# REALIZATION IMPROVED PASSENGER TRANSPORT

## Pilot implementation
## Railway line Dresden-Wroclaw
## D.T2.3.4

Progress report
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This report was developed by

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# 1. Situation of the rail axis Dresden – Wroclaw

## 1.1. A short history

### 1.1.1. Before 1989

Already in the middle of the penultimate century around 1845, the various sections of this railway line were built. Relatively quickly, the railway line gained international significance. This lasted until the eighties. In 1980, for example, there were still five international express train pairs with destinations such as Krakow, Frankfurt (Main) or Paris.[1] This offer was only slightly reduced until German reunification. In 1985, the timetable rejected four international express trains per direction and some additional trains during the weekends.[2]

### 1.1.2. Development since 1990

After German reunification, the offer was further reduced, but partly also offered new relations. The three express train pairs were running from Leipzig, Frankfurt (Main) and Munich with the destinations Warsaw, Lublin and Krakow. In 1999 the first InterRegio began running on the line. This offer has been extended in the next few years up to four trains per direction, replacing the old express trains.

In the winter of 2000/2001 there were still four InterRegio train pairs of the now “line 27a” connection Dresden – Wroclaw. As a penultimate InterRegio line ever in Germany the connection was stopped in December 2004.[3]

After the discontinuation of DB long-distance traffic, the "Dresden Wrocław Express" was put into operation as a cross-border regional express operated by DB Regio and Przewozy Regionalne following a long break in March 2009. After financing was discontinued by the Lower Silesian Voivodeship, traffic on the Polish side was discontinued as of March 1st in 2015, which again put an end to cross-border traffic.

From December 13th of the same year, the connection was reestablished as “trilex Express” in cooperation with Koleje Dolnośląskie. The previous name "Dresden Wrocław Express" was no longer used for the now much slower connection which stopped on the Polish side at nearly all stations.

Again, the direct connection Dresden – Wrocław was stopped with the 2017 timetable change. The entire connection will continue to be marketed by the rail operators - but now as a connecting link.

[1] DB-Auslandskursbuch, edition summer 1980

[2] DR-Kursbuch, international edition, edition 1985/86

[3] Bodack, Karl-Dieter, InterRegio – die Geschichte eines beliebten Zugsystems, Freiburg, 2005

RB 60 RE 1 D 10 **Dresden - Görlitz - Wrocław**

| | Zug | RB60 trilex | D10 KD | RE1/D10 trilex/KD | RB60 trilex | RE1/D10 trilex/KD | RB60 trilex | RE1/D10 trilex/KD | RE1/D10 trilex/KD |
|---|---|---|---|---|---|---|---|---|---|
| | Zugnr. bis Görlitz | 74133 | | 74101 | 74141 | 74107 | 74147 | 74113 | 74113 |
| | Zugnr. ab Görlitz | | 5791 | 5791 | | 5793 | | 5795 | 5795 |
| | Mo-Fr | ■ | | ■ | ■ | ■ | ■ | ■ | ■ |
| | Sa | ■ | | ■ | ■ | ■ | ■ | ■ | ■ |
| | So/F | ■ | ■ | | ■ | ■ | ■ | ■ | ■ |
| | Datum: | | 1 | 2 | | | | 3 | 1 |
| **Dresden Hbf** | ab | 5 25 | | 6 08 | 10 32 | 12 08 | 16 32 | 18 08 | 18 08 |
| Dresden Mitte | ab | 5 28 | | 6 11 | 10 35 | 12 11 | 16 36 | 18 11 | 18 11 |
| Dresden-Neustadt | ab | 5 31 | | 6 15 | 10 39 | 12 15 | 16 39 | 18 15 | 18 15 |
| Dresden Industriegelände | ab | 5 34 | | \| | 10 42 | \| | 16 42 | \| | \| |
| Dresden-Klotzsche | ab | 5 38 | | 6 21 | 10 46 | 12 21 | 16 46 | 18 21 | 18 21 |
| Langenbrück (Sachs) | ab | 5 43 | | \| | 10 51 | \| | 16 51 | \| | \| |
| Radeberg | ab | 5 48 | | 6 29 | 10 56 | 12 29 | 16 56 | 18 29 | 18 29 |
| Arnsdorf (b Dresden) | ab | 5 52 | | 6 34 | 11 00 | 12 34 | 17 00 | 18 34 | 18 34 |
| Bischofswerda | ab | 6 10 | | 6 44 | 11 14 | 12 44 | 17 14 | 18 44 | 18 44 |
| Bautzen | ab | 6 25 | | 6 57 | 11 29 | 12 57 | 17 29 | 18 57 | 18 57 |
| Löbau (Sachs) | ab | 6 44 | | 7 11 | 11 49 | 13 11 | 17 49 | 19 11 | 19 11 |
| **Görlitz** | an | 7 04 | | 7 26 | 12 09 | 13 26 | 18 09 | 19 26 | 19 26 |
| ***Görlitz*** | *ab* | ↳ | *7 33* | *7 33* | ↳ | *13 33* | ↳ | *19 33* | *19 33* |
| *Zgorzelec* | *ab* | | *7 38* | *7 38* | | *13 38* | | *19 38* | *19 38* |
| *Węgliniec* | *ab* | | *8 02* | *8 02* | | *14 04* | | *20 02* | *20 02* |
| *Bolesławiec* | *ab* | | *8 22* | *8 22* | | *14 25* | | *20 22* | *20 22* |
| *Legnica* | *ab* | | *8 54* | *8 54* | | *15 11* | | *20 56* | *21 05* |
| ***Wrocław Główny*** | *an* | | *9 49* | *9 49* | | *16 02* | | *21 50* | *22 06* |

RB 60 RE 1 D 10 **Wrocław - Görlitz - Dresden**

| | Zug | D10/RE1 KD/trilex | RB60 trilex | D10/RE1 KD/trilex | RB60 trilex | D10/RE1 KD/trilex | RB60 trilex |
|---|---|---|---|---|---|---|---|
| | Zugnr. bis Görlitz | 5790 | | 5792 | | 5794 | |
| | Zugnr. ab Görlitz | 74104 | 74136 | 74110 | 74142 | 74116 | 74148 |
| | Mo-Fr | ■ | ■ | ■ | ■ | ■ | ■ |
| | Sa | ■ | ■ | ■ | ■ | ■ | ■ |
| | So/F | ■ | ■ | ■ | ■ | ■ | ■ |
| **Wrocław Główny** | ab | *6 06* | | *12 18* | | *18 19* | |
| *Legnica* | ab | *7 00* | | *13 13* | | *19 13* | |
| *Bolesławiec* | ab | *7 39* | | *13 45* | | *19 45* | |
| *Węgliniec* | ab | *8 04* | | *14 05* | | *20 06* | |
| *Zgorzelec* | ab | *8 30* | | *14 30* | | *20 30* | |
| **Görlitz** | an | *8 34* | | *14 34* | | *20 34* | |
| **Görlitz** | ab | 8 41 | 9 50 | 14 41 | 15 50 | 20 41 | 22 50 |
| Löbau (Sachs) | ab | 8 56 | 10 11 | 14 56 | 16 11 | 20 56 | 23 11 |
| Bautzen | ab | 9 10 | 10 29 | 15 10 | 16 29 | 21 10 | 23 29 |
| Bischofswerda | ab | 9 22 | 10 45 | 15 22 | 16 45 | 21 22 | 23 50 |
| Arnsdorf (b Dresden) | ab | 9 32 | 10 57 | 15 32 | 16 57 | 21 32 | 0 02 |
| Radeberg | ab | 9 36 | 11 01 | 15 36 | 17 01 | 21 36 | 0 07 |
| Langebrück (Sachs) | ab | \| | 11 06 | \| | 17 06 | \| | 0 11 |
| Dresden-Klotzsche | ab | 9 44 | 11 10 | 15 44 | 17 10 | 21 44 | 0 16 |
| Dresden Industriegelände | ab | \| | 11 14 | \| | 17 14 | \| | 0 20 |
| Dresden-Neustadt | ab | 9 51 | 11 19 | 15 51 | 17 19 | 21 51 | 0 24 |
| Dresden Mitte | ab | 9 53 | 11 21 | 15 21 | 17 21 | 21 53 | 0 27 |
| **Dresden Hbf** | ab | 9 56 | 11 24 | 15 56 | 17 24 | 21 56 | 0 30 |

**1** = fährt 30.03.; 02.04.; 01.05.; 10.05.; 21.05.2018 **2** = fährt nicht 30.03.; 02.04.; 01.05.; 10.05.; 21.05.2018 **3** = fährt nicht 07-25.05.2018 **4** = fährt 07-25.05.2018 ***kursive Fahrzeit*** = *Anschlusszug*

**Figure 1: Actual timetable for connection Dresden – Wrocław**[4]

## 1.2. Regional planning significance

The 280-kilometer railway line connects the European TEN-T transport corridors “Baltic Adriatic” (Polish Baltic coast – Italian/Slovenian Mediterranean coast) and “Orient/East-Med” (German coasts – Greece/Turkey).

In terms of cities, where a stop of long distance trains makes sense, one and a half million people are living along the corridor.[5]

| Cities | Inhabitants |
|---|---|
| Dresden | 547,200 |
| Bautzen | 40,800 |
| Löbau (Sachsen) | 17,000 |
| Görlitz | 57,000 |
| Zgorzelec | 32,000 |
| Węgliniec | 3,100 |
| Bolesławiec | 39,200 |
| Legnica | 100,700 |
| Wroclaw | 637,700 |
| TOTAL | 1,474,700 |

**Table 1: Inhabitants of corridor Dresden – Wrocław (only cities relevant for stops of long-distance trains)**

[4] http://www.laenderbahn.com/downloads/trilex-files/Fahrplan/fahrplan-dresden-breslau-web.pdf

[5] Auswahl basiert auf den Halten früherer Schnellzüge

## 1.3. Technical view on the line

### 1.3.1. Infrastructural conditions

The railway line Dresden – Wrocław has a length of 269 kilometers, which are divided into 104 kilometers in Germany and 165 kilometers in Poland. The track class D4 has an axle-weight of 22.5 tons and today is the standard for new and upgraded lines.

Since June 25th 2000, the route is again double-tracked (last expansion measures were made in the Görlitz area), after war the second track was dismantled as reparation on numerous sections of the route.

The maximum speed on the German side is 120 km/h. In the course of the current expansion, a maximum speed of 160 km/h is reached on the Polish side.

In 1923, the route from Jelenia Gorá was electrified for the first time to Görlitz. After the war-related demolition of the Neisse viaduct, the facilities were transported to Russia as reparations.[6] Currently the electrification of the Węgliniec – Zgorzelec line is under construction, which should be completed by 2019, after the Wrocław – Węgliniec section has already been electrified. The electrification of the Neisse viaduct and thus the route to Görlitz central station is currently being negotiated.

In passenger transport, the following connection relationships exist:

| Station | Connection to |
|---|---|
| Dresden | Leipzig (- Ruhr area/Frankfurt)<br>Berlin<br>Prague<br>Hof (- Nuremberg)<br>suburbahn network |
| Radeberg | Kamenz |
| Bischofswerda | Zittau (- Liberec) |
| Görlitz | Cottbus<br>Zittau |
| Zgorzelec | Jelenia Góra |
| Węgliniec | Żary (- Zielona Góra)<br>Lubań |
| Legnica | Żary (- Zielona Góra)<br>Lubin<br>Swidnica |
| Wroclaw | Posnan<br>Leszno<br>Ostrów Wielkopolski<br>Opole (- Katowice)<br>Bystrzyca Klodzka<br>Swidnica<br>Wałbrzych<br>suburban network |

**Table 2: Connection of the Dresden – Wroclaw line with other passenger lines**

[6] Grenzverkehre, Übergänge, Vorschriften, Vereinheitlichungen, EK-Spezial 120, Freiburg, 2016

After the upgrading of the Węgliniec - Bielawa Dolna – Horka – Hoyerswerda - Ruhland corridor further north, the Dresden – Görlitz - Węgliniec railway line is now only of local importance, but north of Görlitz it has important railway customers which are planning additional investments mainly pending in combined traffic.

### 1.3.2. Line capacity

The current operating program can expect only a few critical points for a two-track mainline. In detail this can be:

| Part of the line | Possible problem |
|---|---|
| Dresden central station - Dresden-Neustadt - Dresden-Klotzsche | line occupancy<br>route conflicts with other lines |
| Bischofswerda | Local situation for combining and splitting trains sets |
| Zgorzelec | Situation for connection with cross-border traffic after electrification only till Zgorzelec |
| Węgliniec | line occupancy<br>competition with international freight trains |

**Table 3: Critical points for extension of traffic along the Dresden – Wrocław line**

### 1.3.3. Operational programme and timetable

For cross-border traffic only transfer connections are offered. There are three options per direction with a short transit time in Central Station.

| Year | Dresden - Wrocław | Görlitz - Wrocław | Remarks |
|---|---|---|---|
| 1980 | 5'30 - 6' | 2'45 - 3' | Stop at the border for more than one hour |
| 1990 | 5'30 - 5'45 | 2'45 - 3' | No bigger changes in comparison to 1980 |
| 1999 | 4'20 | 2'30 | InterRegio trains, reduction of travel time results mostly of short border stop |
| 2014 | 3'25 | 2'15 | Dresden Wrocław Express |
| 2016 | 3'30 - 4' | 2'15 - 2'30 | Direct connection with local trains |
| 2018 | 3'45 - 4' | 2'15 - 2'30 | Connecting train via Görlitz central station |

**Table 4: Comparison of travel times since 1980[7]**

If one compares the travel times of the last 40 years, it shows that the fastest offer so far was the continuous "Dresden Wrocław Express", which crossed the route in just over 3 hours and 20 minutes without changing

[7] Kursbücher Deutsche Bahn / deutsche Reichsbahn of the relevant years

locomotives, and with fast acceleration values. This corresponds to an average cruising speed of 75 km/h, which represents a lower value for a long-distance line.

| Mode of transport | Average transit time |
|---|---|
| Rail (based on "Dresden Wroclaw Express") | 3'25 |
| Bus | 3'30 |
| Car | 2'45 |

**Table 5: Comparison of different transport modes on Dresden – Wroclaw Corridor[8]**

The comparison with other modes of transport shows that there is a significant time disadvantage compared to the car and that even in the fastest version the train reaches just the times of the long-distance bus.

### 1.3.4. Development of number of passengers

Current user numbers for cross-border traffic are not available. Published figures for the former "Dresden Wrocław Express" show that significant increases in passenger numbers can be generated on an originally meaningless connection.

On the other hand, they also show that this cross-border connection is far from exhausting the potential that exists. Per train, the figures given in Table 6 indicate that there are approximately 28-30 passengers per cross-border train.

| Year | Number of passengers |
|---|---|
| Before 2009 | 12,000 |
| 2009 | 46,000 |
| 2010 | 56,000 |
| 2011 | 59,600 |

**Table 6: Development of numbers of passengers with Dresden Wroclaw Express[9]**

### 1.3.5. Rolling Stock

The railway company "trilex" uses the "Desiro Classic" railcars for the German section series (class 642), partly in triple traction.

The 120 km/h fast vehicles have 120 seats with a low-floor middle section, which also houses the accessible toilet and the multipurpose room, which can accommodate up to seven bicycles, baby carriages or wheelchairs. The vehicles are air conditioned.

As a rule, all trains are accompanied by a customer service representative.

The vehicles are suitable for short and medium-haul traffic but were formerly also used in the "Dresden Wroclaw Express", for which they are only partially suitable.

[8] Times are based on the relevant time tables and car-navigation-system

[9] Based on published figures in the internet

**Figure 2: Desiro Classic[10]**

If there are not enough Desiro railcars available, the reinforcement will mainly be railcars of the RegioSprinter type on the trains that stop at all stations along the line.


**Figure 3: RegioShuttle[11]**

Polis part has to be added

[10] http://www.laenderbahn.com/trilex/ueber-uns/fahrzeugflotte/

[11] https://de.wikipedia.org/wiki/Stadler_Regio-Shuttle_RS1#/media/File:StadlerRegio-Shuttle_650739.jpg

### 1.3.6. Ticketing

On the German side the railway line Dresden – Görlitz touches on two transport associations ("Verkehrsverbünde"). Between Dresden Hbf and Arnsdorf applies the tariff of the Verkehrsverbund Oberelbe (VVO), and between Bischofswerda and Görlitz applies the tariff of the Zweckverband Verkehrsverbund Oberlausitz-Niederschlesien (ZVON).

For cross-border journeys there are two special offers in addition to the standard tickets. For transport from Dresden to Wrocław, the "Dresden-Wrocław Special" is offered. It can be purchased for one or up to five and can be used for the round trip within 14 days.

Even on a single trip, this ticket is cheaper than the regular fare (regular fare 47.10 €; Dresden-Wrocław Special 35.00 €).

The ticket is available through:

- trilex agencies,
- trilex train attendants,
- at DB travel centers or DB agencies,
- at DB ticket vending machines
- on the Internet.

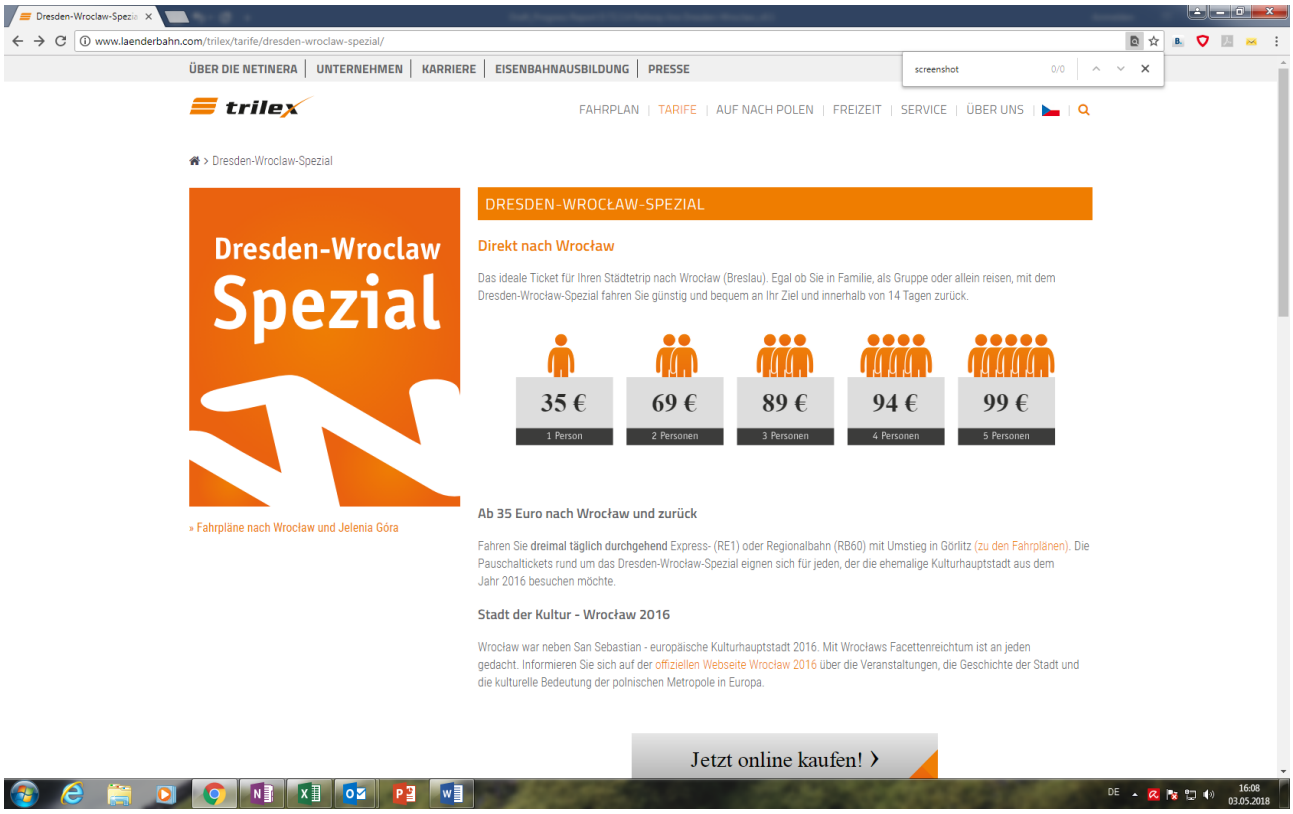



**Figure 4: website of Dresden-Wrocław Special**

Travellers from Görlitz can buy a ticket directly from the train attendant on the train to Poland without additional fee. The actual fare is 27.10 PLN (≈ 6,35 €) per direction. The tickets can only be bought in Polish currency and cash.

The second option is called “Euro-Neiße-Ticket”. This ticket allows cheap travel in the region shown in the map below and is more useful in the tri-border-region.


**Figure 5: Area of validity “Euro-Neiße-Ticket”**

Similar to the “Dresden-Wroclaw Spezial”, it can be purchased for one to five people. The “Euro-Neisse-Tickets” are available with all bus drivers, the train attendants in the trains of Ostdeutsche Eisenbahngesellschaft and trilex, in the ZVON area as well as in the service centers of the transport companies. In Görlitz the tickets are only available in the point of sales of VGG.

Polish part has to be added

## 1.4. Actual development of Dresden – Wrocław line

In 2003, a German-Polish agreement was developed for cooperation in the further development of rail links. In addition to the expansion of the route from the German-Polish border to Dresden to a speed of 120 to 160 km/h, an agreement was also reached for long-term electrification of the line. The most important goal of the expansion is called in the contract text the reduction of travel times of "trains of the categories EC and IC with classic railway vehicles [...] to about 3 hours 45 minutes" between Dresden and Wrocław. However, the implementation of these measures is expressly made conditional on the availability of the necessary financial resources in the two states.[12]

From this, the sub-project extension to 120 to 160 km/h was included in the Federal Transport Infrastructure Plan 2003 in the section "Projects EU-Eastern Enlargement". Both the speed increase and the electrification cannot be found in the resulting demand plan rail (Annex to the Federal Railways Development Act). Both sub-projects are foreseeable financially not understated, a fulfillment of the said intergovernmental agreement from 2003 is not foreseeable for the time being, even if the goal of electrification in June 2011 was reaffirmed in a joint cabinet meeting of the German Federal government and the Polish government.

In the context of the project "Via Regia plus" under the leadership of the Saxony State Ministry of the Interior, the year 2015 was named as a concrete target for the route construction and the electrification. The total cost was estimated at 204 million €. In 2013, the Free State of Saxony announced the expansion and electrification of the route for the 2015 Federal Transport Infrastructure Plan.

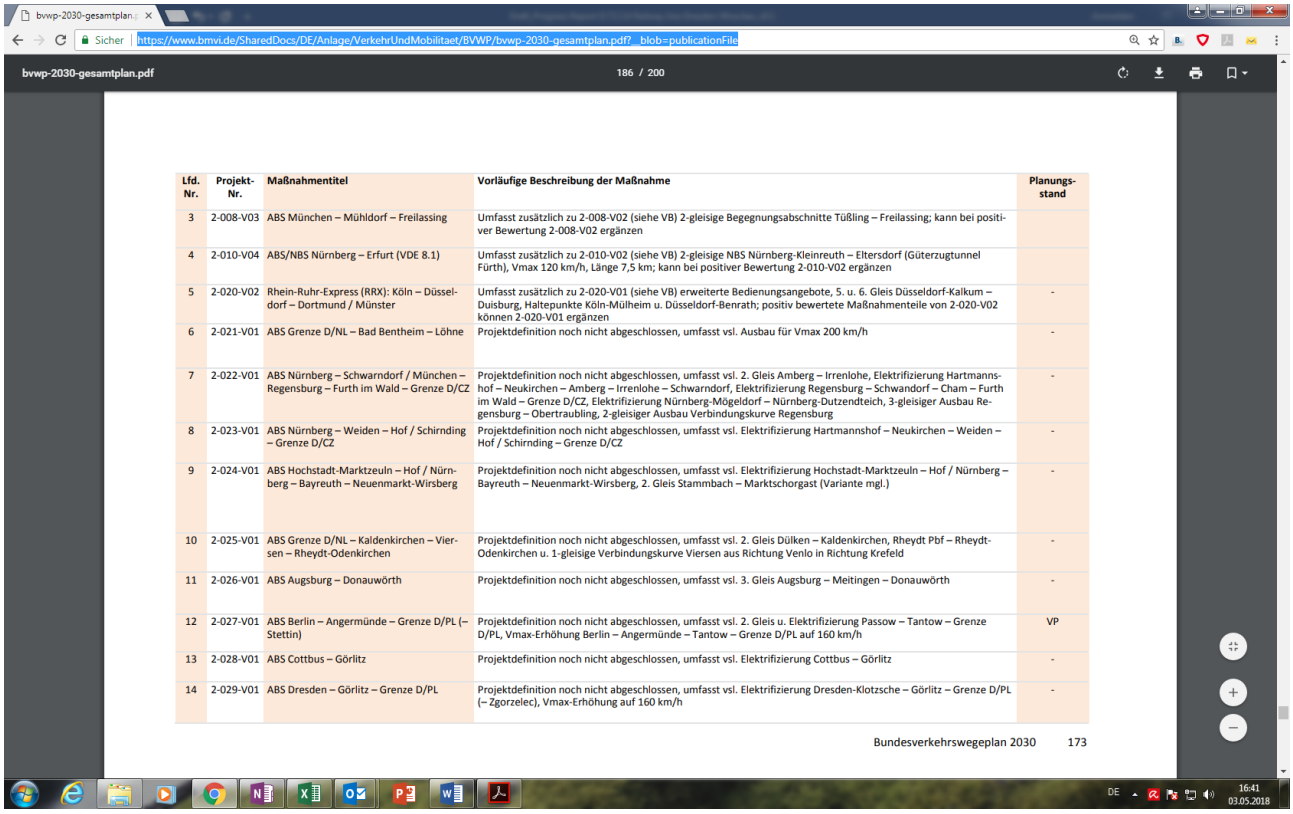
The former Saxonian State Government announced in July 2013 that it intends to commission the preliminary design for electrification.

On 22nd June 2015, the Saxonia State Ministry for Economic Affairs, Labor and Transport announced that Saxony's Minister of Transport signed the planning agreement for phases 1 and 2 of the Electrification Dresden – Görlitz – federal border and passed it to the CEO of Deutsche Bahn AG. The planning costs amounting to 10 million € will be borne by the Free State of Saxony, of which 7 million € are to be allocated for phase 2, subject to the inclusion of the project in the Federal Transport Infrastructure Plan 2030.

In the actual Federal Transport Infrastructure Plan the expansion on the route can be found only in the category "weiterer Bedarf".[13]

[12] Abkommen zwischen dem Bundesministerium für Verkehr, Bau- und Wohnungswesen der Bundesrepublik Deutschland und dem Minister für Infrastruktur der Republik Polen über die Zusammenarbeit bei der Weiterentwicklung der Eisenbahnverbindungen Berlin - Warschau (Warszawa) (C-E 20) sowie Dresden - Breslau (Wroclaw) (E 30/C-E 30)

[13] https://www.bmvi.de/SharedDocs/DE/Anlage/VerkehrUndMobilitaet/BVWP/bvwp-2030-gesamtplan.pdf?__blob=publicationFile



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https://www.bmvi.de/SharedDocs/DE/Anlage/VerkehrUndMobilitaet/BVWP/bvwp-2030-gesamtplan.pdf?__blob=publicationFile

| Lfd. Nr. | Projekt-Nr. | Maßnahmentitel | Vorläufige Beschreibung der Maßnahme | Planungs-stand |
|---|---|---|---|---|
| 3 | 2-008-V03 | ABS München – Mühldorf – Freilassing | Umfasst zusätzlich zu 2-008-V02 (siehe VB) 2-gleisige Begegnungsabschnitte Tüßling – Freilassing; kann bei positiver Bewertung 2-008-V02 ergänzen | |
| 4 | 2-010-V04 | ABS/NBS Nürnberg – Erfurt (VDE 8.1) | Umfasst zusätzlich zu 2-010-V02 (siehe VB) 2-gleisige NBS Nürnberg-Kleinreuth – Eltersdorf (Güterzugtunnel Fürth), Vmax 120 km/h, Länge 7,5 km; kann bei positiver Bewertung 2-010-V02 ergänzen | |
| 5 | 2-020-V02 | Rhein-Ruhr-Express (RRX): Köln – Düsseldorf – Dortmund / Münster | Umfasst zusätzlich zu 2-020-V01 (siehe VB) erweiterte Bedienungsangebote, 5. u. 6. Gleis Düsseldorf-Kalkum – Duisburg, Haltepunkte Köln-Mülheim u. Düsseldorf-Benrath; positiv bewertete Maßnahmenteile von 2-020-V02 können 2-020-V01 ergänzen | - |
| 6 | 2-021-V01 | ABS Grenze D/NL – Bad Bentheim – Löhne | Projektdefinition noch nicht abgeschlossen, umfasst vsl. Ausbau für Vmax 200 km/h | - |
| 7 | 2-022-V01 | ABS Nürnberg – Schwarndorf / München – Regensburg – Furth im Wald – Grenze D/CZ | Projektdefinition noch nicht abgeschlossen, umfasst vsl. 2. Gleis Amberg – Irrenlohe, Elektrifizierung Hartmannshof – Neukirchen – Amberg – Irrenlohe – Schwarndorf, Elektrifizierung Regensburg – Schwandorf – Cham – Furth im Wald – Grenze D/CZ, Elektrifizierung Nürnberg-Mögeldorf – Nürnberg-Dutzendteich, 3-gleisiger Ausbau Regensburg – Obertraubling, 2-gleisiger Ausbau Verbindungskurve Regensburg | - |
| 8 | 2-023-V01 | ABS Nürnberg – Weiden – Hof / Schirnding – Grenze D/CZ | Projektdefinition noch nicht abgeschlossen, umfasst vsl. Elektrifizierung Hartmannshof – Neukirchen – Weiden – Hof / Schirnding – Grenze D/CZ | - |
| 9 | 2-024-V01 | ABS Hochstadt-Marktzeuln – Hof / Nürnberg – Bayreuth – Neuenmarkt-Wirsberg | Projektdefinition noch nicht abgeschlossen, umfasst vsl. Elektrifizierung Hochstadt-Marktzeuln – Hof / Nürnberg – Bayreuth – Neuenmarkt-Wirsberg, 2. Gleis Stammbach – Marktschorgast (Variante mgl.) | - |
| 10 | 2-025-V01 | ABS Grenze D/NL – Kaldenkirchen – Viersen – Rheydt-Odenkirchen | Projektdefinition noch nicht abgeschlossen, umfasst vsl. 2. Gleis Dülken – Kaldenkirchen, Rheydt Pbf – Rheydt-Odenkirchen u. 1-gleisige Verbindungskurve Viersen aus Richtung Venlo in Richtung Krefeld | - |
| 11 | 2-026-V01 | ABS Augsburg – Donauwörth | Projektdefinition noch nicht abgeschlossen, umfasst vsl. 3. Gleis Augsburg – Meitingen – Donauwörth | - |
| 12 | 2-027-V01 | ABS Berlin – Angermünde – Grenze D/PL (– Stettin) | Projektdefinition noch nicht abgeschlossen, umfasst vsl. 2. Gleis u. Elektrifizierung Passow – Tantow – Grenze D/PL, Vmax-Erhöhung Berlin – Angermünde – Tantow – Grenze D/PL auf 160 km/h | VP |
| 13 | 2-028-V01 | ABS Cottbus – Görlitz | Projektdefinition noch nicht abgeschlossen, umfasst vsl. Elektrifizierung Cottbus – Görlitz | - |
| 14 | 2-029-V01 | ABS Dresden – Görlitz – Grenze D/PL | Projektdefinition noch nicht abgeschlossen, umfasst vsl. Elektrifizierung Dresden-Klotzsche – Görlitz – Grenze D/PL (– Zgorzelec), Vmax-Erhöhung auf 160 km/h | - |

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**Figure 6: Relevant page of actual Federal Transport Infrastructure Plan**

Meanwhile, the expansion and electrification continues on the Polish side, initially only to Zgorzelec. Currently, a continuation of the catenary wire up to the Görlitz central station is seen as a problem, since there is alleged interference by the 3 kV DC electrification in the electronic interlocking of the main station.

# 2. Pilot and the Action Plan

## 2.1. Objectives

The basic objective of the present action plan is the clear optimization of the cross-border rail link from Dresden to Wrocław in connection with an improved travel time and the use of comfortable rolling stock for the purposes of long-distance transport.

In order to link the two cities of Dresden and Wrocław, due to the size of their population, as well as the two European corridors I and IV, a three-stage procedure is envisaged:

- Improvement measures in the area of what is possible within the short term,
- Optimization through manageable and medium-term realizable investments
  - electrification Zgorzelec – Görlitz central station
  - check of new traction vehicle technologies [e.g. hybrid]
  - concept to split/combine trains on the routes Dresden – Bischofswerda - Görlitz/Zittau to improve the offer without further infrastructure development
- Measures to support long-term planning (essentially continuous electrification)

## 2.2. Methodology

As part of the above measures, the following further investigations are planned:

- Infrastructure
  - Simulation by FBS taking into account new timing ("Sachsen-Takt") resp. target network 2020 and necessary/predefined connections to other railway lines,
  - Analysis of maximum capacity between Dresden central station and Dresden-Klotzsche,
  - Check possible measures and rough estimate of costs/benefits,
  - Presentation of the effects of continuous electrification with regard to operational, financial and customer related topics.

- Vehicles
  - Check technical availability and efficiency of vehicles with alternative power supply as a mid-term-solution if full electrification can only be achieved long-term or potentially never. Basic benefit from bridging gaps between electrified sections.
  - Check opportunities to gain funding of pilot applications from research projects, if the technical risk for operations on this busy corridor is limited.

- Marketing
  - Establishment of a Culture train Berlin – Wrocław, but bilateral, similar to Wrocław - Dresden with Görlitz as a kind of cultural hub (like the successful "Culture train" Berlin - Wrocław); a fast service with very limited stops could show what could be possible on this corridor,
  - Negotiation with PKP-Intercity about the introduction of fast long-distance trains Görlitz - Warsaw or Krakow

# 3. Public involvement

## 3.1. Stakeholders involved

- Federal Ministry of Transport and Digital Infrastructure, Berlin
- Ministry of Transport, Construction and Marine Economy, Warsaw
- Saxonian Ministry of Economics, Labor and Transport, Dresden
- VVO (Verkehrsverbund Oberelbe), Dresden
- ZVON (Zweckverband Verkehrsverbund Oberlausitz Niederschlesien), Bautzen
- Województwo Dolnośląskie, Wroclaw
- DB Netze, Berlin
- PKP-PLK (Polskie Linie Kolejowe), Warsaw
- Local and regional passenger initiatives

## 3.2. Target groups reached

- Commuters between the bigger cities of the corridor, especially to Dresden, Görlitz, Legnica and Wrocław
- All forms of occasional traffic (long-distance travelers, tourists, etc.)

# 4. Timetable

## 4.1. Short term

Fundamentally problematic is the situation that improvements on the Corridor Dresden – Wrocław are not possible in the short term. On the one hand, the electrification of the Dresden-Klotzsche – Görlitz section has currently not a high priority at the level of the Federal Ministry of Transport and Digital Infrastructure. On the other hand, the new transport contract with DB Regio, which will come into effect from December 2019, will not allow major changes to the operating program.

In this respect, only possibilities can be shown within the TRANS-BORDERS project. These consist in particular in the analysis and the timetable simulation for the busy section Dresden central station – Dresden-Klotzsche (- Bischofswerda) and derived studies; which positive effects an electrification of this railway line can have.

These investigations will take place within the year 2018.

## 4.2. Mid term

Within the project two points can be achieved. Based on the aforementioned analyzes, an argumentation aid is provided for the further development of the Dresden – Wrocław railway line. In addition, targeted marketing measures for cross-border traffic will be developed within existing budgets.

# Annex

# REALISATION OF IMPROVED PASSENGER TRANSPORT

**Pilot implementation**

**Railway line Dresden - Wrocław**

**D.T2.3.4**

**2nd Progress Report**

**11/2018**

This Report was developed by

railistics

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# Index

# 1. Introduction and Objective

In the first progress report, the operational, infrastructural and organizational framework conditions in connection with the cross-border rail traffic between Dresden and Wrocław have been explained in detail. Also, current bottlenecks and problems were researched.

Following that, the most important framework conditions and the resulting changes in international rail passenger transport are presented and, within this context, the key aspects and focal points of the examination have been explained within the study.

As a result of the current plannings, in particular due to the extensive expansion and investment plan of the Polish government, changes result in cross-border traffic in the future. An important measure is the complete electrification of the section from Wrocław to Zgorzelec border station, which is due to be completed in 2019. The section between Dresden and Görlitz and further the Neisse Viaduct to Zgorzelec is not electrified. For this reason, probably no cross-border connections will be possible in the future. The Polish railway companies will use electrical commuter railcars for their services. This requires the cross-border travelers to change trains in Görlitz resp. Zgorzelec. So far, it is still unclear how the traffic between Görlitz and Zgorzelec stations will be organized. Regarding this, various concepts are possible. For that reason, additional costs for ZVON and Dolny Śląsk are to be expected. Within the context of this study, the operational and economic effects of an electrification of the track section between Dresden - Görlitz and further to Zgorzelec are illustrated. Furthermore, the study carried out a capacity test according to the UIC Leaflet 406 on the high-traffic section between Dresden Hbf and Dresden-Klotzsche with the aim of obtaining an estimate of the utilization of the section, so that in further steps the possibility of an expansion of the connections can be tested in national and international transport in the medium and long term. Especially with the electrification, a significant increase in the train numbers can be expected. In addition to the regional transport, cross-border long-distance transport concepts can be implemented, which are currently difficult to realize due to the lack of economic efficiency.

One possibility would be innovative drive concepts, which could already be a temporary solution in the medium term, since electrification can be expected not before 2035, taking the planning approval procedure into account. The illustration and evaluation of the innovative drive concepts, for examples Hybrid solutions or multi-system vehicles, is therefore part of the examination.

A second possibility for connecting Dresden with Wrocław is the introduction of a fast train connection between those two cities via an alternative route (Dresden Hbf – Dresden Neustadt – Ruhland – Hoyerswerda – Węgliniec – Bolesławiec – Legnica – Wrocław). This route is completely electrified and a service between Dresden and Wrocław is estimated with a travel time of approx. 3:10 h.[1] Due to the deemed economic inefficiency and the deviation of the Bautzen – Görlitz stretch, this scenario is not analysed in a deeper way in the context of this study.

# 2. Methodology

The basis for the identification of the positive effects of electrification of the track section between Dresden and Görlitz is provided by the current operational and infrastructural framework conditions in year 2018. This state corresponds to the 0-case. In the scenario 2020, the electrification on the Polish side to Zgorzelec has already been completed. Due to the electrification gap, it can be assumed that from this point on there will no longer be any direct cross-border traffic on the Dresden – Wrocław route, because the Polish Railway Undertaking will use electric commuter railcars because of their economic efficiency. An additional change of train in Görlitz will be necessary. For this reason, the travel times in cross border traffic are extended,

[1] Short study – Fast train connection Dresden – Görlitz – Wroclaw, kcw 2018

which could reduce the attractiveness of the connection and lead to passenger declines. In the "electrification" scenario, the complete electrification of the track section between Dresden – Görlitz and Görlitz – Zgorzelec in connection with an increase in the maximum speed to 160 km/h was assumed. The examined scenarios are shown in the following table:

| Scenario | Explanatory Notes/Assumptions |
|---|---|
| **0-case** | – Operation program based on the 2018 timetable |
| **Scenario 2020** | – Operation program based on the target network 2020, taking into account the track electrification to Zgorzelec on the Polish side<br>– Discontinuation of the direct, transfer-free relation Dresden – Wrocław<br>– Decline in cross border passenger numbers due to additional transfers<br>– Determination of additional fictitious costs (e.g. travel time costs) resulting from the discontinuation of the direct cross-border connection |
| **Scenario „electrification“** | – Electrification of the track sections Dresden – Görlitz and Görlitz – Zgorzelec and increasing the maximum speed to 160 km/h<br>– Determining achievable travel time savings by using electric commuter railcars<br>– Determining the benefits of an electrification taking into account possible positive demand effects |

**Table 1: Overview of studied scenarios[2]**

A key factor influencing the investigation is the number of travelers in 0-case and the prognosis of travelers within the scenarios. The determination of future travelers is based on travel time elasticities. The following figure shows the methodical procedure in the context of the calculation of benefits in connection with an electrification of the section Dresden – Görlitz – Zgorzelec.

[2] Source: Railistics

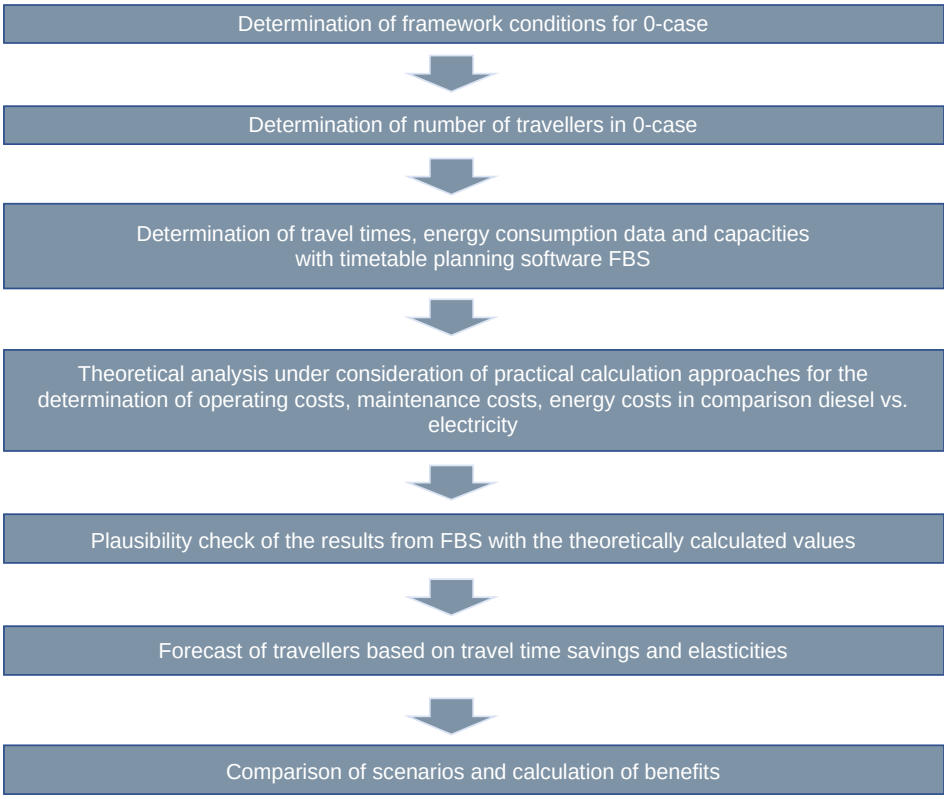



**Figure 1: Methodology steps**[3]

The determination of the passengers in the 0-case is based on the passenger counts of the railway companies Länderbahn and Ostdeutsche Eisenbahn GmbH. Current figures of the passengers in international passenger traffic between Dresden and Wrocław do not exist. Therefore, assumptions have been made.

The number of passengers in Zweckverband Oberlausitz-Niederschlesien (ZVON) has been forecasted to the year based on the number of passengers on each line. The following table shows the number of the passengers in the 0-case for the different relations.

| Relations | Passengers from Dresden to Görlitz | Passengers from Görlitz to Dresden | Total number of passengers |
|---|---|---|---|
| Dresden – Görlitz (RB 60) | 214,032 | 152,360 | 366,392 |
| Dresden – Görlitz (RE 1) | 240,812 | 274,196 | 515,008 |
| Dresden – Bischofswerda (RB 61) | 121,004 | 142,272 | 263,276 |
| Görlitz – Bischofswerda (RB 60V) | 144,919 | 144,919 | 289,838 |
| Dresden – Bischofswerda (RE 2) | 168,480 | 197,600 | 366,080 |
| **TOTAL (non cross-border)** | | | **1,800,594** |
| Dresden – Wrocław (RE 1) | | | 65,000 |

**Table 2: Number of passengers in „Case-0“**[4]

[3] Source: Railistics

[4] Source: Railistics

The domestic passengers on the Polish side have not been included in the examination as electrification on the German side to Görlitz and on to Zgorzelec would have no effect on the domestic passengers on the passsage from Görlitz to Wrocław.

Due to the almost complete electrification on the Polish side, there are very few effects on electrification of the track section Dresden – Görlitz. Exceptions to this are the cross-border connections, especially on the relation between Dresden and Wrocław with the Dresden-Wrocław-Express.

# 3. Possible Drive Technologies

At present national transport and cross-border traffic between Germany and Poland on the corridor between Dresden and Wrocław, commuter rail cars with combustion engines are in operations. In addition to the high emission levels, the operating costs of diesel traction are significantly higher in direct comparison with electric traction. Taking into account the driving dynamics performance characteristics, in particular the acceleration behavior, the commuter vehicles in diesel mode have unfavorable properties.

In the future electrified commuter railcars could be used after the electrification. On the branch line in the direction of Zittau (from Bischofswerda onwards not electrified), railcars with electric and diesel engines could be used. In the following, these technologies are described in detail.

## 3.1. Electro commuter railcar and Dual-Mode-vehicles

At present, the Siemens Desiro commuter railcar are used in peak hours with three coupled units usually. This leads to very high operating costs. After a possible electrification, vehicles should be used as much as possible in single traction. The vehicles must then have sufficient seating capacity.

Single-system and multi-system electric railcars are available on the market. In addition, some manufacturers, such as Stadler or Alstom, offer dual-mode railcars. These have a diesel and an electric enginge. All of the traction vehicles shown in the figure below reach maximum speeds of 160 km/h and have at least 180 seats. The platforms of the manufacturers are usually modular, so that the seat capacities can be increased by longer vehicle units. The figure shows purely electric and dual-mode commuter rail cars of various manufacturers.

**Electric and dual-mode railcars**

| Selection of possible commuter railcars with electric traction | Explanatory Notes/Parameters |
|---|---|
| Stadler Kiss (e.g. four-part)  | - 330 seats<br>- 212 tons |
| Stadler FLIRT (e.g. three-part)  | - 180 seats<br>- 101,1 tons<br>- Many vehicles in practical operation |
| Alstom CORADIA Continental (four-part)  | - 227 seats<br>- 144 tons<br>- Many vehicles in practical operation |
| Bombardier Talent 3  | - 160 seats |
| **Selection of possible dual-mode commuter railcars (Electric + Diesel)** | **Explanatory Notes/Parameters** |
| Alstom Polyvalent (Diesel + Electric)  | - $v_{max}$: 160 km/h (Diesel operation)<br>- 220 seats (in four-part configuration)<br>- For now no trains delivered to Germany |
| Stadler WINK (Diesel + Electric)  | - $v_{max}$: 160 km/h (Electric) and 140 km/h (Diesel)<br>- 180 seats<br>- First delivery to Italy in 2018 |
| Train of project "Eco Train" of DB  | - Approval by EBA expected for end of 2018<br>- Operation on Erzgebirgsbahn in 2021/2022 planned |

**Practical examples multi-system vehicles**

| Multi-system commuter railcars currently in operation | Railway Undertakings | Explanatory Notes |
|---|---|---|
| Stadler Flirt 3-MS  | Abellio Rail NRW for operation on Niederrhein-Netz between Düsseldorf Hbf and Arnhem Centraal | - Five-part with around 260 seats<br>- $v_{max}$: 160 km/h<br>- Automatic coupling |
| Stadler Flirt 3-MS  | Keolis Deutschland Operation on RB 61 Bielefeld – Hengelo | - Train protection system ETCS L 2 and ATB<br>- Five-part with 266 seats<br>- Rental model (rent from Alpha Trains)<br>- $v_{max}$: 160 km/h |
| Stadler Kiss-MS  | Ordered by CFL in 2010, Railcars are specialised for operation between Luxembourg and Koblenz | - Three-part Kiss with 284 seats<br>- $v_{max}$: 160 km/h<br>- Equipped with two different train protection systems |

**Figure 2: Overview of possible commuter railcars[5]**

So far, no electric or dual-mode commuter railcars have been approved for German-Polish traffic. In addition to the differences in the traction current system, there are differences in the train control system, in the

[5] Source: Railistics

train radio and in the approval procedures. Here, a first step would be to harmonize the country-specific approval procedures across Europe. Diesel railcars for cross-border traffic between Germany and Poland are already approved, in contrast to electric commuter railcars.

In addition to the Siemens Desiro (BR 642), the Stadler GTW (BR 646), the BR 628 or the PESA Link (BR 633) further diesel railcars are to be approved in the future for cross-border traffic. To name here the example of the diesel railcar Talent of the manufacturer Bombardier (BR 643/644).

Due to the more complex technical requirements, the approval process of local electric railcars is more complex and likely to be associated with higher costs.

## 3.2. Innovative Drive Technologies

The use of innovative drive technologies such as hybrid and fuel cell technology are an exception on the European railway network. The reasons for this are manifold: on the one hand the techniques are not yet available as standard and mature, on the other hand the acquisition costs are significantly higher compared to conventional, purely electric commuter railcars.

With the hybrid technology (electric drive + battery) the maximum ranges in battery operation, as well as the maximum speeds and the acceleration values, are low. The investment costs for a three-part railcar amount to around 6 – 7 million €. The time horizon to the series-ready market launch is currently not foreseeable.

The first test drive with a fuel cell hybrid train (local transport) took place in 2016 in Japan. Since December, the hydrogen-powered commuter railcar "CORADIA iLint" between Buxtehude and Cuxhaven has been used for test purposes. Official approval by the EBA was granted on 10th July 2018. The capacity of the tanks and accumulators should be sufficient for 600 km to 800 km, with a maximum speed of 140 km/h. The train can be assembled modularly according to the manufacturer and has 180 to 600 seats. The investment costs should be around 6 million €, depending on the vehicle configuration.

The US, China and Australia have some practical experience of using liquefied natural gas (LNG) in heavy road traffic and rail transport. So far, LNG is only used in locomotives. There is no foreseeable future market availability of commuter railcars powered by LNG.

In order to apply concepts such as LNG or fuel technology in regular operation, the necessary refueling infrastructure must be provided, which can lead to high investment costs. Also, it is not yet known if and what savings in driving through the use of technology are possible, which is an important basis for decision to purchase. When looking at the environmental effects, the complete chain should be taken into account from production to local exhausts. For example, the production of alternative fuels is sometimes associated with significantly higher energy consumption than diesel production.

# 4. Electrification Dresden - Görlitz

An electrification and expansion of the track section between Dresden and Görlitz and further on to Zgorzelec would have significant impacts on the rolling stock, the operation program, the efficiency of transports and on many other aspects. In this chapter the possible operational and economic benefits that could be generated by an electrification of this track section is presented.

Although the planned project is part of the German Federal Transport Infrastructure Plan (BVWP), it is only listed as potential demand. This means the federal government does not pursue the implementation of the measure with the highest priority. Only if all first priority measures are completed, projects with potential demand are taken into account. Currently the first planning steps of the electrification of the route from Dresden-Klotzsche to Görlitz are in progress. The Free State of Saxony funds the service phase 1 and 2

(determining fundamentals and pre-design). The conclusion of those planning phases is scheduled for 2019. The results will allow quite accurate statements on the measure's investment costs.

## 4.1. Input data and assumptions

For the investigation data on passenger numbers, operational programs and infrastructure provided by the transport association of Zweckverband Oberlausutz-Niederschlesien (ZVON) and other corresponding documents, programs and studies were taken into account. The basis for the investigations are:

- Determining travel times with the timetable construction software "FBS" depending on the above mentioned differnet scenarios and on infrastructural conditions
- Railistics' data base on maintenance costs and on energy consumption of railcars used in short-distance traffic powered by diesel and electric engines
- Study "Grundsätzliche Überprüfung und Weiterentwicklung der Nutzen-Kosten-Analyse im Bewertungsverfahren der Bundesverkehrswegeplanung", 2015
- "Methodenhandbuch zum Bundesverkehrswegeplan 2030", 2015
- Other scientific studies and reports

The above-mentioned scenarios 0-case and electrification form the basis for the investigation. The scenario 2020 is only mentioned in a side note.

## 4.2. Infrastructure of the track

The ZVON provided the data on the infrastructure for the 0-case. In the scenario electrification it is assumed that a catenary wire is installed and the maximum speed is increased to 160 km/h. As there is no data available on the infrastructure for the polish section of the route in the FBS data base, the required data was collected from several sources and integrated in the program. Thus, it was possible to determine and compare travel times for domestic and cross-border traffic depending on the different scenarios and the type of vehicle being used. Figure 3 shows the current alignment from the FBS for the raltion Dresden – Wrocław.

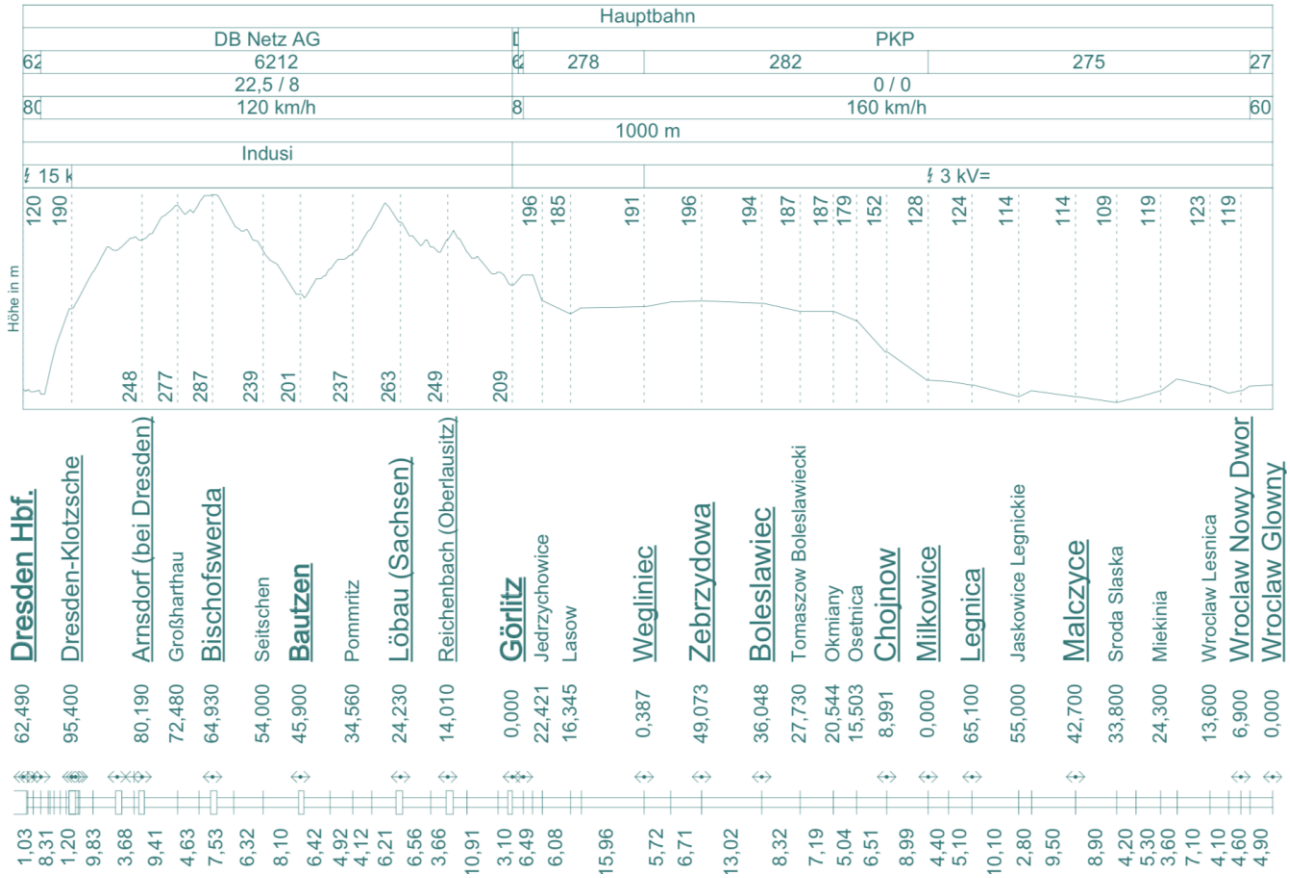



**Figure 3: Alignment Dresden - Wroclaw[6]**

## 4.3. Energy consumption and costs

### 4.3.1. 0-case

Currently on the track section between Dresden and Görlitz and in direct cross-border traffic between Dresden and Wrocław diesel railcars of the model Siemens Desiro are being used. To fulfil the high demand for transportation between Dresden and Görlitz/Bischofswerda during traffic peaks trains operate with three railcars coupled. The Länderbahn GmbH is operating the trains under the brand name “trilex” (occasionally using trains from DB Regio, which is a subcontractor).

Another railway line RB 60V between Görlitz and Bischorfswerda is operated by Ostdeutsche Eisenbahn GmbH (ODEG). Here trains of the type “RegioShuttle” of the manufacturer Stadler are being used. The table below gives an overview of the diesel consumption for the relevant relations. The average traction factor (multiple traction devided by single traction) was taken into account for the investigation. As the trains are accelerating and breaking more or less frequently (depending on the train line) the theoretical values from the studies[7,8] were multiplied with the factor 1.3. The vehicle hours basically content of the travel time and the equipping time. The price for one liter of diesel is assumed 1.10 €.

[6] Source: Railistics

[7] PTV Group: Methodenhandbuch zum BVWP; Berlin, 2016

[8] Planco, TU Berlin: Grundsätzliche Überprüfung und Weiterentwicklung der Nutzen-Kosten-Analyse im Bewertungsverfahren der Bundesverkehrswegeplanung; 2015

| Sections | Vehicle kilometres | Vehicle hours | Total diesel consumption in liter | Total annual costs in € |
|---|---|---|---|---|
| Dresden – Görlitz (RB 60) | 638,385 | 10,710 | 761,930 | 838,123 |
| Dresden – Görlitz (RE 1) | 477,572 | 6,443 | 543,473 | 597,820 |
| Dresden – Bischofswerda (RB 61) | 194,980 | 3,575 | 237,843 | 261,627 |
| Görlitz – Bischofswerda (RB 60V) | 237,250 | 3,346 | 193,359 | 212,695 |
| Dresden – Bischofswerda (RE 2) | 194,545 | 3,132 | 229,962 | 252,958 |
| **total (non cross-border traffic)** | | | | **2,163,222** |
| Dresden – Wrocław (RE 1) | 450,045 | 6,896 | 485,612 | 534,173 |

**Table 3: Energy costs for diesel operation (0-case)[9]**

### 4.3.2. Scenario electrification

There are huge impacts the electrification of train tracks has on the choice of which vehicles are being used and on the vehicle dynamics (e.g. travel time). The acceleration of electric railcars usually is significantly higher and therefore has positive impacts on the travel time and hence on the benefit analysis. For this investigation a railcar of the type "Flirt" by the manufacturer Stadler is being used. Because of high seat numbers the vehicles can be operated by single traction to the greatest possible extent after the line electrification. Furthermore, a higher energy consumption has to be considered, as the maximum speed has increased from 120 km/h to 160 km/h.

On the track section between Bischofswerda and Zittau diesel railcars have to be used even after an electrification of the track section Dresden – Görlitz. It is assumed that future trains on the relation Dresden – Bischofswerda – Zittau will be dragged by dual-mode railcars using electric and diesel engines. The table below shows the energy consumption and costs after an electrification of the track.

| Sections | Vehicle kilometres | Vehicle hours | Total energy consumption in kWh | Total annual costs in € |
|---|---|---|---|---|
| Dresden – Görlitz (RB 60) | 425,590 | 5,300 | 4,626,886 | 705,137 |
| Dresden – Görlitz (RE 1) | 265,318 | 2,616 | 1,775,002 | 270,510 |
| Dresden – Bischofswerda (RB 61) | 162,483 | 2,470 | 1,822,452 | 277,742 |
| Görlitz – Bischofswerda (RB 60V) | 237,250 | 2,008 | 2,275,775 | 346,828 |
| Dresden – Bischofswerda (RE 2) | 149,650 | 1,874 | 1,646,393 | 250,910 |
| **total (non-cross-border traffic)** | | | | **1,890,344** |
| Dresden – Wrocław | 300,030 | 3,312 | 2,032,046 | 309,684 |

**Table 4: Energy costs within the scenario "electrification"[10]**

Costs for traction power supply was set to 0.1524 €/kWh. Costs for equipping are estimated 10 % of the total energy costs. Figures of specific energy consumption were taken from Railistics' data base, which leans on studies related to the review of the CBA in the Federal Transport Infrastructure Plan (BVWP).[11] In a further step the results were validated via FBS on the basis of the calculated energy consumption. FBS supplied figures for the energy consumption on the wheel so that for the calculations surcharges for auxiliary operations and efficiency rates have to be taken into account.

[9] Source: Railistics

[10] Source: Railistics

[11] Planco, TU Berlin: Grundsätzliche Überprüfung und Weiterentwicklung der Nutzen-Kosten-Analyse im Bewertungsverfahren der Bundesverkehrswegeplanung; 2015

## 4.4. Maintenance costs

The amount of maintenance costs heavily depends on the vehicle kilometres and the type of rolling stock being used. Maintenance costs for diesel railcars are higher than for electric railcars.

### 4.4.1. 0-case

In the 0-case the vehicles used at this time are Siemens Desiro and Stadler RegioShuttle. The maintenance costs of the Desiro were set to 0.85 € and of the RegioShuttle to 0.65 € per vehicle kilometre. Following table shows the annual maintenance costs for the different rail cars and lines.

| Railcar | Line (product) | Train kilometres | Vehicle km | Total maintenance costs in € |
|---|---|---|---|---|
| Siemens Desiro | RB 60 | 425,590 | 638,385 | 542,627 € |
| Siemens Desiro | RE 1 | 265,318 | 477,572 | 405,937 € |
| Siemens Desiro | RB 61 | 162,483 | 194,980 | 165,733 € |
| Stadler Regio Shuttle | RB 60V | 237,250 | 237,250 | 154,213 € |
| Siemens Desiro | RE 2 | 149,650 | 194,545 | 165,363 € |
| Siemens Desiro | RE | 300,030 | 450,045 | 382,538 € |

**Table 5: Overview over the maintenace costs for diesel operation (0-case)[12]**

### 4.4.2. Electrification

As already mentioned, maintenace costs for electric railcars are lower than for diesel railcars. The maintenance costs of the Stadler Flirt were set to 0.70 € and of the dual-mode railcars to 0.65 € per vehicle kilometre.

| Railcar | Line (product) | Train kilometres | Vehicle km | Total maintenance costs in € |
|---|---|---|---|---|
| Stadler Flirt | RB 60 | 425,590 | 425,590 | 297,913 |
| Stadler Flirt | RE 1 | 265,318 | 265,318 | 185,723 |
| Stadler Flirt Bimodal | RB 61 | 162,483 | 162,483 | 138,111 |
| Stadler Flirt | RB 60V | 237,250 | 237,250 | 166,075 |
| Stadler Flirt Bimodal | RE 2 | 149,650 | 149,650 | 127,203 |
| Stadler Flirt | RE | 300,030 | 300,030 | 240,024 |

**Table 6: Maintenace costs for the scenario "electrification"[13]**

In total, by using electric or dual-mode railcars annual maintenance cost savings of approximately 661,000 € can be reached. These savings could be used for better services on the regional network ("Ostsachsennetz") and especially in cross-border traffic.

In Germany average costs for regional rail transport account for 15.14 € and revenues for 6.05 € per train kilometre.[14] By savings in maintenance costs additional 43,000 train kilometres could be financed. Furthermore, considering fundings for regionalisation and other subventions performance can be increased even more.

[12] Source: Railistics

[13] Source: Railistics

[14] https://www.lnvg.de/spnv/finanzierung-spnv/kostenzusammensetzung-im-spnv/

## 4.5. Assessment of pollutant emissions

For the assessing of the emission costs for diesel and electric railcars the annual figures of energy consumption serve as a basis. The table below gives an overview over the specific costs of the main emission components exhausted when using electric or diesel railcars:

| Pollutant | Costs for exhausted emission | |
|---|---|---|
| | Electric railcar [ct/kWh] | Diesel railcar [ct/l] |
| $CO_2$ | 6 | 44 |
| $NO_x$ | 0.46 | 31 |
| $SO_2$ | 0.23 | |
| HC | 0.12 | |
| Particles | 0.12 | 4 |
| Total | **6.93** | **79** |

**Table 7: Cost of emissions for different pollutants**[15]

Refering to the emission costs listed in Table 7 and the annual diesel consumption in litres there is a potential of annual cost savings of approximately 2 million € in comparison between the 0-case and the electrification scenario when only looking on the above-mentioned lines.

## 4.6. Benefits in travel time and development of passenger numbers

Passengers' benefits in travel time are directly linked to monetized savings in travel time. Travel times for the scenario 0-case were taken from the annual timetable 2018. For the scenario electrification travel times were calculated with the timetable construction system FBS. Furthermore, as the transfer time for changing the train had to be considered the total travel time with the Dresden-Wrocław-Express increases by 20 minutes in scenario 2020.

| Train product | Travel time 0-case | Travel time scenario 2020 | Travel time scenario electrification | Track section | Side note |
|---|---|---|---|---|---|
| RE 1 | 78 min | 78 min | 57 min | Dresden – Görlitz | |
| RE 2 | 36 min | 36 min | 28 min | Dresden – Bischofswerda | |
| RB 60 | 97 min | 97 min | 72 min | Dresden – Görlitz | |
| RB 61 | 41 min | 41 min | 34 min | Dresden – Bischofswerda | |
| RB 60V (from 2020 RE 1V) | 50 min | 41 min | 30 min | Görlitz – Bischofswerda | from 2020 Siemens Desiro |
| Dresden-Wrocław-Express | 229 min | 249 min | 165 min | Dresden – Wrocław | approach: 20 minutes of transfer time Görlitz – Zgorzelec |

**Table 8: Savings in travel time for different scenarios**[16]

[15] Source: Railistics

[16] Source: Railistics

The figures in Table 8 clearly show that a reduction of travel time can be achieved by electrifying and upgrading the track section between Dreseden and Görlitz. The greatest time savings happen when using the RE 1 as there are only few stops on the track. But also when driving with the stoptrain (RB) time savings up to 30 % can be reached even though the stops are quite close to each other.

As a result of the time savings an increase in demand of transport services is expected. There is no traffic model that allows precise estimations on how the different branches and lines will develop. Alternatively, instead of forecasting demands a view on the travel time elasticity can be useful. Considering the current passenger numbers on inland and cross-border relations between Dresden and Wrocław and considering the calculated time savings allows forecasting the future development of passenger numbers. In this calculation an elasticity of -0.575 is being used.[17] In scientific literature values for the elasticity vary between -0.4 and -0.8. A travel time elasticity equal to -0.575 means that the demand in transport services increases by 5.75 % when travel times are being reduced by 10 %.

Following table presents the calculated passenger numbers and the resulting benefits in travel time.

| Sections | Passenger numbers 0-case | Savings in travel time after electrification | Additional passenger numbers after electrification | Changes in passenger numbers | Benefits due to shorter travel times |
|---|---|---|---|---|---|
| Dresden – Görlitz (RB 60) | 366.392 | 25 min | 54,252 | + 26 % | 1,313,536 € |
| Dresden – Görlitz (RE 1) | 515.008 | 21 min | 79,727 | + 27 % | 1,561,178 € |
| Dresden – Bischofswerda (RB 61) | 263.276 | 7 min | 25,846 | + 17 % | 252,982 € |
| Görlitz – Bischofswerda (RB 60V) | 289.938 | 20 min | 66,663 | + 40 % | 892,000 € |
| Dresden – Bischofswerda (RE 2) | 366.080 | 8 min | 46,777 | + 22 % | 412,857 € |
| Dresden-Wrocław-Express | 65.000 | 64 min | 10,445 | + 28 % | 603,564 € |

**Table 9: Benefits in travel time after electrification[18]**

In this calculation the benefits in travel time is monetarized with 7.50 € per hour, which is a value often used in the context of infrastructure projects and it is also accepted by the Federal Ministry of Transport and Digital Infrastructure (BMVI).[19] Total anual benefits in travel time due to electrification and track expansion to 160 km/h sum up to 5 million €.

## 4.7. Effects of a shift from road to rail

It is being expected that savings in travel time will cause shift effects from road towards rail. Apart from emission savings by using the public transport there are also less accidents. It is assumed that on average 1.3 persons are in each car.[20] This assumption reflects reality as many commuters use their own cars. As there is no data on the average travel distance in Eastern Saxony it was conservatively assumed to be approximately 50 km. The average cross-border travel distance was set to 150 km. Both values are regarded

[17] According to ETH Zürich, IVT

[18] Source: Railistics

[19] Planco, TU Berlin, iTP: Grundsätzliche Überprüfung und Weiterentwicklung der Nutzen-Kosten-Analyse im Bewertungsverfahren der Bundesverkehrswegeplanung; 2015, Berlin

[20] http://www.nachhaltig-links.de/index.php/oeffentlicher-verkehr/1622-mobilitaet-lebensqualitaet

as round trips. Basis for calculating road accident costs and $CO_2$ savings are the figures of expected additional train passengers.

Statistics of the German Environment Agency (UBA) quantify each passenger kilometre driven by car with an equivalent of 142 g of greenhouse gases.[21] External costs of one ton of greenhouse gasses account for 145 €.[22]

Basis for calculating road accident costs and $CO_2$ savings are the figures of expected additional train passengers. As train rides become more attractive it was assumed that passengers will switch from their cars to public transport. In total annual saving of over 2,000 t $CO_2$ can be reached, which is equivalent to 292,079 €.

In order to calculate costs resulting from accidents specific damage rates for rail and road traffic have to be defined. For every train kilometre a damage rate of 0.34 € is assumed.[23]

On the road accident costs per kilometre significantly vary between different countrys. For this investigation there was not made a difference between highways and local roads.

The average damage rates per kilometre for road traffic are 0.006 € in Germany and 0.005 € in Poland. The reason for the slightly different rates may arise from speed limits on polish motorways.[24]

The additional number of passengers in combination with an assumed average passenger numbers of 1.3 for each car result in an annual reduction of roughly 220,000 car rides. Considering a damage rate of 0.006 € per kilometre annual accident costs of 40.000 € will be saved

## 4.8. Overview of benefit factors

For the investigation following factors have been considered:

- Benefits in travel time
- Reduction of accident costs
- Benefits due to reductions of emissions on roads
- Reductions of emissions on railroads (by using electric railcars)
- Savings in energy consumption (by using electric railcars)
- Savings in maintenance costs of rolling stock (by using electric railcars)

The following figure shows all monetarized benefit factors.

[21] https://www.umweltbundesamt.de/daten/private-haushalte-konsum/mobilitaet-privater-haushalte#textpart-5

[22] https://www.umweltbundesamt.de/sites/default/files/medien/378/publikationen/hgp_umweltkosten_0.pdf

[23] DG Move: Update of the Handbook on External Costs of Transport

[24] DG Move: Update of the Handbook on External Costs of Transport

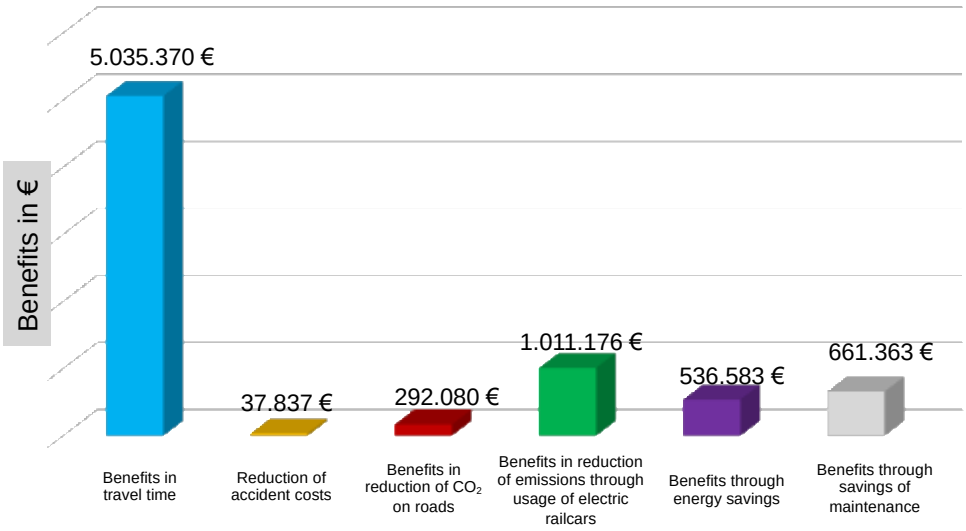



**Figure 4: Overview over monetarized benefit factors[25]**

There are differences between the factors regarding economic benefits and savings for the railroad companies (due to smaller maintenance and energy costs). An annual economic benefit of 6.4 million € and an operational benefit of 1.2 million € can be achieved.

Even though the electrification between Dresden and Görlitz opens new doors for a long-distance line for express trains benefits resulting from it have not been considered in this investigation. For instance, a long-distance line from Dresden over Görlitz to Wrocław would be an attractive relation for many people.

Establishing a culture train, with the Berlin-Wrocław-culture train serving as a blueprint, would emphasize this relation. If and under what circumstances this option can be established will be part of future research within the scope of this project.

## 4.9. Non-monetary and non-quantifiable factors

Apart from the monetary benefit factors presented in chapter 4.8 it is necessary to pay attention to non-monetary and non-quantifiable factors. The electrification of the track from Dresden over Görlitz to Zgorzelec would also have impacts on the economic and social structure of the region. Because of rising rents in metropolitan areas, it is being expected that many people move to more rural areas. This phenomenon can already be seen today.

In this context the connection to public transport systems plays an important role. Due to the electrification the travel time can be reduced significantly so that Eastern Saxony is to become more attractive. Furthermore, the electrification opens new doors for establishing a new long-distance line with a stop in Görlitz.

Many enterprises see it crucial to have a good connection to long-distance railway lines when choosing their location. In addition, employees need to get as fast and convenient as possible to their workplaces. These aspects make an enterprise more attractive, especially considering the shortage of skilled labor.

The electrification of the track would have positive impacts on the economic and social structure as well as on tourism.

[25] Source: Railistics

## 4.10. Conclusions

The electrification of the track section between Dresden over Görlitz to Zgorzelec would generate great benefits nationaly and internationaly. In consideration of the passenger rail transport the electrification and expansion to 160 km/h of the track a benefit of 7.6 milion € could be achieved. In these calculations the establishment of a long-distance line or of a passing track have not been part of the investigation. Furthermore, the electrification and the resulting savings in travel time are key factors for the "Sachsen-Takt" as well as for the „Deutschland-Takt" which means a coordination and synchronisation of all train lines in the major nodes of the network. As the planning and design of the electrification and expansion are still in progress statements on expected investment costs can not be made yet. The completion of the planning phases is scheduled for the end of 2019.

# 5. Impacts of the electrification on future plannings

With establishment of the "Sachsen-Takt" all transport services from long-distance passenger transport to dial-a-ride services should be harmonized and work smoothly together. By this transfer times can be reduced and the attractiveness of public transport can be increased.

In 2017 within an expert report a masterplan was developed giving recommendations for the public transport in Saxony. For instance, the expert report suggests a statewide coordinated investment, infrastructure and vehicle strategy.[26] So far transport associations autonomously determine the requirements for vehicles in regional rail transport.

The same expert report defines objectives regarding the travel time between main nodes. To achieve these objectives, the above mentioned strategies should be applied. Precondition for the establishment of the "Sachsen-Takt" on the relation Dresden – Görlitz is the reduction of the maximum travel time between the main nodes. Under the presupposition that all train stops should still be served this can only be achieved by electrification and increasing the permitted speed. Figure 5 shows the speed-profile graph of an accelerated RE 1 with electric traction.

[26] http://www.verkehr.sachsen.de/download/AbschlussberichtOEPNVStrategiekommission.pdf

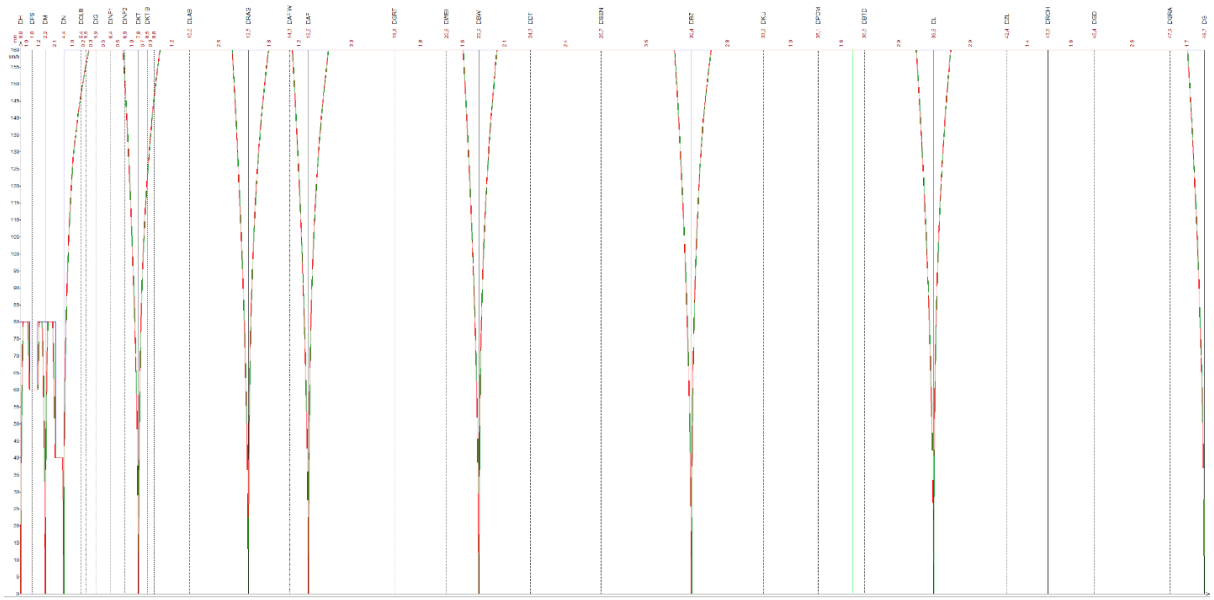
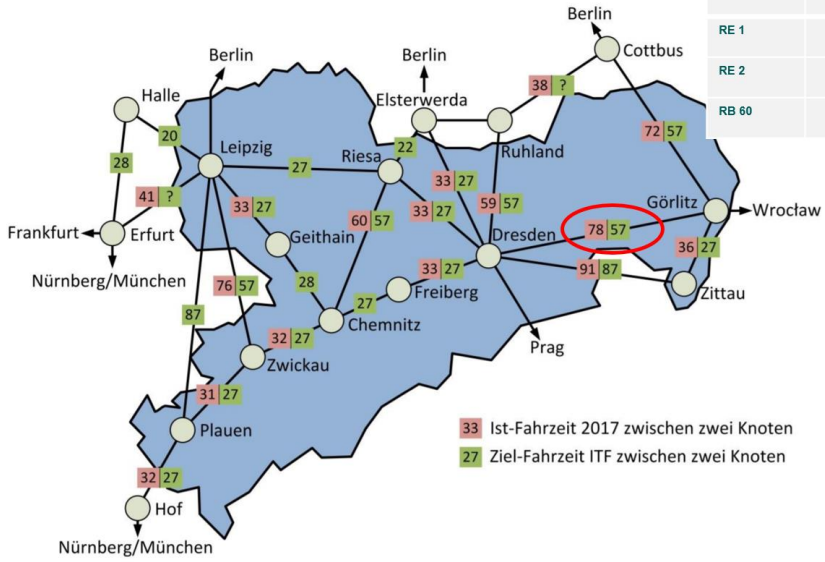


**Figure 5: Speed-profile graph of the RE 1 after electrification[27]**

The figure below shows the actual travel times and the target travel times between the main nodes which are required to implement the "Sachsen-Takt". On the relation Dresden – Görlitz a reduction of the maximum travel time between the main nodes of 21 minutes is necessary. At least on the fast express line (RE 1) the target travel time of 57 minutes can be realized by electrifying the track and increasing the permitted speed.




| Zugprodukt | Reisezeit 0-Fall | Reisezeit „Szenario 2020" | Reisezeit „Elektrifizierung" * | Abschnitt |
|---|---|---|---|---|
| RE 1 | 78 min | 78 min | 57 min | Dresden – Görlitz |
| RE 2 | 36 min | 36 min | 28 min | Dresden – Bischofswerda |
| RB 60 | 97 min | 97 min | 72 min | Dresden – Görlitz |

**Figure 6: Target network for implementation of the "Sachsen-Takt"[28]**

[27] Source: Railistics

[28] Ammended figure on basis of the report by the Strategy Commission for a efficient public transport in 2017

Aside from the importance of the electrification for implementing the "Sachsen-Takt", the track could also become more important for rail freight transport. With completion of the electrification works on the railway line Knappenrode (Saxony) – Horka – Neisse (German-Polish border) in December 2018 the gap towards Eastern Europe, that hinders the rail freight transport, is closed. The construction works of a cross-border double-track line between Horka (Germany) and Węgliniec (Poland) have already been finished in December 2016.[29]

After electrification and expansion of the track section Dresden – Bischofswerda – Görlitz this could be an important alternate route for the rail freight transport. This is why DB Netz sees this project as necessary and supports it. Therefore, the implementation of passing points with lengths of 1,200 m – 1,500 m is required. Furthermore, adjustments of safety systems on the track and in the train stations are necessary. Rastatt (near the German-French border) is a bad example, that showed how crucial diversion lines are for the rail freight transport in general but also for the German as well as for the European economy. As six out of nine TEN-T corridors go through Germany, it is in an outstanding position and thus an excellent transport infrastructure is crucial.

# 6. Intermediate scenario "2020"

It is highly likely that after the electrification of the Polish tracks towards Zgozelec there will be no more direct cross-border realtions because the train operation is much cheaper using electric railcars or locomotives than diesel ones.

As a result of an additional transfer at the train station in Görlitz, which causes longer travel times, decreasing passenger numbers in the cross-border transport can be expected. Thus, the percentage of the motorized individual traffic will increase and therfore lead to higher pollutant emissions.

In scientific literature the values for decline in demand are indicated at 10 % to 20 % when passengers need to do an extra transfer. That also means an increase in travel time. As it is yet to clarify if and how the Polish and German lines are to be connected and harmonized for this study asumptions were made. Even at the best possible synchronisation of the lines the travel time will increase by 20 minutes which is a 9 % longer travel time for the Dresden – Wrocław relation compared to the 0-case. Because of an assumed travel time elasticity of -0.575 there will be a decline in passenger numbers of 6 %. In total the additional transfer causes a decline in passenger numbers in cross-border traffic of 21 %, which corresponds to 13,000 annual passengers. These passengers will instead use their own cars leading to greater accident and environmental costs.

The annual travel time costs amount to approximately 195,000 €. Considering the framework conditions described in chapters 4.5 and 4.7 the accident costs and the costs resulting from a shift from rail to road account for 13.000 €. Economic costs will sum up to approximately 206,305 € each year.

Short-term solution approaches have to be developed to ensure the best possible connection of the Polish and German public transport systems so that the increase in travel time can be minimized. A possible solution could be a bus shuttle concept connecting the train stations of Görlitz and Zgorzelec. Therby the focus should not be on the economic efficiency but the important function for cross-border connectivity.

If there is no longer a direct cross-border connection without transfers this will have impacts on the region's cohesion and especially on the European spirit. As the majority of passengers using the Dresden-Wrocław-Express are tourists with heavy luggage and/or prams an extra transfer means additional effort and reduces the attractiveness of the relation significantly along with a decline in passenger numbers.

[29] https://www.verkehrsrundschau.de/nachrichten/schienengueterverkehr-lueckenschluss-nach-osteuropa-1859278.html

# 7. Calcultion of track capacities

The track capacity is one of the most critical factors when referring to the reliability of train connections. Highly frequented tracks are often associated with delays. With regard to the objective “shift to rail” approaches have to be developed so that tracks without spare capacities will be relieved.

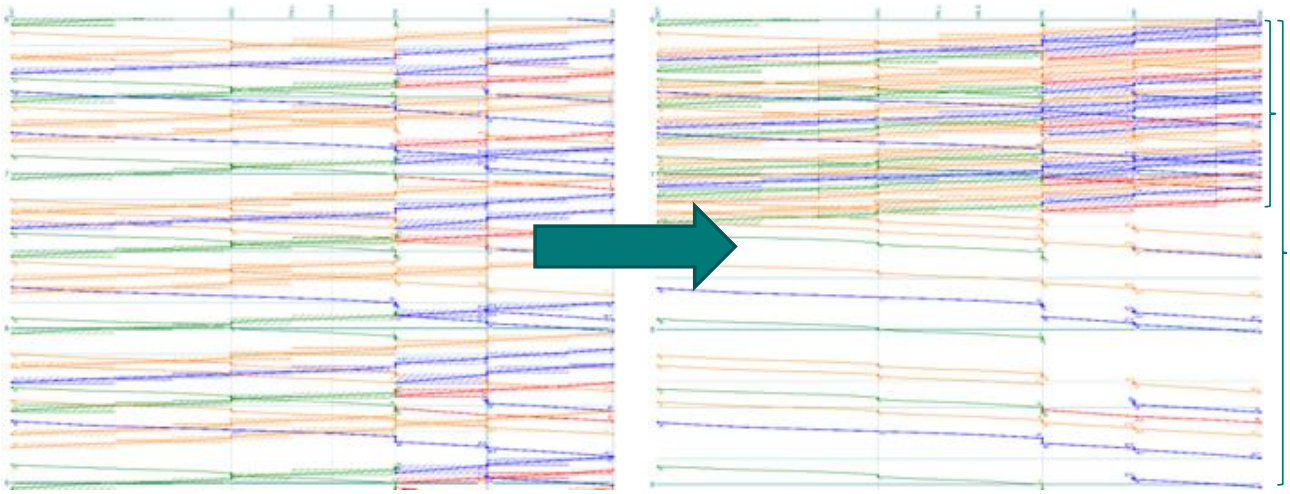
The track section between Dresden central station (Hbf.) and Dresden-Klotzsche is one of the most frequented sections in the study area and therefore the capacity of this section was investigated in this report.

The analysis of the track capacity was undertaken under consideration of the UIC 406 codex. Therby the train paths in a predefined period of observation are compressed which allows determining spare capacities and calculating the degree of occupancy of the tracks. The investigation was carried out with the timetable construction system FBS.

The calculations were based on the annual timetable of 2018. For the evaluation of the track occupancy according to UIC 406 codex following points had to be considered:

- Illustration of the annual timetable (only passenger transports)
- Compressing of train paths
- Determining the degree of occupancy (relation between occupied times to period of observation)
- Rating of the occupancy by comparing it to thresholds according to UIC 406

The following figure shows an illustrative overview for better understanding.

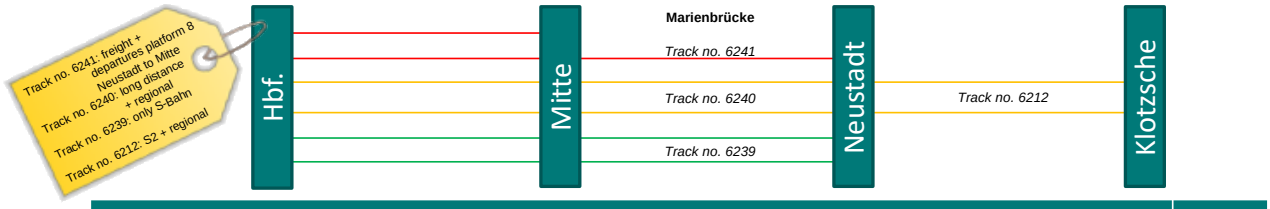


*Example: Train path according to time schedule* *Train paths compressed*

**Figure 7: Visual illustration of the methodology according to UIC 406[30]**

The investigation showed that the degrees of occupancy for the annual timetable 2018 did not exceed the capacity allowed. Thus, to the current state of knowledge the analysed track section has not reached the capacity limit and there are still spare capacities on the track. The findings are presented in the table below.

[30] Source: Railistics




| | Degree of occupancy with passenger trains | | | | | Threshold |
|---|---|---|---|---|---|---|
| 00:00 – 24:00 Uhr | 0,0 %<br>0,0 % | | 12,7 % | | ←<br>→ | 60 % |
| 06:00 – 09:00 Uhr | 0,0 %<br>0,0 % | | 18,0 % | | ←<br>→ | 75 % |
| 15:00 – 17:30 Uhr | 0,0 %<br>0,0 % | | 16,5 % | | ←<br>→ | 75 % |
| 00:00 – 24:00 Uhr | 30,1 %<br>20,7 % | | 14,1 %<br>26,3 % | 24,2 %<br>22,8 % | ←<br>→ | 60 % |
| 06:00 – 09:00 Uhr | 36,4 %<br>32,3 % | | 15,7 %<br>37,2 % | 33,3 %<br>30,1 % | ←<br>→ | 75 % |
| 15:00 – 17:30 Uhr | 40,6 %<br>28,9 % | | 19,0 %<br>38,1 % | 32,1 %<br>29,8 % | ←<br>→ | 75 % |
| 00:00 – 24:00 Uhr | | 21,8 %<br>19,2 % | | | ←<br>→ | 70 % |
| 06:00 – 09:00 Uhr | | 34,3 %<br>26,4 % | | | ←<br>→ | 85 % |
| 15:00 – 17:30 Uhr | | 31,9 %<br>29,7 % | | | ←<br>→ | 85 % |

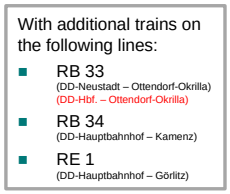
**Table 10: Degree of occupancy for the track section Dresden central station – Dresden Klotzsche (2018)[31]**

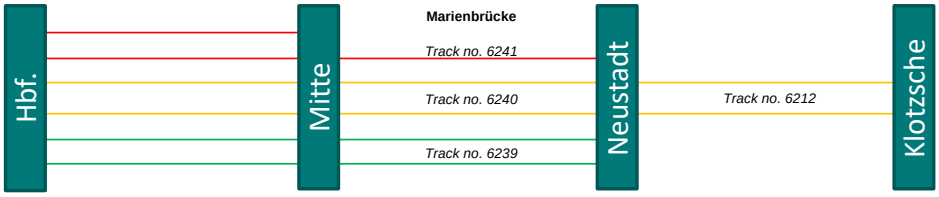
The Verkehrsverbund Oberelbe (VVO) and the ZVON both plan to order new trains for the lines RB 33 (Dresden-Neustadt – Königsbrück), RB 34 (Dresden central station – Kamenz) and RE 1 (Dresden central station – Görlitz). The DB Netz AG says these additional trains would overstress the track section Neustadt – Klotzsche.

That's why in a second step the annual timetable of 2018 was adjusted by including the new train paths orderd by the two transport associations and calculations were rerun. The results showed some train path conflicts which occured between the additional new trains (e.g. RE 1 and RB 33 between Klotzsche and Neustadt) as well as between trains from the annual timetable of 2018 (e.g. RB 60/61 and RE 15/18 between Neustadt and Central Station). This might be resulting because of different states of planning. For the study the train path conflicts were eliminated in order to make calculations possible. As the number of operating trains stayed the same the impacts on the results were marginal. Slight deviations in the calculated figures may be possible, if other solutions for eliminating the path conflicts are found.

Nevertheless, sound statements on the track occupancy can be made.

[31] Source: Railistics




| | Degree of occupancy with passenger trains | | | | Threshold |
|---|---|---|---|---|---|
| 00:00 – 24:00 Uhr | 0,0 %<br>0,0 % | | 21,8 % | ←<br>→ | 60 % |
| 06:00 – 09:00 Uhr | 0,0 %<br>0,0 % | | 28,0 % | ←<br>→ | 75 % |
| 15:00 – 17:30 Uhr | 0,0 %<br>0,0 % | | 29,6 % | ←<br>→ | 75 % |
| 00:00 – 24:00 Uhr | 39,2 % (48,5 %)<br>23,7 % (29,8 %) | | 10,4 % (19,5 %)<br>31,0 % (38,5 %) | 31,6 %<br>34,1 % | ←<br>→ | 60 % |
| 06:00 – 09:00 Uhr | 49,9 % (63,1 %)<br>32,1 % (40,5 %) | | 11,5 % (24,3 %)<br>42,1 % (52,7 %) | 42,7 %<br>44,2 % | ←<br>→ | 75 % |
| 15:00 – 17:30 Uhr | 52,1 % (65,3 %)<br>32,2 % (40,6 %) | | 13,6 % (26,2 %)<br>42,1 % (52,8 %) | 40,9 %<br>44,7 % | ←<br>→ | 75 % |
| 00:00 – 24:00 Uhr | | 21,8 %<br>19,2 % | | | ←<br>→ | 70 % |
| 06:00 – 09:00 Uhr | | 34,3 %<br>26,4 % | | | ←<br>→ | 85 % |
| 15:00 – 17:30 Uhr | | 31,9 %<br>29,7 % | | | ←<br>→ | 85 % |

**Table 11: Degree of occupancy Dresden central station – Dresden Klotzsche (with additional trains)[32]**

With additional trains on the lines RB 33, RB 34 and RE 1 the occupancy of these tracks increases but the thresholds according to UIC 406 are still not reached (see Table 11). The foreseen trains can operate on high quality standards. This counts for the number of trains, the assumed order and the driving characteristics implied, but it does not necessarily meet the exact time desired. The VVO also intends operating all trains of the line RB 33 beyond Dresden-Neusatdt further until Dresden central station. The degrees of occupancy for this case (written in red in Table 11) still do not push the limits, which means there are capcities left for an extension of the line.

# 8. Further steps and time horizon

In the period between November 2018 and spring 2019 concepts will be developed that aim on strengthening national and cross-border passenger rail transport between Saxony and Poland. Theses measures are also part of the action plan between Germany and Poland.

Furthermore, possibilities and requirements for the establishment of a culture train between Dresden and Wrocław will be evaluated. As a positive example there is the existing concept of a culture train between Berlin and Wrocław. This culture train runs every weekend between Berlin, Cottbus and Wrocław, which also was the European Capital of Culture in 2016. Because of its unique cultural program the culture train was awarded with the “European Cultural Brand Award 2017”. Passengers of the culture train are getting discounts in some overnight-stays, whereby an additional value is generated.[33]

The results of the investigation will be discussed with the project partners and options for a near-term establishment will be pointed out and developed.

[32] Source: Railistics

[33] https://www.vbb.de/de/article/wissenswertes/vbbland-und-polen/kulturzug-nach-breslau-wroc-aw/689252.html

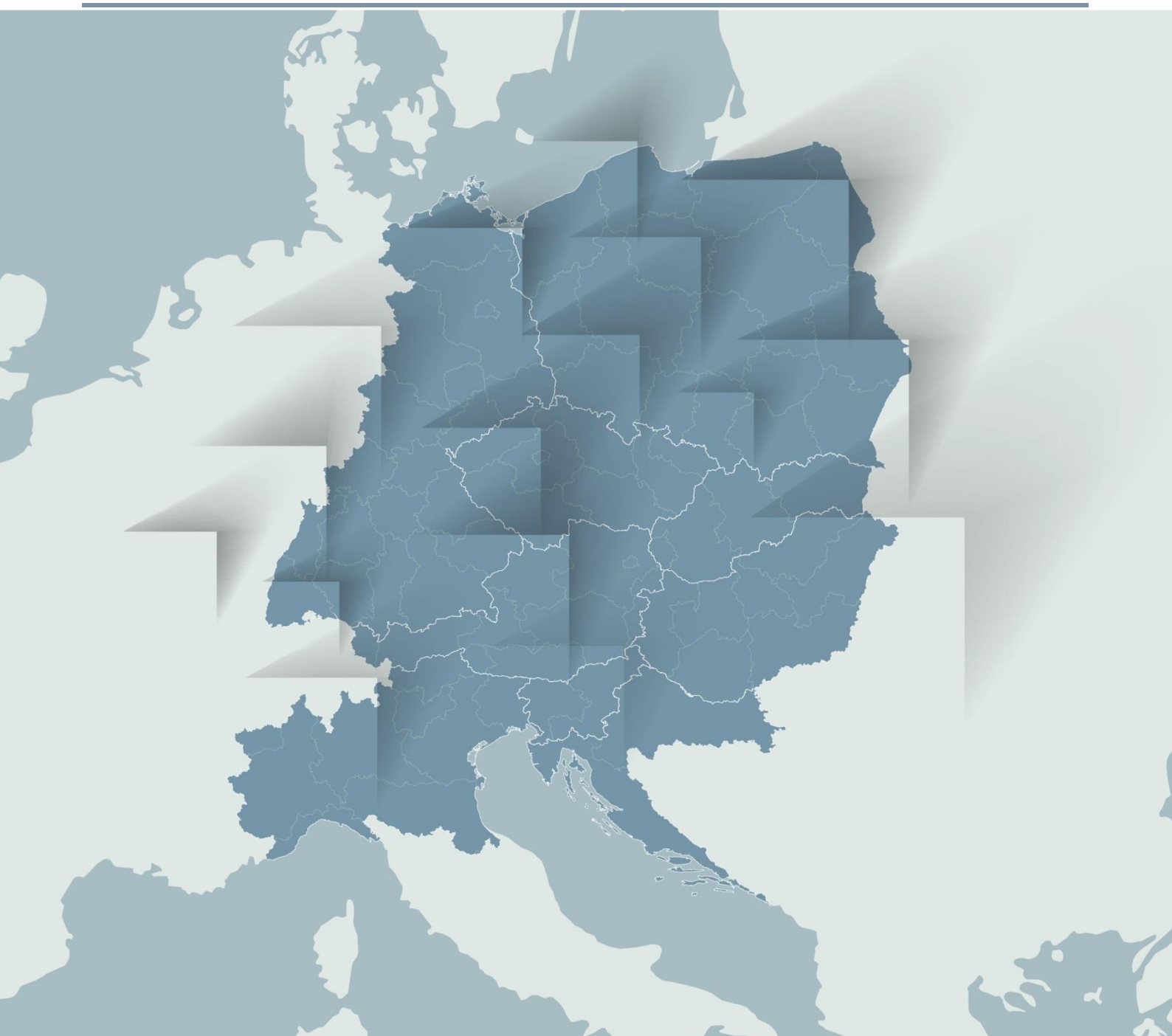
# REALIZATION IMPROVED PASSENGER TRANSPORT

**Delivery to the pilot implementation of improved passenger transport to TEN-T nodes - Railway line Dresden-Wroclaw**

**D.T.2.3.4**

**Final**

**12 2019**



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# 1. Motivation

TRANS-BORDERS aims to improve the accessibility of the TEN-T corridors and their nodes for the more remote border regions. The accessibility of these TEN-T nodes is to be improved not only at the national level but also at the cross-border level.

Nine partners from five countries and two border regions are to look for solutions to achieve substantial improvements for the citizens of the border regions by improving the accessibility of the TEN-T corridors.


**Picture 1: Partnership of TRANS-BORDERS at the Kick-off meeting in Dresden 2016**[1]

The railway connection between Dresden and Wroclaw is the most important public transport connection in the border region of Saxony-Lower Silesia. The problems on this route are complex and do not contribute to significantly improving the attractiveness of the region. Long-distance transport was discontinued in 2016 and there are only local transport connections.

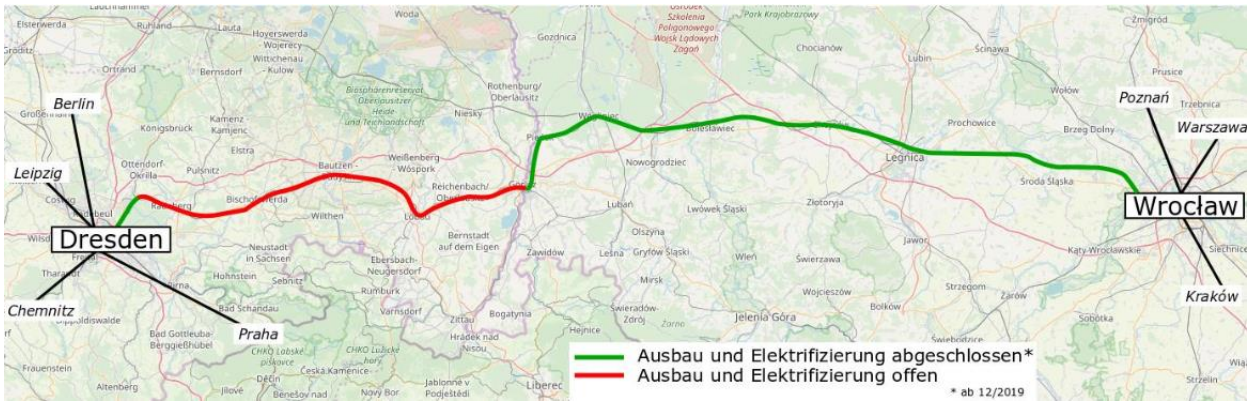
Since December 2004, there has been no long-distance connection with long-distance trains between Wroclaw and Dresden, and the regional authorities responsible for public local transport on both sides of the border have made great efforts to compensate for this deficit with cross-border regional transport services. For this purpose, the orders and the financing of the transport services were coordinated.

The following problems, among others, are connected with this:

- Too many stops on the way with overall too long total travel times due to the regional train character
- Financing is not sustainably secured (different tender periods)
- Limited availability of registered vehicles, which in turn do not offer the same level of comfort as a long-distance service

[1] Source: Saxon State Ministry for Economic Affairs, Labour and Transport

The project aims to identify various measures to significantly improve the rail connection between the two cities. The connection is shown in the map below.




**Picture 2: Railway line Dresden - Wroclaw**[2]

[2] Source: ZVON

# 2. Pilot and the Regional Action Plan

For the region, Saxony - Lower Silesia a regional analysis was carried out and the results were described in a process of joint evaluation and addressed the need for actions. The electrification of the railway line "Görlitz - Dresden" is of central importance for East Saxony, the Görlitz node and cross-border traffic. In addition to the faster accessibility of the TEN-T node Dresden, electric train operation between Wrocław and Dresden would also be possible.

Fast trains with few stops between the TEN T nodes are the key to increasing demand. This will make it possible to classify this route as a genuine long-distance service and to use the regionalization funds previously used to order this connection for its actual purpose - strengthening the region.

Although the Polish route has been extensively reconstructed on the Polish side - electrified and double-tracked - the speed of travel for passengers in the direct connection is insufficient. The reason for this is the financing of the Dresden-Wrocław connection from funds that are actually to be used for regional transport. This results in a high number of stops with the disadvantage of travel time losses. Furthermore, the linkage of regional products with a long-distance connection leads to conflicts in connection design.

In accordance with the development logic, the regional analysis was supported by a joint regional action plan. Various measures were defined by the project partners.

The joint aim of actions is the permanent establishment of high-quality and sustainably financed rail passenger transport between the Free State of Saxony and the Lower Silesian Voivodeship. In order to create the necessary conditions for this, it is necessary to sensitize different groups of decision-makers and stakeholders to the topic and to accelerate or implement corresponding decision-making processes. The focus should be on this:

- a high-quality rail connection Dresden-Wroclaw
- sustainable solutions for financing international rail passenger transport
- the creation of a future discussion and decision-making format for issues relating to international public passenger transport and
- the development of a joint pilot project.

The following measures will be jointly developed within the Trans-Borders project:

- Addressing the topic of rail passenger transport between Saxony and Lower Silesia on a political level (decision-makers)
  - Joint Statement for the 38th Meeting of the Committee for Cross-Border Cooperation of the German-Polish Government Commission for Regional and Cross-Border Cooperation (2019)
  - Prime Minister of the Free State of Saxony and Marshal of the Lower Silesian Voivodeship
  - Transport Minister of Saxony and Lower Silesia
  - Specialist department/departments of the state ministries
- Addressing the topic of rail passenger transport between Saxony and Lower Silesia at a technical level

- Special purpose public transport associations
- Rail transport companies (DB Regio AG, Die Länderbahn, ODEG, KD)
- Infrastructure manager (DB Netz AG, PKP Polskie Linie Kolejowe (PLK) S.A.)
- Euroregion
- Lobby associations (Verband der Deutschen Verkehrsunternehmen e.V. (VDV), Passenger Association (Pro Bahn), German-Polish Rail Passenger Transport Initiative)
- Tourism associations (Landestourismusverband Sachsen e.V., tourism association Upper Lusatia-Lower Silesia, tourism association Elbland Dresden)
- Trade associations (Chamber of Commerce (IHK Dresden), Lower Silesian Chamber of Commerce (Dolnośląska Izba Gospodarcza)
- Lower Silesian Chamber of Crafts (Dolnośląska Izba )
- German-Polish Chamber of Industry and Commerce (Polsko-Niemiecka Izba Przemysłowo Handlowa)
-

- Sustainable solutions for financing cross-border rail passenger transport
  - Model for ensuring the long-term financing of high-quality cross-border rail passenger transport
  - Adapted to the stages of development
- Evaluation of possible coordination formats for issues relating to cross-border public transport
  - Responsibilities
  - participants
  - organizational form

# 3. Pilot details

## 3.1. Current situation

The Polish section on the Dresden-Wroclaw railway line has been continuously electrified between Wroclaw and Zgorzelec since 2019. The Lower Silesian railway company Koleje Dolnośląskie (KD) has procured electric multiple units for this purpose (only Polish power and signaling system). The trains are much more comfortable and faster. However, the shorter journey times on the Polish side will be compensated for on the entire Wroclaw-Dresden line by the additional changeover at the border.

Therefore, the most urgent task for the Saxon side is the electrification of the railway line Dresden-Görlitz-Zgorzelec. In addition, transitional solutions to improve the quality of the cross-border connection are to be found. In the meantime, all conceivable measures are to be taken to secure and accelerate the electrification of the Dresden-Görlitz state borderline. Thus, a changeover from continuous, direct diesel line to electric traction between Wroclaw and Zgorzelec took place with the timetable change 2019/20. Cross-border journeys force a change in Zgorzelec.

The approval of infrastructure projects in the German rail network is the responsibility of the Federal Government, based on inclusion in the Federal Transport Infrastructure Plan. The Free State of Saxony has applied several times for the inclusion of the project in the Federal Transport Infrastructure Plan, without success. In 2018, the federal government initiated an electrification program for the railways with the aim of further reducing CO2 emissions. In this case, too, the railway connection was not taken into account.

In autumn 2019, the financing of the electrification was finally secured. In the future, it will be based on the Structural Strengthening Act, which was submitted to the German Bundestag as draft 19/13398. The Structural Strengthening Act supplements the future law on Germany's coal phase-out (draft in the German Bundestag 19/9920).

The implementation will essentially take place in two stages:

- First, the electrification of Zgorzelec – State border - Görlitz (probably until 2025/26) will be started, which means that the station Görlitz will be electrified.
- In a second stage the section Görlitz - Dresden will be electrified (until 30).

In July 2013, the Saxon state government announced that it intended to commission the preliminary planning for electrification, on the basis of which the Working Group on Economics and Transport had already decided at the end of 2012 that Saxony would provide a total of four million euros for the expansion planning in 2013 and 2014. In June 2015, the Saxon State Ministry of Economics, Labour and Transport informed that the Free State of Saxony had signed the planning agreement for work phases 1 and 2 of the electrification of the Dresden-Görlitz federal border and handed it over to Deutsche Bahn AG. The Free State of Saxony will bear the planning costs of ten million euros, seven million euros of which are for phase 2. After the basic evaluation in 2015, the preliminary planning was put out to tender in April 2017 and will be implemented between August 2017 and November 2019. A continuation is being sought.

Until the final completion of electrification (planned for 2030), possible solutions are currently being sought under the new conditions. The polish side will not accept any offers with diesel multiple units on

its electrified tracks on this line in future. In order to enable a continuous cross-border offer without passenger changeover, different variants were examined. In this respect, a UN investigation has shown that hybrid/bimodal drive concepts are not an interim alternative to the electrification of Dresden-Görlitz, as one of the main objectives is to connect the cities of Bautzen and Görlitz to national and international long-distance traffic.

The subject of the Dresden-Wroclaw railway line is to be further institutionalized. It should become an integral part of the work of a joint EGTC, whatever form it takes. The intention is for the Saxon task bearers to join the German-Polish EGTC Novum, or for the creation of a separate tri-national EGTC Saxony / Lower Silesia / Liberec region. Furthermore, the topic has been successfully established as an essential component of future tasks at the board "Oder partnership round table". This step will essentially help in joint coordination and especially in the search for best practices in German-Polish public rail transport. Best practices are available in the federal states of Berlin-Brandenburg and Mecklenburg-Western Pomerania Measures, all members on this board

## 3.2. Needs and efforts

With the new situation on both sides of the border between Saxony and Lower Silesia, there are questions for the future, which have to be solved to ensure a smooth transition until the final electrification.

Main Problems which must be solved due to the miss of electrification:

- Different financing solutions during the project
- Changes of timetables
- Ongoing electrification on the Polish side (Zgorzelec - State border)
- Various time horizon at Deutsche Bahn
- changing demands on the trains
- Different views on the section Görlitz - state border between SMWA, UMWD, Federal Government, Railway and Polish Ministry of Transport

The following problems must be solved relatively rapidly:

- Coordination of timetables with the new transfer situation in Zgorzelec
- Identification of improvements by securing connections in Zgorzelec as well as the examination of a complimentary offer on the Saxon side to the Polish Sprinter train. With the 2019/2020 timetable change, the use of Sprinter trains on the Polish side between Wroclaw and Zgorzelec resulted in a reduction in journey times of up to 21 minutes. The number of intermediate stops on this route is reduced from 325 to 19 (see table 1)
    - if necessary, financing by using the top-up from the Municipal Transport Financing Act GVFG (The GVFG federal programme will be expanded to 665 million in 2020 and raised to one billion from 2021. The previously necessary amendment to the Basic Law was made on 28 March 2019. As part of a climate protection programme presented in September 2019, the German government intends to increase the GVFG funds to two billion euros per year from 2025.)

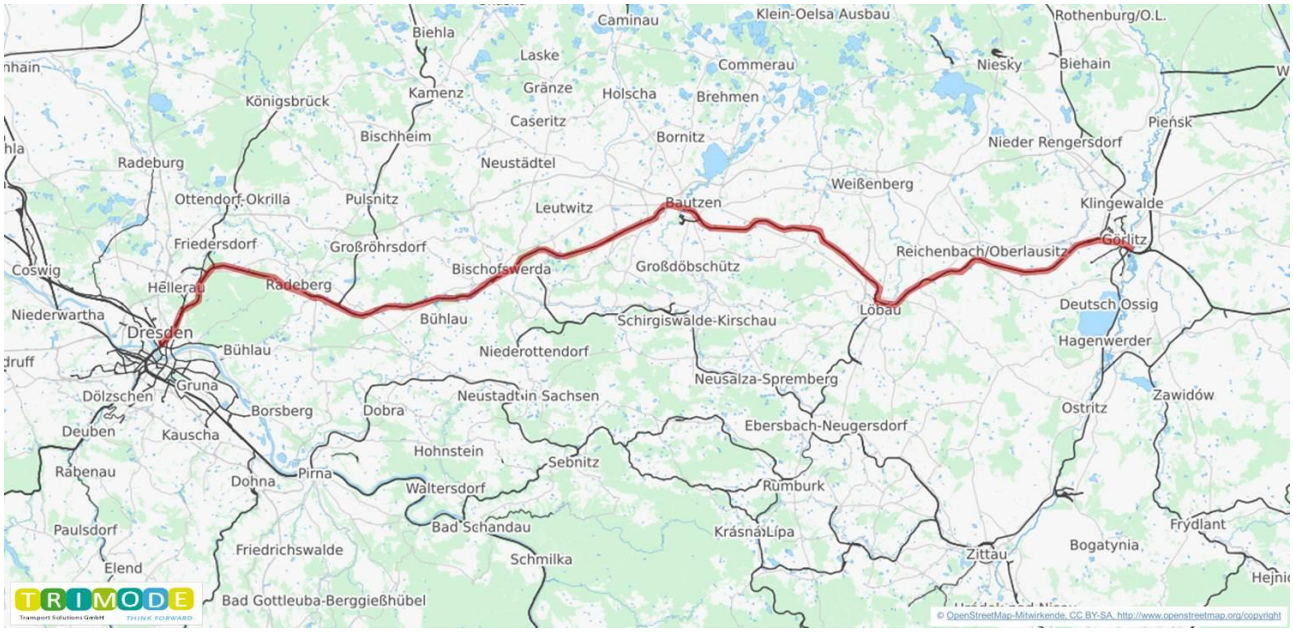
| Travel time comparison Wroclaw - Zgorzelec | |
|---|---|
| Travel time 02:14 | Travel time 01:53 |
| ***Stations*** | ***Stations*** |
| Wrocław Główny | Wrocław Główny |
| Wrocław Muchobór | Wrocław Muchobór |
| Wrocław Nowy Dwór | Wrocław Nowy Dwór |
| Wrocław Żerniki | |
| Wrocław Leśnica | Wrocław Leśnica |
| Mrozów | |
| Miękinia | Miękinia |
| Przedmoście Święte | |
| Środa Śląska | Środa Śląska |
| Malczyce | Malczyce |
| Szczedrzykowice | |
| Jaśkowice Legnickie | |
| Legnica | Legnica |
| Jezierzany | |
| Miłkowice | Miłkowice |
| Chojnów | Chojnów |
| Osetnica | Osetnica |
| Okmiany | Okmiany |
| Tomaszów Bolesławiecki | Tomaszów Bolesławiecki |
| Bolesławiec | Bolesławiec |
| Zebrzydowa | Zebrzydowa |
| Zagajnik | Zagajnik |
| Węgliniec | Węgliniec |
| Pieńsk | Pieńsk |
| Jędrzychowice | Jędrzychowice |
| Zgorzelec Miasto | Zgorzelec Miasto |
| Zgorzelec | Zgorzelec |

**Table 1: Travel time comparison Wroclaw - Zgorzelec[3]**

[3] Source: www.rozklad-pkp.pl

The following issues and problems need to be addressed in the medium term:

- Examination of funding opportunities for the procurement of multi-system vehicles in Germany for the period after completion of electrification
- Close coordination with the infrastructure operator DB Netz and the Federal Ministry of Transport BMVI with regard to construction times, as the planned completion date of 2030 coincides with the new tender for ZVON transport
- Check of a procurement solution analogous to VMS (i.e. ZVON procures the vehicles and only tenders their operation)
- Solution for sustainable or at least synchronized financing of cross-border transport services (depending on the legal situation in Poland)
- Joint efforts by the Saxon State Ministry for Economic Affair, Labour and Transport and the Marshal's Office of the Lower Silesia Voivodeship to find long-distance transport provider, including for the period up to full electrification, as this is not within the remit of the regional authorities responsible for local public rail transport




**Picture 3: Railway line Dresden - Bautzen - Görlitz - State border[4]**

[4] Source: https://www.bvwp-projekte.de/schiene/2-029-V01/2-029-V01.html

# 4. Public involvement

## 4.1. Stakeholders involved

Working on the pilot inevitably requires the involvement of stakeholders, based on the specification alone. The stakeholders are from different areas. For example from politics, besides the ministries also the parliaments, the Saxon state parliament, and the German Bundestag. Individual members of parliament, who are members of the respective transport committees of the parliaments, were regularly informed and involved. Mr. Stepahn Kühn, Member of the German Bundestag, has made the topic of the pilot his own and invited it to a round table discussion in Görlitz in the spring of 2018. All relevant stakeholders and decision-makers were involved.

By far the greatest influence was achieved by the involvement of the Prime Minister of Saxony and the Lower Silesian Marshal. At the same time, the pilot could be placed as a permanent topic at the German-Polish Rail Summit, which meets regularly.

In the last phase of the project, the project and the pilot were successfully placed in the expert group of the "Round Table Transport" of the German-Polish Oder partnership.

In the end, it was successful in addressing the issue of the pilot, the improvement of the Dresden-Breslau connection, to the stakeholders

## 4.2. Target groups reached

For the adjustment to the target groups, it is important to differentiate between rail transports. Broad sections of the public associate the topic with an express train connection between Dresden and Wroclaw. The pilot is only partially suitable for resuming this connection. What is meant is to develop suitable measures to achieve faster continuous electrification of the line. But the project is not suitable for generating offers for rail transport that is the responsibility of the market participants, the railway operators.

The other target groups are the inhabitants of the border region of Eastern Saxony and the social actors in this region. These groups were specifically addressed and given the opportunity to participate, for example at the midterm conference of the project. In addition, the pilot topic was presented to the general public at the Konventa 2019 trade fair in Löbau and at the Three-Border-Day DE/PL/CZ 2019 near Zittau.

Various Facebook channels were used for social media. The specialist content was prepared and distributed on the accounts of TRANS_BORDERS and those of the project partners ZVON and Bolesławiec.