

# SCHWEERBAU'S INNOVATIVE SOLUTIONS FOR REDUCING RAILWAY NOISE AND VIBRATIONS AND IMPROVING AIR QUALITY

by Paul Jessett

## INTRODUCTION

In recent years, main-line and urban railways have experienced unprecedented growth. Passenger numbers have increased, as has freight tonnage. That success has subjected the railway's infrastructure to higher speeds, increased traction and braking forces, and greater gross tonnage on its infrastructure.

As a result, many rail maintenance regimes have been adapted to manage these increases through improvements in inspection and intervention. The railways' steel rails have benefitted from advances in rail grinding and milling to maintain their all-important profile under heavy use, and automatic lubrication systems reduce wheel-flange wear and noise.

However, wheel-rail noise and vibration caused by wear and damage to the rail, often in the form of corrugation and plastic deformation or the effects of rolling contact fatigue (RCF), are still serious problems encountered by many railway systems. Dust from wheel rail interaction, braking and maintenance activities is also becoming a serious problem, particularly in Underground systems.

The noise and vibration disturb residents as well as passengers, while RCF can significantly reduce rail life and increase the risk of broken rail. Tunnel dust affects health and safety of workers and passengers, and it will also lead to increased maintenance requirements to railway vehicles and tunnel equipment. Now, following several years of technological development and testing, Schweerbau has introduced new and innovative railway inspection, mobile rail treatment and tunnel cleaning technologies for Urban railway systems. These technologies are installed within state-of-the-art hybrid/battery powered vehicles - the RT-I and RGE series urban railway maintenance and inspection trains (*Right*).



## RGE SERIES HYBRID POWERED MAINTENANCE VEHICLE

The Schweerbau RGE series machines can be set up in a variety of vehicle configurations depending on the specific requirements. Typically, the RGE vehicle consists include hybrid powered power cars (PC-H) on either end of the consist and can be complemented with wagons installed with:

- ST Silent Track abrasive planing technology
- TC Tunnel Cleaning technology

## ST SILENT TRACK

Unlike conventional rail grinding, which uses rotating circular grinding wheels, the Silent Track rail abrasive planing car, developed by RailTechnology GmbH, consist of 12 abrasive planing blocks which oscillate longitudinally, in the direction of the rails. They can remove metal from both the rail head and shoulders without producing any sparks or dust.

The angle of each abrasive planing block can be adjusted, allowing metal to be removed from any targeted area of the rail profile. Positioning the abrasive blocks at different angles prevents the rail from being flattened during the planing process and also facilitates minor rail-profile changes.

The patented ST Silent Track rail abrasive planing technology incorporates an integrated swarf suction system, assuring that no debris is left behind on the track. The orientation of the abrasive planing blocks also means that there is no need to remove any obstacles such as axle counters and lubricators before planing can begin. Treatment can be performed on both plain-line tracks and switches on any rail type – Vignoles or grooved/embedded rails.

ST Silent Track can be used for a variety of applications including:

- Removal of surface defects including rail head corrugations

- Rail profile optimization
- Rail weld finishing or the improvement of misaligned welds
- Preventive maintenance

Using ST Silent Track to plane the railhead surface can deliver the following benefits:

- Reduced noise and vibrations for nearby residents
- Improved ride comfort for passengers
- Less track deterioration over time
- Reduced risk of rail breakage due to rolling contact fatigue (RCF)
- Minimised vibration and impact loading on other track components

One of the major advantages that the use of ST Silent Track brings is in the control of rail roughness and corrugation.

Corrugated tracks can be up to 20dB noisier than tracks with smooth rails and, although conventional grinding trains are ideal for removing rail wear damage and restoring rail transverse profiles, rotating grinding wheels always leave behind some form of residual roughness. This can not only affect noise but, in certain cases, can also promote the rapid return of corrugations if the peaks in the roughness spectrum are close to the frequency in which corrugation is forming from vehicle/track interaction.

Poor rail weld geometry (misaligned welds) often results in high dynamic impacts from vehicles passing over them. Welds become dipped, and this initiates the propagation of corrugations on the rail head.

Welded rail joints can become dipped or peaked if either the original weld was not aligned properly or the post processing after welding is not carried out correctly.

Vehicles bouncing over misaligned welds and corrugated rails not only cause rapid track deterioration, reducing the life of various track and vehicle components, they also generate a significant noise and vibration nuisance.

Conventional rail grinding has been shown to be ineffective in the removing dips and peaks in welded rails. Indeed, rail grinding trains often make the situation slightly worse, as the rotating grinding wheels tend to follow the vertical alignment of the tracks and so can make dips deeper. Only ST rail abrasive planing technology is truly effective in improving misaligned welds. The abrasive planing blocks used by ST Silent Track do not follow the vertical alignment of the rails but, instead, remove metal from the areas outside of the dips. If sufficient metal is removed, which depends on the depth of the dipped weld, the dip is eliminated.

Where conventional mobile rail grinding technologies often produce flying sparks and airborne dust and can also leave behind dust and debris on the tracks following processing, so they have quite an environmental impact.

Exposing trackside staff to this dust can pose a health risk. In addition, the sparks from grinding (even rail milling needs a final grind to produce an even finish) can introduce the risk of fire both in tunnels and where there is dry vegetation close by. Managing and controlling these health and safety risks can become quite expensive.

ST Silent Track technology overcomes all these disadvantages as it produces no dust and is spark free. As part of the process, it also collects any residual machining debris, so none is left on the track.

## **TC TUNNEL CLEANING**

As the removal of dust and debris from tracks is becoming a major challenge for urban railway systems, often operational for some 20 hours per day, there is the need for high productive cleaning technologies such as the TC technology.

Schweerbau's TC Tunnel Cleaning technology is based on a modular design where 1 or more TC cars can be coupled together depending on the cleaning requirements.

Powered from the PCH onboard batteries, the TC's high performance vacuuming capacity is highly efficient in collecting rubbish, debris, sand, dust and fine dust.

Cleaner railway tunnels are not only important for the health and safety of passengers and workers, but they also reduce the risks of premature failure of for example electrical components, bearings and gearboxes on trains and fires on the infrastructure.



## RT-I SERIES HYBRID POWERED RAILWAY INSPECTION VEHICLE

The Schweerbau RT-I urban railway diagnostics vehicle is a hybrid powered dual cabin compact vehicle which is fitted with various railway inspection technologies. The vehicle, developed by RailTechnology GmbH from Germany can run for several hours on battery power only and fits in nearly any loading gauge, including the tight London Underground deep tunnels. Due to its compact dimensions, the RT-I can be easily transported via road. The RT-I is fitted with the following inspection systems:



- EN 13848 compliant loaded track geometry
- High resolution rail vision
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- Rail wear and profile measuring

- Rail corrugation and roughness measuring
- GPR ballast condition inspection

Mentioned systems allow for high-speed inspections with precise detection of even the smallest defects and anomalies. Additional measuring systems such as Tunnel scan, clearance gauging and third rail position can be added to the RT-I vehicle depending on customer's requirements.



**Above:** Testing of the Schweerbau vehicles on the Kent & East Sussex Railway (Left) and at their terminus at Bodiam (Right).

**Photos:** Paul Jessett / Schweerbau

