



# MIXED TRAFFIC ON HIGH SPEED LINES IN GERMANY

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DB International GmbH

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Ottmar Grein

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Warszawa, 25.02.2014

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# High Speed Rail Senior Consultant Ottmar Grein

## Personal Data

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



## 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

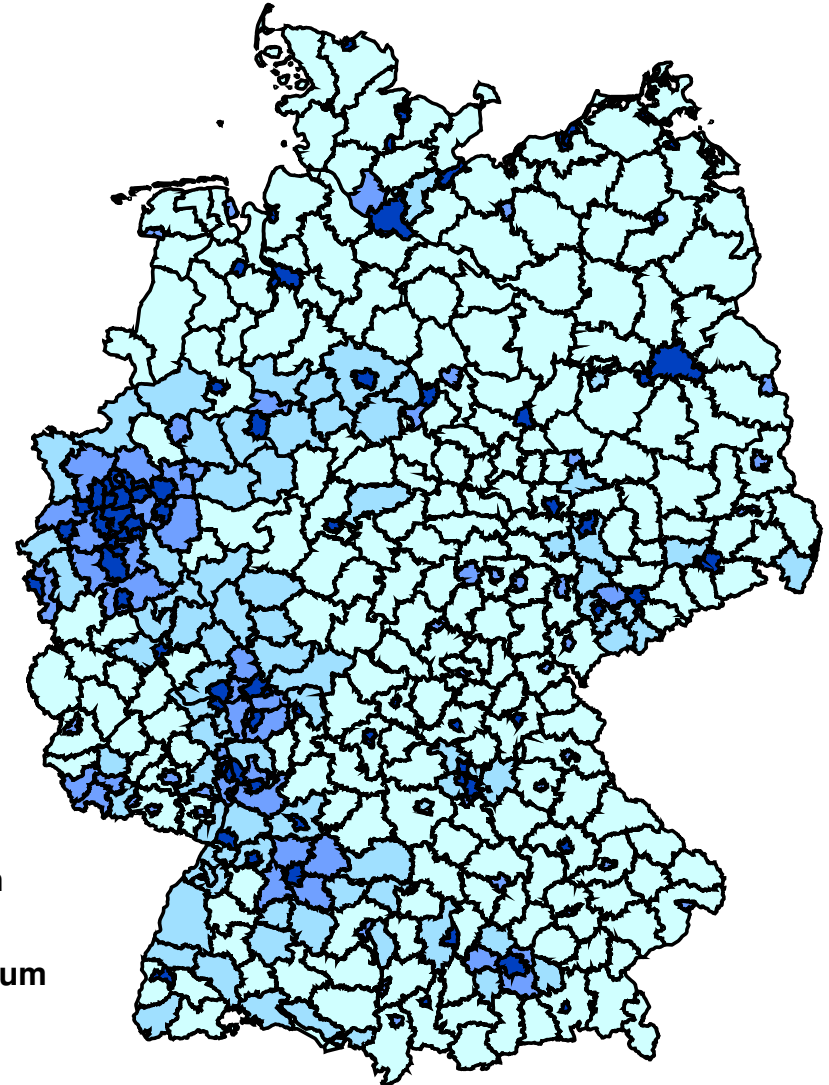
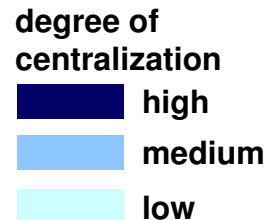
## Core Competences and Projects

- **Core Competences**
  - Development of transportation concepts
  - High Speed Rail systems
  - Feasibility studies
- **Projects (excerpt)**
  - Commissioning of new railway lines in Germany
  - Management of the commissioning of Lötschberg-Basetunnel (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:

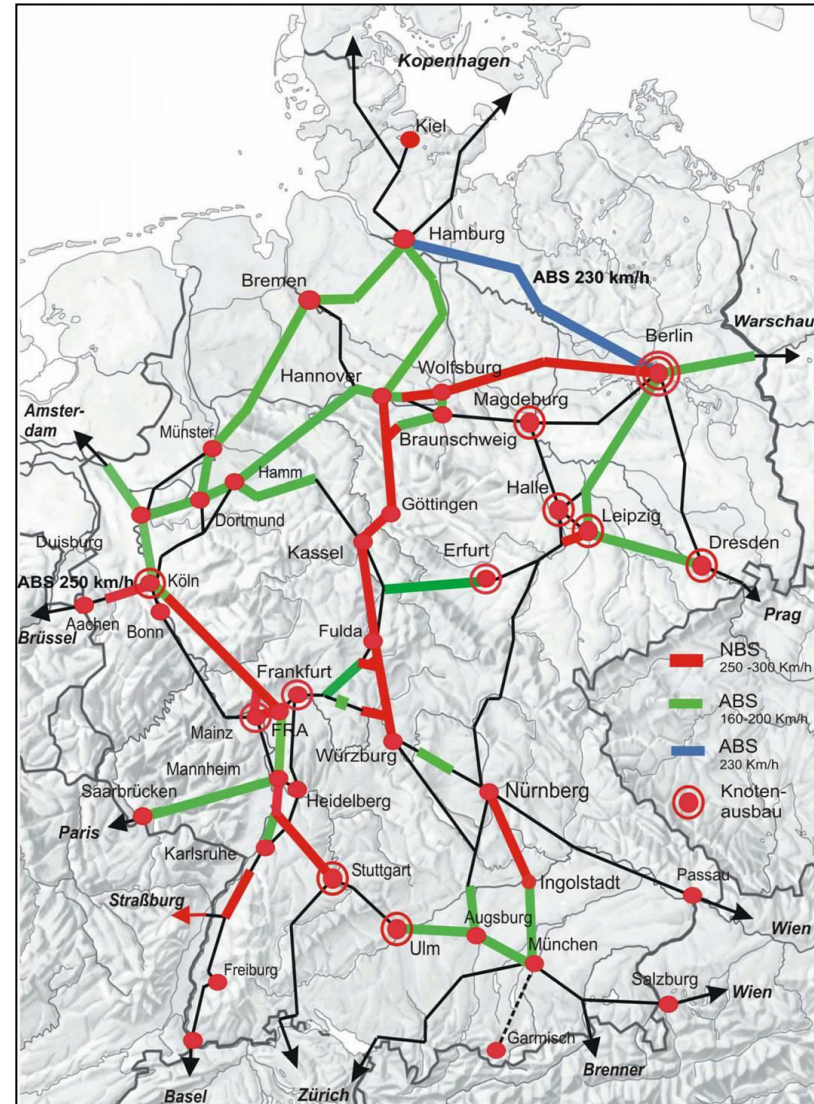
- Several urban regions instead of one
- Few large and numerous medium- and small sized points of origin spread across the entire country
- Densely-populated urban areas prevent exclusive focus on point-to-point services



# The settlement structure in Germany has immediate implications for long-haul rail traffic






## High Speed Network in Germany 2009

A large number of access points for long distance network as a condition for sufficient utilisation of national travel demand potential
















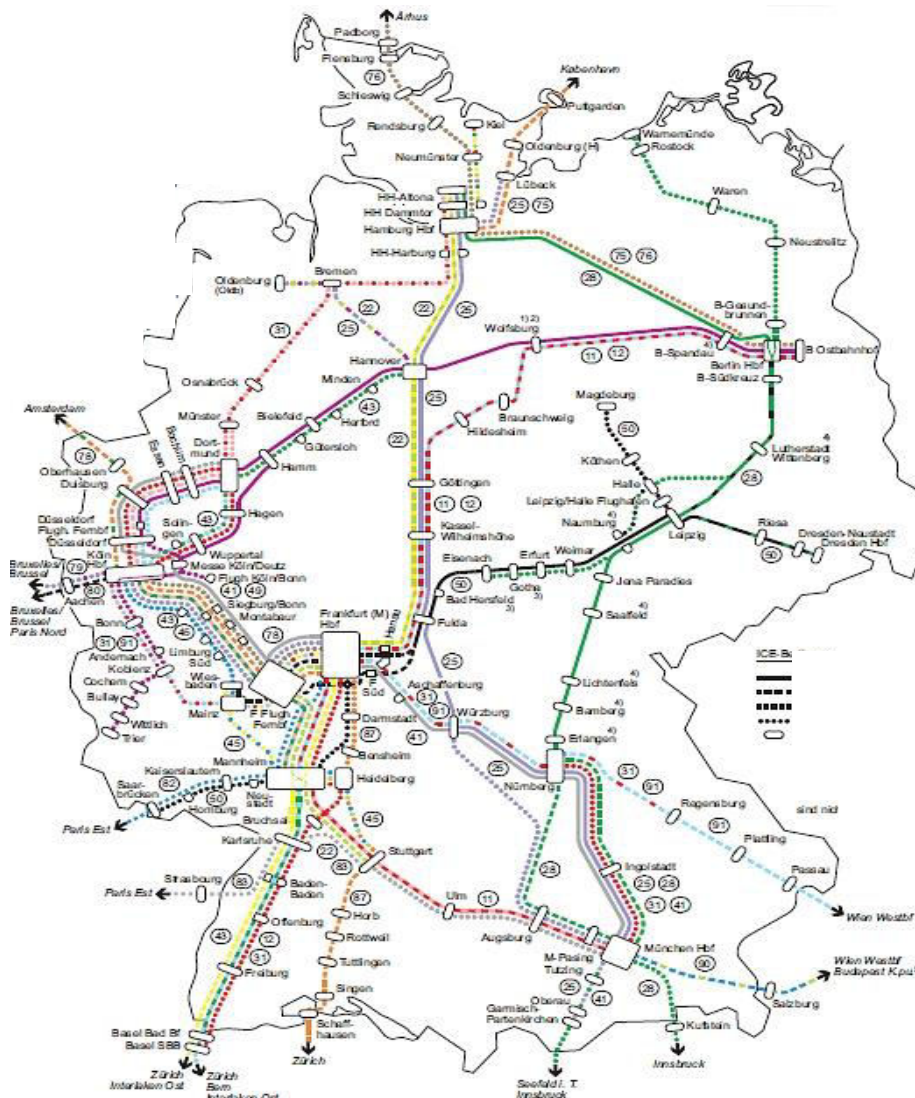
# Our long distance train network for Germany – We serve the Country with high quality railway services

## Legend:

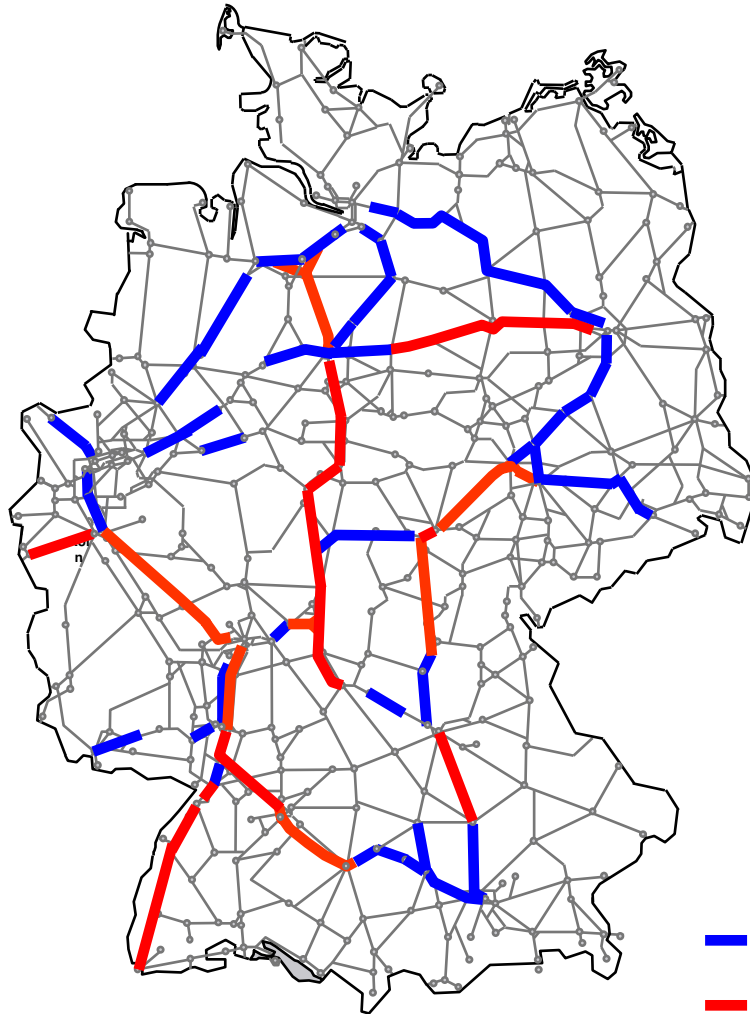
-  ICE Line every hour
-  ICE Line every 2 hours
-  ICE Line every 4 hours
-  Single ICE Trains
-  System Stops

## ICE Lines:

-  Linie 10
-  Linie 11,31
-  Linie 12, 91
-  Linie 20
-  Linie 22, 90
-  Linie 25, 79
-  Linie 28, 43<sup>6)</sup>
-  Linie 41, 83 (TGV)<sup>8)</sup>
-  Linie 42
-  Linie 45, 82, 90 (Railjet)
-  Linie 49, 76
-  Linie 50, 80 (THALYS)
-  Linie 75, 78,<sup>7)</sup> 87



# Target: Finalized HST-network in 2025



## Under construction:

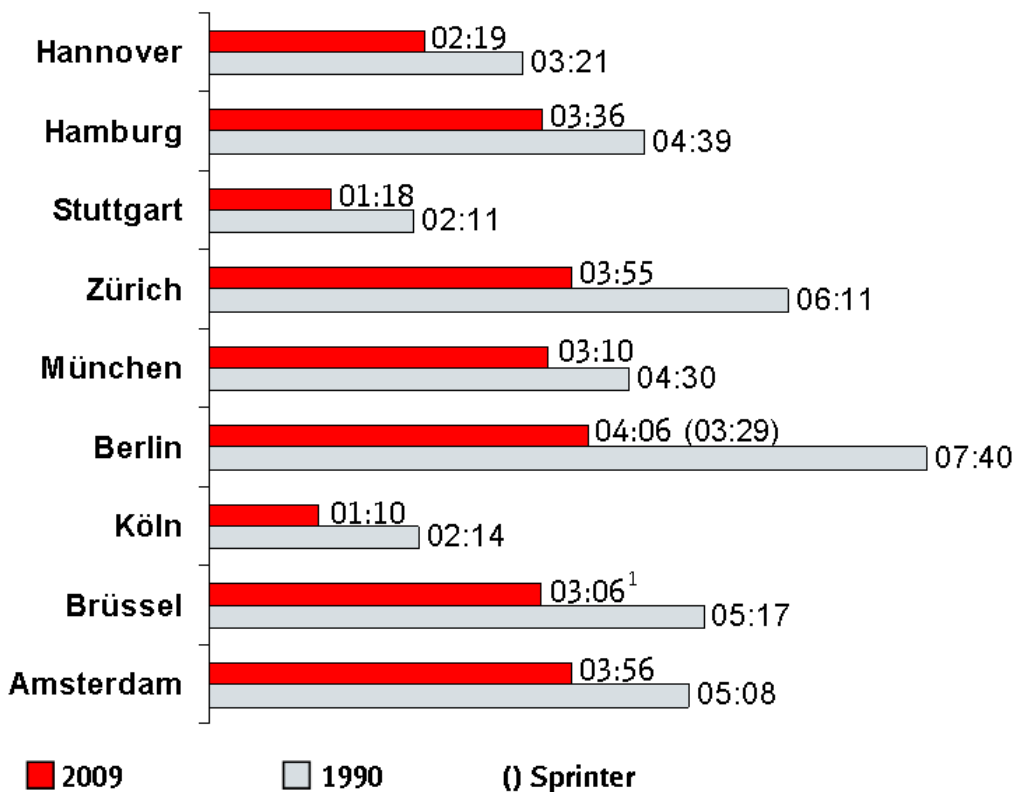
- Nuremberg – Erfurt – Halle/Leipzig
- Karlsruhe – Basle

## Planned:

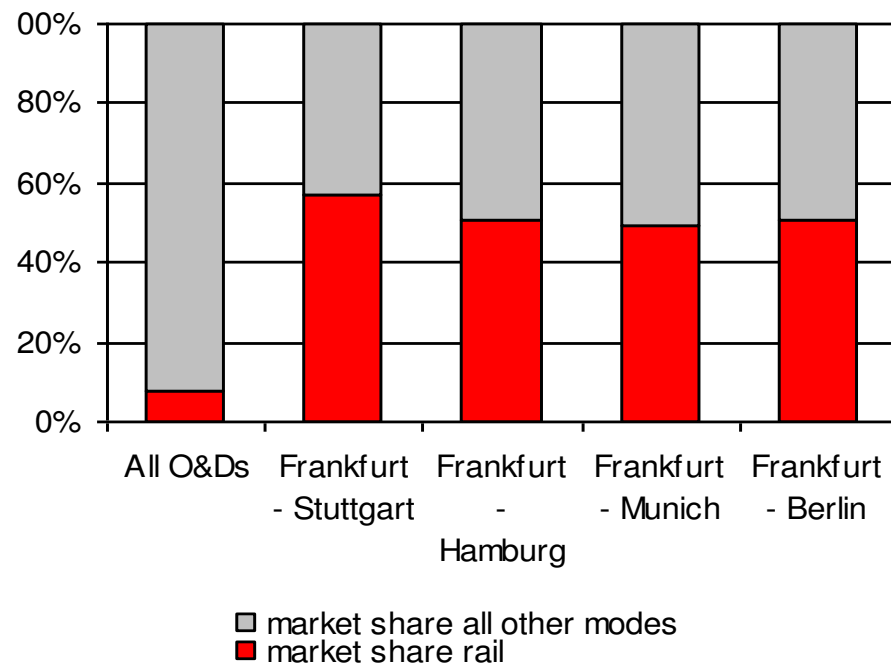
- Hamburg/Bremen – Hanover
- Frankfurt – Fulda
- Rhine/Main – Rhine/Neckar
- Stuttgart – Ulm + Stuttgart 21

# Shortened travel times are essential success factor of ICE; Attractive travel times allow high market shares

## Travel times from Frankfurt to:

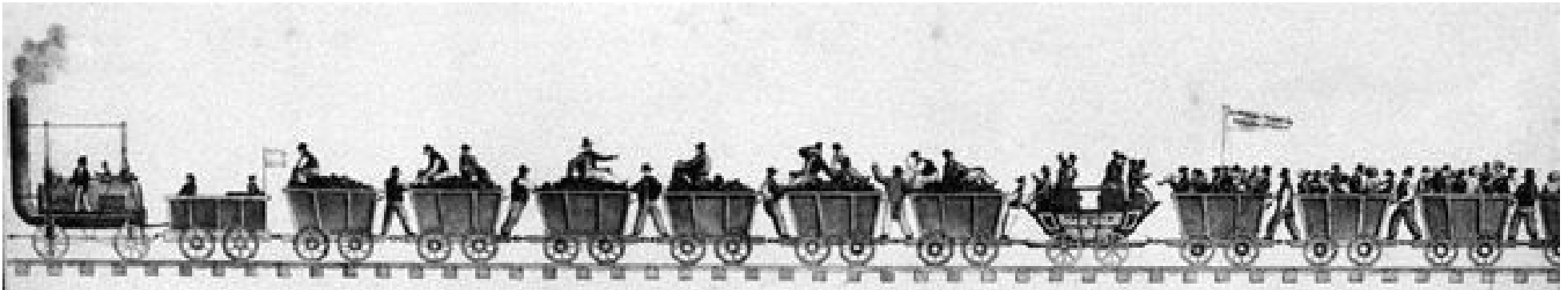


## Rail market shares Passenger transport in Germany



# Mixed Traffic on High Speed Lines in Germany

In the beginning there was mixed traffic.



Mixed traffic in 1825



# Mixed Traffic on High Speed Lines in Germany

## History

### 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.

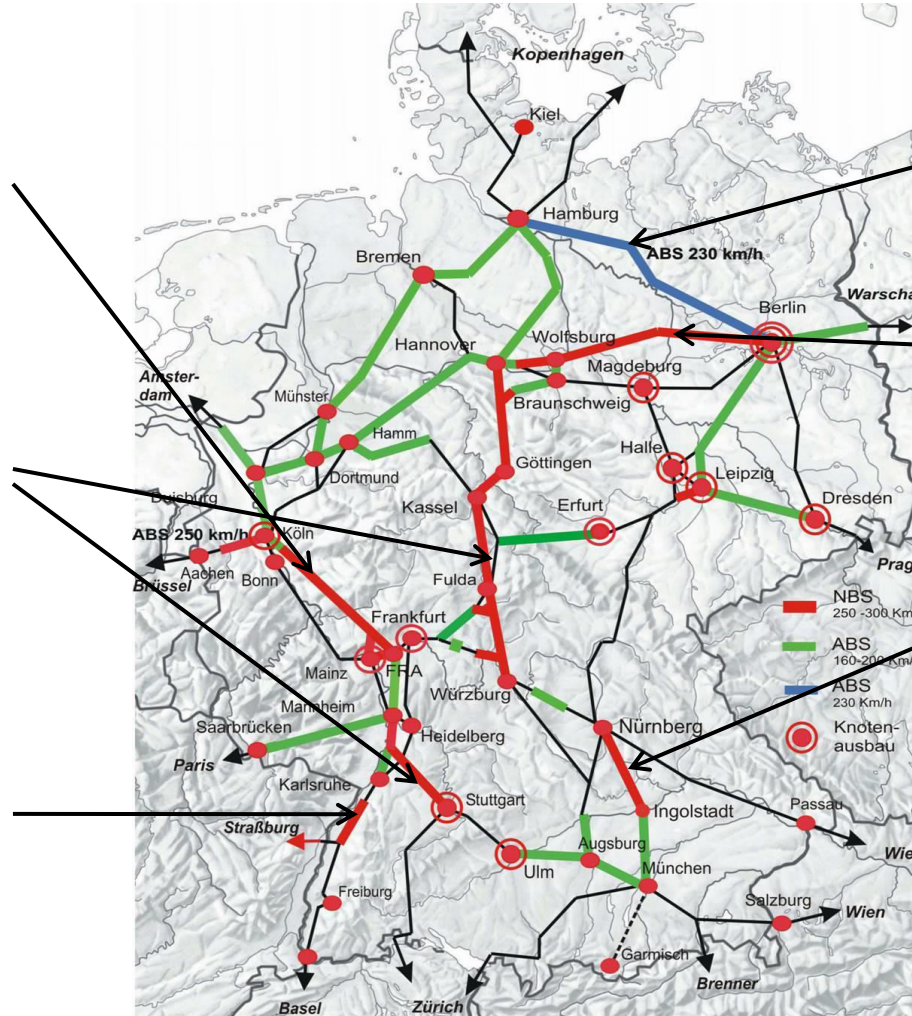
# Mixed Traffic on High Speed Lines in Germany

## German High Speed Network – Mode of Utilization

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

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

NBS 2002  
 $V_{max} = 300 \text{ km/h}$   
 Mixed Traffic



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




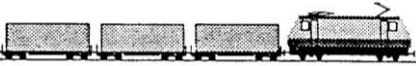
NBS 1998  
 $V_{max} = 250 \text{ km/h}$   
 Mixed Traffic

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

— Green: upgraded conventional lines (ABS)  
 $V_{max} = 200 \text{ km/h}$

# Mixed Traffic on High Speed Lines in Germany

## Train Systems And Maximum Speeds On Different Line Types

	NBS New Lines	ABS Upgraded Lines	Con-ventional Lines *)
 InterCity (IC)+Regional trains	200 km/h	200 km/h	160 km/h
 InterCity Express (ICE)	250 – 300 km/h **)	200 km/h	160 km/h
 InterCargo (ICG)	120 km/h	120 km/h	100 km/h
 Parcel InterCity (PIC)	160 km/h	160 km/h	140 km/h

\*) Lines without continuous automatic train control

\*\*) 250 km/h in tunnels, 280 km/h in general, 300 km/h Cologne-Frankfurt & Nuremberg-Ingolstadt

# Mixed Traffic on High Speed Lines in Germany

**InterCity Cargo  
Express, 160 km/h  
(1988)**

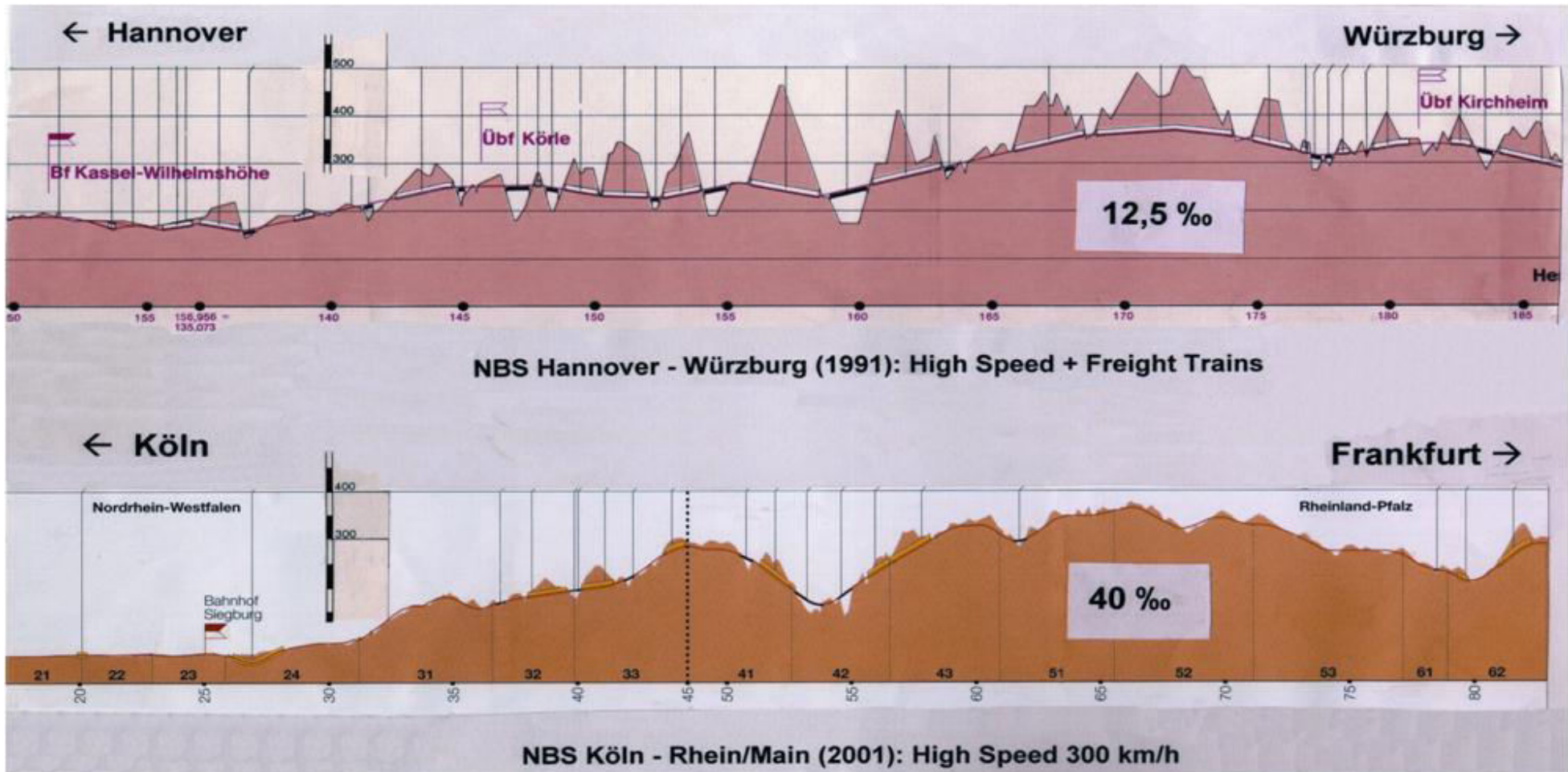
**LZB,  
Axle load only 18 t**

**At present: PIC**



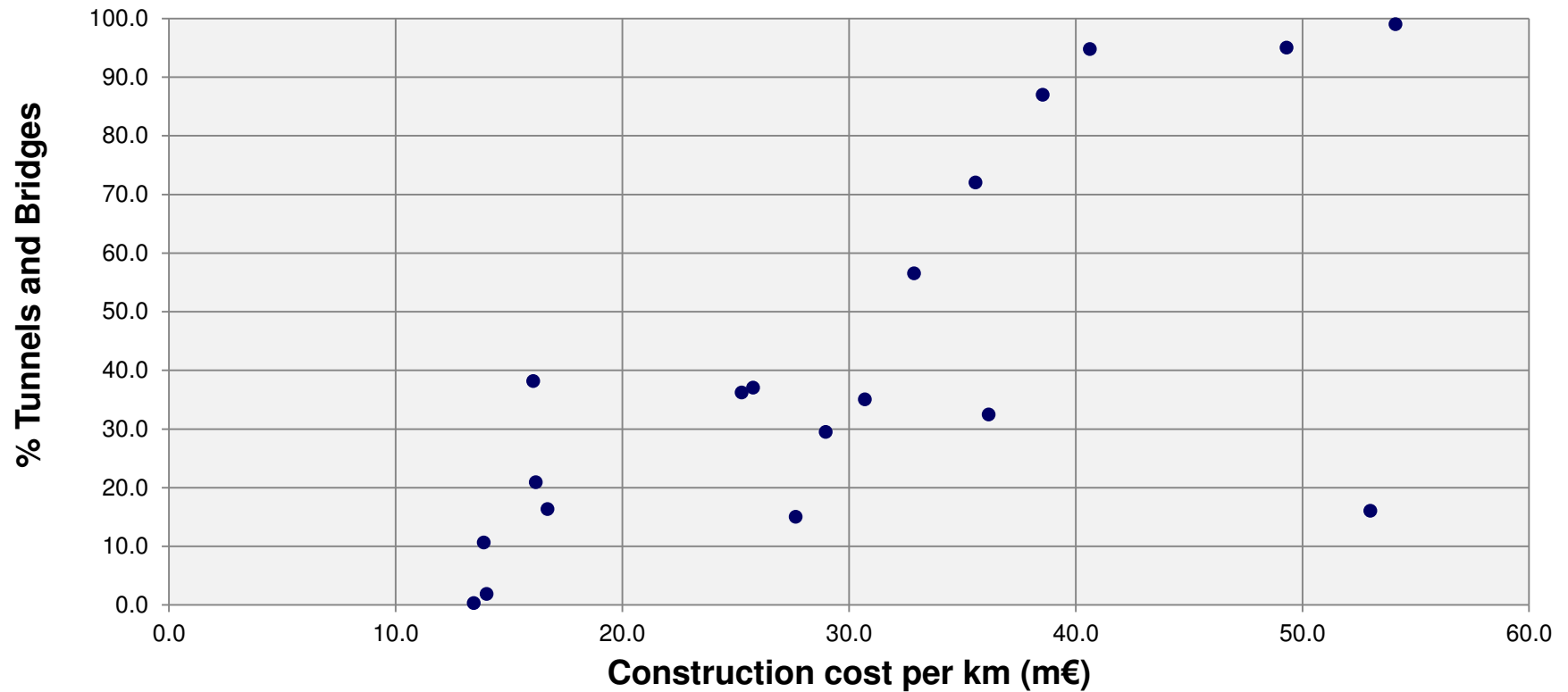
# Mixed Traffic on High Speed Lines in Germany

## Dimensioning of Mixed Traffic Lines



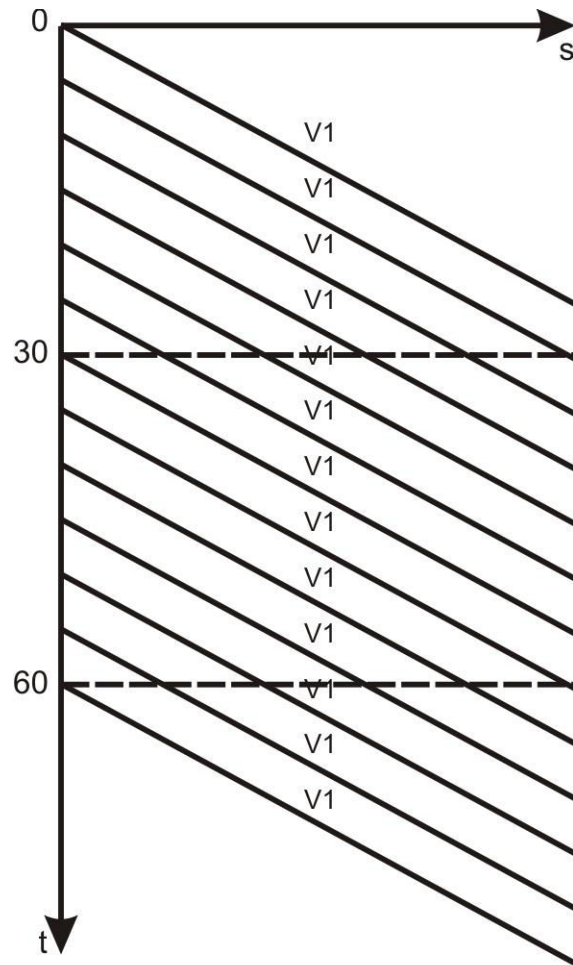
# Mixed Traffic on High Speed Lines in Germany Impacts On Infrastructure Cost

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

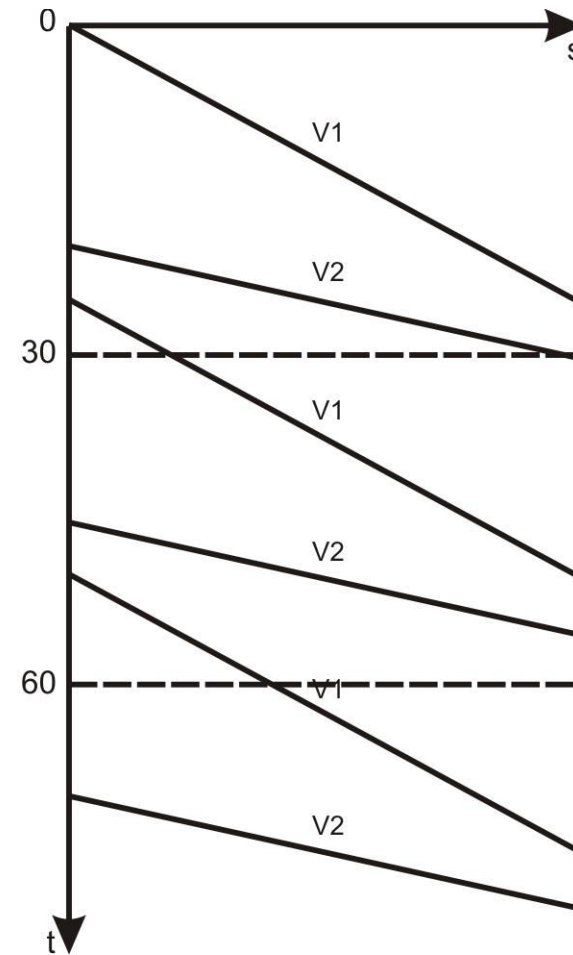


# Mixed Traffic on High Speed Lines in Germany

## 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

## Options for Operation

**From an operational point of view there are several options to increase the capacity of a mixed passenger and freight corridor:**

- **Homologation of speeds**
- **Overtaking as little as possible**
- **Separation of trains with different speeds**

**By different time periods**

**Passenger trains during the day**

**Freight trains during the night**

**By using different lines in a corridor if available**



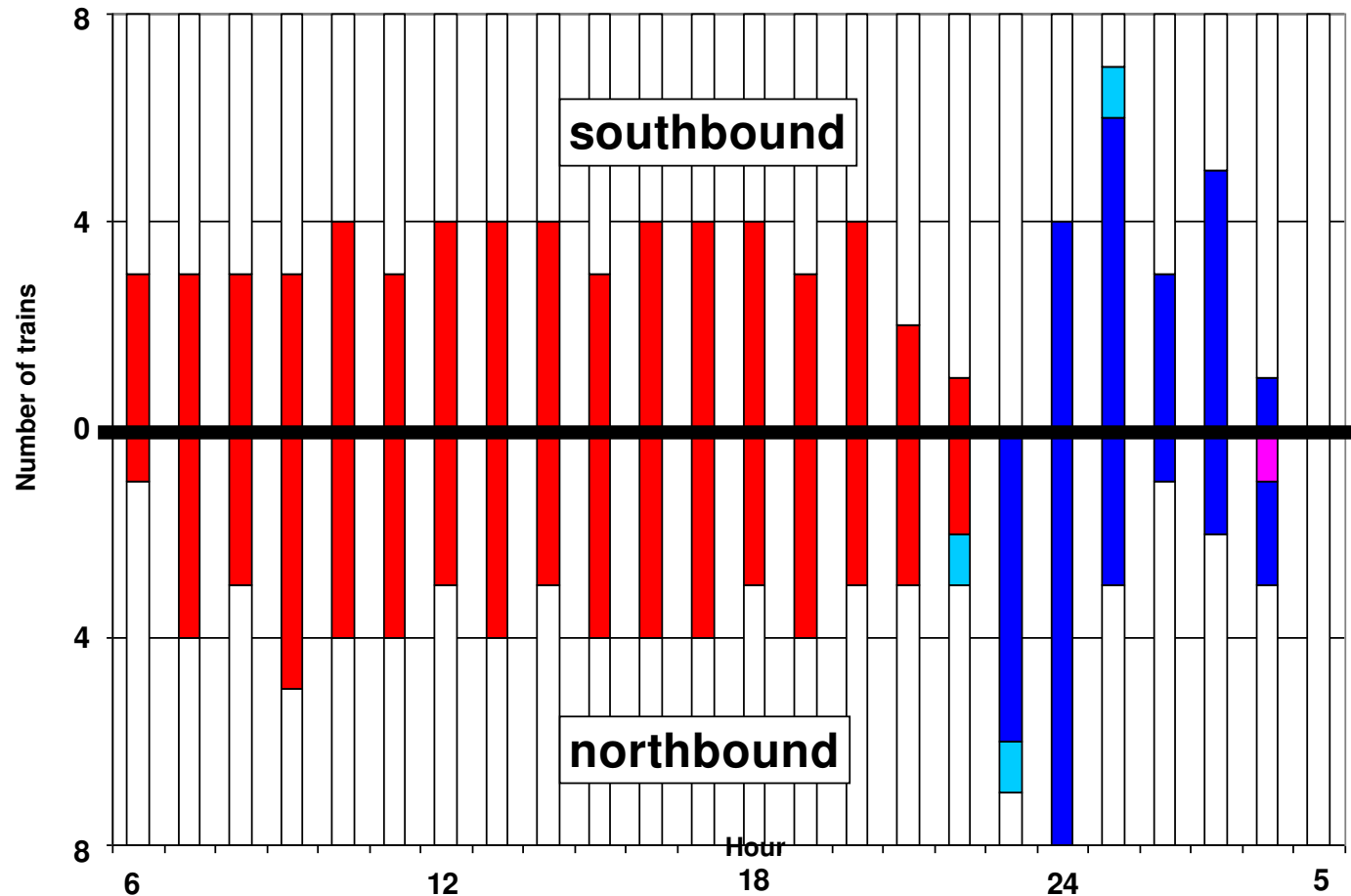
# Mixed Traffic on High Speed Lines in Germany

## Train Distribution on the Hanover – 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



# Mixed Traffic on High Speed Lines in Germany

## Conclusion

**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.**

# Thank you

**Dipl.-Ing. Ottmar Grein**

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