Świebodzin - Zbąszynek	21,7	100 – 160
Zbąszynek - Zbąszyń	6,3	100 – 120
Zbąszyń - Poznań Górczyn	70,2	160
Poznań Górczyn - Poznań Główny	4,5	90

Source: PKP PLK S.A., status: 05/2017

Table 4: Infrastructure projects Border D/PL – Poznań

Project no.	Title	Estimated value (m PLN)	Remarks
1.117	*Works on the freight bypass in Poznań*	*387,1*	*Reserve list*

Source: KPK 2023

- Good level of quality, few speed restrictions (e.g. Zbąszynek – Zbąszyń section)
- In the long term it is planned to improve the freight bypass in Poznań

2.1.2 Infrastructure projects between the German-Dutch border and Berlin

Table 5: Infrastructure projects Berlin – Hannover – Bad Bentheim – Border D/NL

Project no.	Title and description	Estimated cost (m EUR)	Status
2-032-V01	ABS Hannover – Berlin (Lehrter Stammbahn) Ribbeck-Bamme 3rd track, v_{max} 250 km/h; Electrification 3rd track Wustermark-Oebisfelde, v_{max} 160 km/h	431,1	planned; urgent need
L06	ABS Hannover – Lehrte Construction of additional tracks to increase capacity, v_{max} 160 km/h	346,0	finalised
2-016-V01	ABS/NBS Hannover – Bielefeld Construction of additional tracks to increase capacity, sections Seelze – Porta Westfalica / Bad Oeynhausen, v_{max} 180-230 km/h	1.884,8	urgent need
2-021-V01	ABS Border D/NL – Bad Bentheim – Löhne v_{max} 200 km/h	-	potential need

Source: BVWP 2030

- Improvement of capacity for high-speed long-distance transport and freight transport; reduction of travel times between Amsterdam and Hannover

Table 6: Infrastructure projects Stendal – Uelzen – Bremen / Oldenburg – Wilhelmshaven

Project no.	Title and description	Estimated cost (m EUR)	Status
N06; 2-018-V01	ABS Uelzen – Stendal Completion of 2nd track, v_{max} 160 km/h	272,0	partly finalised; urgent need
2-003-V03	ABS Langwedel – Uelzen Electrification, additional crossing stations; part of major project "Optimised Alpha-E + Bremen"	-	urgent need
N03	ABS Oldenburg – Wilhelmshaven Completion of 2nd track, electrification, v_{max} 120 km/h	818,0	under construction

Source: BVWP 2030

- Improvement of hinterland connections of German North Sea ports
- Potentials for additional connections between Berlin, Hamburg and Bremen, former route of the EC Wawel Hamburg – Berlin – Wrocław – Kraków

2.1.3 Infrastructure projects along the German-Polish border

Table 7: Infrastructure projects Berlin – Szczecin

Project no.	Title and description	Estimated cost (m EUR)	Status
2-027-V01	ABS Angermünde – Border D/PL – Szczecin Electrification, v_{max} 160 km/h	298,8	planned; urgent need
4.026	Works on railway lines 408 and 409 Szczecin – Border D/PL (Tantow)	140,0	National project

Sources: BVWP 2030, KPK 2023

- Modernisation and electrification of the railway line Angermünde – Szczecin[2]
- Need for modernisation of railway line Berlin – Angermünde for v_{max} 160 km/h
- High potential for direct connections between Berlin and the Polish Baltic coast, including additional connections to Świnoujście, Kołobrzeg and Gdańsk; need for modernisation of the railway line Szczecin – Gdańsk

Table 8: Infrastructure projects Berlin – Gorzów Wielkopolski – Krzyż

Project no.	Title	Estimated value (m PLN)	Remarks
3.037	Revitalisation of railway line 203, section Krzyż – Gorzów Wielkopolski	100,0	RPO Lubuskie
1.145 *1.146*	*Works on railway lines 18 and 203, section Bydgoszcz – Piła – Krzyż, stage I:* *Bydgoszcz – Piła, stage II: Piła – Krzyż, including electrification*	*350,0* *650,0*	*Reserve list*

Source: KPK 2023

- Additional works are being carried out on the section Berlin – Kostrzyn, including the increase of capacity and the construction of a connecting link to the Berlin Ostkreuz station
- Potential bypass for the railway line Berlin – Frankfurt (Oder); need for the check of feasibility and clarification of possible functions for regional transport, long-distance transport and freight transport

[2] Recently, the decision was made to include the railway line Berlin-Szczecin in the Orient / East-Med Core Network Corridor and to extend the capacity of the railway line Angermünde-Szczecin through construction of a 2nd track

Table 9: Infrastructure projects Gubin – Czerwieńsk – Zbąszynek

Project no.	Title	Estimated value (m PLN)	Remarks
3.038	Modernisation of railway line 358 Zbąszynek – Gubin, section Zbąszynek – Czerwieńsk, stage II	69,8	RPO Lubuskie
1.133	*Works on railway line 358, section Czerwieńsk – Gubin (Border D/PL)*	*197,0*	*Reserve list*

Source: KPK 2023

- Improvement of the accessibility of Zielona Góra for long-distance trains and regional trains from Warsaw and Poznań
- The railway line Guben – Gubin – Czerwieńsk is an important freight bypass with good connections to the "Odrzańka" railway line; it might be used for regional passenger transport, too

Table 10: Infrastructure projects Berlin – Cottbus – Forst (Lausitz) – Wrocław

Project no.	Title and description	Estimated cost (m EUR)	Status
N24; 2-028-V01	ABS Berlin – Cottbus – Görlitz Königs Wusterhausen – Lübbenau v_{max} 160 km/h, electrification Cottbus – Görlitz	242,0	partly finalised; potential need
3.039	*Revitalisation of railway lines 14 (section Żagań – Żary – Forst) and 275 (section Border of the voivodeship – Żagań)*	*205,0*	*RPO Lubuskie, reserve list*

Sources: BVWP 2030, KPK 2023

- Route of the „Culture train" Berlin – Wrocław, need for construction of 2nd track between Lübbenau and Cottbus
- Need for agreement between Lubuskie and Lower Silesia for efficient revitalisation of the railway line Forst (Lausitz) – Żary – Żagań – Legnica
- Discussion on possible extension of electrification from Cottbus to Forst (Lausitz) for freight transport

Table 11: Infrastructure projects Berlin – Cottbus – Horka – Wrocław

Project no.	Title and description	Estimated cost (m EUR)	Status
N24; 2-028-V01	ABS Berlin – Cottbus – Görlitz Königs Wusterhausen – Lübbenau v_{max} 160 km/h, electrification Cottbus – Görlitz	242,0	partly finalised; potential need
N11	ABS Hoyerswerda – Horka – Border D/PL Completion of 2nd track, electrification, v_{max} 120-160 km/h	507,0	under construction
1.012	Modernisation of railway line E 30, stage II, section Bielawa Dolna – Horka: Neisse bridge and electrification	13,5*	POIiŚ 2007-2013

Sources: BVWP 2030, KPK 2023

- Construction works Hoyerswerda – Horka – Border D/PL will be partly finalised until the end of 2018
- Possible route for fast long-distance trains between Berlin, Wrocław and Kraków
- Need for electrification between Cottbus and Görlitz and removal of bottleneck in Königs Wusterhausen station (construction of 2nd track, important connecting link to the future BER airport)

Table 12: Infrastructure projects Dresden – Görlitz – Wrocław / Jelenia Góra

Project no.	Title	Estimated value (m PLN)	Remarks
2-029-V01	ABS Dresden – Görlitz – Border D/PL Electrification, v_{max} 160 km/h	-	potential need
1.046 1.120	Electrification of the railway lines 274 and 278, section Węgliniec – Zgorzelec	0,5* planning documentation	POIiŚ 2007-2013
		70,7	CEF
3.012	Revitalisation of railway line 274, section Jelenia Góra – Zgorzelec, stage I	85,0	RPO Dolnośląskie

Sources: BVWP 2030, KPK 2023

- Intergovernmental agreement on modernisation and electrification between Dresden and Görlitz needs to be implemented
- Intermediate stage: Electrification of Görlitz station with the Polish power system and better access of Polish railcars to the Görlitz node
- Important connection to attractive mountain areas and tourism destinations

2.1.4 Infrastructure projects along the Baltic-Adriatic Core Network Corridor

Table 13: Infrastructure projects Szczecin / Świnoujście – Zielona Góra – Wrocław

Project no.	Title	Estimated value (m PLN)	Remarks
1.049 1.063	Improvement of railway access to the maritime ports in Szczecin and Świnoujście	0,7* preparation works	POIiŚ 2007-2013
		610,9	CEF
1.082	Works on railway line C-E 59, section Wrocław Brochów / Grabiszyn – Głogów	400,0	POIiŚ 2014-2020
4.003	Modernisation of railway line 273, section Głogów – Zielona Góra – Rzepin – Dolna Odra	73,5*	National project
4.037	Works on railway line 273, section Rudna Gwizdanów – Głogów	36,9*	National project
4.029	Improvement of the capacity of main freight lines from Lower Silesia	962,7	National project

Source: KPK 2023

- Revitalisation of the hinterland connection of the ports of Szczecin and Świnoujście
- Possible route of long-distance trains between Berlin, Wrocław and Kraków

Table 14: Infrastructure projects Poznań – Wrocław

Project no.	Title	Estimated value (m PLN)	Remarks
1.007	Modernisation of railway line E 59, section Wrocław – Poznań, stage II, section Wrocław – Border of the Lower Silesian voivodeship	141,7*	POIiŚ 2007-2013
1.008 1.071	Modernisation of railway line E 59, section Wrocław – Poznań, stage III, section Poznań – Czempiń, phase I/II	15,6*	POIiŚ 2007-2013
		354,9	POIiŚ 2014-2020
1.089	Modernisation of railway line E 59, section Wrocław – Poznań, stage IV, section Border of the Lower Silesian voivodeship – Czempiń	1.287,7	CEF

Source: KPK 2023

- Modernisation and upgrade of the railway line Poznań – Wrocław (under construction)
- Possibility of change connections between Berlin and Wrocław with competitive travel times

2.2 Poland

2.2.1 Poznań – Kutno – Warszawa Wschodnia

Table 15: Technical parameters and speed level Poznań – Kutno

Line no.	Length (km)	Number of tracks	Electrification system	v_{max} km/h
3	178,7	2	3 kV DC	100 – 160
Section			**Length (km)**	**v_{max} km/h**
Poznań Główny - Poznań Wschód			5,6	100
Poznań Wschód - Swarzędz			7,4	140
Swarzędz - Konin			87,1	160 100 – 160
Konin - Koło			28,8	120 – 160
Koło - Barłogi			9,6	160 120 – 160
Barłogi - Kutno			40,2	160

Source: PKP PLK S.A., status: 05/2017

Table 16: Technical parameters and speed level Kutno – Warsaw

Line no.	Length (km)	Number of tracks	Electrification system	v_{max} km/h
3 2	130,2	2	3 kV DC	80 – 160
Section			**Length (km)**	**v_{max} km/h**
Kutno - Łowicz Gł.			45,3	160
Łowicz Gł. - Sochaczew			26,3	120 – 160
Sochaczew - Wwa Gołąbki			43,6	140 – 160
Wwa Gołąbki – Wwa Włochy			3,7	70 – 100
Wwa Włochy - Wwa Zachodnia			3,9	90
Wwa Zachodnia - Wwa Centralna			3,1	80 – 90
Wwa Centralna - Wwa Wschodnia			4,3	80

Source: PKP PLK S.A., status: 05/2017

- Different level of quality, railway infrastructure between Poznań and Warsaw has been modernised already several years ago
- Many speed restrictions, different quality of tracks according to direction of travel; insufficient capacity for freight transport

Table 17: Infrastructure projects Poznań – Kutno – Warsaw

Project no.	Title	Estimated value (m PLN)	Remarks
1.009 1.106	Modernisation of railway line E 20, section Warsaw – Poznań, remaining works; section Sochaczew – Swarzędz	22,0* preparation works	POIiŚ 2007-2013
		2.017,1	CEF
1.050 1.104	Modernisation of the Warsaw bypass line, section Wwa Gołąbki / Wwa Zachodnia – Wwa Gdańska	3,8* preparation works	POIiŚ 2007-2013
		237,0	CEF
1.093	Works on the diameter line in Warsaw, section Wwa Zachodnia – Wwa Wschodnia	1.000,0	POIiŚ 2014-2020
1.099	Improvement of capacity of railway line E 20, section Warsaw – Kutno, stage I: Works on railway line 3, section Warsaw – Łowicz	91,7	POIiŚ 2014-2020

Source: KPK 2023

Table 18: Infrastructure projects Łowicz – Łuków (Warsaw freight bypass)

Project no.	Title	Estimated value (m PLN)	Remarks
1.114	*Works on railway line C-E 20, section Łowicz – Skierniewice*	*107,8*	*Reserve list*
1.126	*Works on railway line C-E 20, section Skierniewice – Pilawa – Łuków*	*1.003,8*	*Reserve list, applied for CEF*

Source: KPK 2023

- Optimisation of railway infrastructure for high-capacity freight transport
- Long-term closings of the railway line between Poznań and Kutno, alternative routes of long-distance transport; significant increase of travel times and significant decrease of competitiveness
- Planned modernisation of the Warsaw diameter line and the Warsaw freight bypass

2.2.2 Kutno – Łódź Kaliska

Table 19: Technical parameters and speed level Kutno – Łódź Kaliska

Line no.	Length (km)	Number of tracks	Electrification system	v_{max} km/h
16 15	68,2	1 Kutno-Zgierz 2 Zgierz-Łódź Kaliska	3 kV DC	70 – 100

Section	Length (km)	v_{max} km/h
Kutno – Zgierz	57,3	70
Zgierz - Łódź Kaliska	10,9	100

Source: PKP PLK S.A., status: 05/2017

Table 20: Infrastructure projects Kutno – Łódź Kaliska

Project no.	Title	Estimated value (m PLN)	Remarks
3.042	Revitalisation of railway line no. 16 Łódź Widzew – Kutno, section Zgierz – Ozorków	135,0	RPO Łódzkie
1.124	*Works on railway lines 15 and 16, section Łódź Kaliska – Zgierz – Kutno*	*400,0*	*Reserve list*

Source: KPK 2023

- Low quality of the railway line Kutno – Łódź, revitalisation planned (partly financed from the Regional Operational Programme)
- Need for construction of 2nd track for the metropolitan railway system (ŁKA Łódzka Kolej Aglomeracyjna)

2.2.3 Łódź Fabryczna – Warszawa Zachodnia

Table 21: Technical parameters and speed level Łódź Fabryczna – Warsaw

Line no.	Length (km)	Number of tracks	Electrification system	v_{max} km/h
17 1 2	135,6	2	3 kV DC	80 – 160

Section	Length (km)	v_{max} km/h
Łódź Fabryczna - Łódź Widzew	5,2	120
Łódź Widzew - Koluszki	21,1	150
Koluszki - Skierniewice	39,1	140 – 160
Skierniewice - Wwa Włochy	58,9	160
Wwa Włochy - Wwa Zachodnia	3,9	90

Source: PKP PLK S.A., status: 05/2017

Table 22: Infrastructure projects Łódź – Warsaw and Łódź railway node

Project no.	Title	Estimated value (m PLN)	Remarks
1.019 1.078	Modernisation of railway line Warsaw – Łódź, stage II, unit A – section Wwa Zachodnia – Miedniewice (Skierniewice), phase I/II	95,6*	POIiŚ 2007-2013
		99,6	POIiŚ 2014-2020
1.021 1.079	Modernisation of railway line Warsaw – Łódź, stage II, unit C – remaining works, phase I/II	87,1*	POIiŚ 2007-2013
		192,3	POIiŚ 2014-2020
1.020	Improvement of the Łódź railway node, stage I, section Łódź Fabryczna – Łódź Widzew	202,4*	POIiŚ 2007-2013
1.041	Feasibility study for the construction of the underground railway line from Łódź Fabryczna station to railway line no. 15	1,7*	POIiŚ 2007-2013
1.097	Improvement of the Łódź railway node, stage II, section Łódź Fabryczna – Łódź Kaliska / Łódź Żabieniec	1.927,2	POIiŚ 2014-2020

Source: KPK 2023

- Good level of quality; highly relevant for commuters
- First stage of the Łódź city tunnel has been finalised, realisation of the second stage of the Łódź city tunnel is currently being prepared
- Strategical relevance of the development of the city tunnel and of the metropolitan railway system (ŁKA Łódzka Kolej Aglomeracyjna) for urban development and urban revitalisation

2.2.4 Warszawa Wschodnia – Białystok

Table 23: Technical parameters and speed level Warsaw – Białystok

Line no.	Length (km)	Number of tracks	Electrification system	v_{max} km/h
2 449 6	185,9	2 1 Prostyń Bug – Małkinia Bug	3 kV DC	80 – 160

Section	Length (km)	v_{max} km/h
Wwa Wschodnia - Wwa Rembertów	8,1	100
Wwa Rembertów - Zielonka	8,5	80
Zielonka - Tłuszcz	23,1	130
Tłuszcz - Małkinia	50,1	120 – 130
Małkinia - Łapy	66,1	120
Łapy - Białystok	23,3	100

Source: PKP PLK S.A., status: 05/2017

Table 24: Infrastructure projects Warsaw – Białystok

Project no.	Title	Estimated value (m PLN)	Remarks
1.018 1.080	Modernisation of railway line E 75 Rail Baltica Warsaw – Białystok – Border PL/LT, stage I, section Wwa Rembertów – Zielonka – Tłuszcz (Sadowne), phase I/II	340,8*	POIiŚ 2007-2013
		558,9	POIiŚ 2014-2020
1.040 1.061 1.090	Modernisation of railway line E 75, section Sadowne – Białystok, including remaining works on the section Wwa Rembertów – Sadowne	4,2* preparation works	POIiŚ 2007-2013
	Works on railway line E 75, section Sadowne – Czyżew, including remaining works on the section Wwa Rembertów – Sadowne	1.025,2	CEF
	Works on railway line E 75, section Czyżew – Białystok	1.610,0	CEF

Source: KPK 2023

- Modernisation works between Warsaw and Tłuszcz (Sadowne) have been nearly finalised, including the construction of two additional tracks between Zielonka and Wołomin Słoneczna; expected speed level v_{max} = 160 km/h
- Single-track bridge across the Bug river needs to be replaced
- Modernisation works between Tłuszcz (Sadowne) and Czyżew ongoing, works between Czyżew and Białystok under preparation

2.2.5 Infrastructure projects between Warsaw and the Polish-Belarusian border

Table 25: Infrastructure projects Warsaw – Terespol

Project no.	Title	Estimated value (m PLN)	Remarks
1.010	Modernisation of railway line E 20 / C-E 20, section Siedlce – Terespol, stage II	82,9*	POIiŚ 2007-2013
1.051 1.123	Modernisation of railway line E 20, section Siedlce – Terespol, stage III	1,3* preparation works	POIiŚ 2007-2013
		559,1	CEF
1.103	Improvement of the capacity of railway line E 20, section Warsaw – Mińsk Mazowiecki, stage I	138,9	POIiŚ 2014-2020
1.129	*Improvement of the capacity of railway line E 20, section Warsaw – Mińsk Mazowiecki, stage II: additional tracks Wwa Rembertów – Sulejówek Milosna*	*886,9*	*Reserve list*

Source: KPK 2023

- Modernisation of the railway line Warsaw – Terespol, highly relevant for freight transport along the North Sea-Baltic Core Network Corridor

2.3 Polish-Lithuanian border area

2.3.1 Białystok – Ełk – Suwałki – Kaunas

Table 26: Technical parameters and speed level Białystok – Ełk – Suwałki – Border PL/LT

Line no.	Length (km)	Number of tracks	Electrification system	v_{max} km/h
38 41 39 51	202,3	1	3 kV DC Białystok-Ełk	30 – 120

Section	Length (km)	v_{max} km/h
Białystok - Grajewo	82,5	100
Grajewo - Ełk	20,7	120
Ełk - Olecko	27,5	80
Olecko - Suwałki	43,0	30 – 60
Suwałki - Granica Państwa	28,6	60

Source: PKP PLK S.A., status: 05/2017

Table 27: Infrastructure projects Białystok – Suwałki – Border PL/LT

Project no.	Title	Estimated value (m PLN)	Remarks
1.144	*Works on railway line E 75, section Białystok – Suwalki – Trakiszki (Border PL/LT)*	*2.500,0*	*Reserve list, applied for CEF*

Source: KPK 2023

- Medium level of quality between Białystok and Ełk, low level of quality between Ełk, Suwałki and the Polish-Lithuanian border (speed restrictions, deficient infrastructure, lack of electrification)
- Modernisation works are being prepared, starting with the Białystok – Ełk section; realisation is expected to take place in the 2021-2027 funding period

Table 28: Technical parameters and speed level Border PL/LT – Kaunas

Line no.	Length (km)	Number of tracks	Electrification system	v_{max} km/h
-	115,6	1 1435 mm 1-2 1520 mm	-	100 – 120

Section	Length (km)	v_{max} km/h
Granica Państwa - Mockava 1435 mm	14,3	100 – 120
Mockava - Šeštokai 1435/1520 mm	7,5	120
Šeštokai - Kalvarija - Marijampolė - Kazlų Rūda 1435 + 1520 mm	57,0	120
Kazlų Rūda - Kaunas 1435 + 1520 mm	36,8	120

Source: PKP PLK S.A., status: 05/2017

- Construction of 1435 mm gauge track between Šeštokai and Kaunas, renewal of dual-gauge track between the Polish-Lithuanian border and Šeštokai
- Interoperability problems due to different safety systems, lack of skilled staff and lack of adequate locomotives
- Weekend trains are operated in regional transport
- Lack of multimodal freight transport due to missing (physical) 1435 mm connection between Kaunas main station and Kaunas Intermodal Terminal

2.3.2 Białystok – Sokółka – Suwałki / Grodno

Table 29: Technical parameters and speed level Białystok – Sokółka – Suwałki

Line no.	Length (km)	Number of tracks	Electrification system	v_{max} km/h
6 40	140,1	1	3 kV DC Białystok – Sokółka	80 – 100

Section	Length (km)	v_{max} km/h
Białystok - Sokółka	41,2	80
Sokółka - Augustów	67,6	100
Augustów - Suwałki	31,3	100

Source: PKP PLK S.A., status: 05/2017

- Medium level of quality between Białystok, Augustów and Suwałki; sufficient for regional transport

Table 30: Technical parameters and speed level Sokółka – Grodno

Line no.	Length (km)	Number of tracks	Electrification system	v_{max} km/h
6 57	42,3	1 1435 mm 1 1520 mm	3 kV DC 1435 mm	70 – 80 1435 mm 50 1520 mm

Section	Length (km)	v_{max} km/h
Sokółka - Kuźnica Białostocka - Granica Państwa	20,0	80
Granica Państwa - Bruzgi - Grodno	22,3	70

Source: PKP PLK S.A., status: 05/2017

Table 31: Infrastructure projects Białystok – Grodno

Project no.	Title	Estimated value (m PLN)	Remarks
1.107	Works on railway line 6, section Białystok – Sokółka – Kuźnica Białostocka (Border PL/BY)	187,2	POIiŚ 2014-2020
3.068	Revitalisation of railway line 57, section Kuźnica Białostocka – Geniusze (1520 mm)	90,0	RPO Podlaskie

Source: KPK 2023

- 1435 mm track between Białystok and Grodno (electrified), operation of long-distance trains (Kraków – Grodno) and regional trains (Białystok – Kuźnica Białostocka); parallel 1520 mm track between Geniusze, Sokółka and Grodno, operation of freight transport
- Both tracks shall be revitalised, partly financed from the Regional Operational Programme

3 Connecting functions of urban nodes

This section of the input paper investigates the connecting functions of urban nodes along the Berlin-Poznań-Warsaw-Białystok Commuting Growth Corridor. With this regard, the following urban nodes have been considered:

- Berlin
- Poznań
- Łódź
- Warsaw
- Białystok

Additionally, the connecting functions of smaller nodes have been analysed, too. Figure 2 visualises the connecting functions of urban nodes. It includes the following information:

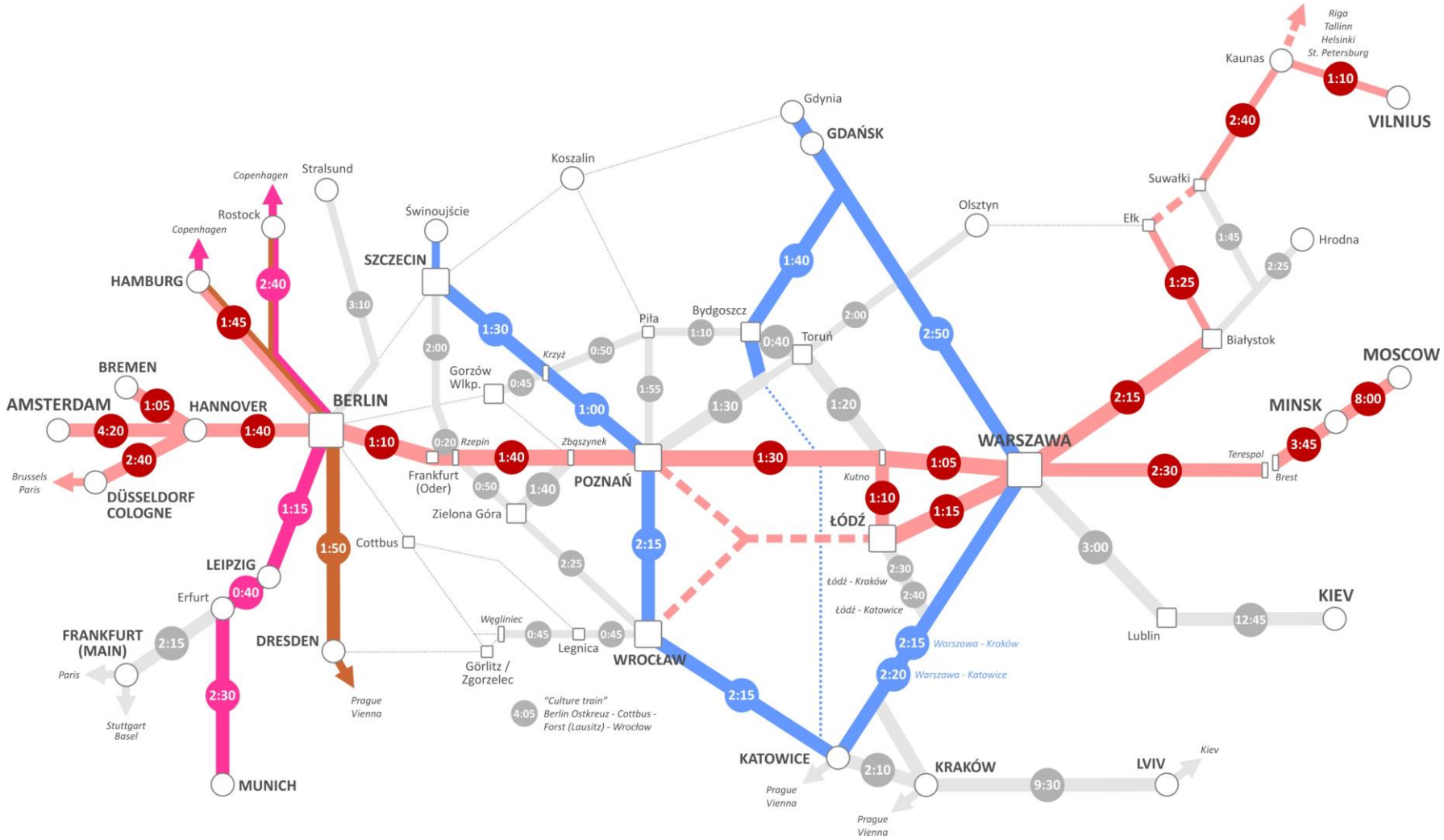
- Density of offers in long-distance transport between nodes (strength of connecting lines)
- Travel time in long-distance transport between nodes (hh:mm)
- Relevance of connecting lines in the Trans-European Transport Networks (TEN-T, core network corridors)

The following TEN-T core network corridors intersect with the Berlin-Poznań-Warsaw-Białystok Commuting Growth Corridor as part of the North Sea-Baltic Core Network Corridor:

- Berlin: Scandinavian-Mediterranean (magenta) & Orient-East Med (brown)
- Poznań & Warsaw: Baltic-Adriatic (blue)

The analysis of travel time between nodes reflects the average travel time in long-distance transport according to the annual timetable 2017/2018, considering current changes of timetables due to construction works. As regards the Berlin-Warsaw section of the Berlin-Poznań-Warsaw-Białystok Commuting Growth Corridor, the analysis of travel time reflects the average travel time in long-distance transport before closure of the railway line Poznań – Kutno for construction measures.

Figure 2: Average travel time in long-distance transport between urban nodes



Source: Analysis of timetable data, status: 07/2018. Travel times between Berlin, Poznań, Łódź and Warsaw reflect the status achieved before closure of the railway line Poznań – Kutno for construction measures

3.1 Berlin

For the Berlin-Poznań-Warsaw-Białystok Commuting Growth Corridor, the Berlin node has the function of the gateway to Germany. Berlin main station is the hub for long-distance and regional transport, which is supplemented by four additional node stations: Gesundbrunnen, Ostkreuz, Südkreuz and Spandau. All stations are well served by public transport (regional train, S-Bahn, metro, tram and bus).

Berlin is directly connected by long-distance trains with a large number of cities and metropolitan areas in Germany and in neighbouring countries. Above all, these include:

- hourly service (ICE): Hamburg (also IC every two hours), Leipzig, Erfurt, Frankfurt (Main), Nuremberg, Munich, Hanover, Ruhr area, Dusseldorf, Cologne
- every two hours (ICE): Halle (Saale), Basel, Stuttgart; Dresden (EC / IC), Prague (EC), Amsterdam (IC)

Some long-distance trains are directly operated to Bremen, Stralsund / Ostseebad Binz, Rostock and Cottbus. Night trains connect Berlin with Malmö, Zurich, Praha / Budapest and Vienna (daily service) as well as Moscow and Paris (weekly service).

A dense network of regional trains completes the travel offer, including connections to Magdeburg, Rostock, Stralsund, Szczecin, Gorzów Wielkopolski, Zielona Góra and Cottbus. Additionally, the “Culture train” provides weekend services between Berlin and Wrocław.

Berlin has two airports (Berlin-Tegel TXL, Schönefeld SXF), which will be replaced until 2020 by the Berlin-Brandenburg airport (BER, under construction). According to current timetables, both airports serve approx. 178 destinations in 57 countries.

The Berlin-Tegel airport is located near the city centre and can be reached by several bus lines. It is connected to Berlin main station through the TXL bus, which operates every 6 minutes (travel time: 17 minutes). The Schönefeld airport is located at the periphery of the city and can be reached by S-Bahn, regional train and bus. It is connected to Berlin main station through airport express trains, which operate every 30 minutes (travel time: 30-34 minutes).

The BER airport is located closely to the Schönefeld airport and will be connected to Berlin through S-Bahn, regional train and bus. Once the reconstruction of the Südkreuz – Blankenfelde section of the railway line between Berlin and Dresden will be finalised, the

airport express trains will be operated every 15 minutes (travel time: 20 minutes). The BER airport can be served by long-distance trains, too.

Long-distance bus connections are mainly operated from and to the central bus station (ZOB), serving dozens of destinations in Germany and throughout Europe. It is located near the exhibition grounds of the Berlin fair and connected to S-Bahn, metro and bus networks. However, the transfer from and to railway stations is rather inconvenient and takes a lot of time and effort.

Additional stops of selected long-distance bus connections are located near stops of the S-Bahn, regional trains and the metro (e.g. Alexanderplatz, Südkreuz), providing better access to public transport. Several IC Bus connections offered by Deutsche Bahn to Warsaw, Wrocław, Kraków and Copenhagen operate from and to Berlin main station.

Both Berlin airports are served by many long-distance bus connections, including several bus (and minibus) connections from and to Poland.

3.2 Poznań

For the Berlin-Poznań-Warsaw-Białystok Commuting Growth Corridor, the Poznań node has the function of the gateway to the Wielkopolskie region. The Poznań main station serves as the hub for long-distance rail traffic.

Poznań is directly connected by long-distance trains with nearly all larger cities and metropolitan areas in Poland. As regards the Berlin-Poznań-Warsaw-Białystok Commuting Growth Corridor, the following long-distance connections with regular EIC, IC and TLK services are of particular relevance:

- Poznań – Szczecin – Świnoujście
- Poznań – Bydgoszcz – Gdańsk / Gdynia
- Poznań – Toruń – Olsztyn
- Poznań – Wrocław – Opole – Katowice – Kraków – Przemyśl
- Poznań – Zielona Góra

Additionally, the links Poznań – Koszalin – Kołobrzeg / Słupsk and Poznań – Gorzów Wielkopolski are served by single long-distance connections.

The regional railway connections from and to Poznań are served by the national railway company Przewozy Regionalne[3] and the regional railway company Koleje Wielkopolskie (KW)[4].

The international airport Poznań-Ławica is located approx. 8 km west of the city centre. It regularly serves around 30 destinations in Europe and the Middle East, including Warsaw, Frankfurt (Main) and Munich several times per day. The airport is connected to the main train station by bus lines 59 and 48. The buses run up to four times per hour, and travel time takes about 20 minutes.

The main bus station in Poznań is located close to the main station. Connections to many Polish cities and to destinations in Europe are being offered, including many connections from and to the Ukraine.

3.3 Łódź

For the Berlin-Poznań-Warsaw-Białystok Commuting Growth Corridor, the Łódź node has the function of the gateway to the Łódzkie region. The most important railway stations are the Łódź Widzew station and the Łódź Kaliska station, but none of them has the function of a main station that could be used from all directions to change trains. In future, the Łódź Fabryczna tunnel station will serve as main station and hub for regional and long-distance connections.

Łódź is directly connected by long-distance trains with several cities and metropolitan areas in Poland. As regards the Berlin-Poznań-Warsaw-Białystok Commuting Growth Corridor, there is a dense offer of long-distance connections between Łódź and Warsaw, and many connections between Warsaw and Białystok are being operated from and to Łódź. Additionally, the long-distance connections between Łódź, Katowice and Kraków are of particular relevance for the connecting functions of the Łódź node.

The regional railway connections from and to Łódź are served by the national railway company Przewozy Regionalne and the regional railway company Łódzka Kolej Aglomeracyjna (ŁKA)[5]. Between Łódź and Warsaw both railway companies offer daily InterRegio (IR) services and weekend ŁKA services.

[3] The railway company Przewozy Regionalne is managed by the state-owned Industrial Development Agency (Agencja Rozwoju Przemysłu, ARP), which owns the majority of shares (50 % + 1 share). The remaining shares are owned by all Polish voivodships.

[4] The railway company Koleje Wielkopolskie is owned and managed by the regional authority of the Wielkopolskie voivodship.

[5] The ŁKA railway company is owned and managed by the regional authority of the Łódzkie voivodship.

The international airport Łódź is located approx. 6 km south-west of the city centre. It serves few destinations in Europe, with regular (daily) flights operating to London and Munich only. The airport is connected to the Łódź Kaliska station by the bus lines 65A and 65B. The buses run up to four times per hour, and travel time takes about 15-20 minutes.

There are currently three bus stations in Łódź, with the bus stations located near the railway stations Łódź Kaliska and Łódź Fabryczna serving long-distance connections. The third bus station, which is located in the north of the city, primarily serves regional connections.

The offer of domestic and international bus connections obviously benefits from the proximity to Warsaw and to the A2 and A1 motorways. As in case of Poznań, connections to many Polish cities and to destinations in Europe are being offered, including many connections from and to the Ukraine.

3.4 Warsaw

For the Berlin-Poznań-Warsaw-Białystok Commuting Growth Corridor, the Warsaw node has the function of the gateway to the Mazowieckie region and to Eastern Poland. The most important railway stations, serving as hubs for long-distance, regional and local transport, are located along the Warsaw cross-city line: Warszawa Zachodnia, Warszawa Centralna and Warszawa Wschodnia.

Warsaw is directly connected by long-distance trains with all larger cities and metropolitan areas in Poland, with the connections from and to Gdańsk / Gdynia, Kraków, Katowice, Poznań and Łódź being the most important ones. Between Warsaw, Gdańsk / Gdynia, Kraków, Katowice and Wrocław Express InterCity Premium (EIP) trains are being operated, delivering the first regular high-speed service (v_{max} = 200 km/h) in Poland.

As regards international connections, Warsaw is directly connected by long-distance trains and night trains with the capitals of nearly all neighbouring countries:

- Berlin: 4 EC trains
- Prague: 2 EC/IC trains, 1 night train
- Vienna: 2 EC trains, 1 night train
- Bratislava / Budapest: 1 EC/IC train, 1 night train
- Minsk / Moscow: 1 night train
- Kiev: 1 night train, additionally 2 day connections with change of trains in Kraków and Przemyśl

Additional day-time connections to Prague, Vienna, Bratislava and Budapest are available with change of trains. Long-distance connections from and to Vilnius are operated by bus only, with several day and night connections.

The regional railway connections in the Mazowieckie region are served by the regional railway company Koleje Mazowieckie (KM)[6] and the local railway companies Szybka Kolej Miejska (SKM)[7] and Warsaw Commuter Railway (Warszawska Kolej Dojazdowa, WKD)[8].

Warsaw has two international airports:

- Warsaw Chopin airport located approx. 8 km south-west of the city centre, with dozens of connections, mainly to Polish and European destinations, but also to North America, North Africa, the Middle and Far East
- Modlin airport, a former military airport located approx. 30 km north-west of the city, with almost 50 scheduled and charter services to destinations in Europe and in the Middle East. Modlin airport is intensively used by low-cost carriers

The Warsaw Chopin airport can be reached from the Warszawa Centralna station and the Warszawa Śródmieście station every 15 minutes by S-Bahn (SKM, lines S2 and S3) and regional trains (Koleje Mazowieckie, travel time approx. 20 minutes). Additionally, it is connected to the Warszawa Centralna station by bus line 175 (up to four times per hour, travel time approx. 25 minutes).

The Modlin airport is connected by bus to the Modlin railway station, which is served by long-distance and regional trains (approx. 42 daily train connections between Warsaw and Modlin, travel time: 40-45 minutes). The bus is operated by the regional railway company Koleje Mazowieckie, and it runs every 20-30 minutes (travel time: 10 minutes).

With the Modlinbus bus company the airport can be reached in approx. 40 minutes directly from the city centre. These buses leave approx. every hour, and direct services from Łódź to both Warsaw airports are offered by Modlinbus, too.

The most important bus station for long-distance bus transport is located near the Warszawa Zachodnia railway station. Several long-distance buses also stop near

[6] The railway company Koleje Mazowieckie is owned and managed by the regional authority of the Mazowieckie voivodship.

[7] The SKM railway company is owned and managed by the Capital City of Warsaw.

[8] The WKD railway company is owned and managed by the regional authority of the Mazowiecke voivodship (95 %) and municipalities located along the railway line (5 %).

Warszawa Centralna railway station (PKiN / Plac Defilad or Aleja Jana Pawła II) and at the bus stations Warszawa Wschodnia, Metro Młociny and Metro Wilanowska.

Many destinations in particular in Central and Eastern Poland can be reached by coach from Warsaw, but also in neighbouring countries – and last but not least in Central and Eastern Europe. Additionally, due to the less dense railway network, in Eastern Poland long-distance bus connections are more important than in Western Poland.

3.5 Białystok

For the Berlin-Poznań-Warsaw-Białystok Commuting Growth Corridor, the Białystok node has the function of the gateway to the Podlaskie and the Warmińsko-Mazurskie region. For the accessibility of the Warmińsko-Mazurskie region, the node of Ełk is of particular relevance. Nearly all long-distance and regional connections start and terminate at the Białystok main station.

Białystok is directly connected by long-distance trains with the Warsaw node. Additionally, long-distance IC and TLK connections are operated in the directions of Ełk and Olsztyn, Suwałki and Grodno (BY).

Despite the construction of 1435 mm gauge track between Šeštokai and Kaunas and the renewal of dual-gauge track between the Polish-Lithuanian border and Šeštokai, currently no long-distance services are being operated between Poland and Lithuania. The reasons are low demand due to long travel times, interoperability problems due to different safety systems, lack of skilled staff and lack of adequate locomotives.

Instead, in cooperation with Lithuanian Railways, weekend trains with special fares are operated by the national railway company Przewozy Regionalne. The regional railway connections in the Podlaskie region are served by Przewozy Regionalne, too.

Białystok has no airport. A new main bus station has been built at the main railway station. From here, bus connections to Warsaw and to the Warsaw airports are being offered, but also to other destinations in Poland and abroad (e.g. Grodno, Minsk, Vilnius).

3.6 Additional nodes

3.6.1 Frankfurt (Oder)

The node of Frankfurt (Oder) provides access to the East Brandenburg region through the regional railway connection to Cottbus and the local railway connections to Beeskow, Königs Wusterhausen and Eberswalde. Additionally, regional trains between Frankfurt

(Oder) and Zielona Góra are being operated by the national railway company Przewozy Regionalne, according to agreements made with the Lubuskie voivodship.

3.6.2 Rzepin

The node of Rzepin provides access to Zielona Góra, the Lubuskie region and parts of the Dolnośląskie region. If timetables (and tariffs) of long-distance trains and regional trains would be better coordinated, Rzepin could serve as connecting station, increasing its relevance as regional hub station and improving in particular cross-border offers.

3.6.3 Zbąszynek

The node of Zbąszynek provides access to Zielona Góra, Gorzów Wielkopolski, the Lubuskie region and parts of the Wielkopolskie region. However, due to the offer of regular direct connections between Zielona Góra, Gorzów Wlkp. and Poznań, the connecting function of the Zbąszynek node is limited to the directions of Rzepin and Leszno.

3.6.4 Kutno

The node of Kutno provides access to Łódź, the Łódzkie region and parts of the Kujawsko-Pomorskie region. Kutno has highest relevance as connecting station for long-distance and regional transport in all directions, therefore the current modernisation of the station (track layout, platforms) will significantly improve its functionality.

After finalisation of the modernisation of the station it will be crucial to improve the capacity of adjacent railway lines, in particular the railway lines Kutno – Warsaw and Kutno – Łódź.

4 Travel offers and competitiveness of railway transport

This section of the input paper investigates the travel offers and the competitiveness of railway transport along the Berlin-Poznań-Warsaw-Białystok Commuting Growth Corridor. Rail transport, individual transport (private car), bus transport and air transport are being analysed, taking into account different aspects of competitiveness (travel time, quality and density of offers, price).

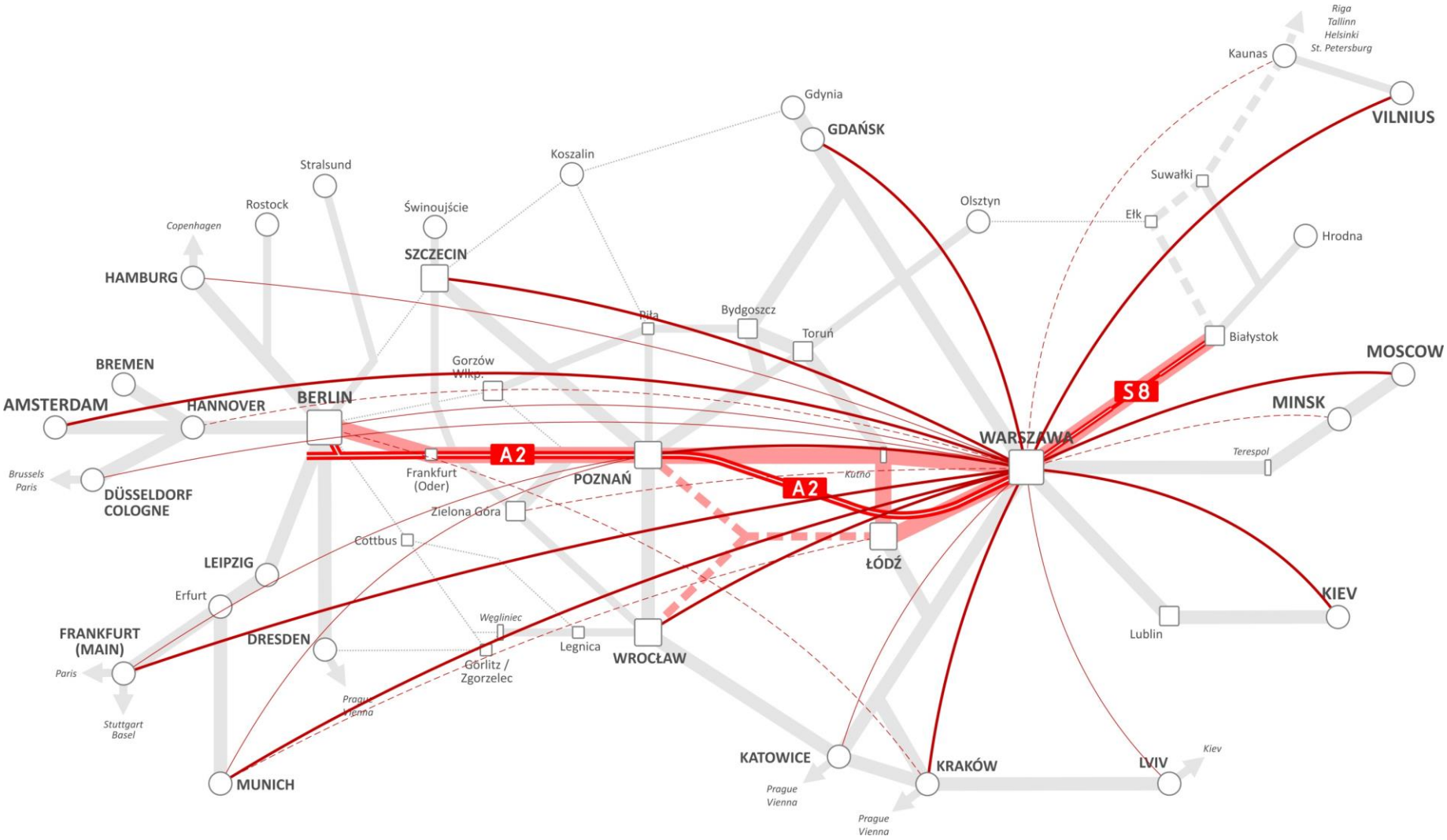
Figure 3 visualises the available road connections and the offer of flight connections along the Berlin-Poznań-Warsaw-Białystok Commuting Growth Corridor:

- Berlin, Poznań, Łódź and Warsaw are connected through the **A2 motorway**. Between Poznań and Łódź, the A2 motorway provides a direct connection, which leads to a competitive advantage compared to railway transport.
- Warsaw and Białystok are connected through the **S8 expressway**, which is nearly completed. Until Ostrów Mazowiecka, the S8 expressway is part of the „Via Raltica“ to the Baltic States. In future, the connection between Ostrów Mazowiecka and the Polish-Lithuanian border will be provided by the S61 expressway (completion might be expected in the funding period 2021-2027).
- As regards flight connections, **Warsaw** and **Berlin** are the crucial hubs for air transport along the Berlin-Poznań-Warsaw-Białystok Commuting Growth Corridor. Warsaw is connected with all larger Polish cities and many German cities through regular flight connections, including Berlin, Hamburg, Düsseldorf, Frankfurt (Main) and Munich. Additionally, Poznań is connected through regular flight connections with Frankfurt (Main) and Munich.

The analysis of long-distance bus transport has been focused on day-time connections, to guarantee the comparability of offers. In general, night bus connections are being operated along several sections of the Berlin-Poznań-Warsaw-Białystok Commuting Growth Corridor, but mostly as part of long-distance European connections e.g. from the Baltic States or Poland to Western Europe. In the effect, night bus connections with attractive times of departure and arrival are available only between Berlin and Warsaw.

The initial investigation of the travel offers and the competitiveness of railway transport has been realised in 2017. In 2018, the investigation has been updated and amended for the purpose of the analysis of the current competitiveness of railway transport, reflecting the effects of the closure of the railway line Poznań – Kutno for construction measures.

Figure 3: Road transport and available flight connections



Source: Research of regular flight connections, status: 07/2018

4.1 General analysis of travel offers in railway transport

The travel offer in long-distance railway transport along the Berlin-Poznań-Warsaw-Białystok Commuting Growth Corridor is provided by PKP Intercity and Przewozy Regionalne. In general, the Polish railway market for passenger transport is still dominated by domestic, state-owned operators.[9] Private operators have entered the market only in few, exceptional cases.[10][11]

Along the Berlin-Poznań-Warsaw-Białystok Commuting Growth Corridor, the following categories of trains are being offered:

- **Express InterCity (EIC):** High-level long-distance trains, operated on commercial basis to provide attractive connections for business travellers from and to Warsaw. Despite some past deficiencies in the quality of rolling stock, the long-distance trains between Berlin, Warsaw and Gdańsk / Gdynia are being operated as EIC trains, too. In Germany, these trains are operated as EuroCity (EC) trains.

- **InterCity (IC):** Regular long-distance trains, which are subsidised by the Polish government as interregional service. IC trains are composed of new or modernised rolling stock with high comfort and standard. Since 2015, the fleet of IC trains includes 20 new Stadler Flirt and 20 new PESA Dart electric multiple-unit trains, significantly increasing the offer of high-level interregional connections. Due to financial support of the purchase and the modernisation of rolling stock through EU funding, the operation of InterCity trains is assigned to designated connections.

- **Twoje Linie Kolejowe (TLK):** Regular long-distance trains, which are subsidised by the Polish government as interregional service. TLK trains are composed of rolling stock waiting for comprehensive modernisation with rather low level of comfort. TLK trains are being operated in all parts of Poland, including peripheral regions. Following the progressing modernisation of rolling stock, TLK trains are successively replaced by InterCity trains.

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9 Operators owned and managed by regional authorities have been established step-by-step since 2008, starting with Koleje Mazowieckie and Koleje Dolnośląskie.

10 The railway company LEO Express operates a commercial long-distance train between Prague, Katowice and Kraków since July 2018. In Germany, LEO Express operates the Flixtrain connection between Berlin and Stuttgart.

11 Since 2008, Arriva RP operates regional and local railway transport in the Kujawsko-Pomorskie voivodship.

- **InterRegio (IR):** Long-distance trains, developed by Przewozy Regionalne on commercial basis (i.e. in competition to subsidised services of PKP Intercity). Currently, the offer of IR trains is limited to the connection between Łódź and Warsaw, which is subsidised by the regional authority of the Łódzkie voivodship.

For the operation of international connections, in 2008 PKP Intercity has purchased 10 multi-system locomotives EU44 "Husarz" (Siemens ES64U4 Taurus), which are on duty between Berlin and Warsaw since 2010. Since then, these locomotives are the only multi-system locomotives at disposal of PKP Intercity. The construction speed is v_{max} = 230 km/h, and the locomotives are approved for operation at v_{max} = 200 km/h.

Between Warsaw, Gdańsk / Gdynia, Kraków, Katowice and Wrocław since 2014 **Express InterCity Premium (EIP)** trains are being operated. These trains are served by ED250 Pendolino trains, which are approved for v_{max} = 250 km/h. However, due to lack of adequate infrastructure, the EIP trains are operated at the speed level of 160-200 km/h.

All Polish Pendolino trains are already equipped with installations for power and safety systems in Germany, Austria and the Czech Republic, so in future – after approval for operation in these countries – these trains might be operated as well on international connections.

Figure 4 shows a "flashlight" of the quality of travel offers along the Berlin-Poznań-Warsaw-Białystok Commuting Growth Corridor before the closure of the railway line Poznań – Kutno for construction measures (status: 05/2017):

- Between **Berlin** and **Poznań** the offer consists of international EC/EIC trains, which serve as well the railway stations in Rzepin, Zbąszynek and Świebodzin. The station of Rzepin is served by long-distance TLK trains between Szczecin and Wrocław, too. Between Zbąszynek and Poznań the travel offer is more dense due to additional connections from and to Zielona Góra.

- Between **Poznań** and **Warsaw** the offer consists of EIC trains, IC trains and TLK trains. Several EIC trains serve connections from and to Szczecin and Zielona Góra. The IC trains serve the connection Szczecin – Poznań – Łódź – Katowice / Kraków. TLK trains complete the offer through connections from Szczecin and Zielona Góra to Warsaw, Białystok and Lublin / Przemyśl.

- Between **Poznań** and **Łódź** the offer consists of IC trains serving the connection from Szczecin – Poznań – Łódź – Katowice / Kraków. Additional connections are available, if trains are changed in Kutno.

- Between **Kutno**, **Lowicz** and **Łódź** the offer consists of IC trains and a TLK train. The IC trains serve the connections Szczecin – Poznań – Łódź – Katowice / Kraków and Gdynia / Gdańsk – Bydgoszcz – Łódź – Katowice / Kraków. The TLK trains serves the connection Gdynia / Gdańsk – Bydgoszcz – Łódź – Katowice.

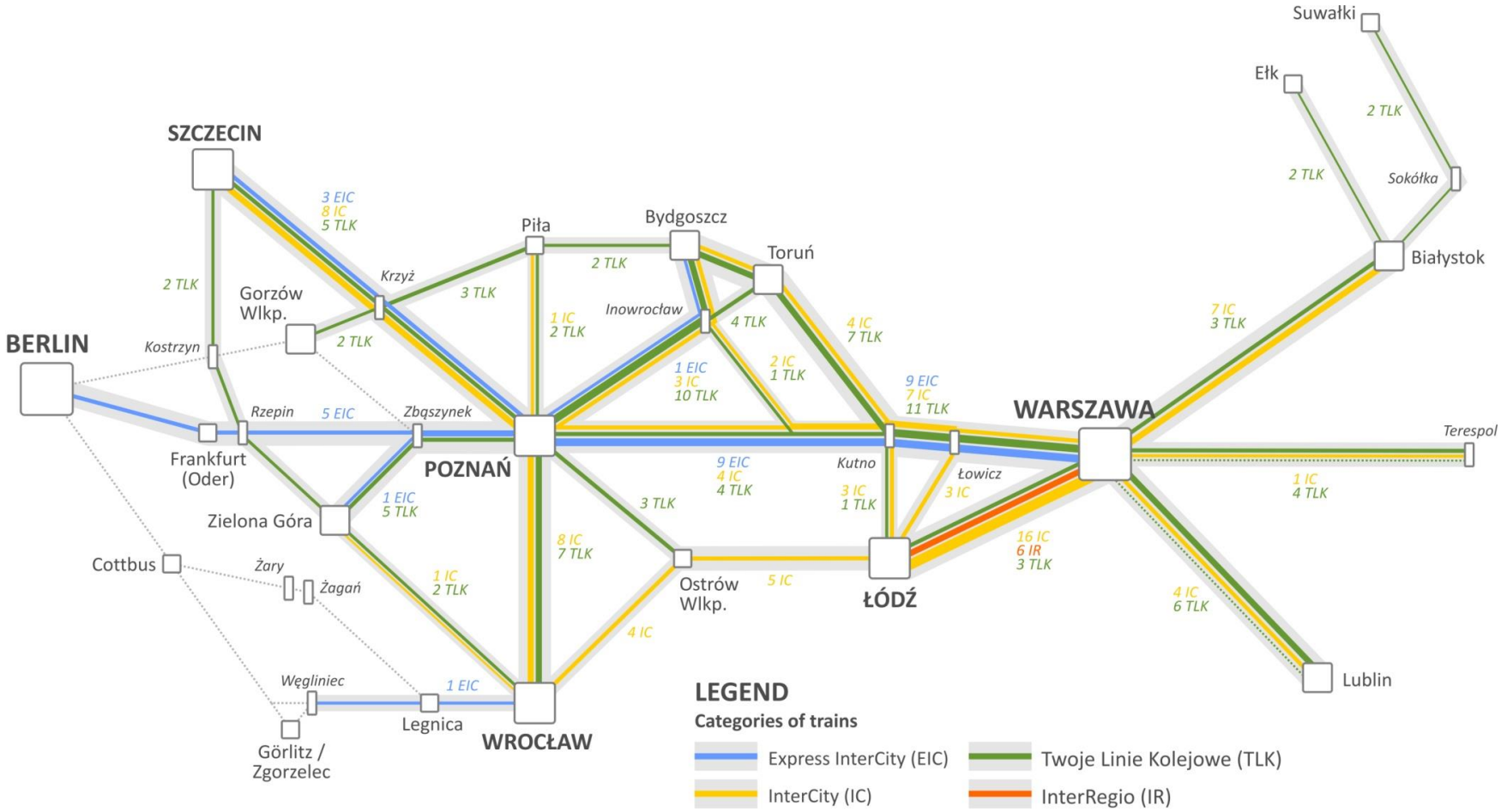
- Between **Łódź** and **Warsaw** the offer consists of IC trains, TLK trains and IR trains. Nearly all trains serve the connection Łódź – Warsaw, except several IC trains serving the connection Łódź – Warsaw – Białystok. Single IC trains serve the connections Łódź – Warsaw – Olsztyn and Łódź – Warsaw – Lublin.

- Between **Warsaw** and **Białystok** the offer consists of IC trains and TLK trains. Several IC trains are operated from Wrocław, Jelenia Góra and Bielsko-Biała. The TLK trains are operated from Kraków to Grodno and Suwałki, from Warsaw to Białystok and from Szczecin and Poznań to Suwalki.

Since closure of the railway line Poznań – Kutno for construction measures in 07/2017, the quality and density of travel offers along the Berlin-Poznań-Warsaw-Białystok Commuting Growth Corridor and connecting links has significantly changed. EIC trains between Poznań and Warsaw and IC trains between Poznań and Łódź are being operated along the routes Poznań – Inowrocław – Kutno and Poznań – Ostrów Wielkopolski – Łódź, leading to significant increase of travel times and reduction of offers (due to the limited capacity of tracks and the limited availability of rolling stock).

The launch of construction measures between Barłogi and Kutno and the modernisation of the railway line Łódź – Sieradz will lead to additional difficulties until the re-opening of the track between Poznań and Kutno, which shall take place in 06/2019. In consequence, it may expected that the quality of travel offers will further suffer.

Figure 4: Travel offers in railway transport



Source: Analysis of timetable data, status: 05/2017

4.2 Analysis of competitiveness of railway transport

The investigation of the current competitiveness of railway transport has been realised according to the most relevant relations along the Berlin-Poznań-Warsaw-Białystok Commuting Growth Corridor:

- Berlin – Warsaw
- Berlin – Poznań
- Poznań – Warsaw
- Poznań – Łódź
- Łódź – Warsaw
- Warsaw – Białystok

For each mode of transport travel time, quality and density of offers and travel cost (price) have been analysed. Travel cost for individual transport has been calculated at the level of 0,30 € / km, taking into account the cost of re-financing and maintenance of a private car. If a car is used by more than one person, the travel cost should be reduced accordingly.

Due to ongoing corrections and changes of timetables and seasonal changes in the offer of PKP Intercity, the quality and density of the travel offer in railway transport documented in this analysis might be subject to relevant changes. However, this “flashlight” delivers a fair picture of the offer delivered to the passengers.

4.2.1 Berlin – Warsaw

Table 32: Travel offers Berlin – Warsaw

Transport mode	Travel time	Quality and density of offers	Travel cost
Railway	6:17 – 7:06 5:25 05/2017	5 trains / day 4 EC, 1 EC / IC	29,90 – 66,80 €
Individual transport (car)	5:40	A12 / A2 motorway	575 km / 172,50 € + 20 € Road tax
Long-distance coach	7:30 – 9:00	2 buses / day Flixbus 1 bus / day Ecolines	e.g. 21,90 €
Airplane	1:20	3 flights / day LOT	51 – 214 € Economy

Source: Information provided by transport operators, additional research

- The daily travel offer between Berlin and Warsaw consists of 4 Eurocity trains (Berlin-Warszawa-Express), 3 bus connections and 3 flights. An additional train connection requires the change of trains (in Poznań or Gniezno).

- Additional connections by night bus are being offered e.g. by Flixbus, Eurolines, Ecolines, EST Lorek, Deutsche Bahn (IC Bus). Several night connections serve as well Łódź and Poznań. Partly, the night connections are operated as part of European long-distance connections.
- In terms of travel time, air connections are most competitive (including change connections with short transfer time), followed by individual transport (private car), train connections and bus connections.
- Due to the closure of the railway line Poznań – Kutno for construction works train connections have lost their competitive advantage compared to individual transport, and attractiveness of train connections has been reduced significantly.
- In terms of travel cost, bus connections are most competitive, closely followed by train connections. However, taking into account the level of travel comfort, train connections are still more attractive than bus connections.

4.2.2 Berlin – Poznań

Table 33: Travel offers Berlin – Poznań

Transport mode	Travel time	Quality and density of offers	Price
Railway	2:43 – 3:02 2:46 05/2017	5 trains / day 5 EC	19,90 – 44,80 €
Individual transport (car)	3:00	A12 / A2 motorway	273 km / 81,90 € + 10 € Road tax
Long-distance coach	3:40 – 3:50	4-5 buses / day Flixbus	e.g. 15,90 €

Source: Information provided by transport operators, additional research

- The daily travel offer between Berlin and Poznań consists of 5 Eurocity trains (Berlin-Warszawa-Express) and 4-5 bus connections. Additionally, several daily minibus connections from and to Berlin airports are being offered (travel time: approx. 3:30, price: 27 – 32 €).
- Direct flight connections are not available between Berlin and Poznań. However, this situation might change after the future BER airport will be operational.
- In terms of travel time, train connections are most competitive, followed by individual transport (private car) and bus connections. As regards the transfer from and to Berlin airports, minibus connections are today more attractive than train connections.

- Travel time of train connections will be reduced after finalisation of construction works between Berlin Ostbahnhof and Erkner, increasing the attractiveness of train connections.
- In terms of travel cost, bus connections are most competitive, followed by train connections. As regards bus and train connections, attractive morning connections from Poznań to Berlin are missing.

4.2.3 Poznań – Warsaw

Table 34: Travel offers Poznań – Warsaw

Transport mode	Travel time	Quality and density of offers	Price
Railway	3:22 – 4:05 2:34 05/2017	11 trains / day 2 EIC, 4 EC, 3 IC, 2 TLK	12 – 32 €
Individual transport (car)	3:00	A2 motorway	311 km / 93,30 € + 10 € Road tax
Long-distance coach	3:50 – 4:05	5-6 buses / day Flixbus	e.g. 6,90 €
Airplane	0:55	5 flights / day LOT	33 – 128 € Economy

Source: Information provided by transport operators, additional research

- The daily travel offer between Poznań and Warsaw consists of 11 train connections, 5-6 bus connections and 5 flight connections.
- Before the closure of the railway line Poznań – Kutno for construction works 17 train connections were available, including 5 Express Intercity (EIC) trains and 4 Eurocity trains (Berlin-Warszawa-Express). At the same time, travel times between Poznań and Warsaw have been increased by 30-40 %, significantly reducing the attractiveness of railway transport.
- In terms of travel time, flight connections are most competitive, followed by individual transport (private car), train connections and bus connections.
- In terms of travel cost, bus connections are most competitive, followed by train connections and flight connections.
- Ticket prices for EIC, IC and TLK long-distance trains have been reduced to minimize the negative effects of increased travel times. However, the ticket prices for Eurocity trains remain still at a high level.

4.2.4 Poznań – Łódź

Table 35: Travel offers Poznań – Łódź

Transport mode	Travel time	Quality and density of offers	Price
Railway	3:27 – 4:26 2:50 05/2017	6 trains / day 2 IC, 4 REG	8 – 13 €
Individual transport (car)	2:20	A2 motorway	204 km / 61,20 € + 10 € Road tax
Long-distance coach	2:50 – 3:00	3 buses / day Flixbus	e.g. 5,90 €

Source: Information provided by transport operators, additional research

- Currently, due to long-term construction works between Łódź Kaliska, Zduńska Wola and Sieradz, the daily travel offer between Poznań and Łódź consists of 2 Intercity trains, 4 regional trains and 3 bus connections. Additionally, several connections with change of trains in Kutno are available.
- Before the launch of construction works, the travel offer consisted of 4 Intercity trains and 6 regional trains, and travel time was shorter by 10 %.
- In terms of travel time, individual transport is most competitive, followed by bus connections and train connections. In terms of travel cost, bus connections are most competitive, followed by train connections.
- Before the closure of the railway line Poznań – Kutno for construction works the Intercity trains between Poznań and Łódź were operated via Kutno, and travel time was at the level of 2:50. Travel time could be further reduced if the quality and the capacity of the railway line Kutno – Łódź would be increased (increase of speed level, construction of 2nd track).

4.2.5 Łódź – Warsaw

Table 36: Travel offers Łódź – Warsaw

Transport mode	Travel time	Quality and density of offers	Price
Railway	1:12 – 1:35	28 trains / day 17 IC, 5 TLK, 6 IR	6 – 7 €
Individual transport (car)	1:35	A2 motorway	138 km / 41,40 €
Long-distance coach	2:00 – 2:30	8 buses / day Flixbus 7 buses / day modlinbus / OK Bus	e.g. 3,90 €

Source: Information provided by transport operators, additional research

- The daily travel offer between Łódź and Warsaw is very dense, reflecting the close socio-economic relations and the close distance between both metropolitan centres. 28 train connections and 15 bus connections are available, including bus connections from and to Warsaw airports.
- In terms of travel time, train connections are most competitive, followed by individual transport and bus connections. In terms of travel cost, bus connections are most competitive, followed by train connections.

4.2.6 Warsaw – Białystok

Table 37: Travel offers Warsaw – Białystok

Transport mode	Travel time	Quality and density of offers	Price
Railway	2:15 – 2:26	10 trains / day 7 IC, 3 TLK	7 €
Individual transport (car)	2:45	S8 expressway	195 km / 58,50 €
Long-distance coach	2:50 – 3:10	7 buses / day PlusBus 5 buses / day ŻAK Express 1 bus / day Gaja Express	e.g. 4,90 €

Source: Information provided by transport operators, additional research

- The daily travel offer between Warsaw and Białystok consists of 10 train connections and 13 bus connections. Due to ongoing construction works the capacity of the railway line is still limited, and the expected speed level of v_{max} = 160 km/h has not been reached yet.

- In terms of travel time, train connections are most competitive, followed by individual transport and bus connections. In terms of travel cost, bus connections are most competitive, followed by train connections.
- The current offer of bus connections emerged during the long-term closure of the railway line between Warsaw and Tłuszcz (Sadowne) with bus replacement services between Warsaw and Białystok. Therefore it is interesting to observe the development of bus connections once the quality of train connections will be further improved.

4.2.7 Białystok – Kaunas

Table 38: Travel offers Białystok – Kaunas

Transport mode	Travel time	Quality and density of offers	Price
Rail	4:42	2 trains / day weekend service	11 €
Private car	3:30	National road no. 8 / Long-distance road A5	250 km / 75 €
Long-distance coach	3:55 – 4:40	1 bus / day Eurolines 1 bus / day Ecolines	e.g. 15 €

Source: Information provided by transport operators, additional research

- The daily travel offer between Białystok and Kaunas consists of 2 bus connections, and 2 train connections are availabe during weekend time. Additionally, between Białystok and Suwałki 2 TLK trains and 4 regional trains are available.
- In terms of travel time, individual transport is most competitive, followed by bus connections and train connections. In terms of travel cost, train connections (weekend trains) are most competitive, followed by bus connections.
- Several day-time and night bus connections between Warsaw, Kaunas, Vilnius, Riga and Tallinn are being offered e.g. by LUX Express, Eurolines and Ecolines. Partly, these connections serve as well the connection Suwałki – Kaunas.

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