




High Speed Grinding

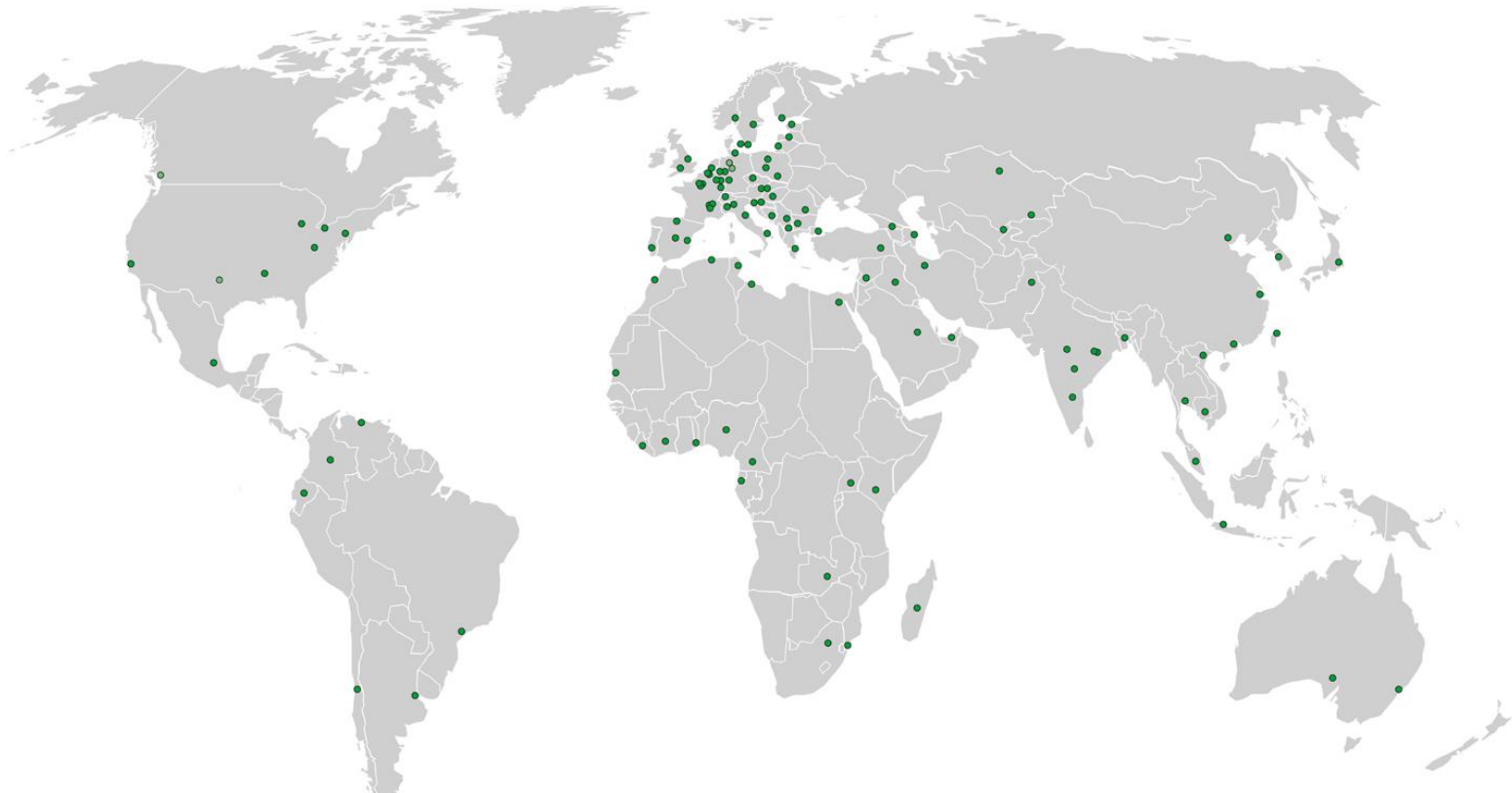
9th of April, Ceske Budejovice

Johannes Bremsteller



Worldwide Business

 Offices and projects in more than 100 countries worldwide



Vossloh Group

Transportation

Sales: approx. 470 million €

Associates: approx. 1,781



Vossloh Locomotives



Vossloh Rail Vehicles



Vossloh Kiepe

Rail Infrastructure

Sales: approx. 910 million €

Associates: approx. 3,155



Vossloh Fastening Systems



Vossloh Cogifer



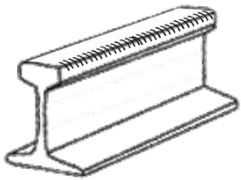
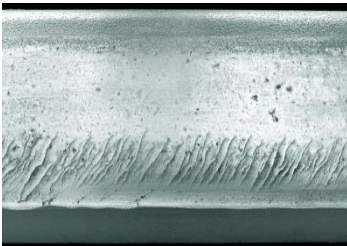
Vossloh Rail Services

Vossloh Rail Services Portfolio Overview



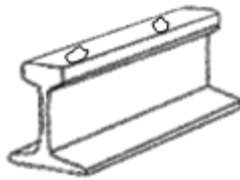
Background & Idea

Selection of rail defects



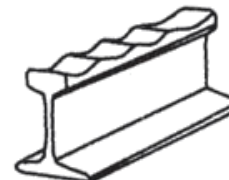
▶ Head checks

- Reduction of life span
- Danger of rail fracture
- Danger of shelling



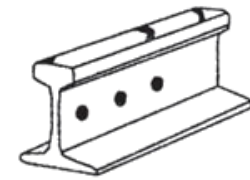
▶ Squats

- Reduction of life-span
- Danger of rail fracture



▶ Corrugation

- Noise
- Damage to the track
- Reduction of life-span

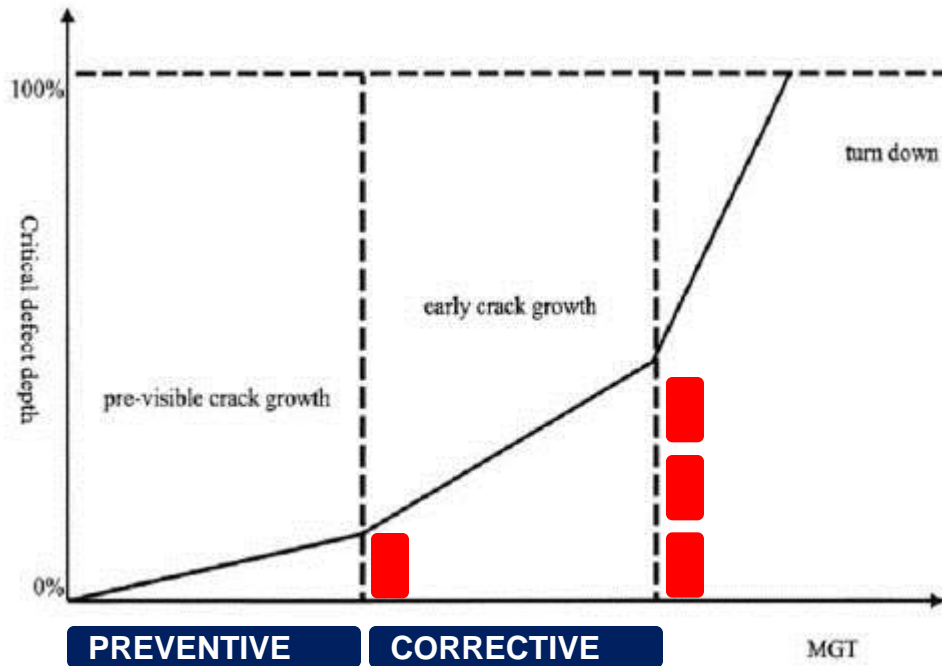


▶ Shelling

- Damage to the track
- Reduction of life-span

Background & Idea

Rolling contact fatigue



- ▶ Surface defects do not develop linear
- ▶ Double of MGT (time) results in triple damage depth
- ▶ Hardened surface layer, approx. 0,06 mm

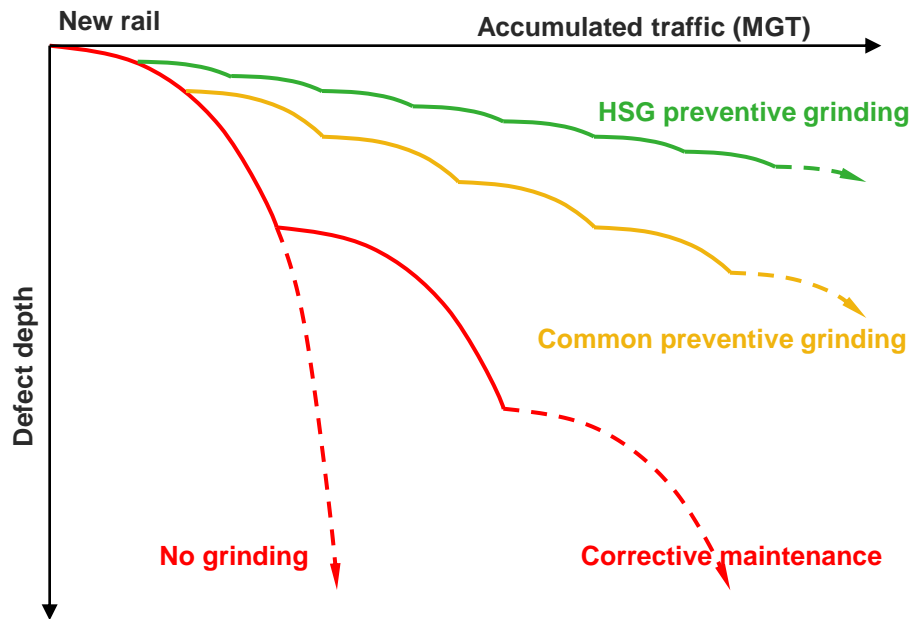
Source Diagram: Dr. Jaiswal, Jay:
International Railway Journal, 2005, vol. 9

Source Hardness zone: UIC Joint Research Project
Proactive measures – Remedial and Repair Technology -

Background & Idea

Grinding routines

Comparison of different rail maintenance strategies

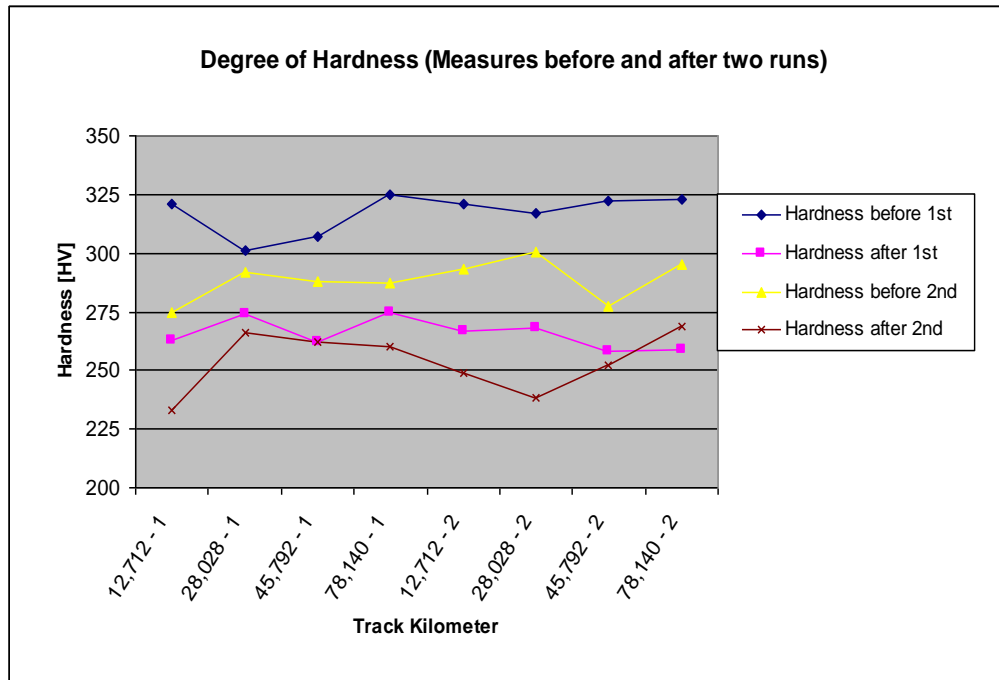


- ▶ HSG acts before surface defects develop
- ▶ HSG removes the worn surface layer of the rail and prevents Rolling Contact Fatigue
- ▶ Regular grinding with small material removal extends the rail life cycle
- ▶ Technical University of Berlin has calculated a 50% reduction in life cycle costs

Source: Vossloh Rail Services GmbH

Background & Idea

Hardness reduction



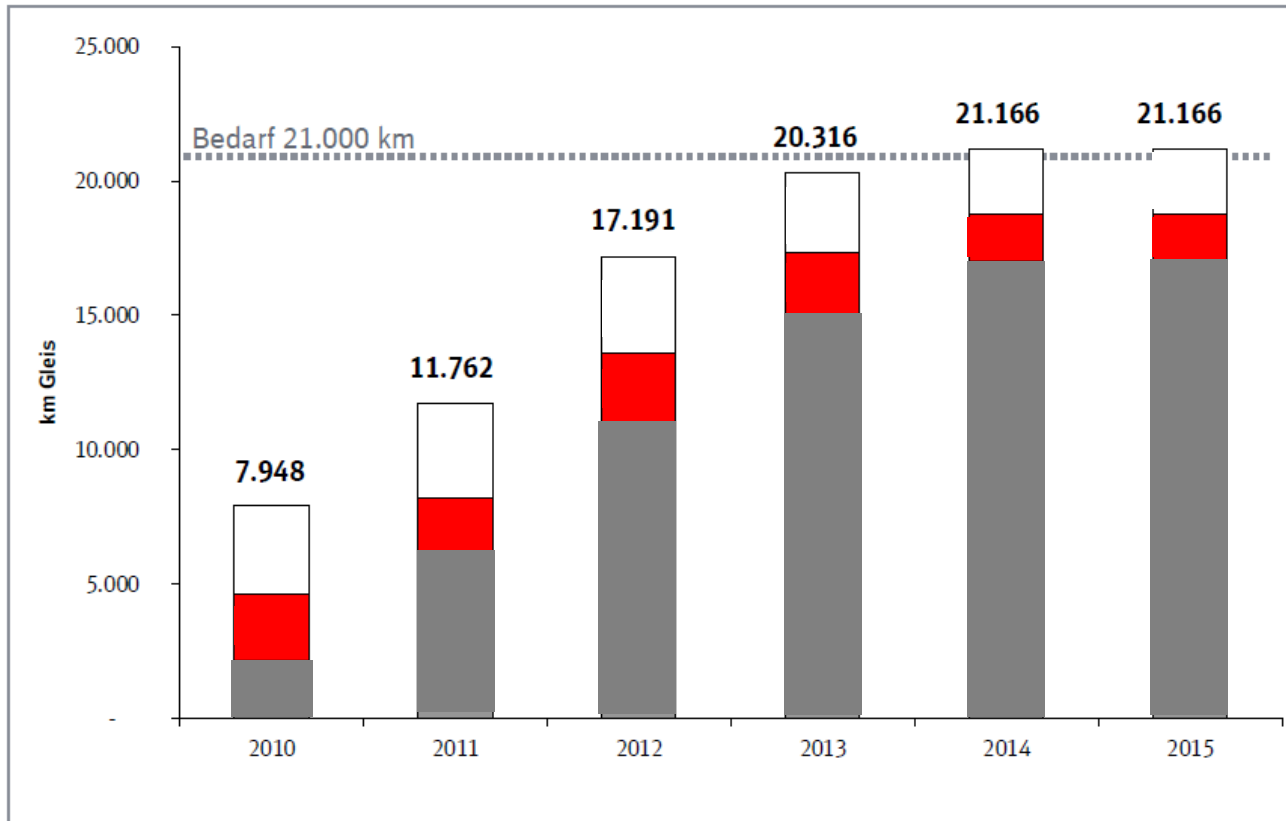
- The measurements confirm the removal of the hardened surface layer
- RCF growth is prevented in the early phase

Source: Vossloh Rail Services GmbH



Background & Idea

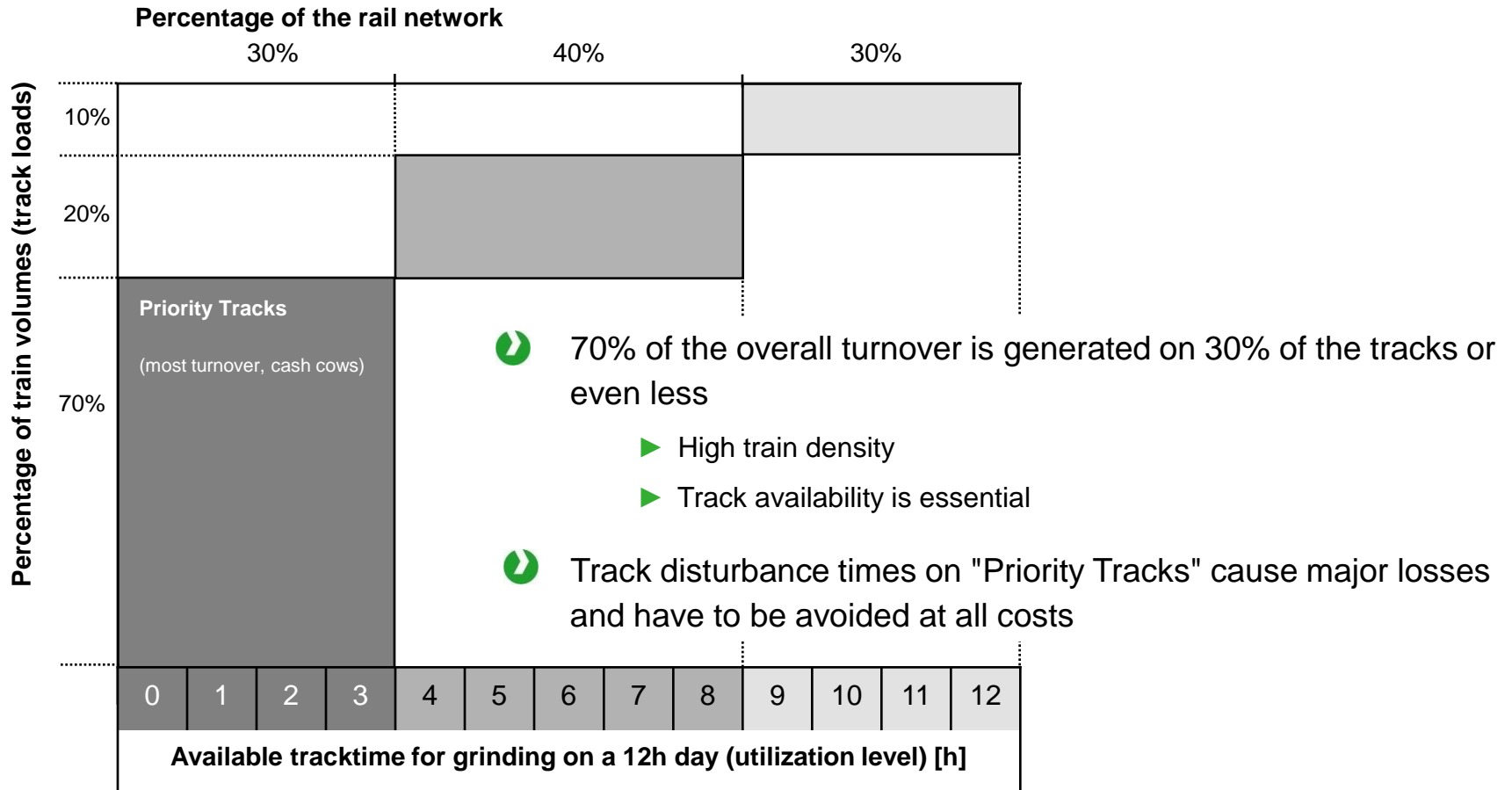
Strategy of Deutsche Bahn



- Milling
- Corrective Grinding
- Preventive Grinding

Background & Idea

Network characteristics



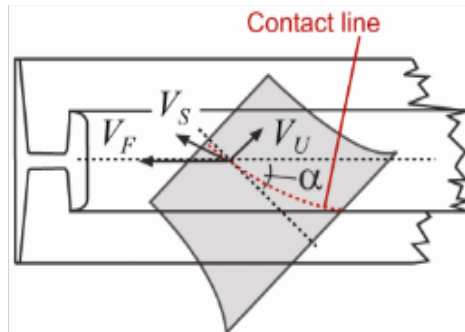
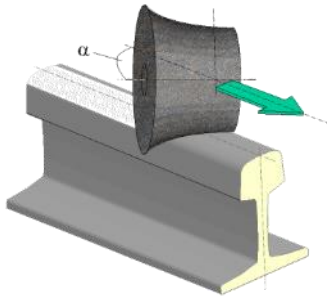
Vossloh Solution: HSG - High Speed Grinding

Source: Vossloh Rail Services GmbH



HSG - High Speed Grinding

Grinding method



- Rotational grinding
- Passively driven grinding stones



- High working speeds
- No facets
- No dismantling of track installations
- Overheating impossible

HSG - High Speed Grinding

Grinding pattern & operational advantages



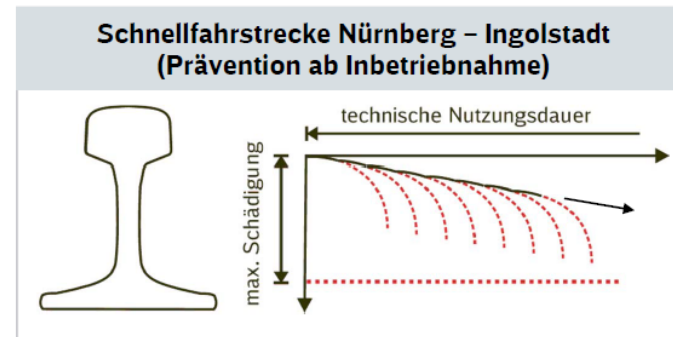
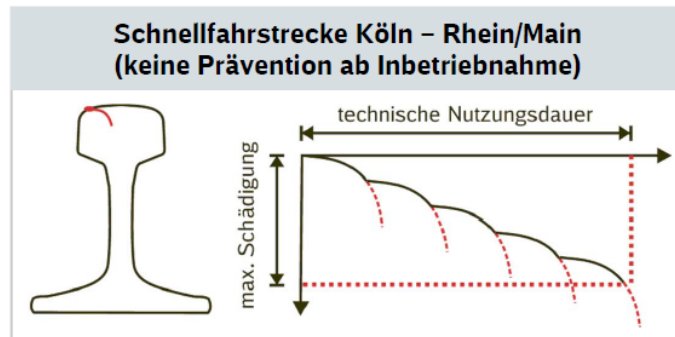
Source: Vossloh Rail Services GmbH

- 80km/h working speed
- Grinding in scheduled traffic

HSG - High Speed Grinding

Deutsche Bahn: proven operational efficiency of HSG

Zwei Beispiele aus der Praxis verdeutlichen die vorteilhafte Wirkung der präventiven Schienenbearbeitung



Comparison of HSL Corridors Cologne –Frankfurt and Nuremberg – Ingolstadt by Deutsch Bahn

► HSL Cologne-Frankfurt

- Maintained with conventional strategy (since 2002)
- Approx. €6 per year and meter
- Expected rail life: 8-12 years

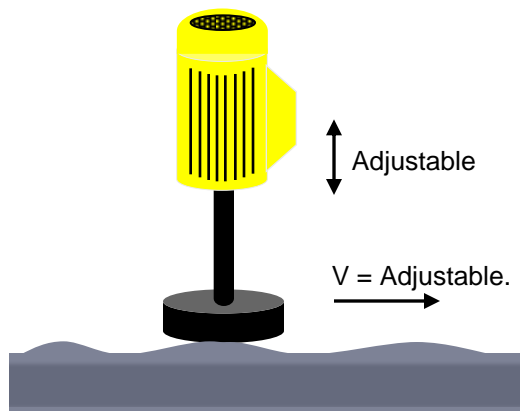
► HSL Nuremberg – Ingolstadt

- Cyclic maintained with HSG (since 2006)
- Approx. €3 per year and meter
- Expected rail life: 15-20 years

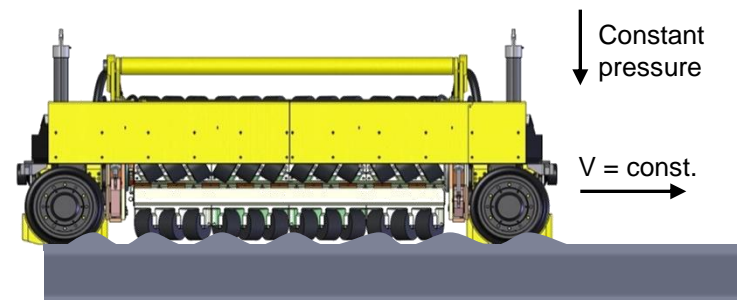
HSG - High Speed Grinding

Conventional Grinding vs. HSG

- ▶ Grinding stones are individually adjusted to the surface of the rail at the very spot
- ▶ Higher speeds corrupt the accuracy of the adjustment process
- ▶ Conventional grinding at high production speed may enhanced corrugation



- ▶ 12 Grinding stones form a rigid beam, comparable to the use of a file
- ▶ Horizontal forces of the grinding stone have a very short lever
- ▶ Since the technology does not allow individual adjustment of grinding stones HSG is **failsafe**



HSG - High Speed Grinding

Comparison Conventional Grinding vs. HSG

Conventional Grinding

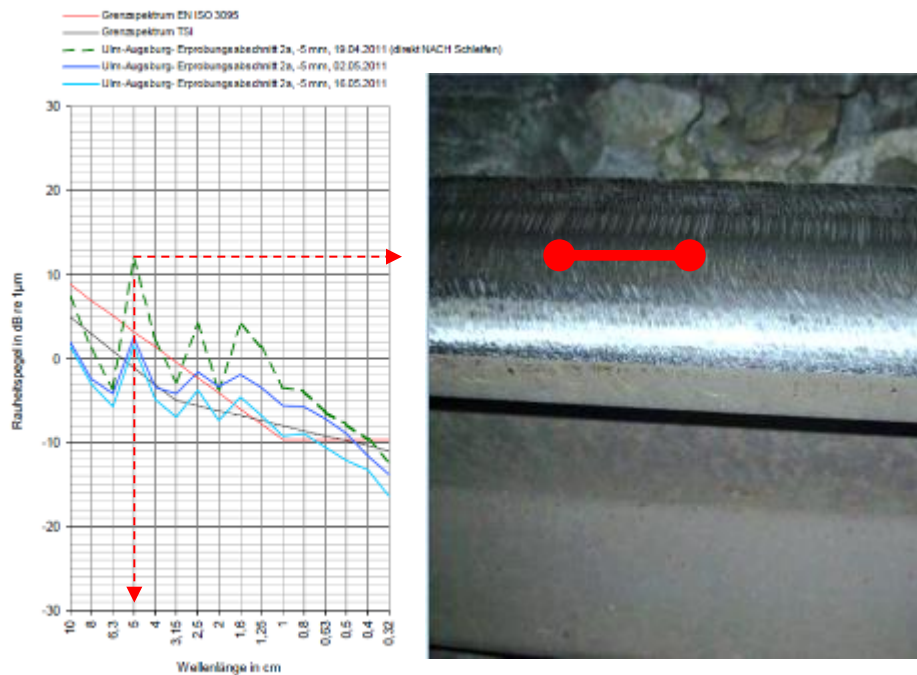


Abbildung F3. Terzband-Wellenlängenspektren der Schienenrauheit, Messkampagne 8 - 10, Erprobungsabschnitt 2a, Spur -5 mm, Grenzkurven nach TSI Noise [2] und EN ISO 3095 [3]

High Speed Grinding

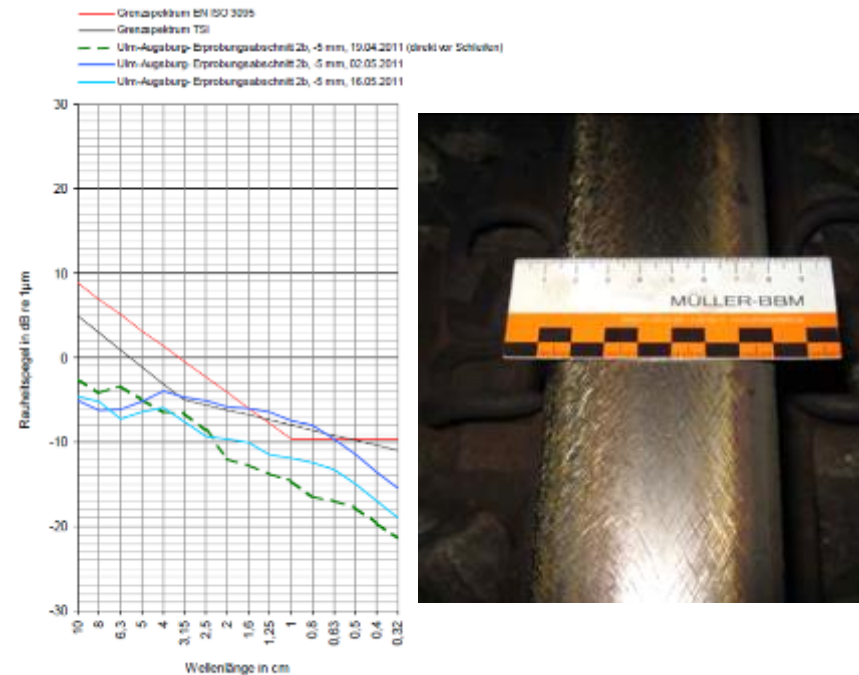
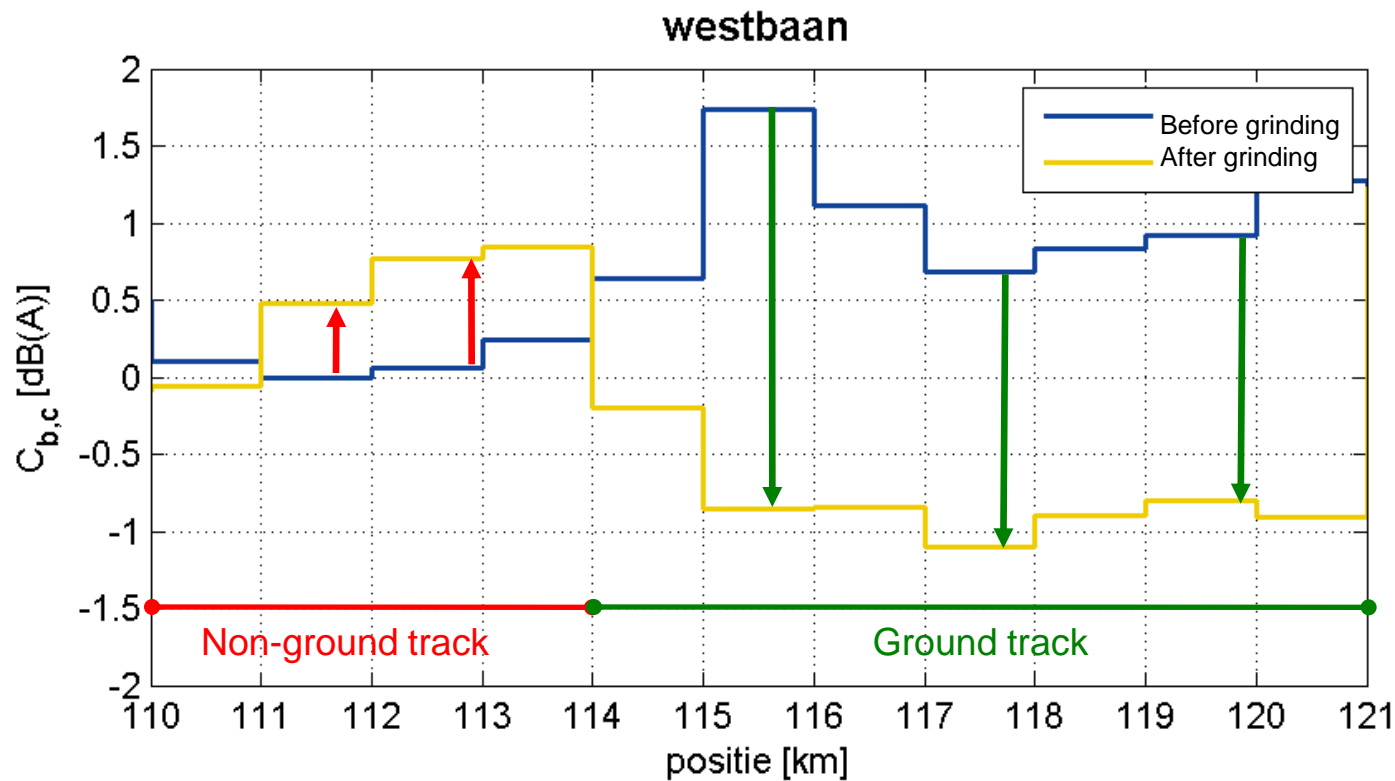


Abbildung F4. Terzband-Wellenlängenspektren der Schienenrauheit, Messkampagne 8 - 10, Erprobungsabschnitt 2b, Spur -5 mm, Grenzkurven nach TSI Noise [2] und EN ISO 3095 [3]

HSG - High Speed Grinding

Noise reduction on HSL Zuid in the Netherlands



HSG - High Speed Grinding Evolution



- ▶ 2002: Prototype aggregate (HSG-Light) to test passive, circumferential rail grinding
- ▶ 2006: First grinding train enters service, its success proves the technologies advantage
- ▶ 2012: Second generation grinding train due to go operative
- ▶ 2013: High Speed Grinding City makes available “HSG” for maintenance of urban rail networks

HSG - High Speed Grinding

Fact sheet – grinding train



➤ Vehicle Specifications

- ▶ 4 grinding units, 96 grinding stones each
- ▶ Automatic exchange system for stones
- ▶ Working speed: 60-80 km/h
- ▶ Operational range w/o stop: 40-100 km
- ▶ Operating within scheduled traffic

➤ Grinding Results

- ▶ Preventive grinding: approx. 0.1mm (three passes)
- ▶ Roughness < 10 μ m
- ▶ Range up to 60 km nonstop

HSG - High Speed Grinding

Fact sheet – HSG-city

🔍 Vehicle Specifications

- ▶ Working speed 25 - 60 km/h
- ▶ 12 Grinding stones per rail
- ▶ Length: 5,72 m (without coupling)
- ▶ Shipping in standard container
- ▶ Available late 2013

🔍 Grinding Results

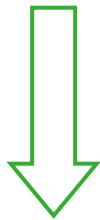
- ▶ Approx. 0,01 mm material removal
- ▶ Roughness < 10 μm
- ▶ Range approx. 20 km nonstop



HSG - High Speed Grinding

Plug'n Play

- ▶ High Speed Grinding is designed to work as a regular train
- ▶ No track preparation, e.g. dismantling of track installations like axle counters
- ▶ No extra work after grinding, e.g. cleaning of insulated rail joints
- ▶ No safety preparation of the track and safety personal required
- ▶ Changing of grinding consumables from inside of the machine
- ▶ Neighbouring tracks keep running regular traffic



- ▶ **Higher flexibility in planning of grinding work**
- ▶ **Less traffic disruption and more effective use of track possession**

HSG - High Speed Grinding Operations in Europe (I)



Germany



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► HSG in operation on almost all major rail corridors in Germany as:

- Nuremberg - Ingolstadt
- Cologne - Aachen
- Cologne - Frankfurt
- Frankfurt - Mannheim
- Offenburg - Mannheim
- Worms - Mainz
- Cologne airport link
- Hamburg - Hannover
- Hamburg - Bremen
- Bremen - Hannover
- Hanau - Gelnhausen
- Berlin - Hannover
- Augsburg – Ulm
- Leipzig - Riesa
- ...and others

HSG - High Speed Grinding Operations world wide

▶ **2008** Germany



▶ **2010** Switzerland



▶ **2011** Denmark



▶ **2013** Sweden



▶ **2013** China Peking-Shanghai PDL



HSG - High Speed Grinding

Automain Project

Luleå University of Technology – University of Birmingham –
Trafikverket – Deutsche Bahn – ProRail – Vossloh – Strukton –
Network Rail

“Optimised maintenance activities like, grinding, tamping and other maintenance processes”

- ▶ HSG and twin HSG present good opportunity for the reduction of track possession time, in comparison with conventional grinding **over 67% reduction in track possession time** is possible.
- ▶ An improved **conventional grinding machine** will have about the same order of cost as the High Speed Grinder, but will most probably give **earlier replacement of rail** than the High Speed Grinder so the **LCC-cost is slightly higher**.

Thank you for your attention!



Further questions:

- ▶ Johannes Bremsteller
- ▶ +49 152 01591115
- ▶ Johannes.bremsteller@vrs.vossloh.com

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