High Speed Grinding

9th of April, Ceske Budejovice

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Worldwide Business

Offices and projects in more than 100 countries worldwide
## Vossloh Group

### Transportation
- **Sales:** approx. 470 million €
- **Associates:** approx. 1,781

![Vossloh Locomotives](image1)
- **Vossloh Locomotives**

![Vossloh Rail Vehicles](image2)
- **Vossloh Rail Vehicles**

![Vossloh Kiepe](image3)
- **Vossloh Kiepe**

### Rail Infrastructure
- **Sales:** approx. 910 million €
- **Associates:** approx. 3,155

![Vossloh Fastening Systems](image4)
- **Vossloh Fastening Systems**

![Vossloh Cogifer](image5)
- **Vossloh Cogifer**

![Vossloh Rail Services](image6)
- **Vossloh Rail Services**
Vossloh Rail Services Portfolio Overview

we care for rails

- High Speed Grinding
- Mobile Milling
- HSG City
- Logistics
- Loading and Unloading
- Rail Exchange
- Rail Maintenance
- Stationary Services
- Mobile Services
- Long Welded Rails
- Rail Recycling
- Semi-stationary Welding
- Mobile Welding
- Inspection/Measuring
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 linearly.
- Double of MGT (time) results in triple damage depth.
- Hardened surface layer, approx. 0.06 mm.

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

![Bar chart showing the need for grinding and milling from 2010 to 2015. The chart illustrates the increase in the need for grinding and milling over the years. The legend indicates that white represents milling, red represents corrective grinding, and gray represents preventive grinding.]
Background & Idea

Network characteristics

- 70% of the overall turnover is generated on 30% of the tracks or even less
  - High train density
  - Track availability is essential
- Track disturbance times on "Priority Tracks" cause major losses and have to be avoided at all costs
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

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

Source: Vossloh Rail Services GmbH
HSG - High Speed Grinding

Deutsche Bahn: proven operational efficiency of HSG

Comparison of HSL Corridors Cologne – Frankfurt and Nuremberg – Ingolstadt by Deutsche 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 enhance 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

High Speed Grinding
HSG - High Speed Grinding
Noise reduction on HSL Zuid in the Netherlands

![Graph showing noise reduction before and after grinding.](image)
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 µm
- 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)

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:

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