Success Factors of the German High Speed Rail System

DB International GmbH
Ottmar Grein
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Ottmar Grein

Personal Data
- **Professional Experience:** >30 Years
- **Position:** Senior Expert
- **Languages:** German, English

Core Competences and Projects
- **Core Competences**
  - Development of transportation concepts
  - High Speed Rail systems
  - Feasibility studies

Education and Professional Experience
- **Education**
  - Civil Engineer (transportation) at Technical University of Darmstadt

- **Professional Experience**
  - Since 1981 project manager and consultant at DB International GmbH Frankfurt

Projects (excerpt)
- Commissioning of new railway lines in Germany
- Management of the commissioning of Lötschberg-Basistunnel (Switzerland)
- Feasibility study for a High Speed Rail system in Norway
- Feasibility study for a High Speed Rail system in the Québec-Windsor Corridor (Canada)
- High Speed Rail system consulting for the HS2 project (UK)
The integration of ICE traffic into the long-haul network is mostly due to the polycentric settlement structure in Germany.

Characteristics of population structure in Germany:

- Several urban regions instead of one
- Few large and numerous medium- and small sized points of origin spread across the entire country
- Densely-populated urban areas prevent exclusive focus on point-to-point services
The settlement structure in Germany has immediate implications for long-haul rail traffic

High Speed Network in Germany 2014

A large number of access points for long distance network as a condition for sufficient utilisation of national travel demand potential
Our long distance train network for Germany – We serve the Country with high quality railway services

Legend:
- ICE Line every hour
- ICE Line every 2 hours
- ICE Line every 4 hours
- Single ICE Trains
- System Stops

ICE Lines:
- Linie 10
- Linie 11, 31
- Linie 12, 91
- Linie 20
- Linie 22, 90
- Linie 25, 79
- Linie 28, 43
- Linie 41, 83 (TGV)
- Linie 42
- Linie 45, 82, 90 (Railjet)
- Linie 49, 76
- Linie 50, 80 (THALYS)
- Linie 75, 78, 87
Shortened travel times are essential success factor of ICE; Attractive travel times allow high market shares

Travel times from Frankfurt to:

- Hannover: 02:19 03:21
- Hamburg: 01:18 02:11
- Stuttgart: 01:18 02:11
- Zürich: 02:11 03:55 06:11
- München: 03:10 04:30
- Berlin: 04:06 (03:29) 07:40
- Köln: 01:10 02:14
- Brüssel: 03:06 05:17
- Amsterdam: 03:56 05:08

Rail market shares Passenger transport in Germany

- All O&Ds
- Frankfurt - Stuttgart
- Frankfurt - Hamburg
- Frankfurt - Munich
- Frankfurt - Berlin

- Market share rail
- Market share all other modes

2009 | 1990

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Passenger Intermodality is the key for HSR networks

- Interchange Stations to link with Feeder Systems
- Direct connection of airline hubs by rail
- Park & Rail facilities for commuters
- Car Rental / Car sharing at station
- New ticket systems, e.g. Integrated City Transit & HSR tickets
In the beginning there was mixed traffic.

Mixed traffic in 1825
Development of a High Speed Network

1970  First ideas for a nation-wide 300 km/h High Speed network including upgrading of existing lines for 200 km/h operation

1973  First transport master plan including the HSL Hannover-Würzburg and Mannheim-Stuttgart

1975  Priority for freight operation on new lines for economical and capacitive reasons. Operation with loco hauled passenger trains at 200 km/h and all kind of freight trains.

1984  Decision for High Speed: ICE trains at 250 km/h and freight trains at 80 km/h.
Mixed Traffic on High Speed Lines in Germany

German High Speed Network – Mode of Utilization

ABS 2004
$V_{\text{max}} = 230 \text{ km/h}$
Mixed Traffic

NBS 1998
$V_{\text{max}} = 250 \text{ km/h}$
Mixed Traffic

NBS 2006
$V_{\text{max}} = 300 \text{ km/h}$
Local and High Speed Passenger Trains
Optional Light Freight

NBS 2002
$V_{\text{max}} = 300 \text{ km/h}$
High Speed only

NBS 1991
$V_{\text{max}} = 250/280 \text{ km/h}$
Mixed Traffic
Day: High Speed
Night: Freight

NBS 2002
$V_{\text{max}} = 250 \text{ km/h}$
Mixed Traffic

Green: upgraded conventional lines (ABS)
$V_{\text{max}} = \text{up to 200 km/h}$
Mixed Traffic on High Speed Lines in Germany

InterCity Cargo Express, 160 km/h (1988)

LZB, Axle load only 18 t

At present: PIC
Mixed Traffic on High Speed Lines in Germany
Dimensioning of Mixed Traffic Lines

NBS Hannover - Würzburg (1991): High Speed + Freight Trains

NBS Köln - Rhein/Main (2001): High Speed 300 km/h
Mixed Traffic on High Speed Lines in Germany
Impacts On Infrastructure Cost

Construction cost of several High Speed Lines and the corresponding share of bridges and tunnels

Construction cost per km (m€)

% Tunnels and Bridges
Mixed Traffic on High Speed Lines in Germany
Capacity as a Function of Different Speeds And Train Mixture

12 trains per hour

5 trains per hour
Mixed Traffic on High Speed Lines in Germany
Train Distribution on the Hannover – Würzburg Line

Göttingen – Kassel section, 2003

Red: High Speed trains
Dark blue: freight trains

Maintenance windows
hours 4 to 5 and 5 to 6 respectively

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Construction and operation of mixed traffic High Speed Lines show advantages but also disadvantages compared to passenger dedicated lines:

+ Higher capacity and shorter transport time for freight trains,
+ Better utilization of expensive infrastructure (higher revenues),
- Reduction of line capacity without segregation of fast and slow trains,
- Higher infrastructure cost in mountainous areas,
- Less time slots for maintenance.
Target: Finalized HST-network in 2025

Under construction:
- Nürnberg – Erfurt – Halle/Leipzig
- Karlsruhe – Basel
- Stuttgart 21
- Stuttgart – Ulm

Planned:
- Hamburg/Bremen – Hannover
- Frankfurt – Fulda
- Rhein/Main – Rhein/Neckar

200 to 230 km/h
250 km/h and more
VDE 8 NBS/ABS Nürnberg – Erfurt / NBS Erfurt – Halle/Leipzig
VDE 8.2 NBS Erfurt – Halle/Leipzig

Length of line: 123 km
Design speed: 300 km/h

Trackwork: Slab track
Tunnels: 3 (total length 15.4 km)
Bridges: 6 (total length 14.4 km)

Commissioning: 2015
(Gröberts-Leipzig since 2003)

Total costs: 2.7 Bil. €

Running times:
Erfurt – Halle: 31 min (today 77 min)
Erfurt – Leipzig: 39 min (today 66 min)
VDE 8.2 NBS Erfurt – Halle/Leipzig
VDE 8.2 NBS Erfurt – Halle/Leipzig
VDE 8.1 ABS/NBS Nürnberg – Erfurt

Length of line 190 km
Thereof NBS 107 km

Design speed
NBS 300 km/h
ABS 230 km/h

Commissioning 2017

Total costs 5.3 Bil. €

Running times
Nürnberg-Erfurt 66 min
(today via Fulda 172 min)
Reduction of Travel Times by VDE 8

<table>
<thead>
<tr>
<th>Route</th>
<th>Today</th>
<th>New</th>
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<tbody>
<tr>
<td>Berlin – Munich</td>
<td>6:00</td>
<td>4:15</td>
</tr>
<tr>
<td>(Sprinter)</td>
<td>3:45</td>
<td>3:45</td>
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<tr>
<td>Leipzig – Frankfurt</td>
<td>3:30</td>
<td>3:00</td>
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</table>
Improved international rail service on various corridors – on main lines product upgrade to ICE

**International services DB Fernverkehr**

**Status:** schedule year of 2010

**Figures:** number of daily connections in day traffic

- Significant enhancements in past years

### Projects realized

#### 2007-2008

- 2-hourly ICE T service Stuttgart-Zürich
- Extension of services to Switzerland via Basel
- ICE service to Denmark with direct link Berlin
- High-speed services to Paris by ICE/TGV
- 2-hourly ICE T service Frankfurt-Vienna

#### 2009-2010

- 3 additional connections Berlin - Amsterdam
- Double frequencies Munich-Vienna, railjet launch
- New direct connections to Klagenfurt/Graz
- Acceleration of ICE services to Brussels
- 2-hourly IC bus Nuremberg – Praha
- Restructuring of Brenner services to Italy with ÖBB/FNM – including launch of marketing unit

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**Schedule Year**

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<thead>
<tr>
<th></th>
<th>Copenhagen</th>
<th>Prague</th>
<th>Warsaw</th>
<th>Poznan</th>
<th>Berlin</th>
<th>Paris</th>
<th>Brussels</th>
<th>Amsterdam</th>
<th>Basel</th>
<th>Bern</th>
<th>Zürich</th>
<th>Budapest</th>
<th>Zagreb</th>
<th>Klagenfurt</th>
<th>Pristina</th>
<th>Poznan</th>
<th>Graz</th>
<th>毳cale</th>
<th>2-hourly IC bus Nuremberg – Praha</th>
<th>Restructuring of Brenner services to Italy with ÖBB/FNM – including launch of marketing unit</th>
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<td>1</td>
<td>6-7</td>
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<td>6</td>
<td>5</td>
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<td>4</td>
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<td>4</td>
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<td>2-hourly ICE T service Stuttgart-Zürich</td>
<td>Extension of services to Switzerland via Basel</td>
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<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>3 additional connections Berlin - Amsterdam</td>
<td></td>
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</tbody>
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DB International GmbH, 15.05.2014
Improved international rail service on various corridors
Thank you

Dipl.-Ing. Ottmar Grein

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