

Rail Milling Advantages for Railway and Light Rail Infrastructures

WRI
EU 2015

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Machines
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TEAMS WORK.

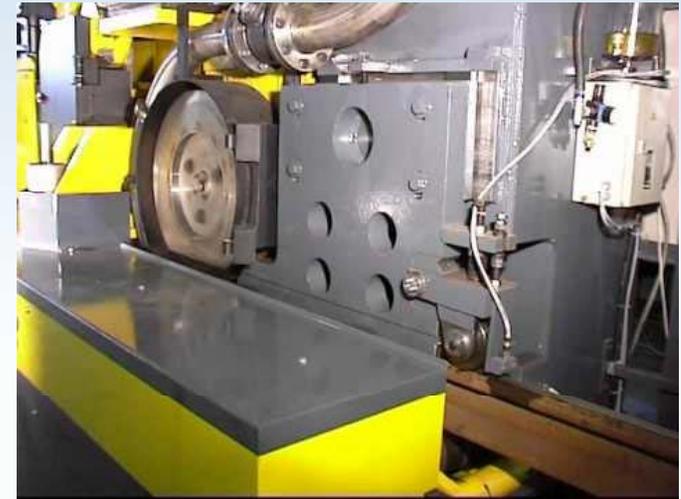
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Rail Milling – Agenda

1. Background of the milling technology
2. The technology principals
3. Application and benefits
4. Case Studies
5. Summary

1. BACKGROUND

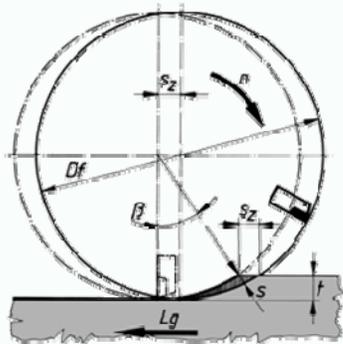
- Rail Grinding established as a preventive approach for rail management → known since decades
- But rail that still had „life“ was scrapped → Rail recovery to milling plant → than plant to track location → expensive
- Now different mobile milling machines on market



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2. TECHNOLOGY PRINCIPALS

- Milling with surface grinding



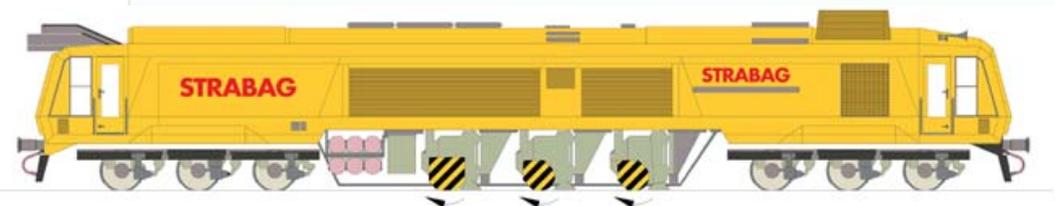
Grinding wheel with capture device



2. TECHNOLOGY PRINCIPALS



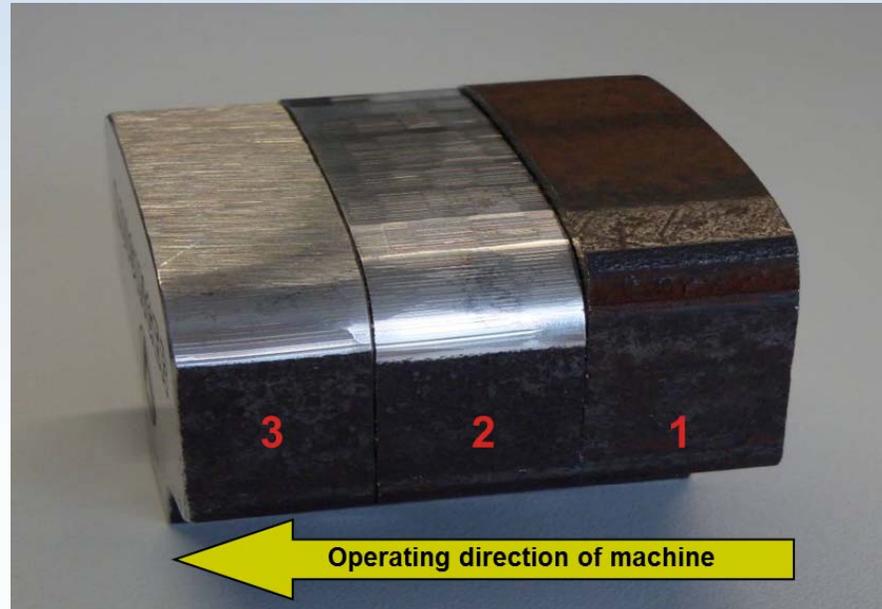
- **Step 1: Milling**
 - SF02 W-FS Truck: 1 unit (on each side)
 - SF03 W-FFS: 2 units (on each side)
- **Step 2: Grinding**
 - SF02 W-FS Truck: 1 unit (on each side)
 - SF03 W-FFS: 1 unit (on each side)



2. TECHNOLOGY PRINCIPALS

TREATMENT RESULT

1. Untreated Rail
2. Milled Rail
3. Milled rail with surface grinding



Complete control from Cab

- Left side: milling operation
- Right side: travel

3. APPLICATION AND BENEFITS

- New rails- starting with 0.3-0,5mm metal removal
(not very economical)

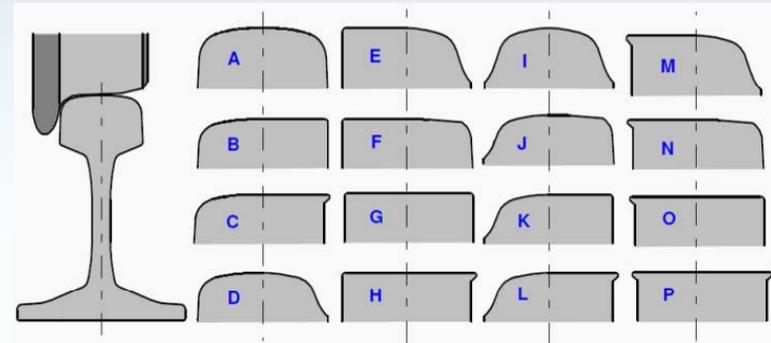
- Rail defects

- Treatment of RCF (rolling contact fatigue)

- Gauge widening

- Restoring transverse profile or bringing new profile type on the rails

- Treatment of all profile types



Rail defect: head check



Rail defect: squat



Restoring rail profile

3. APPLICATION AND BENEFITS

- Short Spark stream → low fire risk



- Minimal dust
- Low noise <82 dB
- Low visual impact
- Tunnel capability
- No hazard to work groups or passing trains
- Low risk for operating crew

3. APPLICATION AND BENEFITS

- Enclosed heads



- All waste gets recovered.
- The swarf separate from the grinding dust



- Operator and machine environment

3. APPLICATION AND BENEFITS

- No blueing of the rail → all heat goes into the swarf pieces
- No facets in gauge corner



- Too strong grinding pattern
- Blueing

3. APPLICATION AND BENEFITS

On Tracking with Rail-Road Miller



3. APPLICATION AND BENEFITS

On Tracking with Rail-Road Miller – LESMAC mobile level crossing



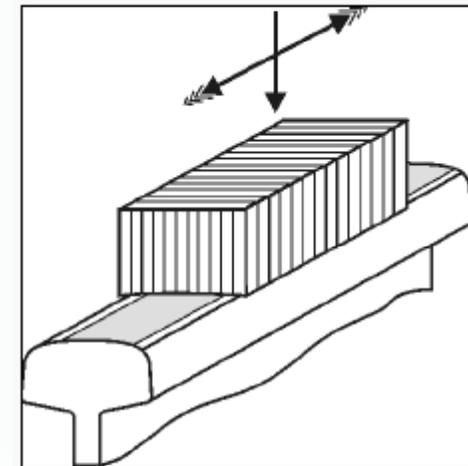
3. APPLICATION AND BENEFITS

Possible to mill under different weather conditions



3. APPLICATION AND BENEFITS

Milling with GWM (Schweerbau) BÜG in Berlin



3. APPLICATION AND BENEFITS

Unloading of swarf → Big Bag System



3. APPLICATION AND BENEFITS



Overview of Working Procedures and Their Applications

Operating procedure		New rail treatment	Prevention	Maintenance / defect removal	BÜG	Gauge correction
Oscillating grinding					✓	
Rotating grinding		✓	✓	✓		✓
Milling		(✓) ¹		✓	(✓) ²	✓
Planing				✓		✓
High-Speed grinding			✓		(✓) ³	

1 Only when combined with other work, since the material removal is too great
 2 Only in combination with oscillating grinding
 3 Recognition of EBA in preparation

3. APPLICATION AND BENEFITS

Milling



- Working speed:
0.6 – 1.0 km/h
- Material removal per pass:
≤ 1.8 mm
- Optimum application:
Maintenance /
defects removal



Advantages

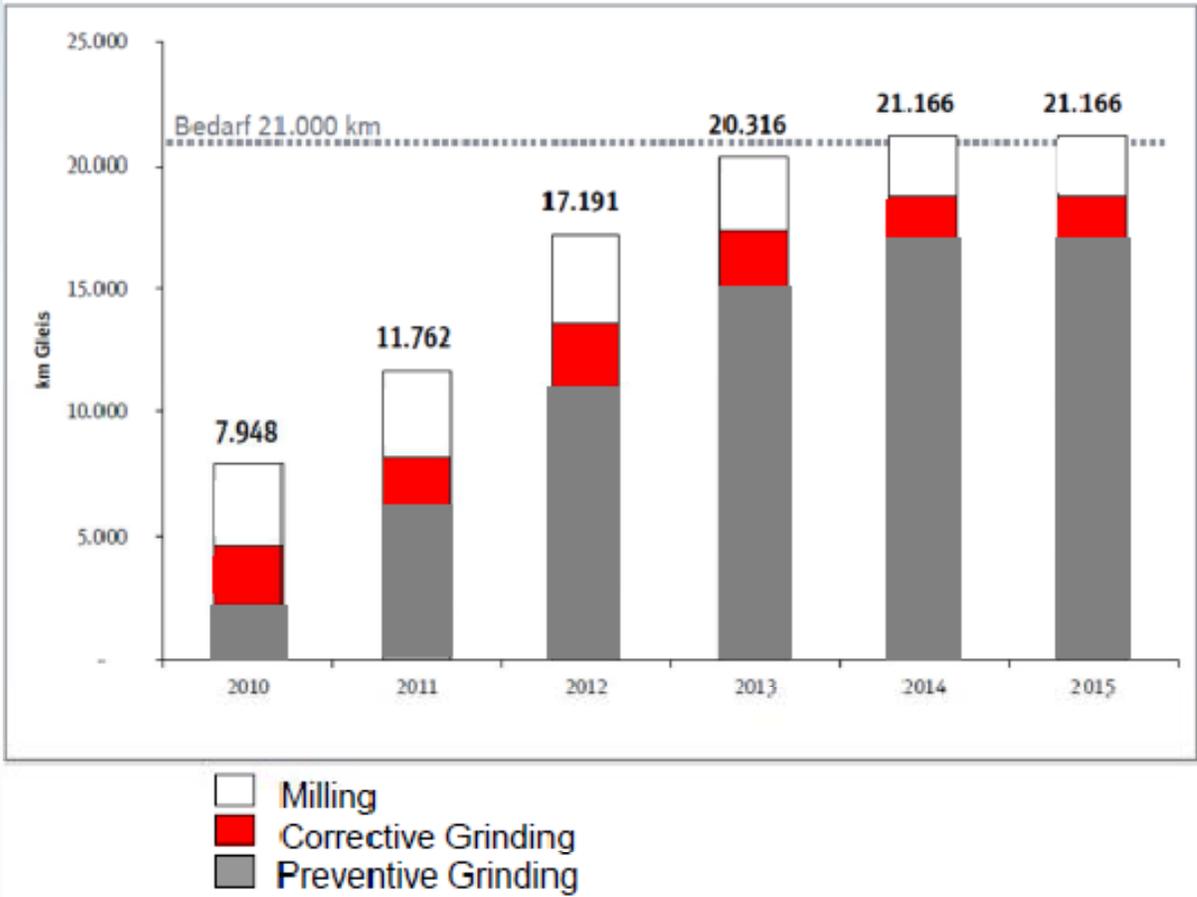
- Restoration of the longitudinal and transverse profiles in a single pass
- High transverse profile accuracy
- No need to remove obstacles (contacts, sound absorbers, ...)
- No sparks emitted

Disadvantages

- Profiling cannot be performed on tight curves where the rail exhibits side wear
- Only one direction of operation
- No changes can be made to the transverse profile geometry



3. APPLICATION AND BENEFITS



3. APPLICATION AND BENEFITS -- MEASURING TOOLS

Miniprof



DQM



RAILMONITOR



RMF2.3E

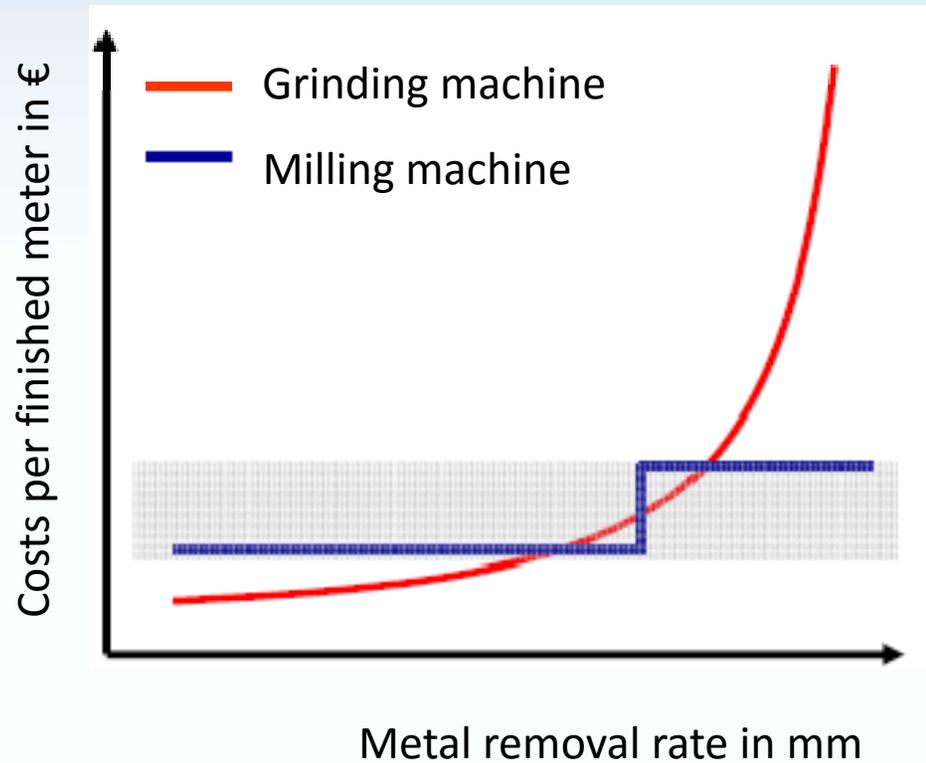


WPG PLR



WILMEC

3. APPLICATION AND BENEFITS -- COMPARED WITH GRINDING



Milling becomes more beneficial at a higher metal removal rate

4. CASE STUDIES

LONDON UNDERGROUND

RAMS RAIL DEFECT REDUCTION PROJECT PHASE 1+2

- **Client:** Transport for London – London Underground Ltd.
- **Schedule:** 04/2014 – 02/2015
- **Used machine technology:** SF02 W-FS Truck “Einstein”
- **Scope of works:**
 - Working in open sections (LG 3) throughout LUL network on District, Metropolitan, Hammersmith & City and Central Line
 - Rail head reprofiling with milling and simultaneous grinding
 - Prevention and removal of rail defects (e.g. head checks)
 - Overall completed lineage of ca. 85 km of track
 - Single or two pass (0.8-1.8 mm material removal)
- **Special remarks:**
 - STRABAG has established milling as an alternative technology next to grinding



4. CASE STUDIES

LONDON UNDERGROUND

RAMS RAIL DEFECT REDUCTION PROJECT PHASE 1+2

- Normally only limited spark time available through shifts in RAMS 1 due to infrastructure limitations but during 76hr-possession in May 2014 the full possible performance of the machine was shown
- Largest single weekend milling and grinding scope ever delivered on TFL LUL infrastructure (with 3 suppliers overall 37 km of track have been reprofiled)
- STRABAG worked in 12h blocks with each 8h milling time, 2 teams
- Rail head reprofiling, defects removal (pitting) and corrugations
- Total finished tracks of 13.5 km by STRABAG on Central Line:
 - West Ruislip / Northolt 10.5 km track finished as planned by client
 - Additional 3 km to Perivale treated as original planned programme was outbalanced by STRABAG's machine performance



4. CASE STUDIES

BVB BASEL SWITZERLAND

PROJECT BASEL 2012-2014

- **Client:** Basler Verkehrs-Betriebe
- **Schedule:** 08/2012 – 10/2014
- **Used machine technology:** SF02 W-FS Truck “Big Ben”
- **Scope of works:**
 - Rail milling and grinding of 42.3 km track, mainly grooved rail (gauge of the track: 1,000 mm)
 - Refurbishment of head of the rail (double and wide groove)
 - Very hard welding material (up to 2,200 N/mm²)
 - Metal removal 5-8 mm from top edge of the rail
- **Special remarks:**
 - Modification of SF02 W-FS Truck by machine manufacturer before the project in order to treat grooved rail
 - Use of new developed milling wheels
 - Only grinding technique of competitors is not successful here



4. CASE STUDIES

BVB BASEL SWITZERLAND

PROJECT BASEL 2012-2014



4. CASE STUDIES

BVB BASEL SWITZERLAND

PROJECT BASEL 2012-2014



BEFORE



2 milling passes



FINISHED

4. CASE STUDIES

BVB BASEL SWITZERLAND

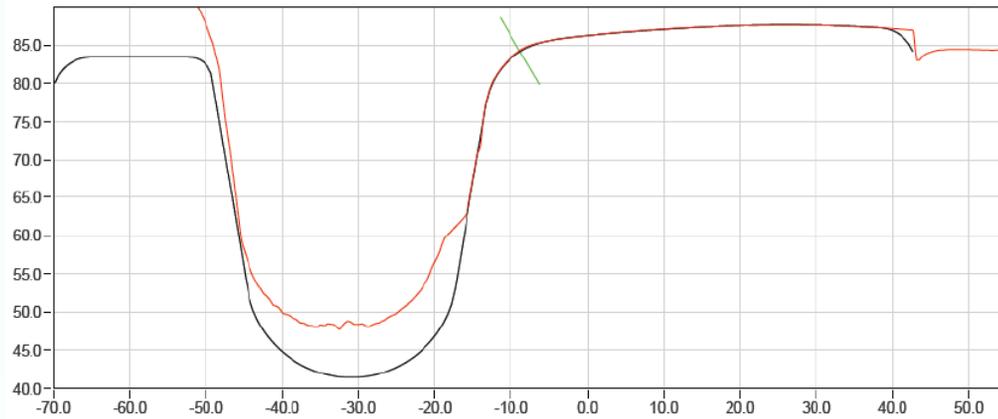
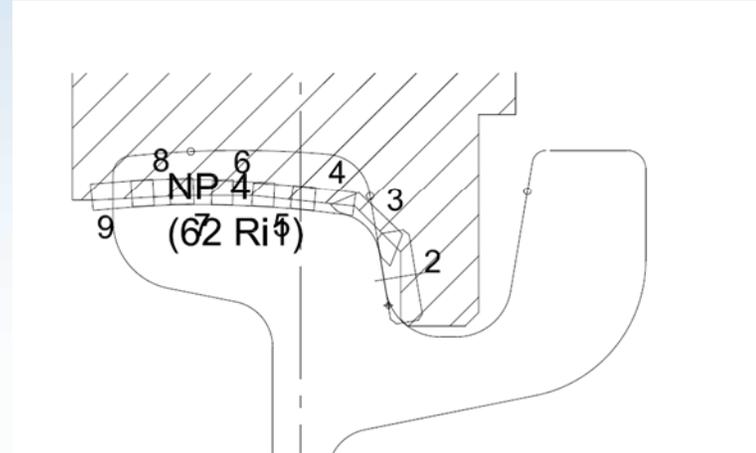
PROJECT BASEL 2012-2014



4. CASE STUDIES

BVB BASEL SWITZERLAND

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4. CASE STUDIES

BVB BASEL SWITZERLAND

PROJECT BASEL 2012-2014

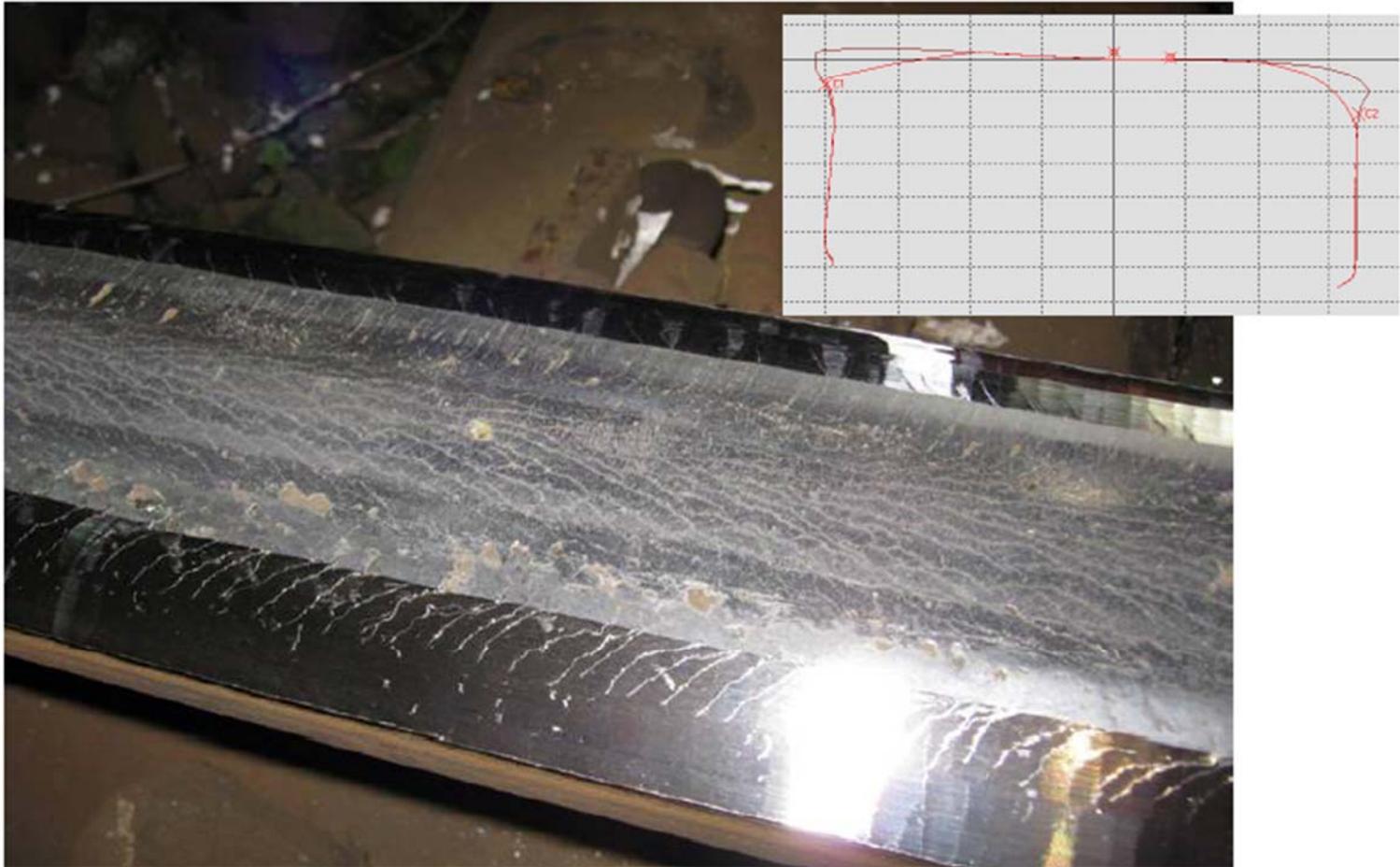
- vignol rail also
- still cheaper as renewal of rail
- Milling work during night time –
no closure of track during daytime
- Positive support from operator



4. CASE STUDIES

NETWORK RAIL LIVERPOOL STREET STATION

Result after 1 milling pass



4. CASE STUDIES

NETWORK RAIL LIVERPOOL STREET STATION

Result after 2 milling passes



4. CASE STUDIES

NETWORK RAIL LIVERPOOL STREET STATION

Finish after 5 milling passes and simultaneous surface grinding pass

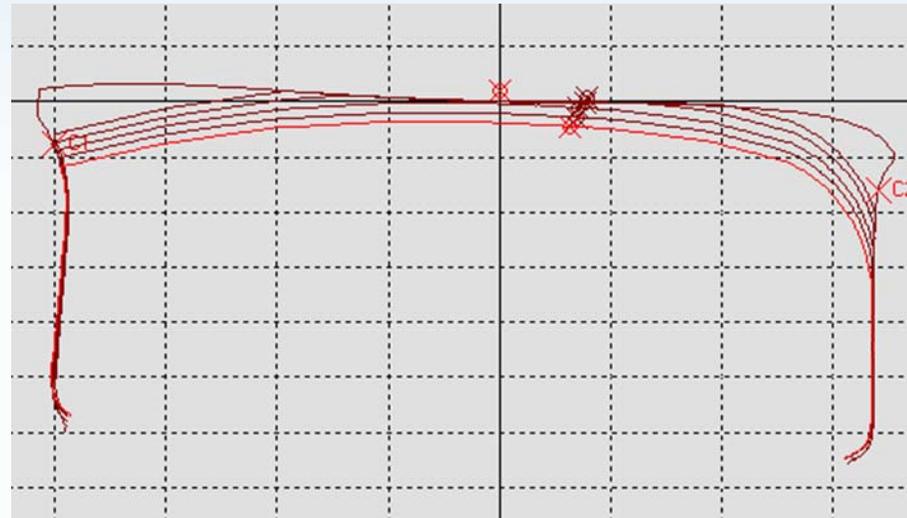


Diagram showing metal removal layers

4. CASE STUDIES

NETWORK RAIL LIVERPOOL STREET STATION

High metal removal rate to restore complete rail profile is possible

	60m Location		120m Location		180m Location	
	Gauge / Field Corner	Centreline	Gauge / Field Corner	Centreline	Gauge / Field Corner	Centreline
Pass 1	4mm	0mm	3.3mm	0mm	1.7mm	0mm
Pass 2	0.8mm	0mm	1.3mm	0mm	0.8mm	0.2mm
Pass 3	0.8mm	0.3mm	0.9mm	1.0mm	0.9mm	0.9mm
Pass 4	0.9mm	0.9mm	0.8mm	0.9mm	0.9mm	0.9mm
Pass 5	0.8mm	0.8mm	0.9mm	1.0mm	1.0mm	1.0mm
TOTAL	7.3mm	2.0mm	7.2mm	2.9mm	5.3mm	3.0mm
Remaining rail depth		4.1mm		5.6mm		9.0mm

4. CASE STUDIES

NETWORK RAIL WARRINGTON

- **Client:** Network Rail Infrastructure Ltd.
- **Schedule:** 07/2015 – 07/2015
- **Used machine technology:** SF02 W-FS Truck “Einstein”
- **Scope of works:**
 - Site: Warrington (UK), Arpley Junction to Monk Sidings
 - Rail head reprofiling with milling and simultaneous grinding
 - Removal of rolling contact fatigue (RCF) at 5-6 mm depth
 - 4 shifts, overall completed lineage of 1.5 km
 - 2-6 passes required depending on track condition
- **Special remarks:**
 - Establishment of milling as an alternative technology next to grinding as first company on Network Rail managed infrastructure
 - Requirement for full RIS-1530-PLT Issue 5 certification



Left-hand side:
RCF before treatment



Right-hand side:
RCF removed

4. CASE STUDIES

NETWORK RAIL WARRINGTON



(1) After 1 pass



(2) After 2 passes



(3) Finish after 4 passes



(4) Defects before treatment



(5) Finish after treatment

4. CASE STUDIES

ÖBB National Railroad Austria

- 44 hours long possession from 26-27 september 2015
- Terfener Tunnel area Innsbruck
- No milling before → HeadChecks > 3mm
- Total 16.000 meters
- New ÖBB22 Profile
- Unloading swarf with skip on closed track



4. CASE STUDIES

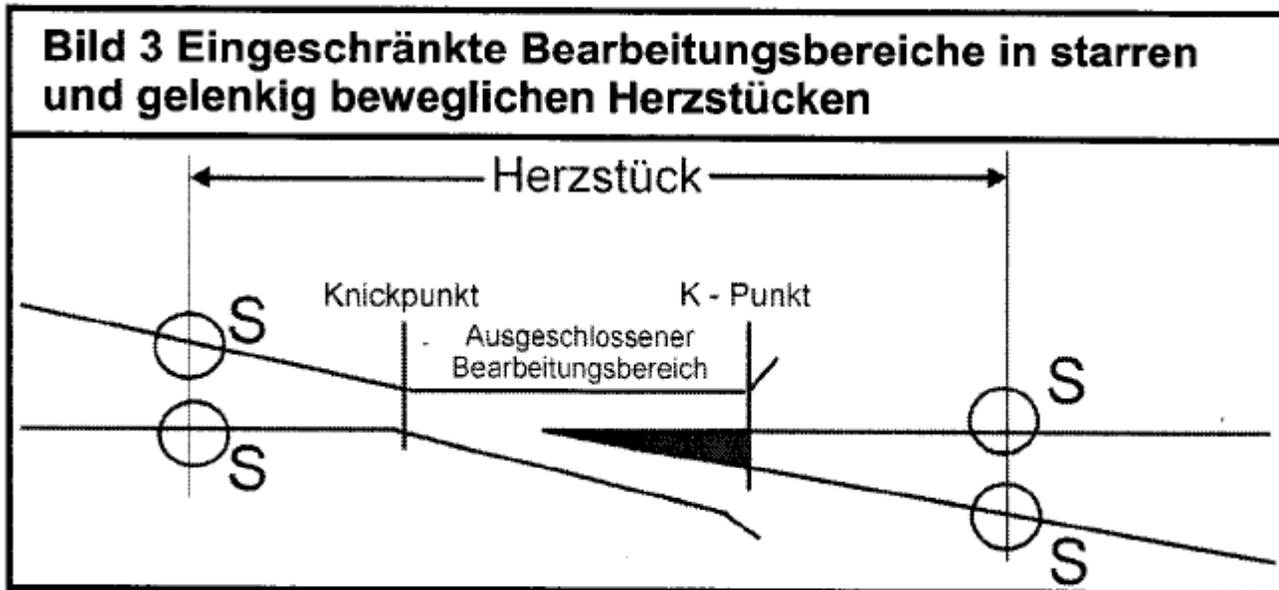
OTHER

A lot of defects are clearly shown after first milling pass.



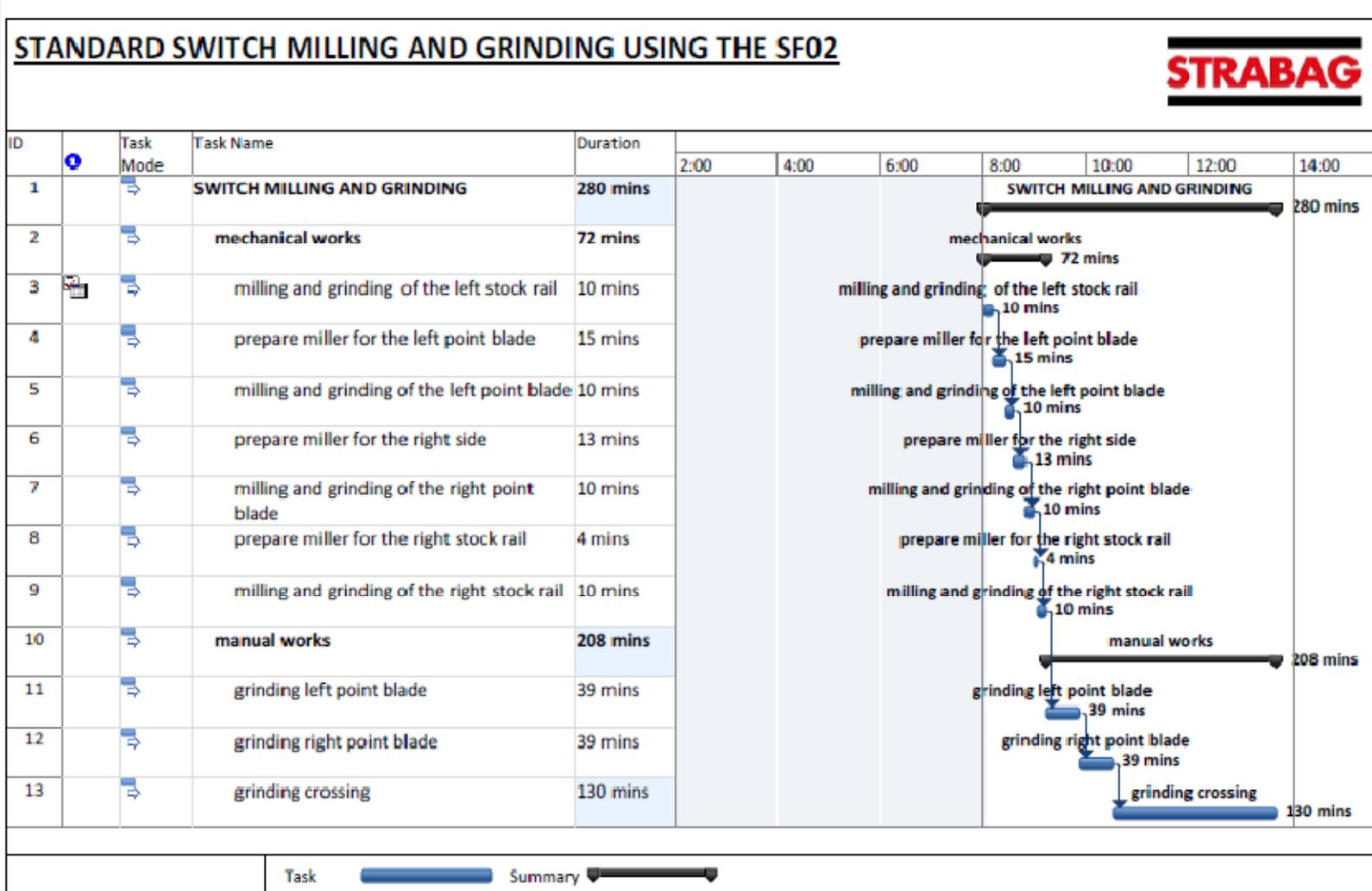
4. CASE STUDIES

MILLING OF SWITCHES



4. CASE STUDIES

MILLING OF SWITCHES



5. SUMMARY

MILLING

- Corrective rail profiling technique
- Potential to remove RCF cracks
- Potential for 5mm+ metal removal per pass (gauge corner)
- Perfect finish- no facets in small radius
- All defects will be taken out completely
- Finish in one pass – depends on track condition
- All profiles can be done
- Environmental friendly





Thank you for your attention!!

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