ONLINE SEMINAR

Network Rail track renewals

AUTHOR: Chris Parker

Chris is a Chartered Civil Engineer, and a Fellow of the PWI and ICE. He has worked in the rail industry since 1972 retiring in 2004. His experience covered track and structures, design and maintenance and infrastructure management. After retiring Chris has remained active as a technical writer as well as writing reports for the PWI Journal and other organisations.

This seminar scored two “firsts” for the series, being the first to take place entirely online, and the first to employ online audience polling. The event was introduced by Network Rail’s Liam Jackson, who chaired the session. After briefing the participants and inviting them to partake in a trial poll, Liam introduced the first speaker, John Edgley, Interim Chief Technology Officer, Network Rail (NR):

PRESIDENTIAL ADDRESS

JOHN EDGLEY, PWI PRESIDENT

John commenced with well earned thanks to those responsible for the organisation and delivery of the seminar, mentioning in particular Liam, Kate Hatwell and the rest of the PWI team. Networking, John said, is a key part of the role of the PWI, and he hoped that this would become possible once again soon, when we recover from Covid-19.

The main substance of John’s address concerned his view of the principal challenges facing the rail industry, and how he sees the PWI fitting into this scenario. These challenges include:

- Recovery from Covid-19
- Asset reliability and performance
- Affordability
- Climate change and decarbonisation

John described each of these in more detail, explaining that the focus of the PWI will be:

- Supporting the Members: this is continuing despite the pandemic, using online methods. Membership numbers are increasing, and good progress is being achieved with the spread of professional registration.
- Joan Heery’s presidential themes: work on these continues, strongly supported by the 7 Vice Presidents. Corporate Membership development and the plan for young people are the two themes.
- 2020/21 presidential theme: Industry Competence is John’s theme for his presidency. He related this right back to the original aims of the Institution’s Founders. The entire industry needs to do more on professional competence, and the PWI will lead, encourage and support this. John aims to have in place a common, agreed competence framework by the end of 2021.
- Presidential themes of future Presidents: Nick Millington is to succeed John as President, and his theme will be Safety and Performance. Peter Dearman is to succeed Nick, and will take forward the theme of Electrification.

BEST PRACTICE IN CAPITAL DELIVERY PROJECTS

TONY MORGANI, ENGINEERING MANAGER
STUART WITTS, SENIOR ENGINEERING MANAGER

J. MURPHY

The speakers began with an online poll, asking what people considered to be the greatest challenge they had encountered on their most recent project or task. Out of a list of about 6 possible issues, over half the audience chose “lack of clarity in requirements/ scope”. Tony began the main presentation by speaking about the Phase 2 Works at the Harbury Cutting site on the NR Oxford/ Birmingham route. These works were designed to prevent the cutting to the east of Harbury Tunnel from causing a similar problem to that which occurred in 2015 on the other side of the tunnel, when a massive landslip closed the line for about 6 weeks.

The works included stabilising the slopes over the tunnel portal by installing over 660 soil nails, regrading the lineside cutting slope, installing a contiguous pile wall along part of the cutting crest and installing berms to assist stability and aid access for future inspection and maintenance. An interesting aspect mentioned by Tony was the design and installation of the piled wall, using a reinforced concrete guide beam which was incorporated into the permanent pile cap once the piles were completed.

Stuart described the renewal of a canal bridge on the FHR5 line (Preston/Burnley/Heiden Bridge) in East Lancashire. The 100-year-old structure consisted of traditional brick abutments, supporting two tracks through wrought iron decks, each carrying one track over the canal.

As the site was effectively landlocked by surrounding features, it was necessary to use rail mounted craneage for the works. The whole design was dictated by the need to ensure that a Kirov crane could handle everything. The result was the use once more of two separate decks, but this time made from weathering steel.

It was feared that the old abutments might be unstable once the propping effect of the bridge decks was removed, particularly given the surcharge loading of the big crane behind one of them. The abutments were therefore propped by means of a substantial temporary works structure between them, installed below the original decks before their removal.

The works were enlivened, if that is an appropriate expression, by the arrival of Storm Dennis in the middle of the 9-day blockade. The high winds meant that a mobile crane in the site compound was unable to work, but fortunately it was possible to use the Kirov crane safely, and this was able to undertake the lifts that the smaller crane could not, as well as carrying out its intended duties. Delays to the works were therefore minimal.

TRACK AND S&C TECHNICAL STRATEGY 2020-2040

GARETH EVANS, PROFESSIONAL HEAD OF TRACK, NETWORK RAIL

Gareth and his team have been producing a working draft strategy and seek collaboration across the whole industry in order to refine and develop it into a document that is accepted throughout. He set out the vision for this development, covering such things as cost effectiveness, safety, reliability and resilience. Its purpose is to support collaboration across the regions and the whole industry. It should cover the whole asset lifecycle and support all the other assets/disciplines.

It has been assumed that the basics remain unchanged (for example, steel wheels and rails), that there are similar societal demands to today, and that the NR license remains.

Gareth described where this strategy fits into the bigger picture and discussed objectives and themes. He described how it has taken cognisance of the Rail Industry Technical Strategy that has been developed by the Rail Delivery Group (RDG) - Technical Leadership Group and is to be issued shortly. Vision statements for 2025 and 2040 are key parts of Gareth's draft. He discussed in more detail the objectives, themes and vision statements, as developed to date, and emphasised that a key aim is to deliver a step change in reliability, availability and whole-life costs.

Gareth ended by emphasising that the next steps involve going into listening mode, encouraging wide review of the document by others and consulting with them. He strongly encouraged people to get in touch with him and his colleagues accordingly.

SOUTH RAIL SYSTEMS ALLIANCE (SRSA) SUSTAINABLE WORKSITES

NICK MATTHEWS, PROJECT ENGINEERING MANAGER, SRSA

Nick gave an inspiring presentation about the work that is going on within the SRSA to decarbonise worksites. Traditionally, worksites have depended heavily upon carbon based fuels, principally diesel or petrol. These are used to generate electricity and also to power tools. This creates noise and pollution and is unsustainable. In addition, maintenance of powered plant and generators is costly and the process of refueling is potentially hazardous and costs time, resources and money.

Internal combustion engines (ICEs) needed to be eliminated. However, there were apparent reasons not to do this. The weather/climate of the UK, the size and cost of the alternative equipment, and the fact that solar panels cannot work in the dark or under cloud cover, these all looked like serious obstacles to change.

There is a solution: solar harvesting. This means the employment of power storage that gathers in solar power whenever it's available, and releases it when the demand arises. Typically this means arrays of solar panels feeding into battery banks. When the power is to be used, inverters convert the stored energy to the appropriate form (Voltage, AC or DC, as required) and deliver it to the users.

Nick showed a video that featured a site at Gloucester in 2019, where an S&C renewal site was powered in this fashion. Together with energy saving measures like heavily insulated site cabins with PIR control of internal lighting, energy efficient appliances and electrically powered tools, major changes were made. Consequently, the consumption of diesel on the site was reduced by 98% with a cost saving estimated at £210,000 and a cut in carbon dioxide emissions of some ½ million kg.

Other issues were addressed as well, for example, the use of single-use plastics, which was significantly reduced. Similar approaches are now being used consistently by SRSA, incorporating lessons learned in order to continuously improve. Work continues with tool and plant suppliers to find and improve electric and battery plant and tools. A solar powered CCTV system (Gate Guardian) has been developed and work is under way on solar powered depots, RRVs that don't use fossil fuels, and more.

MANCHESTER METRO CITY CENTRE RE-RAILING

JENNIFER MCKINNEY, HEAD OF INFRASTRUCTURE
NICK COLES, CAPITAL WORKS DELIVERY MANAGER

MANCHESTER METRO

Jennifer started the presentation with an overview of Manchester Metrolink, which she said is the largest UK light rail network. It is operated and maintained by joint venture KAM (Keolis Amey Metrolink), with Transport for Greater Manchester (TfGM) responsible for renewals, enhancements and extensions. Keolis is also a member of other joint ventures, and in the UK help to run the Docklands Light Railway and the Wales & Borders Railway.

The challenging project involved rectification of rail damage and wear on the Market Street curve in the centre of Manchester. KAM was managing the defective rails by means of a 5mph temporary speed restriction and a temporary approved non-compliance. Measures required to manage this involved a special testing and monitoring regime. Unfortunately, this could not continue indefinitely, and it was eventually going to lead to line closure unless the rails were changed. This was problematic, since there are few experienced suppliers capable of carrying out the works. These were all heavily engaged on works on other UK metros at the time. Whilst "DIY" is not a normal activity for KAM, this time it was decided that it was the only viable way out of the problem.

KAM engaged with Pod-Trak, a company with relevant experience from the Birmingham tram system, to carry out the work together. Jennifer continued to describe the challenging timescales, the measures taken to allow continued Metro operation via alternative routes and the management of customers and city centre visitors. Service alterations, bus substitutions and customer liaison and control were all employed. The management of relations with key stakeholders like the Mayor, Council, local businesses and more was an essential element.

Nick gave more details about the practical aspects, such as worksite mobilisation, security and signage. A major issue was the block paving of the Square, significant areas of which needed to be lifted to give access to the track. He likened this to a large and weighty jigsaw and said that a key lesson learned was that the blocks should have been surveyed before they were moved, and marked so as to identify them for correct repositioning after the track works were completed. He reemphasised Jennifer's point about the crucial importance of good liaison with stakeholders. Another serious influence was the weather, which threw everything it had at the team during the site works.

Despite all the challenges, the works were successfully completed in the eleven days that were eventually allowed for the job after the agreement of a two-day extension to the original plan. Many lessons were learned besides the one about paving. These included the need for remote condition monitoring of the infrastructure and automated measurement of rail wear and degradation.

PROJECT HEINEKEN & KILSBY TUNNEL

AMEET MASANIA, HEAD OF INNOVATION
JAMES HARVEY, OPERATIONS DIRECTOR

CENTRAL RAIL SYSTEMS ALLIANCE (CRSA)

Ameet began by describing Project Heineken. This is a mapping tool that allows the visualisation of all the works needing to be undertaken in a given geographical area, in order to maximise the efficient use of track access. The background to its development is the devolution of track renewals works to the Regions/Routes in Network Rail, sitting alongside signalling, maintenance, civils, enhancement and works delivery. It uses a wide range of data sources. Ameet showed a video presentation that depicted how it works and what data sits within it. Following that, he described a trial application at North Wembley. The results of that, he said included the successful completion of twelve additional tasks that would not have been closed out under normal processes, and consequent great feedback from stakeholders.

James next presented about Kilsby Tunnel, describing how at only three weeks' notice, stakeholders had agreed that NR could have a blockade of the tunnel to carry out work to remove condition of track speed restrictions within it. This was made possible by the reduction in train services that had come about from the Covid-19 pandemic, which made it practicable to divert traffic for the duration. The line was closed from 2-17 May 2020.

Network Rail and the CRSA were challenged to maximise the use of this unexpected track access, which affected a significant length of route either side of the tunnel, as well as that structure itself.

The blockade was finalised at very short notice, leaving only two weeks to plan the works to be carried out. Nevertheless, a huge quantity of work was successfully undertaken by multiple teams. James described how this was organised to safely make the best of a blockade that might have cost £25 million under normal circumstances.

SYSTEM APPROACH TO ELECTRICAL CLEARANCES AT OVERLINE STRUCTURES

TOM KEMP, PRINCIPAL PROJECT ENGINEER (PPE) (E&P)
ANDREW JARMAN, PPE (B&C)
DAVID WOODS, PPE (TRACK)

NETWORK RAIL

Aspects of the Trans-Pennine Route Enhancement project and Bolton/Wigan Electrification project were discussed to examine the issues around electrical clearances for electrification. Tom began by explaining that the key objective is to deliver cost-effective electrification. Andrew Haines, he said, has endorsed the necessity of electrification in order to meet essential carbon reduction targets. Tom spoke of the process used to obtain the endorsement of the Route Asset Managers (RAMs) of all three disciplines for proposed methods and designs, in order to ensure that all are happy with the solutions selected. The industry has a traction decarbonisation strategy that requires the electrification of 11,700 single track kilometres (stk) out of the 15,400 stk that are currently not electrified. A crucial tool in cost effectively meeting this objective will be the concept of Voltage Controlled Clearances (VCC), as developed for application at the intersection bridge at Cardiff. Tom then talked about how NR has developed an agreed process for applying the optimal solutions to each and every affected structure on a route to be electrified. A wide range of stakeholders were involved in and agreed to this development, which has resulted in the creation and application of a "one page" document for the review of the options for a structure and agreement to the selected approach.

David and Andy each gave their overview of this procedure from the perspectives of their respective disciplines, before Tom discussed the process in more detail and showed examples from the Trans-Pennine Upgrade project. He told how the VCC concept could obviate the need for structural interventions at all four tunnels and 22 of the bridges on the affected routes. David described similarly how the Bolton/Wigan Electrification is also significantly benefitting from this. He emphasised that whole-lifecycle assessment is being applied, not just short-term project costing.

HATFIELD 20 YEARS ON

BRIAN WHITNEY, ENGINEERING EXPERT,
TRACK AND STRUCTURES, NETWORK RAIL

Brian began with a brief resume of the sad events of 17 October 2000, when the 12.10 departure from Kings Cross derailed on the Welham Curve about 16 miles north of Kings Cross, at 115 mph. In the resulting crash four people were tragically killed and 30 were hospitalised. The cause of this crash was the failure of the high rail of the curve, which shattered into some 300 pieces over a significant length. This failure was found to have resulted from rolling contact fatigue (RCF) damage, which took the form of what was then known as gauge corner cracking (GCC).

The crash led not only to an inquiry into the incident itself, but also very significant emergency precautions across the UK rail network, a massive amount of research and investigation into RCF, wheel/rail interaction and related matters, major changes in the management of rails and much more. It led to the demise of Railtrack and the creation of Network Rail.

Brian described the key points that were the results of the formal incident inquiry. These included: the failure to properly appreciate the risks of RCF/GCC, the failure of the local inspection regime, the failure to take proper actions to maintain and ensure the safety of the line, the failure to complete the urgent proposal for the re-railing of the curve and a failure to act upon audit reports.

Brian then considered what has been done since. Firstly, there was a massive change in the management of rails. From the early 1960s until 2000 there was a consistent figure of about 1000 rail breaks per year on the NR network. Within a very short timescale after Hatfield, this was reduced to about 100 per year. A significant element of this was initially achieved by a huge re-railing programme.

Re-railing was not the sole contributor however, and would alone not have caused a sustained reduction in the rail failure rate. Brian described the other actions that have continued to suppress the failure rates since the early post-Hatfield years. These include inspection and maintenance improvements that have enabled the suppression and control of rail defects, such as RCF defects like squats and GCC.

He was insistent that we cannot rest on our laurels or take this past success for granted. A sobering view he presented was that of the history of train accidents on the same curve at Hatfield. Since 1850, there have been 22, including three rail break incidents that derailed passenger trains.

We must look at whether the controls introduced in the last 20 years are still effective. We must look out for new phenomena and be prepared to learn new lessons. "50 by 30" is Brian's mantra – it is not good enough to rest at 100 rail breaks a year. A long continuous improvement plan is being implemented, based upon monitoring, data driven analysis and the understanding of root causes.

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