



Seminar report

PLANT & MACHINERY

SUPPORT TO RAIL INFRASTRUCTURE RENEWAL AND MAINTENANCE FOR THE 2020S AND BEYOND

PWI TECHNICAL SEMINAR
24 NOVEMBER 2021
NEWCASTLE UPON TYNE

CHAIRS AM: PHIL KIRKLAND - PWI VICE PRESIDENT NORTH-EAST | PM: JACK PENDLE - M&EE NETWORKING GROUP

SAFETY COMES FIRST

NICK MILLINGTON - PRESIDENT, PWI
SAFETY TASKFORCE LEADER - NETWORK RAIL

Nick explained (via video message) that plant is vital to the rail industry, particularly for increasing safety, by reducing the number of personnel required on-track.

Unfortunately, the last 12 months have seen a deterioration in safety levels on the railway with a number of injuries and even fatalities having occurred. Greater use of plant can assist in tackling this issue, but people and plant must still be kept apart.

Advances in the use of devices to monitor exclusion zones, and any incursions into them, is to be encouraged. Safety briefings also highlight the need to ensure that working with plant is kept safe at all times from depots to the worksite.

INNOVATION IN PLANT

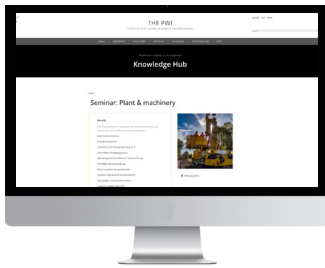
BOB BROWNING - HEAD OF CORPORATE STRATEGY
QUATTRO PLANT

The first of the day's presentations was by Quattro Plant's Bob Browning, titled 'Innovation and who is going to pay for it?' Bob began by explaining that innovation is the practical implementation of ideas that result in the introduction of new goods or services, or an improvement in offering goods or services. He also said that Thomas Edison could be seen as being the father of innovation as in 1870 he famously innovated the electric light bulb rather than inventing it.

Quattro Plant is looking to innovate and find new clean propulsion technologies for its fleet of over 750 diesel-powered machines, a process it started five years ago.

The company has partnered with the University of Exeter to look at the options available, as well as opening a research and development centre at its Newton Abbot Depot. So far, two road / rail machines have been converted to fully electric power - a John Deere Gator and a Neotec/Haulotte Skyraider 160 MEWP - using technology developed by Quattro Plant and the University of Exeter.

After successfully completing trials with the two machines, it is now planned to convert further examples of both types including obtaining all the necessary approvals and certification. This will be undertaken in-house, as well as initial work to convert a road/rail tracked 360° excavator. Bob later explained that the company is also looking at the infrastructure aspects of supporting electric vehicles as the next phase of the project. This will cover the charging of vehicles, particularly on-site, and have some form of standardised plug arrangement.



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AUTOMATED TAMPING

**BERNHARD ANTONY - HEAD OF TECHNOLOGY CENTRE
PURKERSDORF, PLASSER & THEURER**

Up next was Bernhard Antony from Plasser & Theurer with a presentation on the automation of the tamping process. As Bernhard explained, there have been four milestones in the development of on-track machines over the last 70 years, the first of which was the introduction of mechanised track maintenance. This was followed by the development of assembly line processes for tasks such as track renewals and ballast cleaning. The production of alternative hybrid and all-electric propulsion systems for machines was the third milestone, with the fourth being the digitalisation and automation of machine operation. For the latter, the development and introduction of smart tamping machines will reduce human intervention, with technology replacing the practical experience of operating staff.

This will lead to less machine down time, increased efficiency, a better quality of output and fewer mistakes. Having undertaken a considerable amount of research and trial operations, Plasser & Theurer has been able to develop an automated system that will enable a tamping machine to undertake in-situ measurements of the track and ballast prior to any intervention.

It was found that clean ballast required less forces to be applied than dirty ballast, highlighting the need to treat them differently. The system can analyse the compaction effort required and also determine the ballast condition, before treating the track as required. Once completed, it is possible to provide a data log of the work undertaken including a visualisation of the area treated. There is also increased quality of the trackwork through dynamic compaction control, the ability to monitor the ballast condition and, therefore, predict the intervals required for cleaning.

OTMS ACROSS THE UK

**MICHAEL ZEIDLER - HEAD OF PLANT
MATT WHITING - SENIOR PROJECT MANAGER
SWIETELSKY BABCOCK RAIL**

Swietelsky Babcock (SB) Rail's Michael Zeidler and Matt Whiting were next to take to the stage with a presentation titled, 'Operating plant from the Channel Tunnel to Thurso'. They began by giving the background of the Joint Venture (JV), formed in 2004, that owns and operates On-Track Machines (OTMs) in the UK.

Typically, SB Rail now delivers over 3,500 OTM shifts per year through its framework agreement with Network Rail and has the youngest fleet in the UK. The JV has evolved, increasing its number of OTMs and sphere of operation. In 2011, it began working on High Speed 1 (HS1), utilising machines from Swietelsky Austria, and has now achieved over 10 years of operation on the route.

Whilst tampers form the largest proportion of SB Rail's fleet, it also includes ballast regulators, finishing machines and rail cranes. The organisation has always been at the forefront of new technology, having introduced many firsts to the UK like Kirow KRC250 UK cranes with rotator heads, track finishing machines and Plasser & Theurer 09-4x4/4S Dynamic tamping machines, with it now having six examples of the latter in its contract with Network Rail.

The JV started using biodegradable Panolin lubricants in machine hydraulic systems over 12 years ago, and in 2017 began replacing mineral oil in all major components with the equivalent Panolin product. Combined with regular sampling and analysis, this is providing considerable savings in waste oil and costs. Other environmental initiatives are also in place with regard to when a machine's main engines are in operation in order to reduce emissions and save fuel. Looking to the future, SB Rail would like to see more of the UK rail network electrified, as this will enable the introduction of the hybrid electric OTMs, resulting in reduced emissions and fuel usage.

M&EE NETWORKING GROUP

**JACK PENDLE - CHAIR, M&EE NETWORKING GROUP
MICK JAMES - DEPUTY CHAIR, M&EE NETWORKING GROUP**

The M&EE Networking Group's Chair, Jack Pendle, and Deputy Chair, Mick James, gave a presentation on the Group and its activities. Infrastructure Maintenance Units (IMUs) and Track Renewal Units (TRUs) were created in 1994 as part of privatisation of British Rail, later being offered for sale and becoming stand-alone companies as IMCs and TRCs.

A requirement of the Railway (Safety Case) Regulations was for the successor organisations to each have a professional Head of M&EE who became the controlling mind in respect of plant operations and M&EE. By forming a group of the newly-appointed heads, the philosophy of 'a problem shared is a problem halved' could ensue and the first M&EE Group meeting was held in 1994.

Through changes and mergers, the Group has continued with a strong commitment from its members to promote safe working practices with plant, help each other with reviewing incidents and accidents, and freely share knowledge to resolve problems.

Subsequently, the Group was also opened up to the operations side of the industry and now has 14 permanent member companies with over 25 attendees at each meeting. At first, no standards or procedures existed covering the operation of OTMs or On-Track Plant, so the Group produced its first Code of Practice (COP) in 1996. Today, 48 COPs have been produced, along with a series of safety posters, all available through the RSSB website.

Last year, the Group developed a memorandum of understanding with the Infrastructure Safety Liaison Group (ISLG) to work together to coordinate efforts. The need for an integrated plan for safety improvement was identified and this will be published shortly. A new sub-group has also been established to examine data on incidents / accidents involving plant, to understand the risks posed and determine priorities for further work. The overall aim being to identify trends and develop mitigations to prevent further incidents.

ELECTRIFICATION INNOVATION

OWEN MILLS - HEAD OF ENGINEERING, KELTBRAY RAIL

'Plant innovation for electrification' was the title of the presentation given by Keltbray Rail's Owen Mills. In this talk, Owen detailed the way in which the company has come up with innovative ways of how to improve the use of plant during the installation of electrification.

He detailed the barriers to investing in innovation such as short contract durations, the time period before a return is made on the investment, the limited UK market and the time taken to achieve Network Rail Product Acceptance.

An industry change came in 2015 with the introduction by Network Rail of a modular OLE system, as used on the electrification of the Great Western Main Line. However, this actually resulted in

larger and heavier equipment with an increased manual-handling challenge. There was also the need for the industry to ramp up for delivery projects, overcoming skill shortages, after the previous quiet period for electrification work.

Keltbray has responded by introducing a number of innovative plant solutions for the work. Examples Owen illustrated included road/rail lorry-based MEWPs being also equipped with a crane capability, a road/rail lorry-based wiring system with full tensioning, a means of installing high voltage cables safely, a road/rail excavator attachment for manipulating OLE masts and a rotational drilling head for OLE installation under bridges or in tunnels.

The company has also invested heavily in the training and development of staff for specific tasks and projects, which has delivered benefits on-site.

PROTECTION SYSTEMS

STEVE PINKNEY - PROGRAMME DELIVERY DIRECTOR
XYZ RAIL AND CIVILS

Concluding the morning's session was a presentation by XYZ Rail and Civils' Steve Pinkney on the I-System high performance protection Any Line Open (ALO) system for off-track machines. Steve began by explaining what ALO working was and what the parameters of an exclusion zone would be against an open line in various track configurations. These were all as stated in the M&EE Networking Group COP for ALO working.

He then discussed the I-System equipment and how it could control machines that are working in the exclusion zone. It creates a virtual wall along a boundary line using I-Markers placed at three-metre intervals. The installed I-System recognises these markers and, through the Rated Capacity Indicator (RCI), cuts the machine's power as it approaches the virtual wall, but also allows a safe movement away.

The system has the advantage that it can be easily and quickly moved to adapt to changing sites and situations. Three different versions of I-System are available, which can be fitted to any excavator, depending on the level of protection that is required.

SITE SAFETY

DOMINIC BALDWIN - MANAGING DIRECTOR
HASTEC RAIL

Dominic Baldwin from Hastec Rail gave a presentation on its Collision Avoidance System (CAS) and the Isolation Limit Control System (ILCS). In January 2020, working with its sister company Elmec Solutions, Hastec Rail commenced research and development into the CAS, the initial plan being to install it on Elmec's road/rail hire fleet. Successful trials of the CAS were undertaken in December 2020 and the progress was presented to Network Rail.

As a result, in April 2021, Hastec Rail was commissioned to undertake trial installations of the CAS on some of Network Rail's road/rail lorry-based MEWPs. The CAS is integrated into a machine's control system and has a number of embedded, enhanced vehicular controls to limit both worksite and travel mode speeds.

Its visual and non-visual system detects obstacles in the direction of travel, via an exclusion zone radar and camera monitoring system, with an audible cab alarm and warning lights. It is calibrated to function within W6 gauge and a safety-exclusion demarcation zone is visualised externally by a low magenta light. Once the vehicle engages in rail mode, a live and recorded video safety surveillance system is also activated.

The CAS has received Network Rail Product Acceptance for the current machines with other types imminent. Reminder of Live Exposed (RoLE) equipment provides a means of identifying the safe working limits on-site, as detailed on an overhead line permit. The CAS has been enhanced to enable the ILCS to be an integral part for a machine fitted with a transmitter system to detect RoLE equipment. On detection, the operator receives an audible notification and a visible warning that they are approaching the isolation limits, with the vehicle then brought to a controlled stop.

The system is currently in advanced development with a number of site trials having been conducted.

INDUCTION WELDING

NICK MATTHEWS - HEAD OF TRANSFORMATION AND
CONTINUOUS IMPROVEMENT, SOUTH RAIL SYSTEM
ALLIANCE, NETWORK RAIL
NICK MOUNTFORD - MANAGING DIRECTOR, MIRAGE RAIL

A joint presentation was given next by Network Rail's Nick Matthews and Mirage Rail's Nick Mountford titled 'Induction welding and the experiences of breaking into the rail market'. Nick Matthews began by explaining that the objective had been to find a way of welding rail that was solid phase, but that did not have the waste area associated with flash-butt welding. It would need to have a bend strength close to that of an original piece of rail, minimal rail consumption for S&C installations and be delivered by a lightweight mobile-welding head, which could be deployed from various road/rail vehicles.

Nick explained, following various bench tests, prototype weld heads were developed and trialled, resulting in a production prototype. This has met the objectives with a less than seven-minute weld process time, but some difficulties have been encountered. The Covid-19 pandemic has also not helped for undertaking further trials and staff availability, but it is hoped to build a second prototype head incorporating the lessons learnt.

Nick Mountford then took over to explain the challenges Mirage Rail has encountered in breaking into rail, with the company's background in the automotive, food and pharmaceutical production equipment markets. He reflected on the various costs associated with entering the rail market for certifications and organisation memberships, in addition to the actual development costs for the technology which was funded by Network Rail. He would like to see some simplification of the processes and systems in order to encourage greater innovation.

QUICKER RAIL WELDING

MICHAEL COWAN - MANAGING DIRECTOR
GOLDSCHMIDT SMART RAIL SOLUTIONS

Continuing on the welding theme, Michael Cowan from Goldschmidt Smart Rail Solutions was next to give a presentation, on the Smartweld Advanced Cooling Equipment (ACE).

The Smartweld ACE is a purpose-designed cooling unit used to minimise the time taken to produce an aluminothermic weld in rail. It achieves this through the direct application of a fine water mist spray on to the sheared weld surfaces.

When an aluminothermic weld is cast, the temperature is around 1,400°C. Grinding of the weld cannot take place until the temperature has cooled below 400°C, which can take approximately

30 minutes by natural cooling. Hot grinding of a joint can lead to depressions or dips in the head of the rail when it has fully cooled.

The Smartweld ACE reduces the cooling time through the application of a fine water mist. However, it is important to carefully control the rate of cooling of the weld as too high a rate will cause the formation of martensite within the weld, which will weaken it and potentially lead to failure.

The equipment comprises a controller and two application heads, one for standard welds and another for head repair welds, and is certified and approved for use on both Network Rail and TfL infrastructure. Michael then went through the weld processes and the timings, along with the savings that could be made, using Smartweld ACE.

DTS TECHNOLOGY

CHRIS CHRISTIANSEN - TECHNICAL ENGINEER, PLASSER UK

Returning to OTMs, Plasser UK's Chris Christiansen gave a presentation titled 'Dynamic Track Stabiliser (DTS) the latest technology in the forefront of maintenance and renewal'. Chris began by detailing the OTM types with DTS equipment fitted that are available in the UK.

DTS technology has had many trials and papers written about it over more than 40 years, being probably the most investigated machine

Plasser & Theurer has ever built, with research still ongoing. He went on to explain how DTS works, on both plain line and S&C, and the different types of DTS units - fixed and imbalance.

The latter can be found on the very latest Plasser & Theurer 09-4x4/4S Dynamic tampers operated by Colas Rail UK and SB Rail. It has been found that by adjusting the variable aspects of DTS operations - frequency, imbalance, the vertical load and the machine speed - optimum results can be achieved for the settlement of ballast. Chris later referenced the work by Network Rail's Graham Penfold on the use of DTS for maintenance activities and the success it has achieved.

AUTOMATING TRACK MAINTENANCE

MICHAEL REITER - TECHNICAL ENGINEER, ROBEL

The final presentation of the day was 'Seizing opportunities for automated track maintenance' by Michael Reiter of Robel. He started by saying there were five reasons that moved Robel to develop automated rail maintenance solutions. They were:

- A bottleneck of well-trained core staff, which was compromising business results.
- Track maintenance windows are getting shorter and work is carried out during stressful night shifts, so safety has to be paramount.
- Jobs have to be done right the first time, in full control and must meet rising quality standards.
- Emissions in railway maintenance have to be reduced to protect staff and the environment.
- The total cost of ownership has to decrease, so return on investments can be shortened.

Robel's approach to answer these is to deliver resource-saving, reliable and safe automated track maintenance solutions. The company is doing this by using proven, flexible manipulators, such as robots, into which industrial PLC systems solutions are applied. Industrial standard BUS systems and protocols are used for ease of integration, along with standard toolings and connectors. The area of automated rail defect repair is Robel's first aim to show the feasibility of the technology. This covers defect detection, defect removal, heating, welding, finishing and documentation.

Michael then detailed how the six stages of the process work and the technology involved. Robel's robotics platform is a flexible solution to varying tasks on-track, which comprises two robots, all within a standard 40' ISO container with hybrid power that combines diesel and battery technology.

Michael concluded by saying that the development in technology had been achieved by seven people in the company, in just two years, which was a remarkable achievement.

CLOSING REMARKS

STEPHEN BARBER
CEO, PWI

The day was brought to a conclusion by Stephen Barber, Chief Executive, PWI. He thanked Phil and Jack for chairing the morning and afternoon sessions, as well as the speakers for their presentations. Stephen commented that some of the key aspects that could be taken away from the day's proceedings were safety, electrification and electric power for plant, which all sit with the emissions challenges that are on the horizon and the potential modal shift changes in the use of rail.



AUTHOR: ALEX HALL

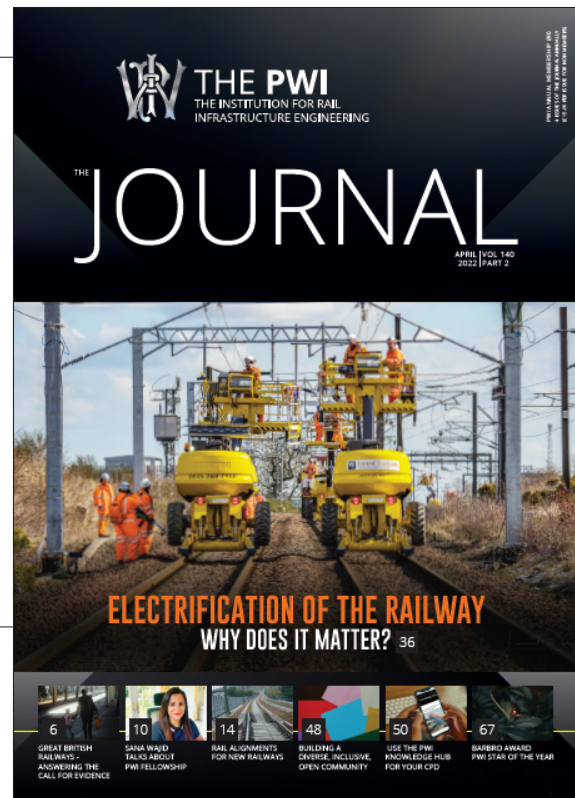
Alex is the Production Manager for Rail Infrastructure magazine. He started a career in railway publishing in 1994 and, in 1998, joined his now colleague, Roger Butcher's company, NPT Publishing, to establish Rail Infrastructure magazine. As well as undertaking the design, production and some editorial compilation of the publication, Alex has also been extensively involved in producing the series of reference books on railway plant and equipment by NPT publishing, the latest of which – On-Track Plant 11th Edition – was recently published.

TECHNICAL ARTICLE

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