Railway Gazette
INTERNATIONAL

NORTH AMERICA

Railway Interchange

US rail development to be debated at Indianapolis convention

PAGE 30

INTERVIEW

Alexander Misharin

Work to start next year on Moscow – Kazan high speed line

PAGE 54

IN FOCUS

Performance

Understanding punctuality measures that reflect the passenger experience

PAGE 62

www.railwaygazette.com September 2017

On track to better infrastructure

Apps support welding as digital worksite emerges

The emergence of connected devices and electronic documentation is starting to change the way infrastructure maintenance possessions are undertaken. Track welding is one area where a digital workflow is being implemented to improve the consistency and reliability of work.

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Today, we can no longer imagine a world without smartphones. It is not possible to envisage the modern, connected world of business without digitisation, and — in the German-speaking world at least — Industry 4.0 is on everyone's lips. Meanwhile, tightening regulatory standards for quality, reliability, transparency and efficiency are placing greater demands on those responsible for the construction and maintenance of railways. Yet if you visit a railway worksite today, you will often struggle to see much evidence of these modern trends taking root.

The aluminothermic welding process for joining rails is just one such example. When joining rails using the Thermit welding process, a defined gap in the rail is filled with liquid Thermit steel, which is produced through a vigorous exothermic reaction of aluminium with iron oxide. After solidification, the joint is machined to recreate the rail profile. The individual steps in this process must be carried out precisely as set out in the instructions from the process provider in order to guarantee the quality of the weld. However, until now the steps have not been recorded. A key criterion for acceptance is the geometry of the welded joint created after the final grinding step; this geometry is measured using a steel rule and feeler gauge and is documented by hand on the final possession report.

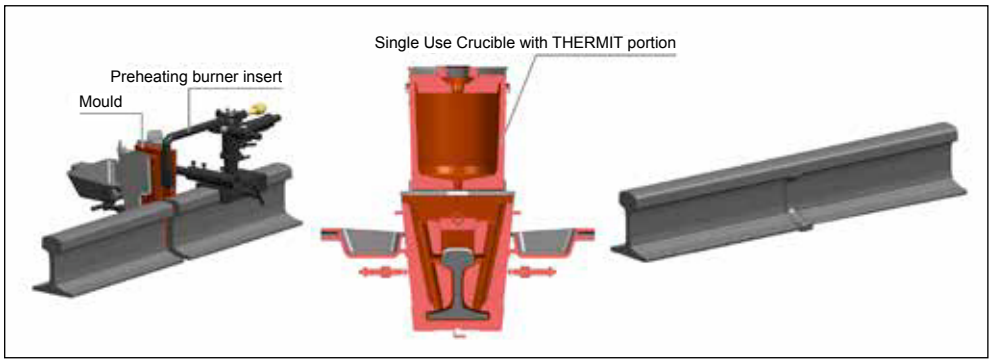


Fig 1. Gap in the rail to be welded with mould(s) and preheating burner (half section); Single Use Crucible with Thermit portion (full section); welded joint after grinding.

Screenshot of the Goldschmidt Digital App and Smartweld application.

Digital application

The emergence of digital tools over recent years means that there is the potential to update this methodology considerably. Almost everyone has a smartphone or tablet, and is connected to the web most of the time. Goldschmidt Thermit has developed the Goldschmidt Digital App to offer a secure digital platform for recording and documenting the rail welding workflow in real time. Combined with our related hardware that can connect to a smartphone by means of a Bluetooth interface, it is possible to digitise all the necessary documentary evidence of the welding process (right).

This detailed workflow can be stored within the app to help welders through the rail joining process on a step-by-step basis. The app can identify which welding process is to be used with which rail profile and grade, and automatically completes the relevant fields in the documentation. Preset values can be confirmed by the welder or adjusted for bespoke applications, and notifications warning of contradictory parameters — relating either to the Thermit element or the rail sample — can be generated automatically.

The digital format allows the various stages of the rail joining process to be programmed into the connected device, which increases the reliability of the weld. At the same time, the weld data are recorded and made available to the user in PDF or CSV format.

The digital worksite

In future, the automated recording and processing of data in real time will enable the documentation of highly complex sequences on the worksite. Measured data for relevant parameters can be recorded, checked, logged, compared and sent securely using just a smartphone or tablet. This ensures end-to-end traceability, and facilitates quality assurance and consistency of workflow. But more effort will be needed to improve the automation of data recording and processing for the digitisation of worksites to fulfil its potential.

Currently, for example, weld parameters can be linked to the electronic profile measurement using a project number. The respective logs are transferred to the customer system in PDF or CSV format, where they are analysed and evaluated. In future, the data will be stored centrally in an overarching digital platform, where all welding data can be stored, analysed, recorded and identified. This would open the door to adding digital records of other parameters, such as neutral temperature, to create a comprehensive 'digital

TOOLS & SMALL PLANT

Connected devices support reliable welding

Goldschmidt Thermit has introduced a number of tools and small plant to support welding jobs which can communicate with its digital app via a Bluetooth interface.

Smartweld Record: a burner handle with gas pressure sensors

The burner handle supports the intelligent monitoring and documentation of the preheating process for the Thermit weld and, as a result, its traceability. The pressure sensors for the fuel gas and oxygen transfer the measured values to the connected smartphone or tablet during welding. It is possible to document that the preheating process has been carried out in line with the work instruction. Both the pressures and the preheating time are collected and recorded in the log. In addition, GPS data, the date and time and, if necessary, the identification of the welder can also be documented. The burner handle is fully compatible with conventional Thermit equipment and can be used without further staff training.

Preheating with the Smartweld Record device.

Smartweld Jet: an automated propane/air preheating device

Smartweld Jet is the next step towards further automation of the welding process. The device is self-monitoring and can be used on its own or together with the digital app. The burner works with compressed ambient air, meaning that it does not require industrial oxygen, and automated preheating supports a consistent and reliable welding process. After scanning the weld portion, the app can generate the required preheating parameters and transmits these to the Smartweld Jet. Preheating itself is not initiated by the software but by the operator controlling the device directly. The stored programs can be updated and adapted in the app, meaning the control system of the preheater can be managed without the device being physically present. As the app can be loaded onto any Android smartphone or tablet PC, no specific additional control equipment needs to be procured.

Electronic measuring devices

As well as the weld parameters, the geometric data for the welded joint after the final grinding process can be documented in line with country-specific requirements. Depending on the application, various electronic measuring devices can be used. All of these are able to measure and analyse the geometry of the running surface and/or gauge face in compliance with relevant local technical standards. As a result, PDF or CSV records of the completed welded joint can be exported, raising the prospect that in future, the separate acceptance measurement of the final grinding by the asset owner or independent certifier could be eliminated. ■

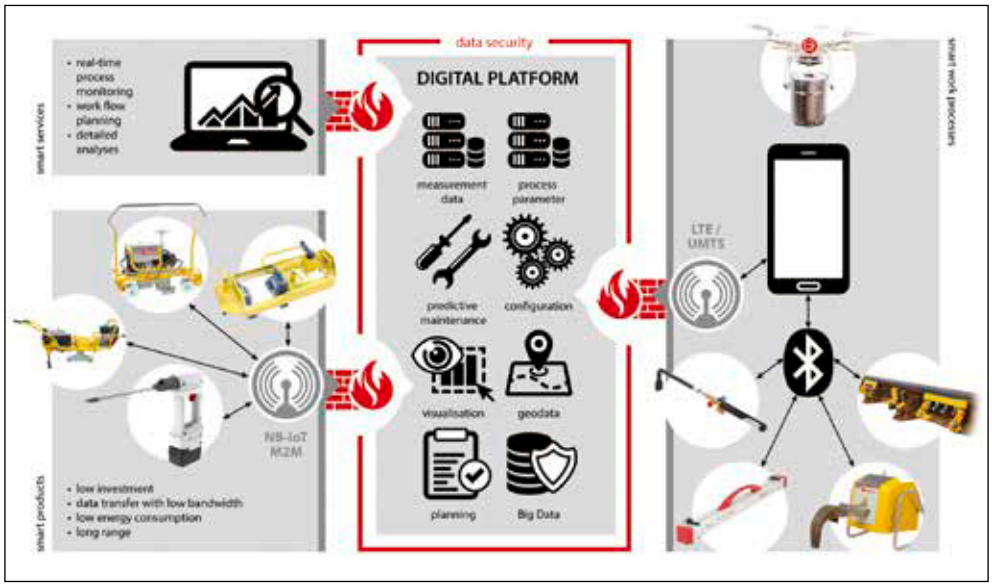
Left: **Smartweld Jet is an automated propane/air preheating device.**

Right: **Railstraight Dual is used for simultaneous measurement of the running surface and the gauge face.**

track asset file'. This could be shared via APIs with the infrastructure manager and contractors' own ERP databases.

Elsewhere, emerging geodata capability means that in future asset managers will be able to develop web-based interfaces that can both record and interpret worksite data and locate it. This will help identify productivity problems and failure rates for a given piece of infrastructure, and help the introduction of condition-based monitoring of on-site tools.

These tangible examples of 'Internet of Things' applications suggest that the industry is already making the first steps towards digitising infrastructure maintenance, and modernising best practice in track welding methodology is an important element in establishing the digital worksite. ■



Goldschmidt Thermit is developing an overarching digital platform to monitor, record and analyse welding performance.