Timetable study
New Dresden – Prague line

DB Netz AG

Regional Unit South East

Infrastructure development (I.NM – SO – E)

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1 Project description

1.1 Reason for and background to the timetable study

The (Berlin) – Dresden – Prague rail link forms part of the Orient/East – Med (OEM) core network corridor of the 2014 revision of the Trans-European Transport Network (TEN-T). The existing line through the Elbe valley and the Bad Schandau/Czech Republic border crossing is shown as a future bottleneck in the study of the OEM commissioned by the European Commission. The "Connecting Europe Facility" has recommended more extensive studies on the removal of this bottleneck and connecting the capitals of Berlin and Prague with a high-speed line.

The state of Saxony has been working on alternative routes to avoid this bottleneck for several years. In this connection, the state of Saxony, the Czech Republic and various planning consultancies have been preparing the EU-subsidised study of "Pre-planning services for the new Dresden – Prague railway line". DB Netz AG has been involved in the advisory group meetings as an infrastructure manager, .

The study includes consideration of context focussing on legal, technical, geological, hydrological and environmental aspects of a cross-border route outside the Elbe valley.

The object is both the establishment of express (Berlin –) Dresden – Prague passenger services, the transfer of most of the express freight traffic out of the Elbe valley on to the new line and the creation of additional cross-border rail capacity to South-East Europe via Germany and the Czech Republic.

This could produce various long-term effects such as a reduction in rail passenger journey times, greater capacity for passenger and freight traffic, a reduction in noise on the existing line in the Elbe valley and a flood-proof route.

A timetable study is to be produced for the new route, in addition to the technical focuses already covered by the study.

1.2 Area covered by and parameters of the study

The subject of the timetable study is the new Dresden – Prague line, more specifically the Heidenau – Ústí n.L. section. The scope covers the section of the new line and its integration into the Dresden hub, including the Dresden – Friedrichstadt und Dresden – Neustadt border yards. The existing line through the Elbe valley to the Bad Schandau – Děčín border crossing is also considered.

Table showing the operating locations affected (new line only)

Abbreviation from GL 100	**Place name**
D 623	Heidenau-Süd junction (working designation)
DGOS	Goes yard (working designation)
DXGO	DB/SZDC boundary
XTUH	Ústí nad Labem západ

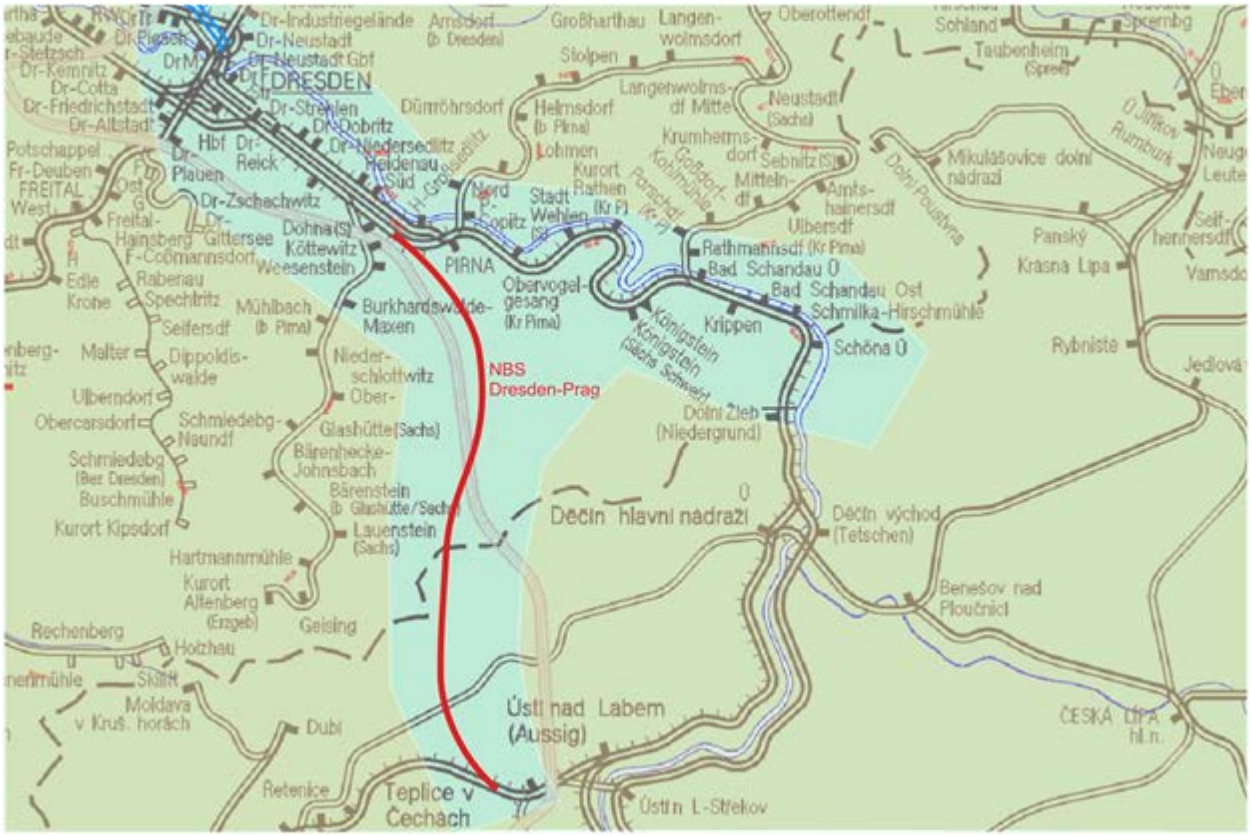


Fig. 1.2.1 Position on the network and area covered by the study (shaded in green) (Map: DB Netz AG)

1.3 Bases and infrastructural parameters

Various planning documents from the "Pre-planning services for the new Dresden – Prague railway line" study (August 2014 – December 2015) have been used as a basis.

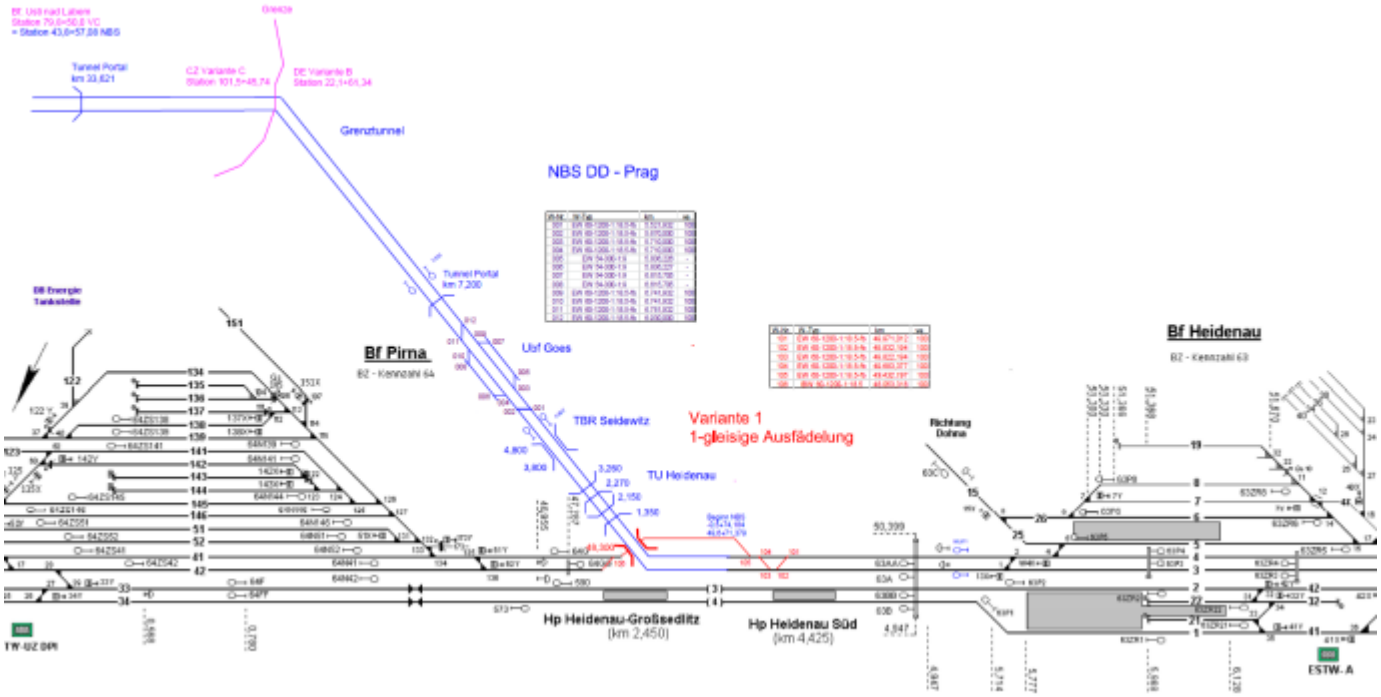
- **Technical parameters:**

Distance between Heidenau-Süd junction and Ústí n. L. západ	~ 44.3 km
Distance between Heidenau-Süd junction and DB/SZDC boundary	~ 22.7 km
Length of the Erzgebirge tunnel	26.53 km (planning status as at October 2015)
Maximum gradient	12.5‰
Route availability	D4 with the option of E5
Multimodal gauge	P/C 80/410

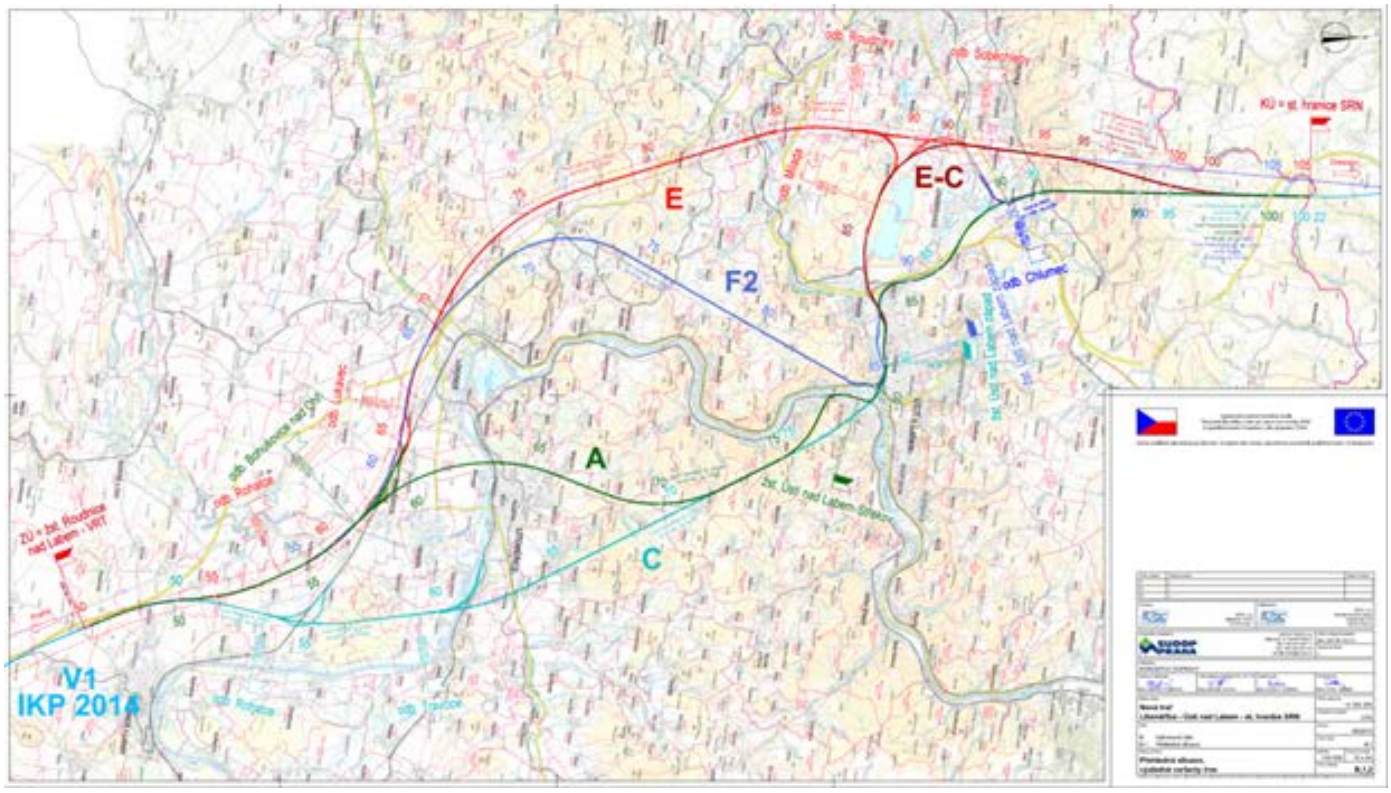
The Erzgebirge tunnel is to be built with two bores. This will obviate the operating restriction on the efficiency of the new line of a ban on passenger and freight trains passing in the tunnel.

- **General diagrammatic plan**

The diagram below (not to scale) below was used for the timetable study. The new line is shown in blue and the existing line between Bad Schandau border and Dresden – Neustadt and the Pirna – Heidenau section of the Pirna – Coswig bei Dresden rapid transit line are shown in black. The area covered by the junction between the new and existing lines at Heidenau-Süd is shown in red.

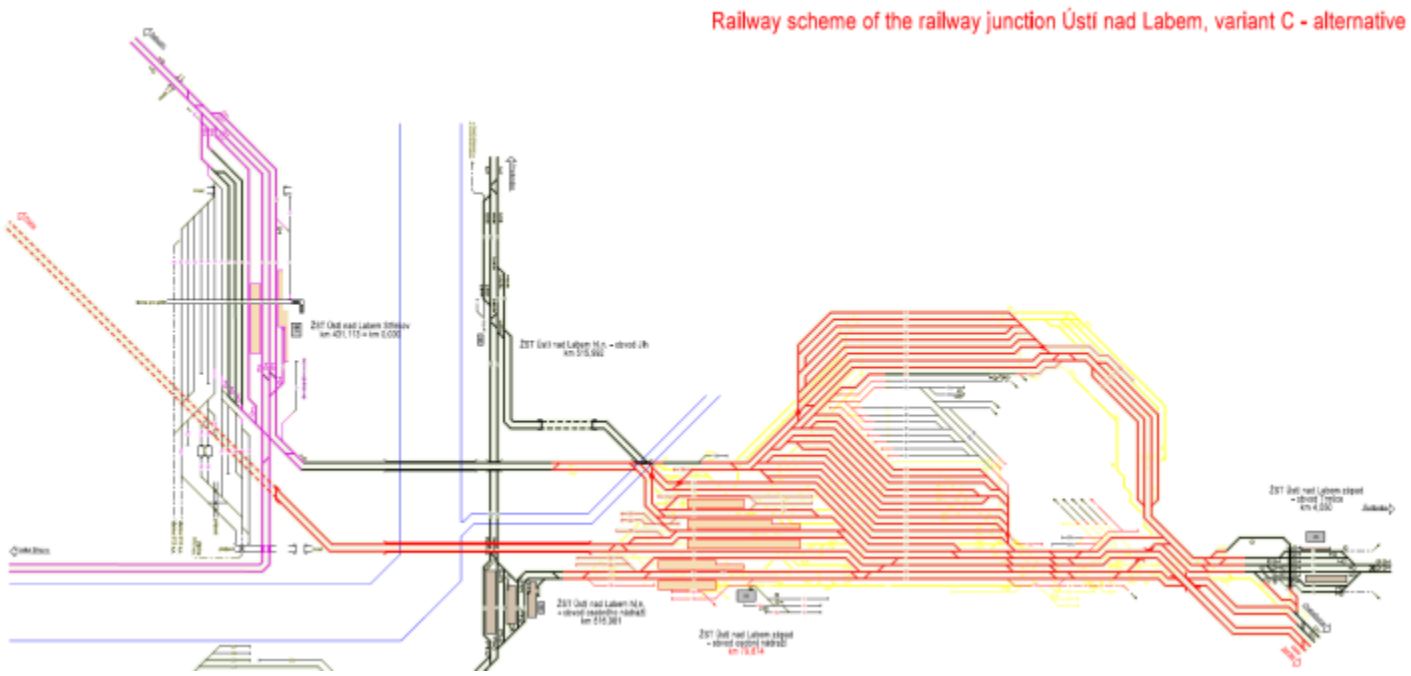


- **General plan of alternative D/CZ – Prague routes**



Alternative C between the German/Czech border and Usti junction (shown on the map with alternative A superimposed in green) was selected as a basis for the timetable study.

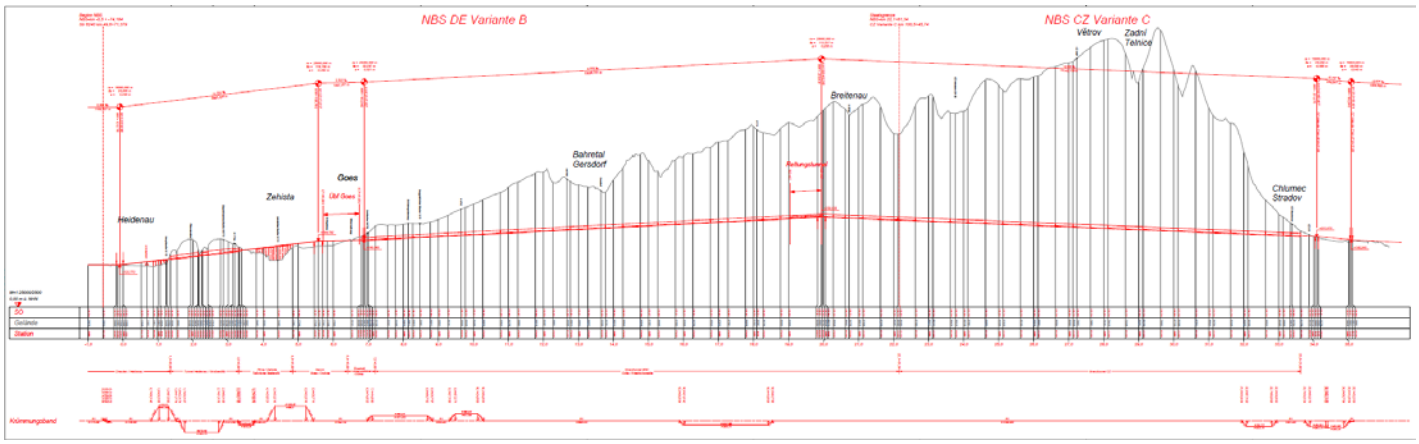
- **Ústí nad Labem junction**



The timetable study does not reproduce Ústí nad Labem (Ústí n.L.) junction in full. Only Ústí n.L. station is shown, in simplified form.

- **Route plan**

General elevation plan H_25000_2500__DE_B__CZ_C__150903 dated 3 September 2015 (DE alternative B, CZ alternative C)



According to the current status of planning, the summit will be at 258 m above sea level, in the Erzgebirge tunnel. The steepest section, extending over about 6 km with a gradient of 12‰, is between Heidenau-Süd junction and Goes yard on the northern ramp of the Erzgebirge tunnel. A gradient of 2.5 ‰ is planned for the Goes yard area, according to planning guideline 413.

- **Speed**

The new line has been laid out for a design speed of 230 km/h. A line speed of 200 km/h has been taken as a basis for the timetable study and an alternative of 230 km/h examined. All the points at Heidenau-Süd junction and Goes yard have been designed for a turnout speed of 100 km/h.

1.4 Infrastructure modelling assumptions

- **Traction current switching point**

A harmonisation of traction current at 25 kV, 50 Hz is planned in the Czech Republic in the medium term.

No plan is yet available for the site of the switching point. It will probably be located on open track between Ústí n. L. and the southern portal of the Erzgebirge tunnel.

Almost instantaneous traction current changeover has been assumed for the purposes of the timetable study. A corresponding ETCS level 2, baseline 3 vehicular function is anticipated.

- **Primary current limit**

It has been assumed that the power supply will be scoped for a primary current of 1500 A in accordance with the standards applicable to the new Dresden – Prague line. A lower primary current limit of 900 or 750 A would affect journey times.

- **Control and command technology (CCT) planning**

No CCT plans are yet available within the scope of the "Pre-planning services for the new Dresden – Prague railway line" study.

DB guideline (GL) 413 "Infrastructure design" lays down basic stipulations for the configuration and scoping of infrastructure. Module 0301A03 (page 2 of 5) makes the following stipulation on the basis of use by mixed traffic up to 230 km/h (= line standard M 230):

- Block section length 3.0 km (within a range of 1.5 – 4.0 km /upper and lower limit depending upon the operating programme)

It is also assumed that division of the up and down lines into block sections is identical. Constant reversible line working is therefore a requirement. The principal benefit is that scheduled overtaking at Goes yard can be flexibly converted into overtaking on the move (both trains moving) by using reversible working. Secondly, greater line capacity is possible in the case of single-track occupation, e.g. for maintenance work, by grouping trains in one direction. This possibility does not increase the timetable study's degree of freedom.

1.5 Study questions

1. **Implementation of the forecast operating programme**

The core question of the timetable study is whether the forecast number of freight trains can operate in harmony with passenger services on the Dresden – Ústí n. L. section.

Two sources are available for defining a forecast operating programme (see no. 2):

- "Study of acceleration of Dresden – Prague and Munich – Prague rail services (final report, July 2010, issued by the consultancy BVU).
- Forecast for 2025 from the revisions of requirements of the 2003 Federal Transport Infrastructure Plan (BVWP)

An expedient joint requirement for an operating programme has to be derived from the data.

2. **Link with the existing line at Heidenau-Süd junction**

The new line is to diverge from line 6240 Bad Schandau border – Dresden Neustadt in the vicinity of km 48-49. Parallel line 6239 Pirna – Coswig bei Dresden is to be retained in its current state between the halts of Heidenau-Süd and Heidenau – Grosssedlitz.

As a basic alternative, line 6240 is to diverge to the south as a single-track section with an approximate length of 1.1 km. The study is to clarify whether the reduction in capacity under Section 11 of the German General Railway Act (AEG) is sufficient for the operating programme on the heavy rail lines in the direction of Pirna.

Alternatively, divergence in a central position between the new tracks could be considered, in order to avoid Pirna – Dresden trains having to cross Dresden – new line trains on the level.

At most, a double junction could emerge from the studies, completely avoiding a reduction in capacity on existing line 6240.

3. Line speed 200/230 km/h

The timetable study is to examine the effects which a line speed of 230 km/h, as opposed to 200 km/h, would have on the efficiency of the new line.

In particular, negative effects on rail freight traffic must be exposed.

2 Operating program

2.1 Target operating programme train numbers

Target operating programme day/night train numbers by line

Line no(s).	Abbreviation from GL 100		Up									Down								
			Express passenger			Local passenger			Freight			Express passenger			Local passenger			Freight		
	From	To	06:00–22:00	22:00–06:00	Total	06:00–22:00	22:00–06:00	Total	06:00–22:00	22:00–06:00	Total	06:00–22:00	22:00–06:00	Total	06:00–22:00	22:00–6:00	Total	06:00–22:00	22.00–06.00	Total
6240	Dresden Hbf	Dresden – Reick carriage sidings	35	5	**40**	11	2	**13***	50	18	**68**	35	5	**40**	11	2	**13***	54	19	**73**
6240	Dresden – Rieck carriage sidings	D 623 (Heidenau-Süd junction)	14	2	**16**	11	2	**13***	50	18	**68**	15	1	**16**	11	2	**13***	54	19	**73**
6240	D 623 (Heidenau-Süd junction)	Pirna	0	0	**0**	11	2	**13***	2	1	**3**	15	1	**16**	11	2	**13***	2	1	**3**
7819**	D 623 (Heidenau-Süd junction)	DB/SZDC boundary	14	2	**16**	0	0	**0**	48	17	**65**	15	1	**16**	0	0	**0**	52	18	**70**

Source of train numbers: "Study of acceleration of Dresden – Prague and Munich – Prague rail services (2010), Forecast for 2025 from the revision of requirements (as at week 41/2014) and Specification for preparation of thetimetable study (Saxony Ministry of the Economy, Employment and Transport [SMWA]) 2015; *of which 5 are light running/empty coaching stock (ECS) movements; **Working designation

The forecast for 2025 from the revisions of requirements of the Federal Transport Infrastructure Plan does not assume the new line. For this reason, the transfer of traffic flows from the Study of acceleration of Dresden – Prague and Munich – Prague rail services (issued by BVU in 2010) has been used. The traffic requirements of a new Dresden – Bad Schandau – Ústí n. L. RegionalExpress (RE) line have also been considered by the Saxony State Ministry for the Economy, Employment and Transport (SMWA).The RegionalExpress represents a replacement for the loss of express trains through the Elbe valley, providing a fast connection between Dresden, Pirna, Bad Schandau, Děčín and Ústí n.L. which cannot be provided by the rapid transit system.

2.2 Passenger traffic operating programme

Trains have been entered in the timetable study on the basis of the numbers under no. 2.1 with the frequencies, stopping patterns and configurations shown in the table.

Line	Route	No. of trains per day and direction	Timetable paths per hour and direction	Stopping patterns in the area considered	Train configuration
EC 27	Berlin – Prague	16	1	Dresden – Neustadt, Dresden Hbf	Class 183 + 9 coaches; v_{perm}=200 km/h

ICE 27	*Berlin – Prague*	*Alternative*			*2x class 406 v_{perm}=300 km/h*
RE 20	Dresden – Ústí n. L. hl.n.	8	0.5	Dresden Hbf, Pirna, Bad Schandau, Decin hl.n., Ústí n. L. hl.n.	Class 189 + 4 coaches; v_{perm}=140 km/h
ICE 50, IC 17, 55	Dresden Hbf – Dresden – Reick carriage sidings	24	2.5	–	Various

As in the 2018 express plan, line 27 operates at an hourly frequency with clockface arrival and departure times of:

Dresden Hbf arr. xx.04/dep. xx.07 → continuing towards Prague
Dresden Hbf arr. xx.55/dep. xx.58 → continuing towards Berlin.

The upgrade of the Berlin – Dresden line to 160 km/h has been assumed, but not the reconnection of the Dresden line to the southern outer ring in Berlin. If this project and the upgrade to 200 km/h come to fruition, the reduction in journey time could have an effect on times in the direction of Prague. As the precise reduction in the journey time is not yet known, it has been ignored for the purposes of the timetable study.

Alternative consideration of operation of ICE 3 (instead of EC) stock on express line 27 is justified because the Czech Republic is planning its connecting line between Ústí n.L. and Prague for 300 km/h (with the option of 350 km /h), making the use of high-speed trains (instead of just EC stock) on the Berlin – Prague route (via the new Heidenau – Ústí n.L. line no less probable than the use of locomotive-hauled EC trains.

2.3 Rail freight (SGV) operating programme

The following specimen freight trains (typical freight trains) have been identified on the basis of the freight trains currently running through the Elbe valley. The numbers of trains per day have been broken down into a daily traffic distribution curve and entered as derived trains per timetable path per hour.

Display of **typical freight trains** in the area covered by the study:

Route	**Number of trains per day and direction**	**Timetable paths per hour and direction**	**Traction unit**	**Overall length Gross weight**	**v_{max} and braked weight percentage**
Dresden – Ústí (new line)	64/70	2	Class 185	619 m, 2285 t (load 2200 t)	90 km/h, P 60
		2	Class 186	719 m, 1884 t (load 1800 t)	100 km/h, G 80
Dresden – Děčín	3	0.5	Class 180	617 m, 2084 t (load 2000 t)	80 km/h, P 60

2.4 Operating programme of other traffic in the study area

Other lines and trains not specified in nos. 2.2 and 2.3 have also been considered:

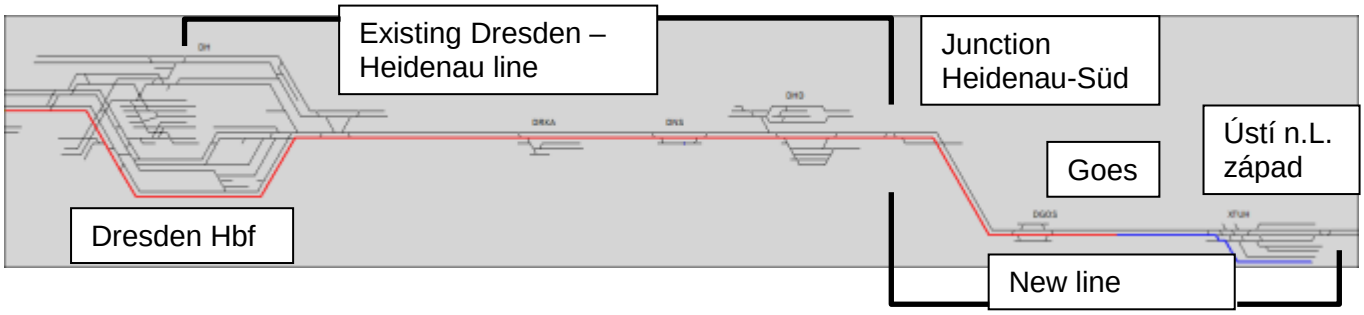
- S 1 Meissen Triebischtal – Schöna Journey times as in 2015 timetable
- S 2 Dresden Airport – Pirna Journey times as in 2015 timetable
- IC 17 Dresden – Warnemünde Journey times in accordance with the "Germany in

		sync" concept
-	ICE 50 Frankfurt – Dresden	Journey times in accordance with the 2018 draft timetable
-	IC 55 Dresden – Cologne	Journey times in accordance with the 2018 draft timetable
-	RE 50 Leipzig – Dresden	Journey times in accordance with the 2018 draft timetable
-	RE 18 Dresden – Cottbus	Journey times in accordance with the 2016 timetable
-	RB Dresden – Elsterwerda-Biehla	Journey times in accordance with the 2016 timetable
-	Lines in the direction of Eastern Saxony:	
-	TLX (Trilex) 1, 2, 60, 61;SBS 33, 34	Journey times in accordance with the 2016 Timetable, with adjustments
-	SBS Pirna – Dresden ECS	

3 Results of the timetable study

3.1 Timetable and journey times

Infrastructure modelled for the timetable study using computer-aided train path management



ζ Model timetable

A model timetable was produced on the basis of the infrastructural and traffic stipulations in no. 2.

Two forms of display are intended to illustrate the results: firstly, a graphic timetable and secondly an occupancy graphic, showing the individual block section occupancy times.

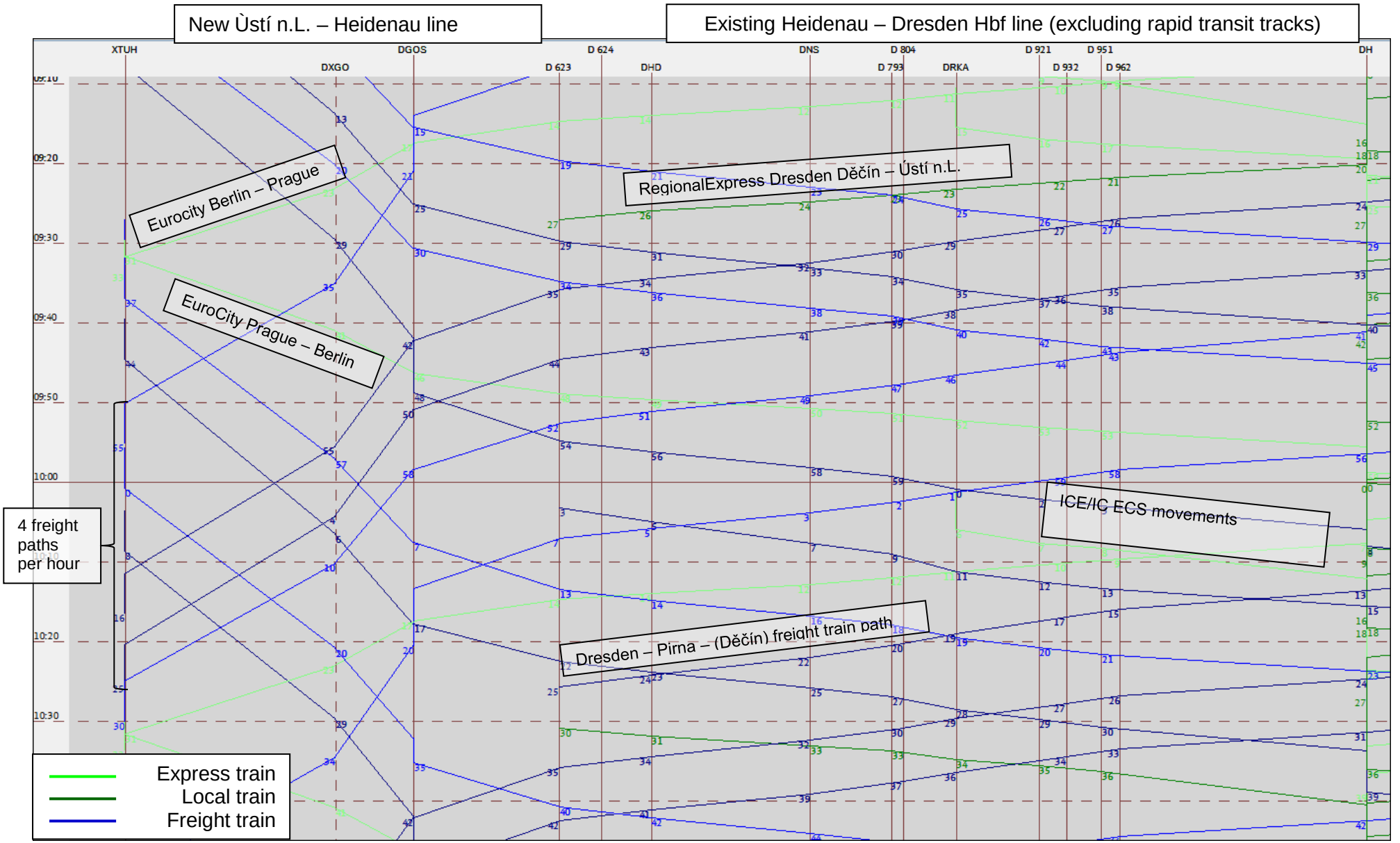
The graphic timetable shows that the requirements formulated in respect of the number of trains to be derived are fulfilled. One express train path and four freight train paths per direction and hour can be derived for the new line in accordance with DB GL 402.

The occupancy graphics show that residual capacity on the new line cannot be used for additional train movements because of the higher occupancy of the Dresden – Heidenau section. An additional 2.5 trains per hour operate (two-hourly Dresden – Děčin, two-hourly freight train path Dresden – Pirna (– Děčin) and three ECS movements to Dresden-Reick carriage sidings) every two hours.

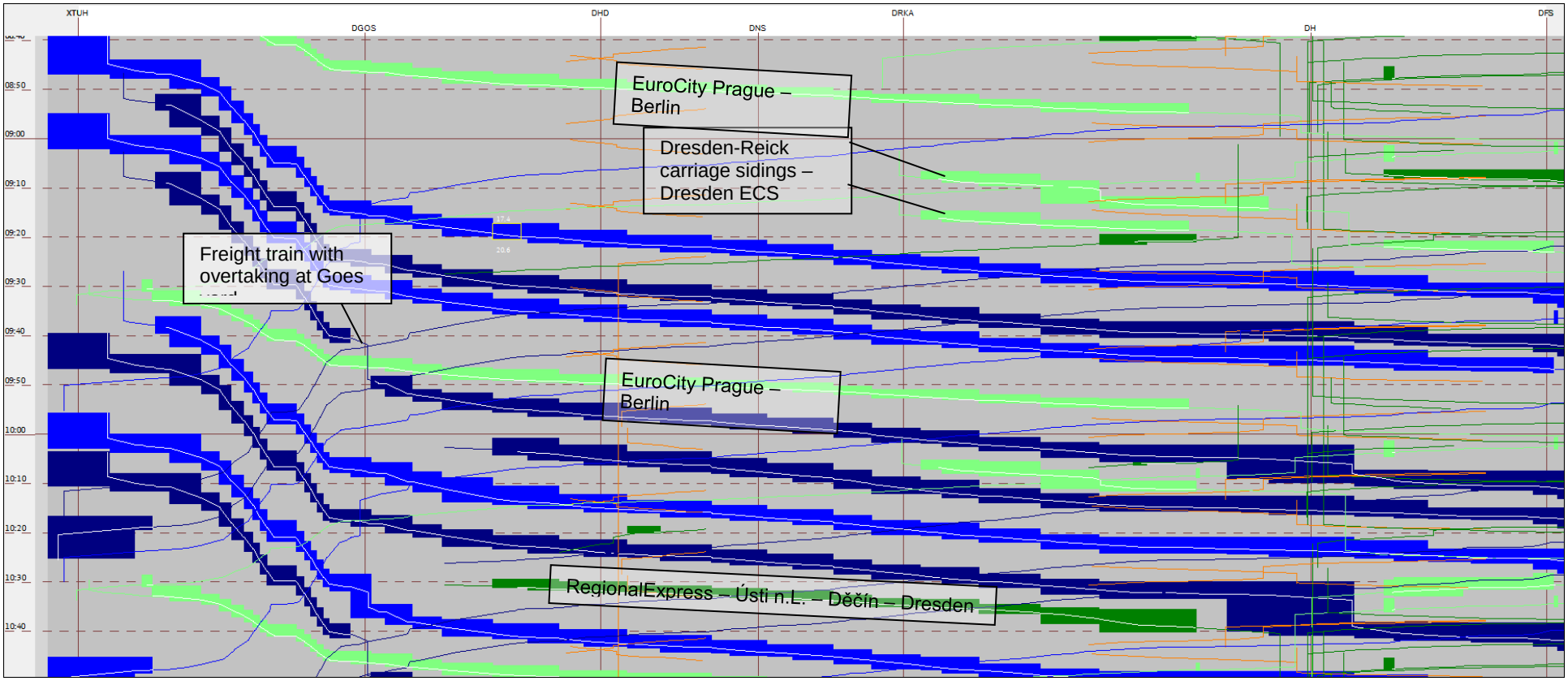
One in four freight train paths per hour on the new line cannot operate between Dresden and Ústí n. L. without overtaking. Overtaking at Goes yard is necessary, as only a freight relief loop with a useful length of 584 m, which is too short, is available at Dresden-Niedersedlitz. The difference in speed between passenger and freight traffic is conspicuous, so a freight train (in the direction of Dresden) must depart from Ústí n.L. no later than 24 minutes before the departure of the express train, so that it can reach Goes yard in good time and not affect the passenger service.

Without Goes yard, the freight train would have to leave Ústí 29 minutes earlier, meaning that the freight train in front could not operate. Goes yard therefore generates additional capacity of five minutes per hour, corresponding to an approximate increase of 9% in line capacity.

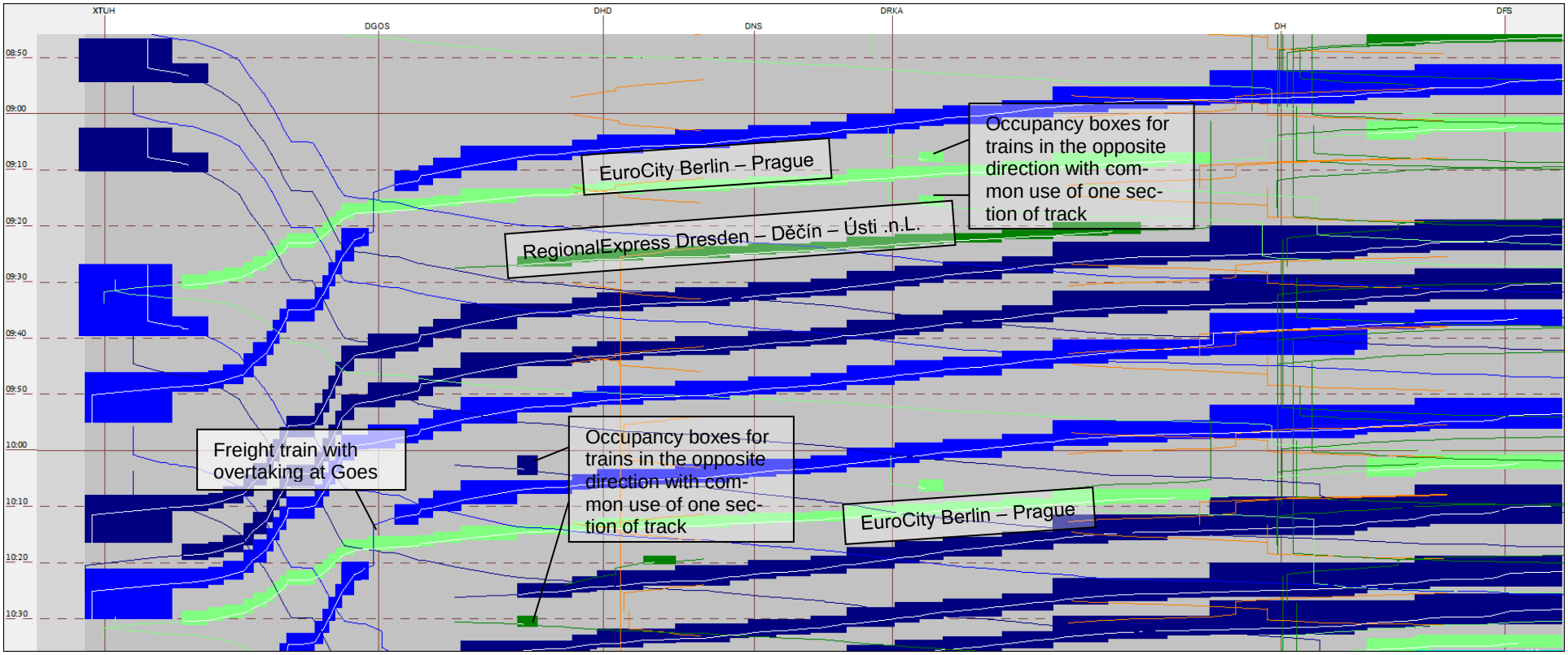
The single-track junction on the existing line is compatible with the timetable due to occupancy by two trains per hour, but the crossing of the Pirna – Dresden trains with Dresden – Ústí services is problematic. The effects can be seen on the Dresden – Ústí graphic. Even minor departures from the timetable will delay trains in the direction of the new line, and the trains following them.


New Ùstí n.L. – Heidenau line
Existing Heidenau – Dresden Hbf line (excluding rapid transit tracks)
XTUH
DXGO
DGOS
D 624
D 623
DHD
DNS
D 804
D 793
DRKA
D 921
D 932
D 951
D 962
DH
09:20
09:30
09:40
09:50
10:00
10:20
10:30
Eurocity Berlin – Prague
EuroCity Prague – Berlin
RegionalExpress Dresden Děčín – Ústí n.L.
ICE/IC ECS movements
Dresden – Pirna – (Děčín) freight train path
4 freight paths per hour
Express train
Local train
Freight train

Occupancy graphic Ústí n.L. – Dresden



Dresden – Ústí n.L. track occupancy graphic

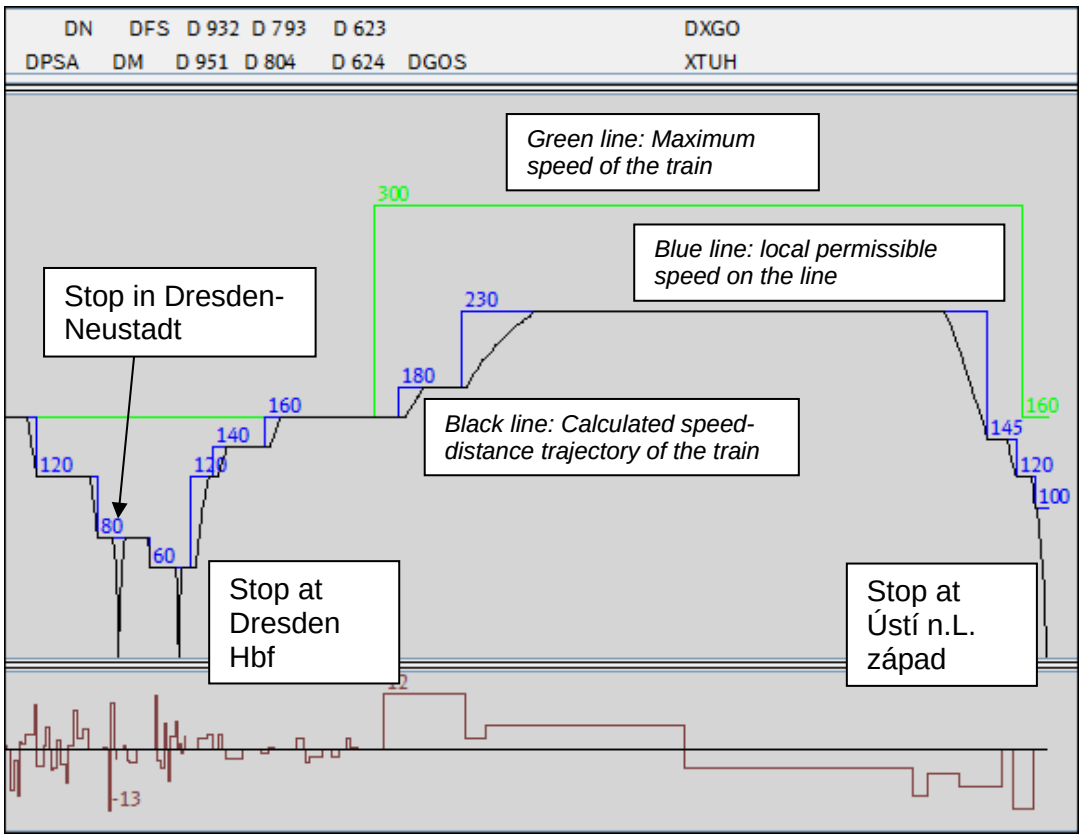


Requirements		
	Hourly frequency SPFV Dresden – Ustí n.L. u.z.	4
	Two-hourly Regional Express frequency Dresden – Děčín – Ustí n.L. u.z	4
	4 freight trains per hour Dresden – Ustí n.L. u.z.	4
	1 freight train Dresden – Děčín u.z. every 2 hours	4

ζ Plots for individual types of train

Qualitative statements on the effects of gradients and changes in speed or speed limits can be made on the basis of speed-distance trajectories (plots).

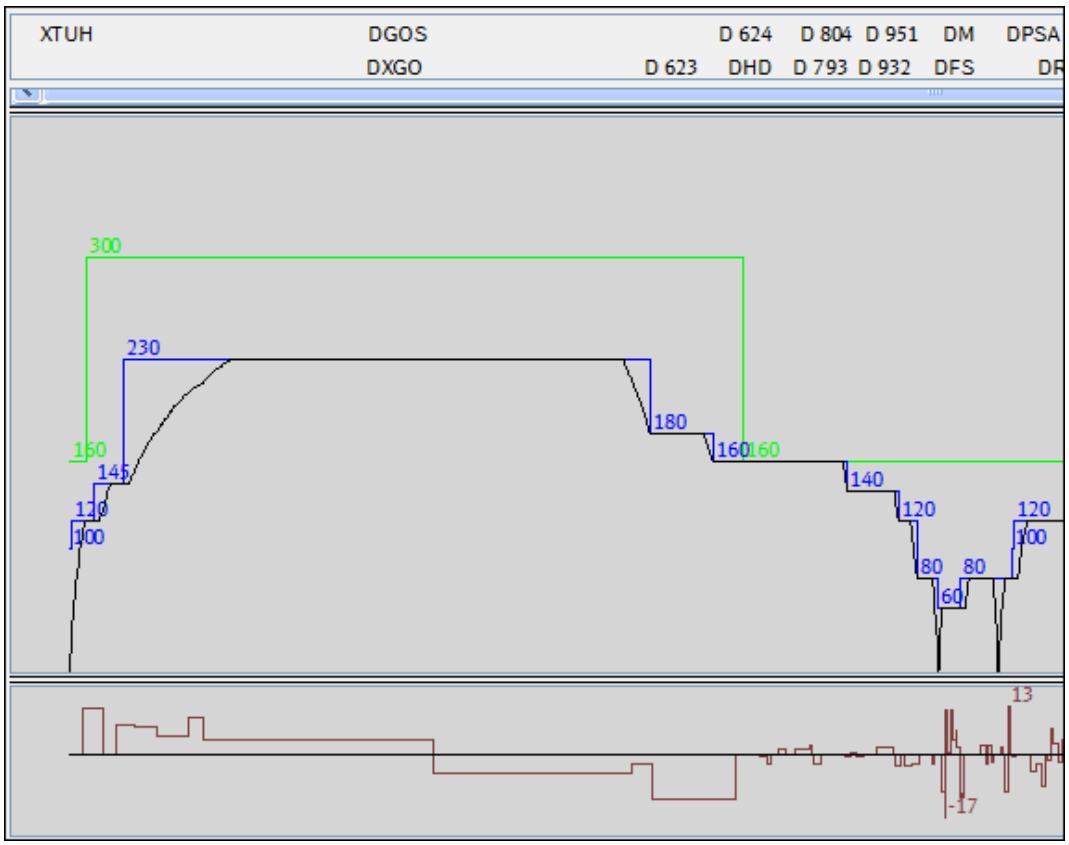
1. ICE 3 in the direction Dresden – Ústí n. L.



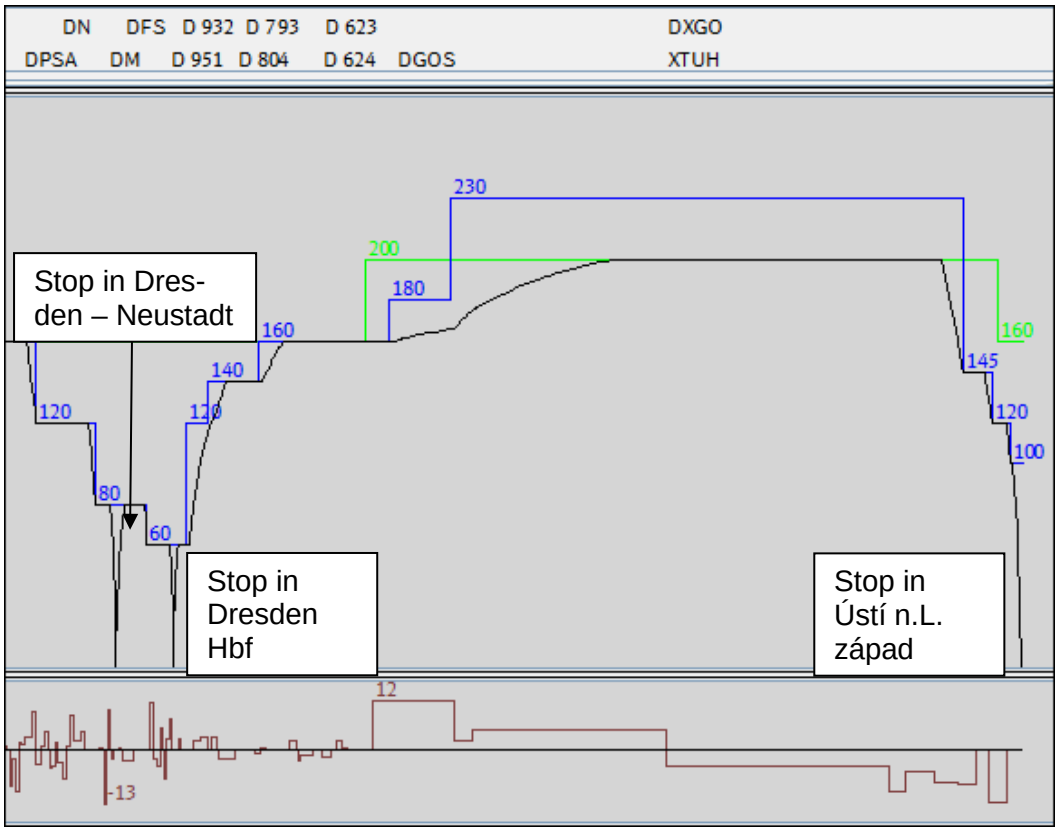
The high-acceleration ICE 3 makes optimum use of the speed profile, but requires primary current of 1500 A. This train configuration makes the shortest Dresden – Ústí n.L. journey time possible (see next paragraph).

2. ICE 3 in the direction Dresden Ústí n. L. – Dresden

The ICE also makes almost optimum dynamic use of the possible speeds in the other direction . However, the effect of the gradient on the southern ramp is discernable, due to the relatively slow acceleration from 145 to 230 km/h. A shift of the 145/230 km/h speed change in the direction of Ústí n.L. would further reduce the ICE 3 journey time.

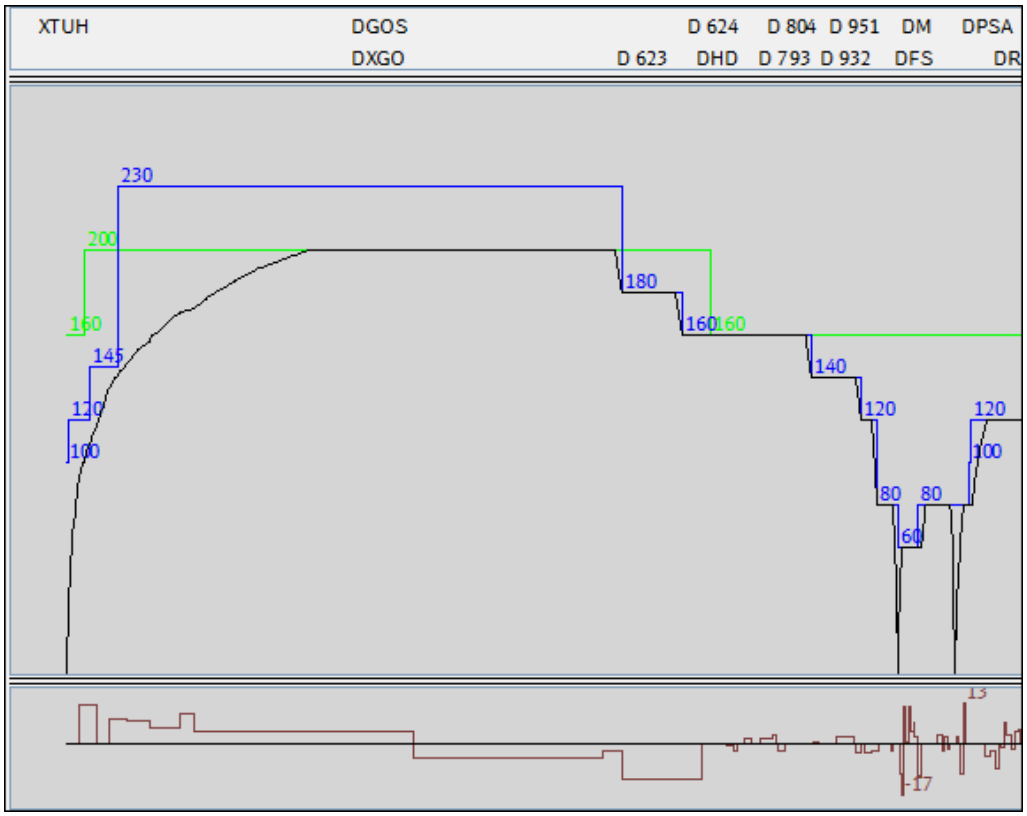


3. EC in the direction Dresden – Ústí n. L.



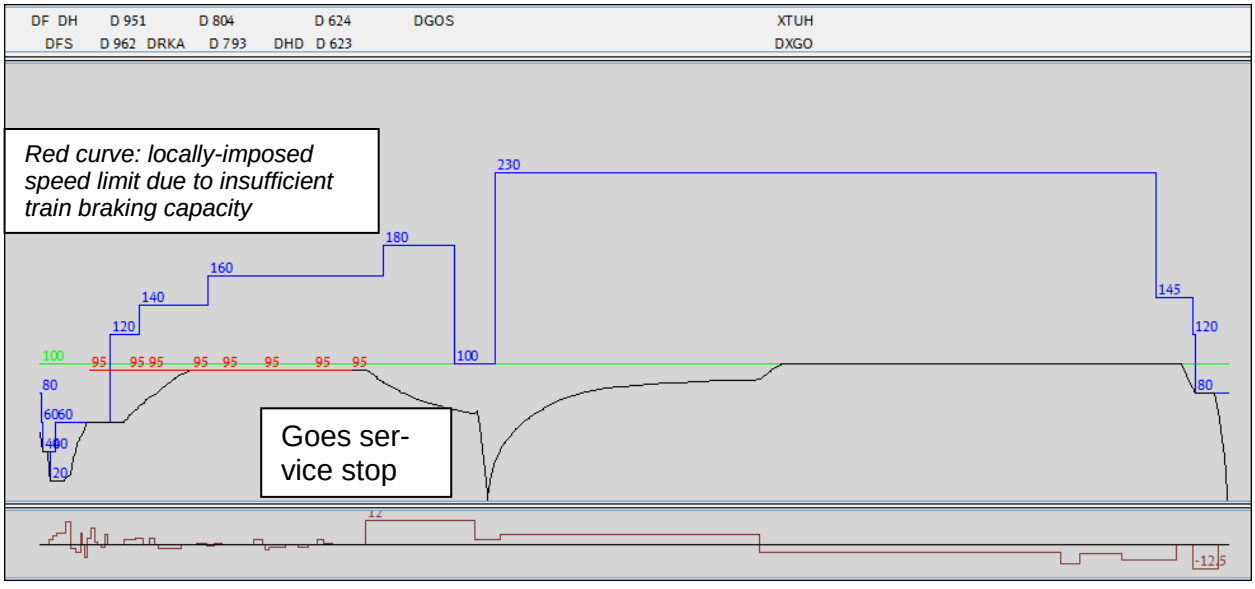
The speed limit of 180 km/h does not have a restrictive effect on locomotive-hauled trains, unlike the ICE 3. The maximum speed of 200 km/h is only reached shortly before the summit. Use of a powerful locomotive could be considered if more than nine coaches were to be used in the long term.

4. EC in the direction Ústí n. L. – Dresden



In this direction, the locomotive-hauled express train only reaches its maximum speed of 200 km/h 16 km after stopping at Ústí n.L. The reason for this is not only the stop, but also the class of locomotive used. In the other direction, the train encounters the gradient on the new line at an initial speed of 160 km/h, thus reaching 200 km/h considerably earlier.

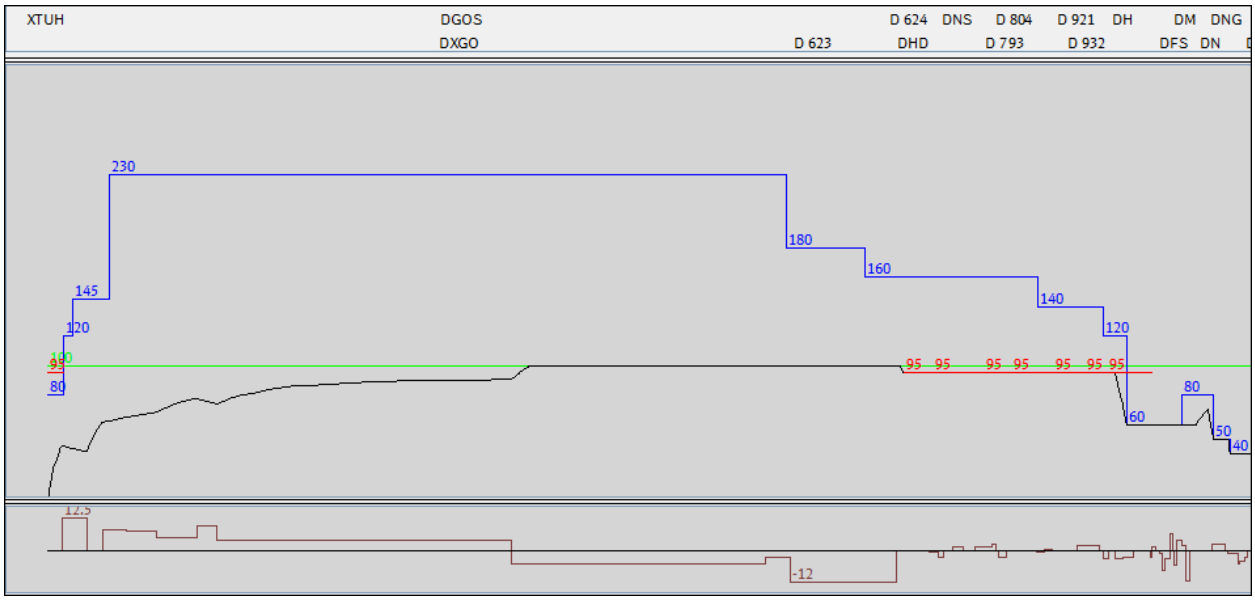
5. Freight train in the direction Dresden – Ústí n. L. (100 km/h, 1800 t load, 720 m)



The freight train makes a service stop at Goes yard (overtaking by express traffic) and is therefore crucial to evaluation of the planned gradients. The speed drops significantly to about 65 km/h between Heidenau-Süd junction and the stop at Goes. A simulated stop at Heidenau-Süd junction facilitates reliable starting. In this case a maximum speed of about 59 km/h (not shown here) is reached.

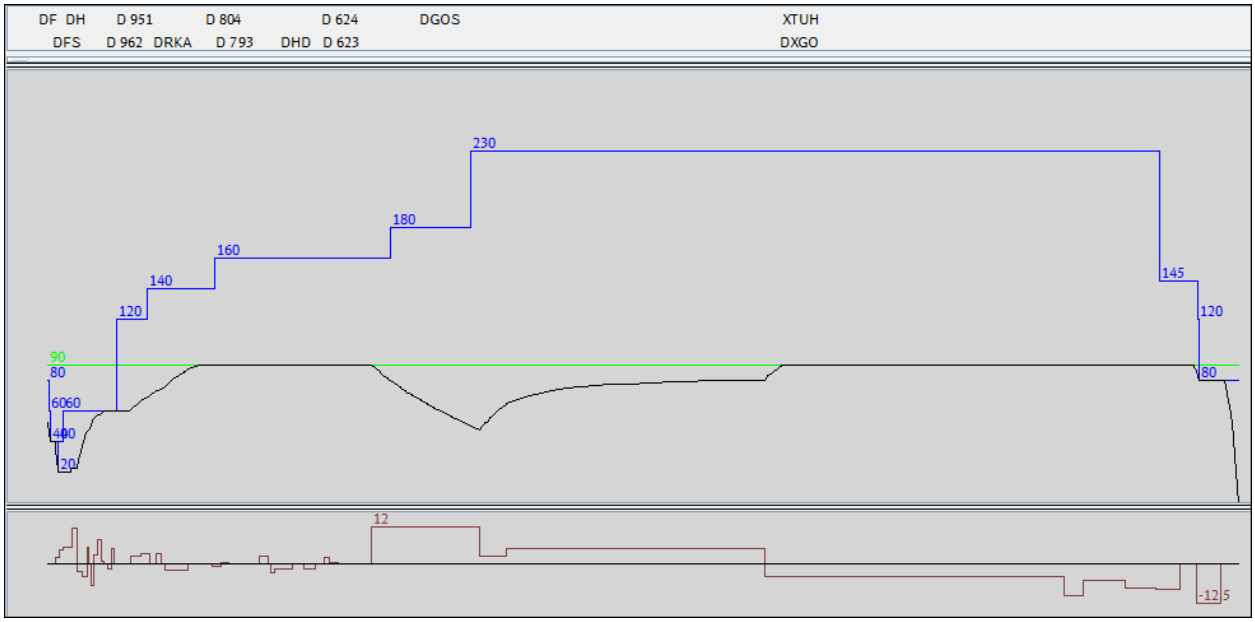
In the further course of the journey, the train only reaches its maximum speed after the summit. Restarting after the stop at Goes is dynamically unproblematic and acceptable.

6. Freight train in the direction Ústí n. L. – Dresden (100 km/h, 1800 t load , 720 m)



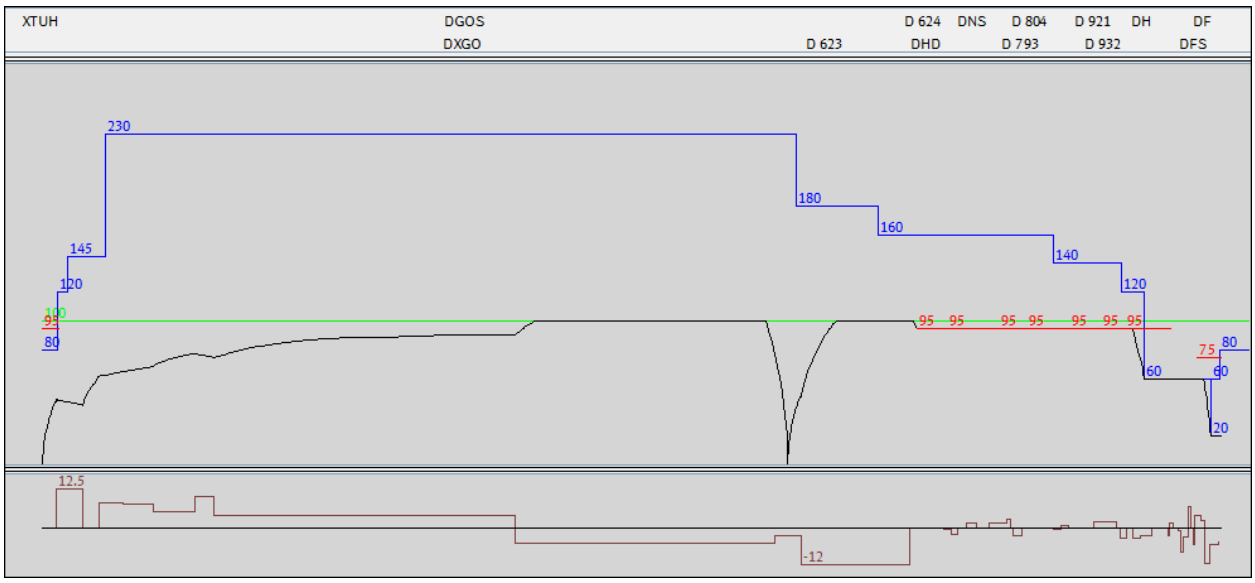
The irregular acceleration pattern following the stop at Ústí n.L. in the direction of Ústí n. L. – Dresden is conspicuous. The section with the 12.5‰ gradient beyond Ústí n.L. produces "negative" acceleration due to the characteristics of the train used, i.e. the train slows down. The direct transition from the Elbe valley to the rising gradient of the southern ramp of the Erzgebirge tunnel is dynamically unfavourable, particularly as it cannot be assumed that freight trains will pass through Ústi n.L. without stopping (getting up speed), due to the complicated layout of the junction.

7. Freight train in the direction Dresden – Ústí n. L. (90 km/h, 2000 t load, 620 m)



The heavy specimen train makes it clear that the Heidenau-Süd – Goes section is crucial to trains in the direction of Ústí n.L. In the case of this specimen train, the speed falls to 48 km/h. The flat gradient at Goes yard and beyond in the direction of the summit compensate relatively well for this, so the use of capacity for these trains remains compatible. Higher loads must be regarded critically from a dynamic point of view. Steeper gradients must be avoided on this section in the further course of planning.

8. Freight train in the direction of Ústí n. L. – Dresden (90 km/h, 2000 t load , 620 m)



The plot in the opposite direction shows that the heavier specimen freight train also has a similar acceleration profile to the freight train with a weight (excluding the locomotive) of 1800 t. The maximum speed can only be reached after the summit.

ζ Express rail passenger transport

Journey times for express rail passenger transport on the Dresden – Ústí n.L. line were determined in the analysis of acceleration on the Dresden – Prague and Munich – Prague rail routes (issued by BVU in 2010).

The planning consultancy commissioned by the Czech Ministry of Transport also calculated journey times within this framework. These figures are compared with the journey times from this study below:

Train configuration	Direction	2015 journey times	Journey time Dresden – Prague on completion of the new line determined by		
			BVU (2010)	SUDOP (2015)	DB Netz (2015)
EC, locomotive-hauled train 200 km/h	Dresden Hbf – Ústí n.L.	64 min	–	–	**23.9 min** [inc. 4% standard recovery time and 1.5‘ engineering work recovery time ≈ 10% recovery time]
	Ùsti n.L. – Dresden Hbf	63 min		23.4 min [inc. 9% recovery time]	**23.9 min** [inc. 4% standard recovery time and 1.5' engineering work recovery time ≈ 10% recovery time]
ICE 3, class 406 300 km/h	Dresden Hbf – Ústí n.L.	–	20 min	23.1 min [inc. 14% recovery time]	**22.2 min** [inc. 5% standard recovery time and 1.5' engineering work recovery time ≈ 12% recovery time]
	Ùsti n.L. – Dresden Hbf			23.0 min [inc. 14% recovery time]	**22.2 min** [inc. 5% standard recovery time and 1.5' engineering work recovery time ≈ 12% recovery time]

This study has failed to confirm the journey times from the 2010 BVU study. Standard and engineering work recovery time were presumably not considered, as the pure (theoretically achievable) journey time for an ICE between Ústí n.L. and Dresden Hbf is 19.6 min. The journey times shown in the table represent all the journey times including recovery time required by DB GL 402 which can be used in the draft tender and timetable design.

The differences between SUDOP and DB Netz journey times for locomotive-hauled trains may have their cause in the different traction units used.

ζ Rail freight traffic transit times

Traction unit	Overall length Gross weight	v_{max} and braked weight percentage	Transit time Dresden Hbf – Ústí n.L. západ	Transit time Ústí n.L. západ – Dresden Hbf
Class 185	619 m, 2285 t (load 2200 t)	90 km/h, P 60	~ 47 min	~ 49 – 58* min
Class 186	719 m, 2084 t (load 2000 t)	100 km/h, G 80	~ 43 – 53* min	~ 47 – 50 min

Rail freight transit times can be reduced considerably in future. Current daytime transit times between Dresden and Ústi n.L. are around 80 – 90 minutes using multi-system locomotives. The current transit time also varies because lines are available on both banks of the Elbe from Děčín.

Journey times are longer in the direction Ústí n.L. – Dresden because trains restart in Ústí n.L. and therefore cannot enter the gradient section in the direction of the Erzgebirge tunnel at their

maximum speed. In the other direction, freight trains enter the new line at Heidenau at their maximum speed and can thus achieve shorter transit times.

Differences in transit times with a group of specimen trains arise because some of the trains are overtaken by an express at Goes yard (these trains are marked with an asterisk).

3.2 Feasibility of the target operating programme

The timetable study substantiates the feasibility of the target operating programme.

From the aspect of consolidation of express traffic into an hourly frequency (double the current offer), there is room for manoeuvre for a further increase in freight traffic in excess of the forecast (135 trains per day).

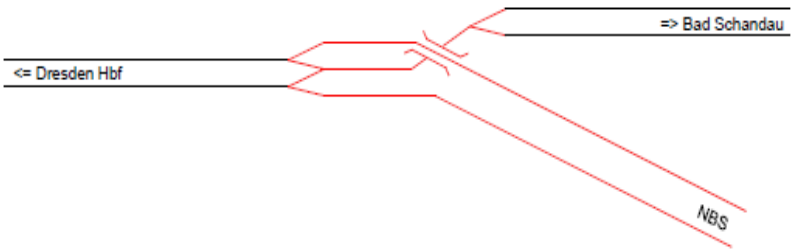
Four freight trains per hour in each direction could run during the day (06.00 – 22.00 hrs), when express and local passenger services are operating.
Up to eight freight trains per hour could run in each direction during the night (22.00 – 06.00 hrs) in the absence of, or with very light, passenger traffic.
Up to 128 freight trains per day and direction could thus run on the new line, under the parameters and assumptions considered.

[N.B. Statements about the total capacity of a line are always conditional upon the efficiency of adjacent hubs and adjoining line. They always assume unlimited (idealised) capacity at neighbouring hubs and on adjacent lines.]

3.3 Design of the integration of the new line into the existing line at Heidenau

The necessity of a double junction on the existing line in the direction of Pirna cannot be justified by two pairs of trains per hour. However, Pirna – Dresden trains crossing Dresden – Ústí trains entails a likelihood of delay and is critical to operation and flexibility. DB Netz AG proposes to examine the alternative of connecting the single main line in the direction of Pirna centrally, between the two tracks of the new line. This is the optimum solution from the point of view of the infrastructure manager.

Alternative:



3.4 Necessity of the relief loops at Goes

Relief freight loops between Dresden and Ústi n.L. are necessary to implement the operating programme. The Dresden – new line – Ústi n.L. section is about 55 km long. No useable relief line is available for trains longer then 580 m on this section. A relief loop in the direction of Dresden – Ústí n.L. only is available at Dresden-Niedersedlitz for shorter trains.

The timetable study has been able to demonstrate that one in every four freight trains per hour cannot be operated without being overtaken.

As the target status of the Dresden – Pirna section is four-track following the upgrade, the solution to the necessary freight/express overtaking must be sought on the new line. The Goes relief loops, one in each direction, with a useful length accommodating trains 740 m long, fulfils the requirement raised by the result of the timetable study.

The yard can also be used as a stabling point for a hot box and blocked brake detector (HOA/FBOA).

3.5 Effects of different maximum speeds 200/230 km/h

The maximum speed of 230 km/h affects the efficiency of the line. However, the gain of 1.7 min at 230 km/h does not entail any loss of capacity for other trains. Preceding and following freight trains allow displacement without having to lose one of the four hourly freight train paths. A speed higher than 230 km/h would, however, have such an effect and not permit the requisite number of trains.

3.6 Effects of changes to the assumption on infrastructure modelling

If it were not possible to carry out the system changeover without stopping, the effects on the result of the examination would be significant. It would not be possible to fulfil the demands of the operating programme to their full extent. This should be a focus in the course of further planning and the switching point should be sited on as flat as possible a section of line on the southern ramp.

The ETCS block section length of 3 km is necessary for dense clustering of freight trains and cannot be extended without consequences.

The fastest Dresden – Ústí journey time of 22.2 minutes requires primary current of 1500 A. A journey time of 23.5 min is required for a lower primary current limit of 900 A.

4 Recommended actions

On the basis of the timetable study conducted, DB Netz AG recommends planning for a maximum speed of 230 km/h between Heidenau and Ústí n.L., as it renders a further reduction in journey time of about 8% (= 2.2 min) possible, compared to 200 km/h. The increased use of capacity at a maximum speed of 230 km/h does not entail loss of the derived freight train movements at 200 km/h.

The traction current switching point should be sited north of Ústí n.L. station, about 750 m beyond the last set of points, on a level or slightly graded section, if possible. (The section from km 81.974 to 82.807 is level, according to route plan alternative C).

Should the chord from the new line in the direction of Teplice be built (outside the scope of this study), the system switching point must also be provided on as level a section of track as possible on the chord.

The layout of the chord from the direction of Teplice must also be designed for a speed of at least 80-100 km/h. Teplice must also be configured for at least 80-100 km/h, otherwise freight trains will not be able to accelerate sufficiently, due to the gradient in the direction of the Erzgebirge tunnel.

The selected (ETCS) block length of 3 km must be retained as a minimum.

Primary current of 1500 A is necessary and must be planned accordingly when the power supply is scoped.

As the gradient on the Heidenau-Süd – Goes section is crucial, opportunities for reducing it must be considered within the scope of further planning. In the opposite direction, the gradient of 12.5‰ directly beyond Ústí n.L. západ is crucial. Possibilities of laying out a separate junction for freight trains with an overall gentler gradient must be examined in the course of further planning.

5 Conclusion

This timetable study confirms the implementation of the specified target operating programme with 32 express and 135 freight trains per day on the Dresden – Ústí .n.L. section of the new Dresden – Prague line.

Timetable design has taken place applying DB GL 402 "Path management", allowing for buffer time and standard and engineering work recovery time.

Paths for one express passenger train and four freight trains per hour can be designed in.

Hourly express passenger services are compatible with the new line, in order to implement the freight traffic forecast of 135 trains per day. Further concentration of express passenger traffic into a 30-minute frequency (64 trains per day) would mean that two out of four hourly freight train paths would no longer be available on the new line. These two freight train movements would have to be shifted back to the existing line via Děčín.

One relief loop on both the up and down sides (each with a useful length of 750 m) is necessary to design in the four hourly freight train paths. As no such facility is available on the existing line, the planned yard at Goes on the new line would be used for this purpose.

The efficiency of the new line makes relief of the existing line in the Elbe valley (Bad Schandau border crossing) possible.

The new line, 32 km shorter, and its higher speed make significant reductions in passenger journey time from 64 min to 24 min and in freight transit time from 80-90 min to 43-58 min possible.

The planned junction with the new line at Heidenau-Süd should be laid out as described in paragraph 3.3.