



Always ready for the track: Asset Management

Rail Inspection
Data Processing
Training and Consulting



WE MAINTAIN WHAT YOU VALUE

Rail defects form during manufacture and over the rail's entire service life due to the stresses of normal operation. The different types of defects include structural irregularities (inclusions and slag), longitudinal defects, transverse defects or cracks (separations in the structure), welding defects (during manufacture), fatigue cracks and brittle fractures.

Vossloh's asset management aims to ensure that your rail infrastructure is always maintained in the best possible condition according to the following criteria:

- Operational reliability
- Availability
- Life cycle costs
- Planning
- Noise reduction

Ultrasonic testing trolley "Rail Road Runner"



Eddy current testing trolley

Our service: Inspections

Eddy current testing

One established method for detecting surface defects is eddy current testing. Network operators use this method to detect and evaluate surface defects with depths of **between 0.1 and 2.7 mm** that are caused mainly by rolling contact fatigue. Four eddy current probes are deployed per rail and these probes can be used on all the common rail profiles like S 49, UIC 54 or UIC 60. They are set at different angles relative to the rail's running edge. By exploiting the probe's optimum depth range, we can quantitatively determine the crack length and crack depth of head checks more precisely. Eddy current testing examines the rail's running surface and running edge and records both the defect frequency per meter and damage depths of up to 2.7 mm below the running surface. The method is also suitable for inspecting the flexible area on the switch points.

ADVANTAGES

- High accuracy when determining the depth and frequency of defects
- Optimal suitability for turnouts
- Low-wear single-probe tracking
- Filter function to prevent detection errors
- Follow-up data evaluation possible
- Very large memory capacity (> 500 km of track)
- Very reliable defect detection

Visual testing

Visual inspections are an integral component of **non-destructive rail testing**: With the naked eye and aided by mirrors, a magnifying glass and artificial light, our specialists can determine which testing method is most suitable.



Magnetic particle testing

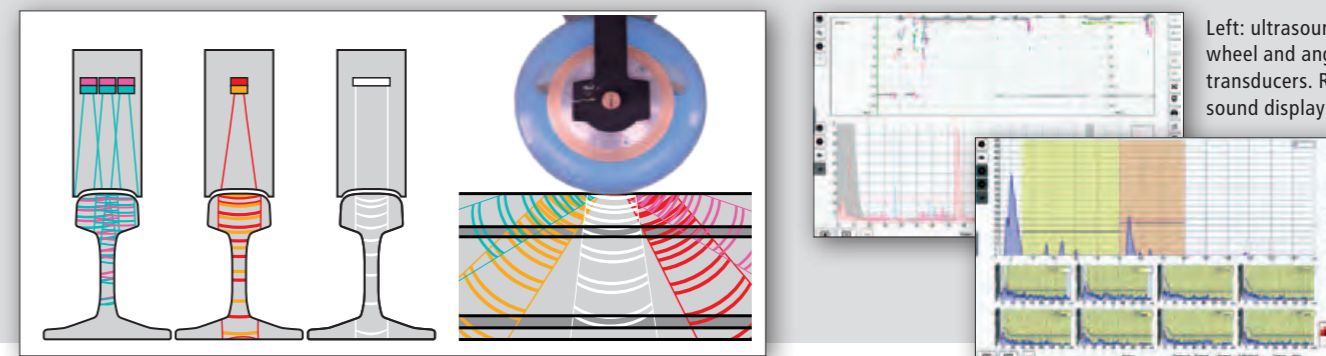
Magnetic particle testing

Magnetic particle testing can detect surface defects in any components that can be magnetized and is used in particular to test the quality of welds.

Ultrasonic testing

Ultrasonic testing is the most widely used method for examining rails for flaws and irregularities in the metal. The rail's susceptible areas are examined using nine transducers set at angles of 0, 40 and 70 degrees. All rail defects in the rail head, web and base can be seen in **real time**. The data collected during the test, e.g. **B-scans**, permanently document the rail's condition at the time of inspection.

Besides recording any irregularities, the inspection also easily recognizes squats, deep head checks and corrosion on the rail base. Audible and visual signals reveal exactly where a flaw in the rail is located. The user can set the threshold values and all the parameters such as fault length, depth and amplitude are recorded and saved. The findings can be sent directly to the office via the internet.



Left: ultrasound inspection wheel and angles of transducers. Right: ultrasound display screens



Our Service: Measurements

In addition to the results from the non-destructive testing, the rail's longitudinal and transverse profiles also need to be measured in order to be able to draw reliable conclusions about a rail's current condition.

Geometric measurements of the condition of track superstructure systems (track, switches, crossings, rail expansion joints) are taken and compared with standards, regulations and/or company-specific target values.

To this end we use devices for measuring transverse profile, corrugations, gauge width, groove width, twist and cant.

Transverse profile measurements

The rail head is measured using a number of coordinates. The rail type is determined and its current condition compared with the original profile (when new) from the rail library. This provides important information about wear. The rail height, head width, rail inclination, and rail lip as well as the wear from different angles are measured. The shape of the wheel-rail contact area is particularly important here.



Testing welding joint geometry



Inspecting rail straightness

Longitudinal profile measurements

The system for detecting short-wave defects in the rail head measures all the corrugations between 10 mm and 1 meter. With up to four configurable wavelength spectra, it can record different corrugation types in a single pass. The results and historical data are then used to deliver exact information for planning rail machining measures.

Height measurements

Here, material loss on the rail is measured by determining the Delta using reference points.

Switch measurements

Switches are measured using a portable inspection unit to record measurement parameters on the tracks and points such as track gauge, cant, groove width and distortion. The measured data is saved to a memory card, analyzed by computer and the results then displayed as a graph. Data can also be recorded for the German railway's IISSystem. Distortion is measured every 3.6 m (every 6 sleepers).



Our equipment range for sale: Rail Road Runner – ultrasonic rail inspection in a single pass

The Rail Road Runner (RRR) rail testing trolley is used for **regular inspections** over short sections of track and also in switches, crossings and stations. It employs an ultrasonic inspection method to detect material irregularities and internal flaws. Susceptible areas are examined by 9 transducers at angles of 0, 40 and 70 degrees, and any internal rail defects in the rail head, web and foot are traceable in **real time**.

The data recorded during the scan, e.g. **B-Scans**, provide permanent documentation of the condition of the rails at the time of inspection. A **service desk** is available to answer user questions, exchange information and forward change requests, user demands and software upgrades. The RRR is ideal for network operators, rail infrastructure businesses and railway industry service providers.

SERVICES

- Purchase
- Customer training at the Vossloh training center
- Analysis of customer data via web access
- Field management
- Maintenance and spare parts support



Rugged 10,1" tablet

Tracking system

Powerful ultrasonic system

Multiple ultrasonic views

Very easy to operate

All internal rail defects traceable

Training, analysis, data integration

Rail Road Runner: functions and advantages

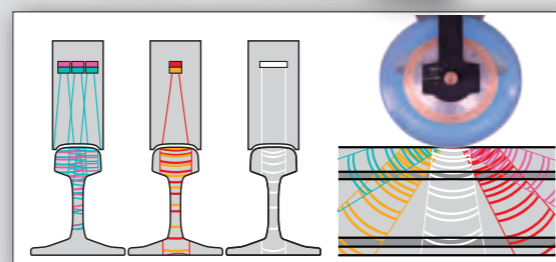
Rugged 10.1" tablet PC IP65 MIL-STD-810G

- Easy to remove for use in the office
- User interface with intuitive touch-screen display
- Day and night mode
- Eagle view allows quick zoom in and zoom out
- Can be used in all weathers under any kind of light



Powerful 12-channel ultrasonic system with a 9-transducer roller search unit (RSU)

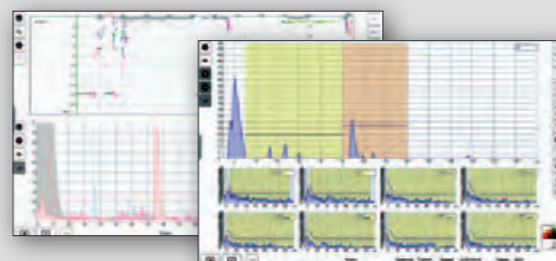
- Six 70° transducers (3 facing forwards and 3 backwards) for the running edge, center, and outside edge)
- Two 40° transducers (1 forwards and 1 backwards)
- One 0° transducer



70° transducers 40° transducers 0°-transducer

Multiple ultrasonic views

- A-Scans of all 9 ultrasonic channels in a single view
- B-Scans of all 9 ultrasonic channels in a single view
- Detailed A-Scan of one channel and thumb views of the other 8 ultrasonic channels in one view
- A-B-Scan
- Echo dynamic



Easy to operate

- Optional extra channel to verify results without the trolley
- Lightweight carbon fiber construction
- Low couplant water consumption thanks to software-controlled valves
- Greater operating distances thanks to low energy consumption
- Sets up and dismantles easily and quickly
- Suitable for right-handers and left-handers
- New tracking with exact positioning in both forward and backward operation

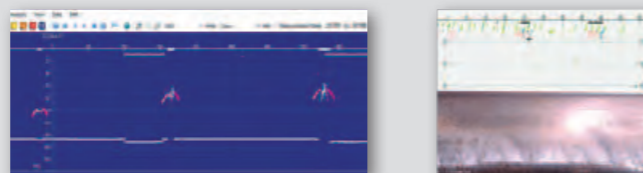


RRR trolley with separate standard ultrasonic transducer

Documented ultrasonic inspection also possible without the RRR trolley (optional)

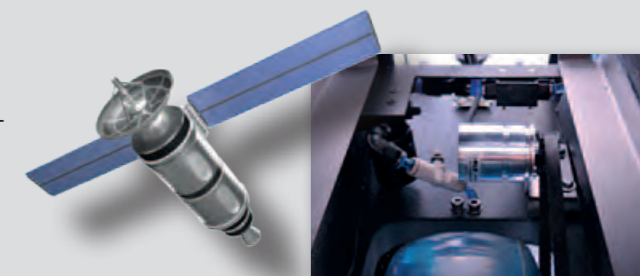
Detects all internal rail defects such as squats and head checks

As well as detecting any internal defects in the rail head, web and foot, the system also easily identifies severe head checking, squats and rail foot corrosion. Acoustic and visual alarms indicate the rail defect's exact position.



Location info from tracking system

The RRR tracking system supplies all the available location information and incorporates it into the ultrasonic inspection data: GPS, Glonas, QZSS, Hectomarker, Landmarker, Track ID, Pedometer function using encoder technology



Training, data processing, reporting and data integration

- Customer training sessions given by a certified Level III instructor in the use of the RRR and FURIS AB VIEW software programs at Vossloh's training centers in Berlin, Hamburg and Leipzig
- A field manager can supervise your testing activities
- All inspection data is available long-term for documentation, quality and evidence purposes
- Data analysis can be done off-site in a safe environment
- Unclear ultrasonic indications can be discussed with the supervisor immediately by phone (transfer B-Scan using SIM card module) or later in the office
- Raw and analyzed data of each report are available if any questions arise later
- Comparison between past and current inspection data with conclusions

- If the customer's capacity is limited, the collected data can be analyzed as a service via secured, web-enabled access
- Inspection results can be imported into the customer rail infrastructure asset management database



Our equipment range for sale: RIC-city rail inspection car

How do you inspect your rails and switches?
Are all the fastenings tight?
How do you detect corrosion on the rail base?
Is your network still using trackwalkers?

How do you detect head checks and other flaws such as cracks in the rails?
At last you can precision-inspect your railway routes in a single pass and completely in sync with the schedule. With rails and switches under the RIC microscope, any deviation or damage is detected and documented – together with a recommendation for its proper removal.

ADVANTAGES

- Rails are tested and measured in sync with the normal timetable
- Testing is performed at speeds of up to 60 km/h
- Capable of providing a complete overview of the railway infrastructure
- Decisions on improving operational safety are taken in good time
- Select your preferred model
 - Purchase
 - Leasing

Upon completion of the software analysis, all the data that the RIC-city collects can be combined and displayed. Precise documentation and regular monitoring save huge costs because defects are recognized early and as such can be rectified inexpensively.



Video monitoring

monitors the condition of the rails, switches and fastenings



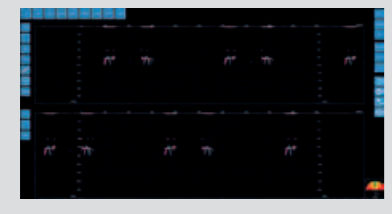
Eddy current testing

detects open defects in the rail head

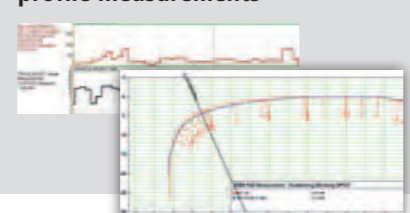


Ultrasonic testing

detects flaws inside the rail



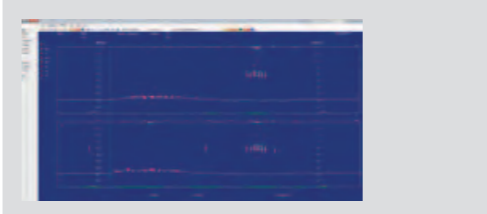
Longitudinal and transverse profile measurements



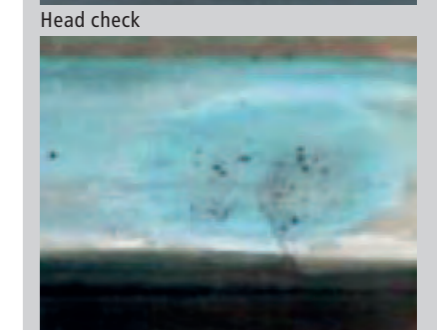
Inspections in sync with the schedule

RIC-city is fast and accurate, enabling railway operators to inspect the majority of their rails without closing off routes.

Detects corrosion on the rail base



Typical rail defects



Loose rail fastening



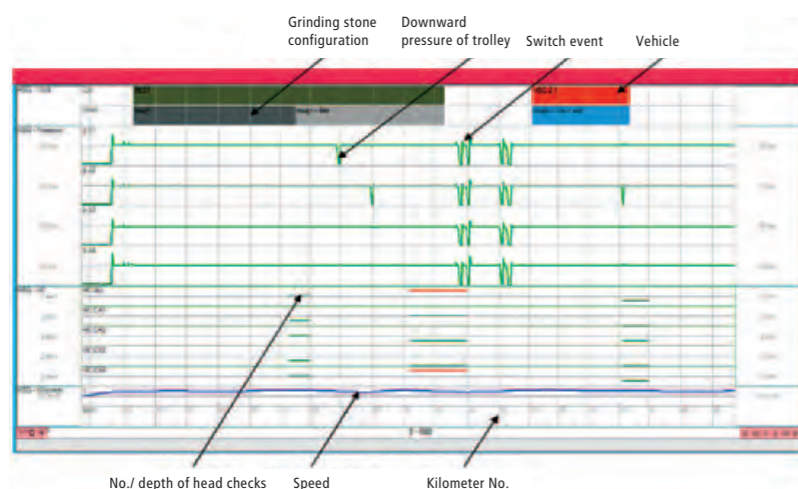
Consistent: Data Processing

Successful rail and switch maintenance **begins with recording and documenting** the actual situation, with intelligent data processing then employed to **prepare and analyze the data**. These standardized procedures enable us to record and assess the specific requirements of different customers using consistent and comparable data handling processes.

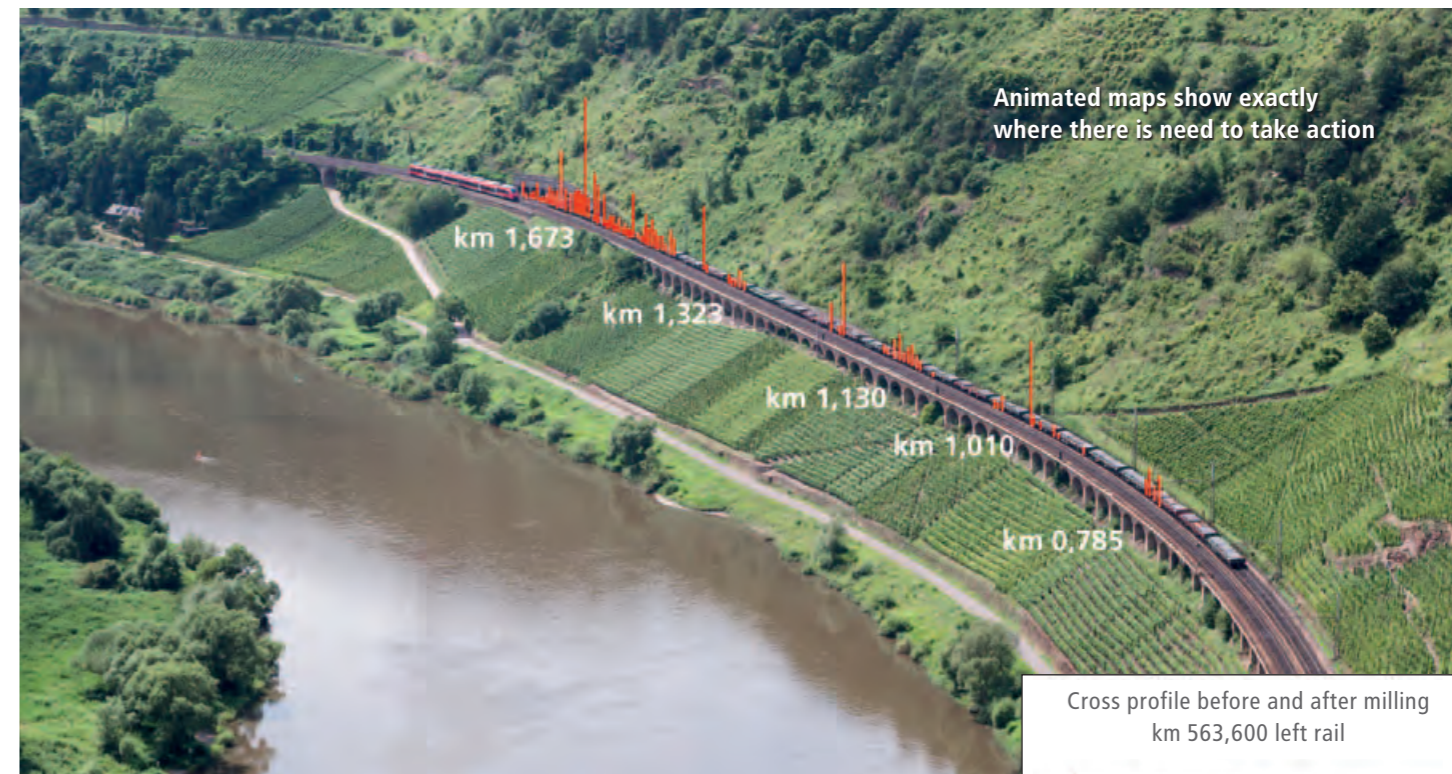
Vossloh draws on its comprehensive knowledge of all phases of a rail's life cycle and dedicates highly specialized personnel and technology to these tasks.

The data can also be sent by the customer directly to Vossloh for interpretation and analysis in our databases. These services include the evaluation and classification of ultrasonic and eddy current data that the customer has collected.

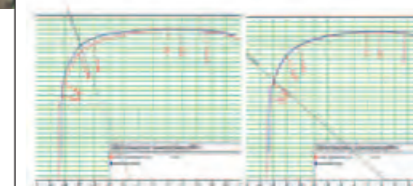
Data processing not only handles the master data of the rail facility's superstructure and the inspection and measurement results, it also processes the data from maintenance procedures such as milling, grinding and renewal data such as rail replacements.



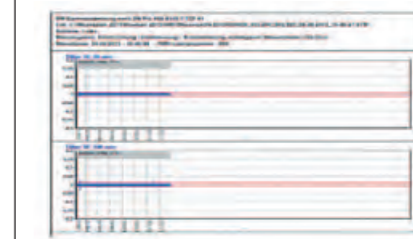
Example screen showing maintenance data (HSG) and inspection data (eddy current)



Cross profile before and after milling km 563,600 left rail



Longitudinal profile after milling km 563,600 – 563,825 left rail



With milling 563,000 – 566,425 right and left rail – all RCF defects removed



Incoming data on the rail's condition is validated, assigned, analyzed and classified

Data processing steps

Validation: Ensure that the data is correct

Sorting: Matching up the data sets, e.g. measurement data with route information

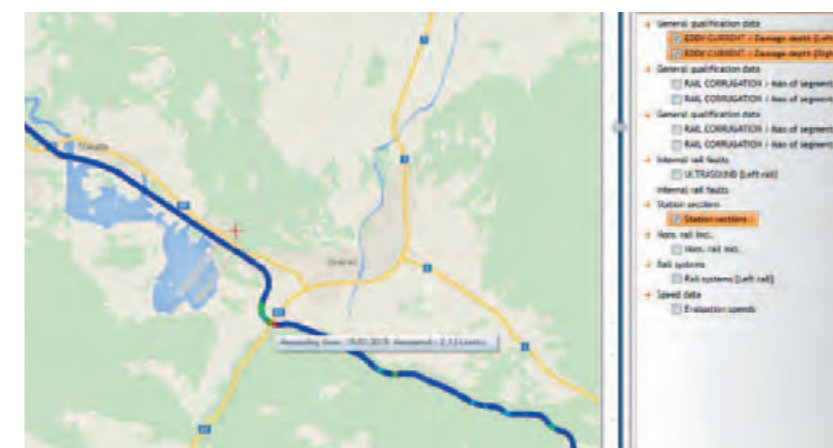
Summarization: Detailed data is summarized

Aggregation: Different data sets are combined

Analysis: Collection, analysis and interpretation of data

Classification: Data is classified into different categories, e.g. defect categories as per customer specifications

Reporting, e.g. inspection reports



Inspected section of route



A practical example for data processing: Maintenance strategy for Croatia's rail network

All network operators strive to extend rail life and reduce infrastructure costs over the medium term. A holistic approach is the key to achieving this and Vossloh and its client in Croatia are going down this road together. An **initial analysis** of the railway infrastructure's condition performed as part of the Asset Management System enabled us to select from the broad service portfolio the most economically viable maintenance method given the condition and the age of the rails.

The customer can rest assured that this customized maintenance strategy will minimize the impact on rail transport and **maximize operating efficiency**. The analyzed test and measurement data were entered into the Asset Management System and the results of the various methods compared and superimposed using a software-based tool. Accurate documentation and graphical representation of the data formed the basis for determining a custom-fit **maintenance strategy** and also provided a reference with which later measurements of the infrastructure's condition can be compared. Interestingly, each route has its own characteristics in relation to wear and damage, and it is this profound observation that clarifies the true potential for optimization that will minimize track closures and costs over the long term. Using the values determined for the Croatian rails'

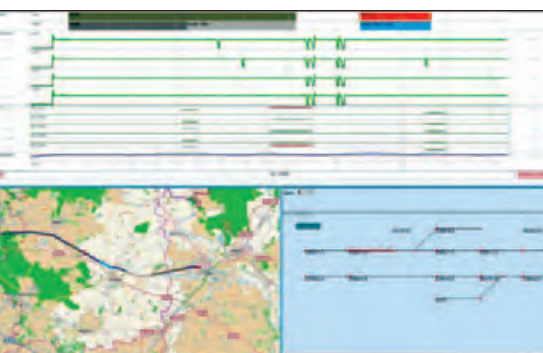
actual condition, Vossloh calculated the required metal removal for longitudinal and transverse machining of the rail profile and chose milling as an appropriate rail machining procedure to rectify the problem. From this we derived a catalogue of appropriate measures and adjusted it to the budget.

Our core tasks in Croatia:

- Elimination of rolling contact fatigue, or RCF defects
- Restoration of the rail cross section
- Elimination of longitudinal undulations in the rail (ripple)

Ultimately: HSG

After rectifying the defects, the routes were preventively maintained using High Speed Grinding at 80 km/h without any disruption to normal rail traffic.



Example of an inspection report

We coach and consult

Training

Vossloh trains its customers' employees in every aspect of asset management from measuring and testing railway lines to data evaluation, data analysis and independently determining rail maintenance strategies. We are also there to help our customers with advice and assistance concerning monitoring and regular updating their knowledge base. The training we provide also covers precise instruction on the functionality of Vossloh equipment like the Rail Road Runner or the RIC rail inspection car.

Consulting

Our customers are more successful because they continually turn their attention to the condition of their rails and – with our help – introduce the right measures at the right time. This is the main goal of our consulting services, which we provide at Vossloh or at the customer's location. We are also available to supervise works carried out by the customer.



Consulting in practice (top) and theory



Find out about
our other rail
maintenance
services:



**Factory-based
Rail Production Services**

Long rail manufacturing
Rail transition points and insulated joints
Profile processing
Logistics



**Perfectly connected
on the move**

Welding on the route
Mobile welding factory
Rail replacement




**Co-ordinated
Perfectly**

Loading & Logistics:
Transporting and loading rails and turnouts
Construction site logistics



**Rails perfectly
maintained**

High Speed Grinding
High Performance Milling
Flexis System



Rail System and Turnout Services

Inspection and testing
Diagnostics
Maintenance
Asset management
Delivery of standard Vignol-rail turnout