

Analysis of potential for capacity optimization of the railway line Berlin - Frankfurt (Oder) – Rzepin to meet evolving needs of the growth of regional, long-distance and rail freight transport along the TEN-T core network corridor (CNC) North Sea – Baltic **FINAL REPORT, AUGUST 2019**



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INITIAL SITUATION AND OBJECTIVE OF THE STUDY

- Reluctant extension of railway line Berlin – Frankfurt (Oder) since the 1990s.
→ Growing commute traffic in the metropolitan region Berlin-Brandenburg and international rail freight transport has not sufficiently been taking into consideration.
- For further extensions coordinated forecasts are missing as well as a supply concept in the regional, national and EU wide planning authorities. Contradictory statements are frequently found.
- Aim of the study is therefore:
 - Development of a coherent traffic forecast
 - Analyse whether the capacity of the proposed infrastructure is sufficient for the predicted traffic volumes
 - Identification of bottlenecks
 - Feasibility of the removal of bottlenecks and the identification of the related costs.

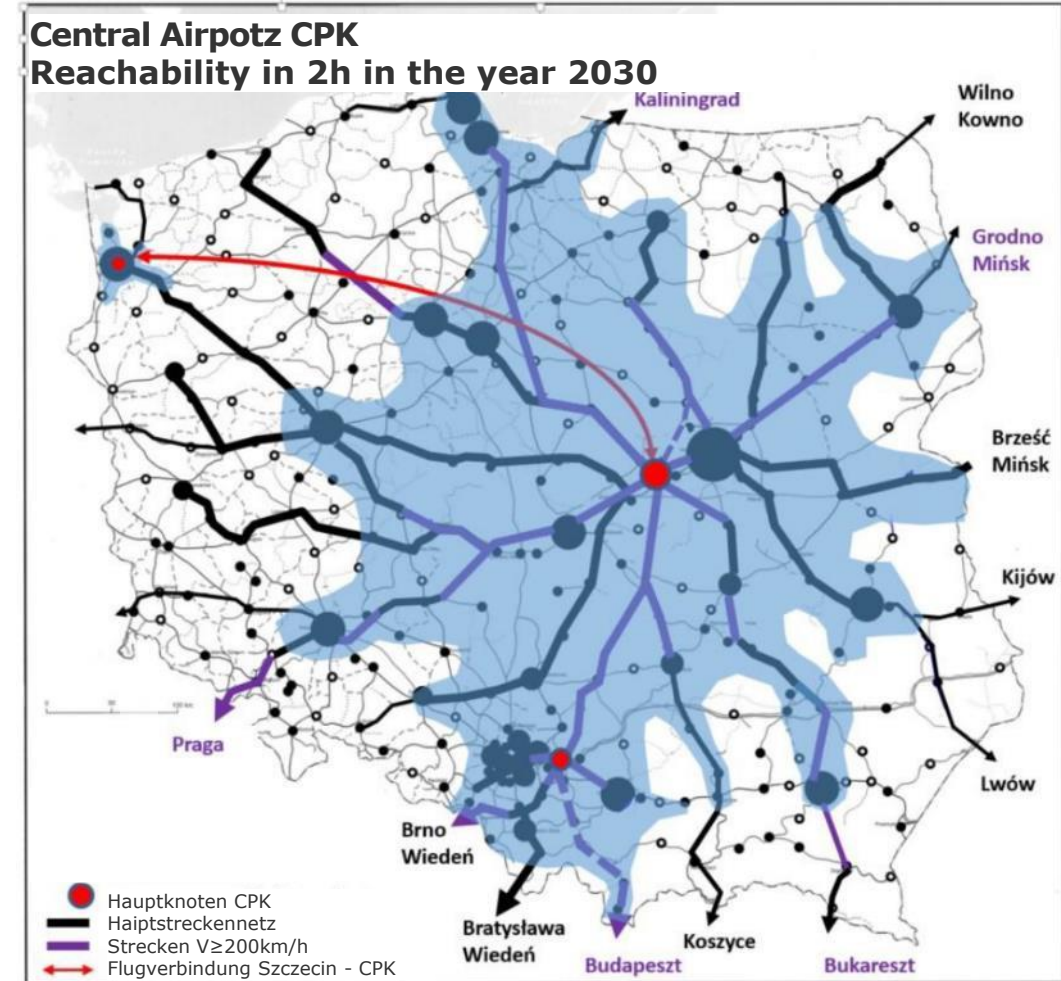
AP1: INVENTORY

DATA BASIS IN GERMANY AND IN THE BALTIC COUNTRIES

- The German planning documents are aligned and state specific number of trains for the corridor
 - Corridor studies of the VBB transport association and infrastructure program i2030
 - expansion in the offer of regional trains (3 trains per hour and direction in peak times)
 - Conception for the synchronized timetable (Deutschland-Takt) target schedule 2030
 - Planning efforts of VBB are depicted, cross-border regional trains are missing completely
 - Disclosure of system routes larger than expected number of trains
 - Federal Transport Plan 2030 (basis of planning DB Netz AG)
 - De facto expected number of trains
- International perspective of rail freight transport is not sufficiently being taking into consideration by the planning authorities. Notably the forecasts for the standard gauge line of Rail Baltica, which from 2026 will connect Warsaw with Tallinn
 - Cost-Benefit-Analysis from Ernst&Young (2017), number of trains for all sections
 - Operational Plan from ETC (2018), timetables for all sections

AP1: INVENTORY DATA BASIS IN POLAND

- Numerous current documents and planning bases are available
- But no route-related supply or demand data, only isolated aggregated figures for the whole of Poland
- For international traffic, there is neither a traffic forecast for both passenger and freight traffic, nor an offer concept based on this forecast
- The planned new central airport is to be connected with the entire country by extensive expansion measures; open financing
- The completion of the feasibility study Kostrzyn - Piła planned for the first quarter of 2019 is delayed.



Quelle: Masterplan für den Zentralflughafen

AP1: INVENTORY OVERVIEW AND EVALUATION

- There is no coherent and coordinated planning basis for the entire German-Polish border area.
- The individual documents each have a specific or regional focus and often ignore overarching and supra-regional factors.
- There are no plans for both regional and supra-regional traffic flows for passenger and freight transport, including all relevant international routes.
- The commissioning of Rail Baltica planned for 2026 is not sufficiently taken into account in the documents analysed in Germany and Poland.
- The additional capacities resulting from the opening of the Horka - Bielawa Dolna border crossing are not effective for the considered traffic towards central and northern Poland and the Baltic States (relief of the southern corridor).

AP2: FORECAST OF POTENTIAL LOCAL PUBLIC TRANSPORT CONCEPT I 2030 BERLIN-BRANDENBURG

Forecast

- Passenger demand on the RE1 line will increase by up to 63 percent* by 2030.

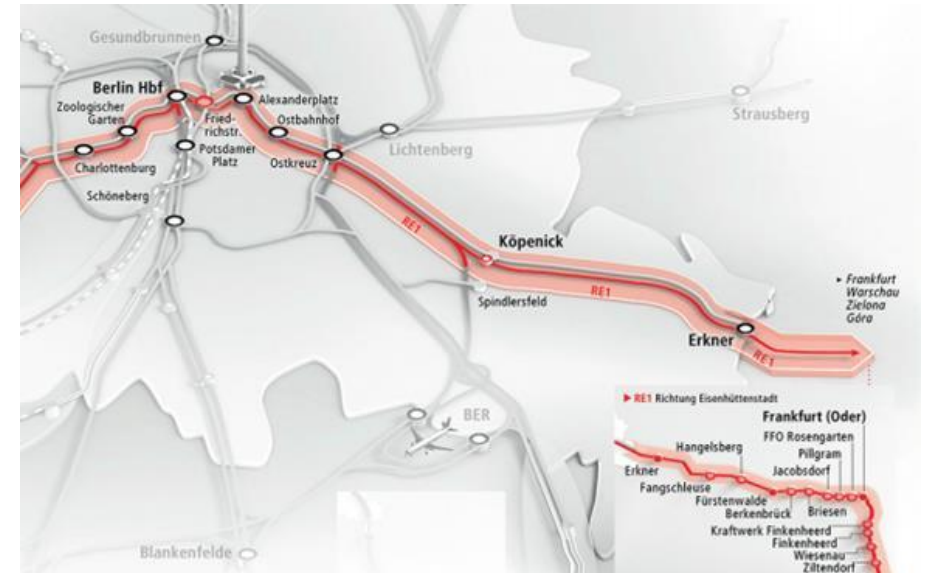
Offer extension (VBB-Orders):

- 3 trains per hour Berlin-Frankfurt/Oder in peak times from the end of 2022 (Elbe-Spree network)
- Differentiated stopping concept Erkner-Frankfurt/Oder (capacity increase for freight trains, short travel times between main locations, identical edge times between hub stations)

Further expansion requirement

- Capacity increase RE 1 (target: 800 seats) through additional wagons: platform length uniformly adjusted to 210m (Brandenburg)

* Source: VBB, www.i2030.de



Source: VBB, www.i2030.de

AP2: FORECAST OF POTENTIAL

SUMMARY – FORECAST 2030

- Current plans for 2030:

Prognostizierte Zugzahlen / Geplante Trassen (beide Richtungen zusammen)

Berlin - Frankfurt(O.)	SQ (2015)				D-Takt Zielfahrplan 2030 (2019)				DB Netz 2030 (2019)			
	FV	NV	GV	Ges	FV	NV	GV	Ges	FV	NV	GV	Ges
Berlin - Frankfurt (O)	12	72	50	134	32	96	120	248	20	92	79	191
Frankfurt (O)- Kunowice	12	8	35	55	32	0	120	152	20	10	43	73

- Take into account the expansion of services (in the SPNV Berlin - Frankfurt/Oder)
- Cross-border SPNV remains at very low level (5 train pairs; 2019: 3 train pairs)
- Only very moderate expansion of long-distance services (10 train pairs; 2019: 7 train pairp)
- Significant expansion of freight train routes synchronized timetable (Deutschland-Takt) (5 lines in 2h per direction)
 - Restrictions not yet specified in detail during rush hour.
 - This concerns day times with three train pairs per hour in regional passenger transport, as well as hours during which EC operates (a total of 3 or 4 passenger trains per hour and direction).
 - The number of forecasted cross-border freight trains remains largely underestimated at the current level of Rail Baltica (30%-50% of freight trains are expected to travel from/to Germany).



Güterzüge/d LT/PL	2018	2026	2056
	< 1	54	84

AP3: EFFICIENCY ANALYSIS

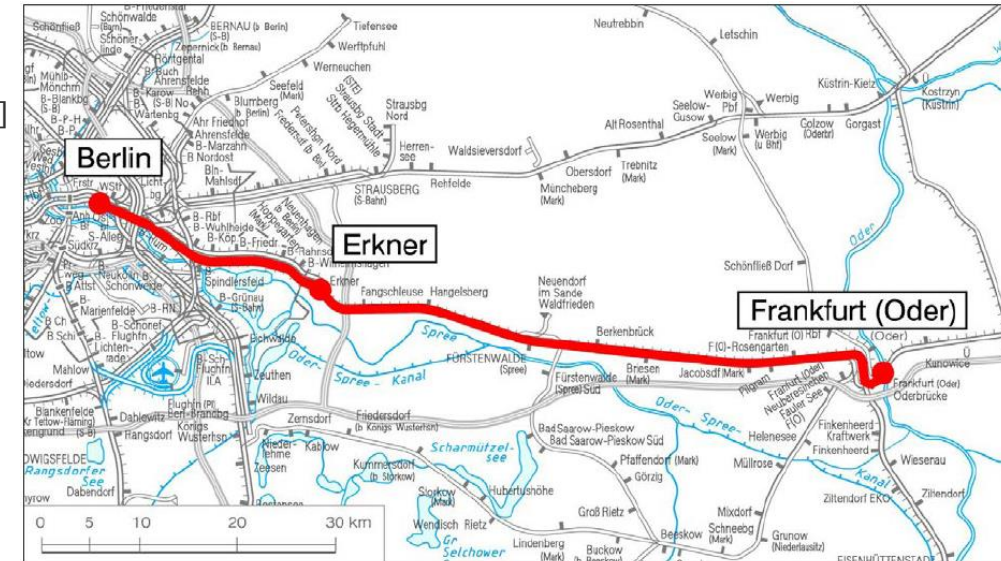
STATE OF INFRASTRUCTURE EVALUATION – FEDERAL TRANSPORT PLAN

Introduction of train protection system ETCS, Level 2

- Section Erkner - Frankfurt/O. - State border until 2023 [1]
- Equipment state border - Warszawa to be completed by 2023 [3]
- Multi-system locomotives equipped with ETCS can pass through Oderbrücke border station without stopping

Upgrade for longer freight trains

- Existing infrastructure designed for a maximum train length of 600 m (incl. border station Oderbrücke)
- Expansion of line planned for 740 m train length
- Realisation planned after 2026
- The first measures (signal relocations at Fangschleuse and Berkenbrück) are part of the BVWP requirements plan project "Overtaking tracks for 740 m trains"[2].



Source: BMVI: Verkehrsinvestitionsbericht 2016

[1] Nationaler Umsetzungsplan ETCS, Stand: 11.12.2017

[2] BT-Drs 19/1609

[3] Technical specification for interoperability "Control-command and signalling" National Implementation Plan, Stand 06/2017

AP3: EFFICIENCY ANALYSIS

INFLUENCE OF MAXIMUM SPEED FOR LONG-DISTANCE TRAFFIC

Planned speed Fernverkehr (Fv)	100 km/h	Status Quo (Construction)	160 km/h** (D-Schedule-Draft)	200 km/h	230 km/h
Travel time Ostbahnhof – Frankfurt (Oder)	0:54	0:49	0:38	0:28	0:26
Difference in travel time	plus 5 minutes	-	minus 11 minutes	minus 21 minutes	minus 23 Minuten
Precise 20'-interval RE 1	possible*	possible*	Only possible when overtaking the RE 1 or on sections of a 3. track	Only possible when overtaking the RE 1 or on sections of a 3. track	Only possible when overtaking the RE 1 or on sections of a 3. track
Precise 30'-interval RE 1 + Support (3 trainpairs/h total)	possible*	possible*	possible*	Only possible when overtaking the RE 1 or on sections of a 3. track	Only possible when overtaking the RE 1 or on sections of a 3. track
Number of freight train routes	plus one trass per long-distance train	-	Like status quo	Like status quo	Like status quo
Overtaking of freight trains***	-	-	One per long-distance train (only → east)	At least one per long-distance train (both directions)	At least one per long-distance train (both directions)

** The higher speed of 160 km/h would already be partly feasible today if a different route situation were possible and sensible in Poland (earlier in the east, later in the west).

*** Every overhaul considerably reduces line capacity due to the significantly longer braking and acceleration processes of freight trains. Further overhauls cannot be used to construct additional lines, as they erode continuous lines. Overhaul tracks are therefore required less for planned operation than for timetable deviations or maintenance and construction conditions.

AP3: EFFICIENCY ANALYSIS

NUMBER OF FREIGHT TRAIN ROUTES

	Trainroutes per hour and direction			Hours per day	Freight train routes per day and direction
	RE 1	FV (HG 160 km/h)	Güterverkehr		
Rush hour with EC	3	1	2	5	10
Rush hour without EC	3		3	3	9
Off-peak hours with EC	2	1	4	5	20
Off-peak hours without EC	2		5	6	30
light traffic	1		5*	5	25
Sum				24	83
Number of both directions together					166
Actual train numbers according to DB forecast 2030 plus RailBaltica traffic					110
Utilization of existing freight train paths:					59%

--> Number of freight train paths is sufficient for the traffic forecast

* Number is primarily limited by the single-track connection curve(s) to the Berlin outer ring.

AP3: EFFICIENCY ANALYSIS

PREMISES FOR SUFFICIENT FREIGHT TRAIN PATHS

- The location of the local train routes as planned for 2030, i.e.
 - 30' basic interval pulse of RE 1 (with alternating holding policy analogous to status quo or as in D clock pulse)
 - Cycle compressions of the RE 1 every second half hour to a quarter-hour cycle (in the half hours without long-distance road)
 - Route position in outward and opposite direction as planned, i.e. mutual displacement of outward and opposite direction is only possible to a very limited extent in order to allow freight trains to travel on the single-track section between the outer ring and the junction Berlin Stadtforst without conflict.
- The location of the long-distance train routes as planned for 2030, i.e.
 - Travel time reduction Berlin-Ostbahnhof – Frankfurt (Oder)
 - Route location as planned in D-interval (in Frankfurt earlier departures towards Warsaw and later arrivals from Warsaw)
- Infrastructure as planned for 2030, i.e.
 - Continuous third track between Berlin Stadtforst and Berlin-Köpenick
 - 740 m long freight trains on the passing tracks are possible (at least required in Köpenick and Fangschleuse Gbf, others to cushion delays).
 - A new freight train passing track in the direction of Frankfurt at Hangelsberg would additionally offer an overhaul possibility with greater scope; e.g. better distribution of 3 RU 1 per hour).

A standardised freight train (6.4 MW traction power, 1,800 t load, 740 m length) is used as the basis for calculating the route capacity.

AP3: EFFICIENCY ANALYSIS

OVERVIEW OF MEASURES TO INCREASE CAPACITY

Complementary infrastructure measures for sustainable expansion of the corridor in the Berlin - Frankfurt (Oder) section

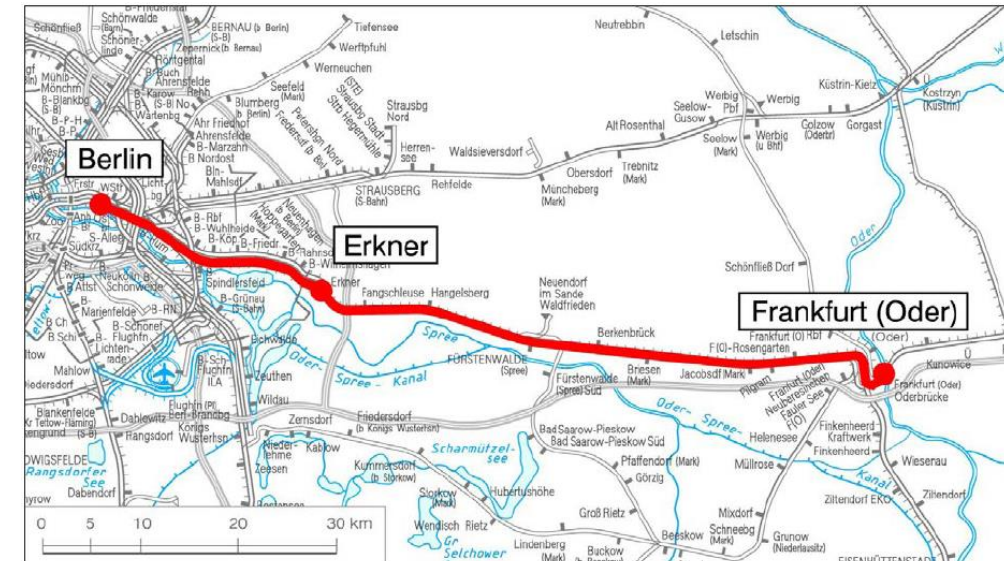
- Upgrading Frankfurt (Oder) railway station Oder bridge (additional tracks and extension to 750m useful length for 740m long trains), separate proposal for measures and cost estimate
- Upgrading of overhaul stations Berkenbrück and Fangschleuse for 740 m trains, part of federal programme, therefore no separate consideration in this study
- Platform extension to increase capacity in regional transport, subject of project i2030, therefore no separate consideration in the study
- Optional additional overtaking track at Hangelsberg in direction Frankfurt (Oder)

AP3: EFFICIENCY ANALYSIS

STATION FRANKFURT (ODER) ODERBRÜCKE

Station Frankfurt (Oder) Oderbrücke – Bottleneck for rail freight transport

- Due to its limited useful length of 600m and the small number of existing tracks, the Oderbrücke railway station is the decisive bottleneck for freight traffic on the section Poznań - Berlin.
- Trains arriving in Germany which have to be treated in Oderbrücke would therefore be limited to a length of 600m even after implementation of the 740m programme if they had to stop in Oderbrücke.
- With the commissioning of ETCS it will be possible for trains equipped with multi-system traction vehicles to cross the border without stopping in Frankfurt Oderbrücke.
- Nevertheless, railway undertakings will still need a transfer station close to the border in the future, which can serve as a buffer for the synchronisation of vehicle and personnel deployment on both sides of the border.
- On the German side, there are no tracks near the border which could be used or upgraded as an easily accessible alternative.



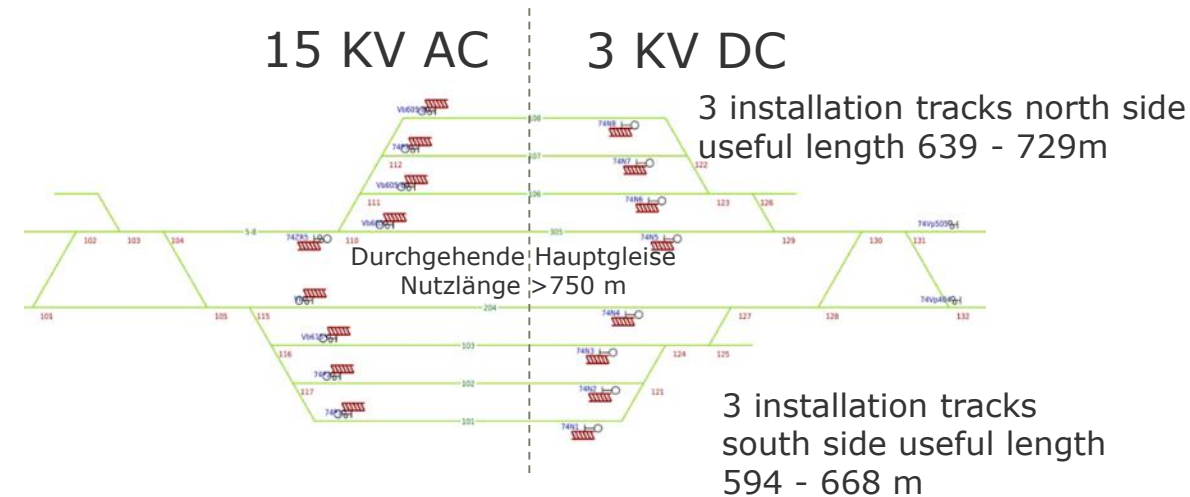
Source: BMVI: Transport Investment Report 2016

AP3: EFFICIENCY ANALYSIS

STATION FRANKFURT (ODER) ODERBRÜCKE – STATUS QUO

Current state

- No possibility to handle 740 m trains in the tracks (track length, current signal locations)
 - 3 installation tracks each on the north and south side
 - Two continuous main tracks
 - Traction power supply: 2 power systems 15KV DC (D) / 3 KV AC (PL) with system separation point in the middle of the station (support by diesel locomotive required when changing locomotives)
- **Low track capacity leads to frequent backlogs of trains in the network already in the status quo**
- **Improved coordination of track occupancy is currently being sought**
- **Long-term expansion of track capacity makes sense in order to expand the corridor in line with market requirements**



Source site plan sketch :
 Infrastrukturregister DB Netz AG <https://geovdbn.deutschebahn.com/isr>
 Stand: 06/2019

AP3: EFFICIENCY ANALYSIS

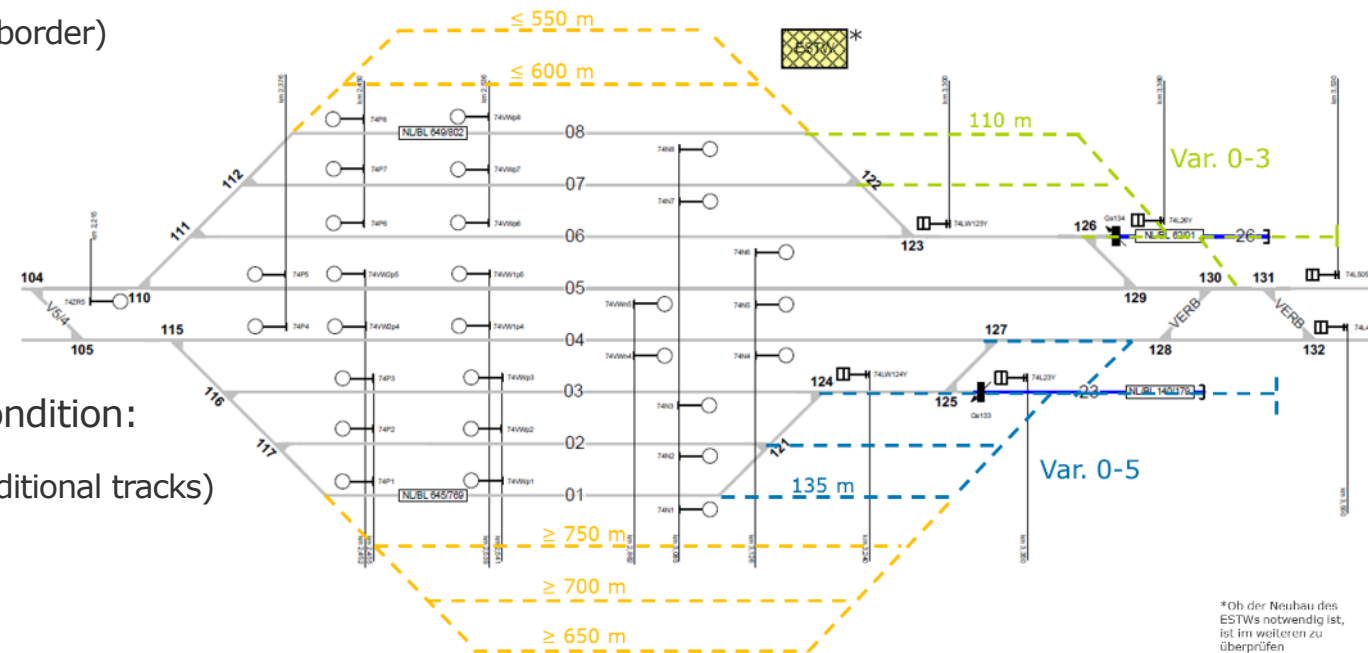
STATION FRANKFURT (ODER) ODERBRÜCKE – EXTENSION OPPORTUNITIES

Possibilities for expansion

- Considering the environmental conditions:
 - Signal locations (neighbouring operating sites / national border)
 - Topography
 - Existing infrastructure (tracks, buildings)

different variants for the adaptation of the track topology have been tested
- Preferred variant offers in maximum configuration condition:
 - Approximately doubling capacity for train handling (5 additional tracks)
 - Sufficient possibilities for handling 740 m trains (a total of 7 installation tracks can be used)
- The feasibility of the measures proposed here and their environmental compatibility must be supported by technical feasibility studies.

Track topology preferred variant



Quelle Anlagen Bestand: Infrastrukturregister DB Netz AG

AP4: ESTIMATED COSTS

Costs for capacity increase at Frankfurt (Oder) railway station Oder bridge

Position	Kosten Mio. EUR	Kommentar
acquisition of land	0,50	
substructure	1,38	Earthworks/deep drainage
superstructure	7,63	Simple to medium conditions, incl. approx. 400 m retaining wall south side
catenary systems	3,25	
signalling equipment	5,75	Assumption: ESTW can remain at actual location
lighting equipment	0,43	
Compensatory measures Area	0,5	
Sum	19,4	
Contingency award	9,72	50%
Net construction costs	29,16	
planning costs	8,74	30% construction costs
Gross construction costs	37,88	

Basics:

- Current construction prices
- Cost parameter catalogue railway infrastructure DB AG
- Extrapolation to reference year 2030 (2% increase p.a.)

→ Construction costs for upgrading Oderbrücke railway station approx. 38 - 40 million Euro

RESULTS (I)

- There is still a lack of a uniform traffic forecast and an offer concept based on it at regional, national and European level for the section Berlin - Frankfurt (Oder) - Rzepin as part of the TEN-T core network corridor North Sea - Baltic.
→ These are to be developed independently of the recommendations made here and are indispensable for their further reduction.
- The German plans (BVWP or i2030) do not take sufficient account of the potential in international freight transport. The forecasts are based on the status quo and exclude decisive potentials from road traffic or from the planned standard gauge line Rail Baltica - which is scheduled to go into operation in 2026.
- With the planned increase in the number of regional passenger rail services from 2022, the planned consolidation and acceleration of long-distance traffic, the potential volume of freight traffic on the planned railway infrastructure cannot be handled with sufficient quality.
- The most important measure is to extend the Oderbrücke railway station to a useful length of 740m --> Buffer for the highly occupied Frankfurt (Oder) - Berlin section.

RESULTS (II) – STEP-BY-STEP CONCEPT

1. To ensure sufficient operational stability on the highly frequented section Berlin outer ring - Frankfurt (Oder), the buffer capacities at the access points must be expanded (Oder bridge).
2. A fundamentally higher line capacity is only possible with an additional "system track" between the Polish border and Berlin. A third track on the Berlin-Frankfurt line is much more difficult to build than the electrification and partial expansion of the Ostbahn Berlin - Kostrzyn:
 - Investment costs on the Ostbahn: 125 million €
 - 1.5 additional freight train routes per hour and direction in the HVZ
 - Capacity expansion, acceleration and connections in the SPNV possible
 - Greater flexibility through two parallel electrified lines in the Rail Baltica - Access (if the section Kostrzyn - Bydgoszcz - Olsztyn - Elk is continuously electrified)
3. A further acceleration of long-distance traffic is only possible by building a new line, since higher speeds on existing lines would lead to capacity restrictions.