

Practical Trackwork Challenge Churnet Valley Railway

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It seems such a long time ago that we last held a Practical Trackwork Challenge (PTC) event and indeed it was, October 9 - 10 2019 to be precise and you don't need me to remind you what happened in the intervening two and a half years.

But here we were again on the evening of the 29 March 2022 in the Borough Arms Hotel, Newcastle Under Lyme, welcoming our delegates to the fourth Practical Trackwork Challenge event, the location of which was the Churnet Valley Railway (CVR).

The Borough Arms Hotel acted as a base for the event for two nights and provided an opportunity for both the PWI to explain the event and for delegates to mix and share experiences.

The PTC is essentially a training course that allows people who work in the industry, but who have little or no site knowledge to experience working in a live railway environment in a safe and controlled manner.

After the evening meal at the hotel Roy Hickman led the Construction & Design Management 2015 (CDM2015) briefing to all the delegates, and he explained along with Tony Hancock of the CVR the history of the area, the safety arrangements and the work to be undertaken over the next two days.

The event was organised by the PWI under the control of experienced track engineers, Roy Hickman, Kevin Percival and Andy Steele. The plan was to renew 183 metres of 1961 flat bottom wooden sleepers track one and half miles northwest of Froghall station. Here the single line railway lies on a

shelf in a narrow valley flanked by the river Churnet to one side and the Caldon canal on the other. This makes the site narrow and difficult for machine and personnel access and as a worksite. The new materials were provided by the CVR and had been taken to site in advance. These were serviceable F27 concrete sleepers at 24 per length, new cropped 50ft (15.25m) 113lb (56kg) rails and approximately 650 tons of reclaimed ballast.

The site had been chosen by the CVR because of the high number of broken and rotten timber sleepers in the area and the high number of rail metallurgical defects in the existing track. Logistically the site would prove problematic as it was one and half miles from the nearest station access at Froghall and was heavily overgrown.





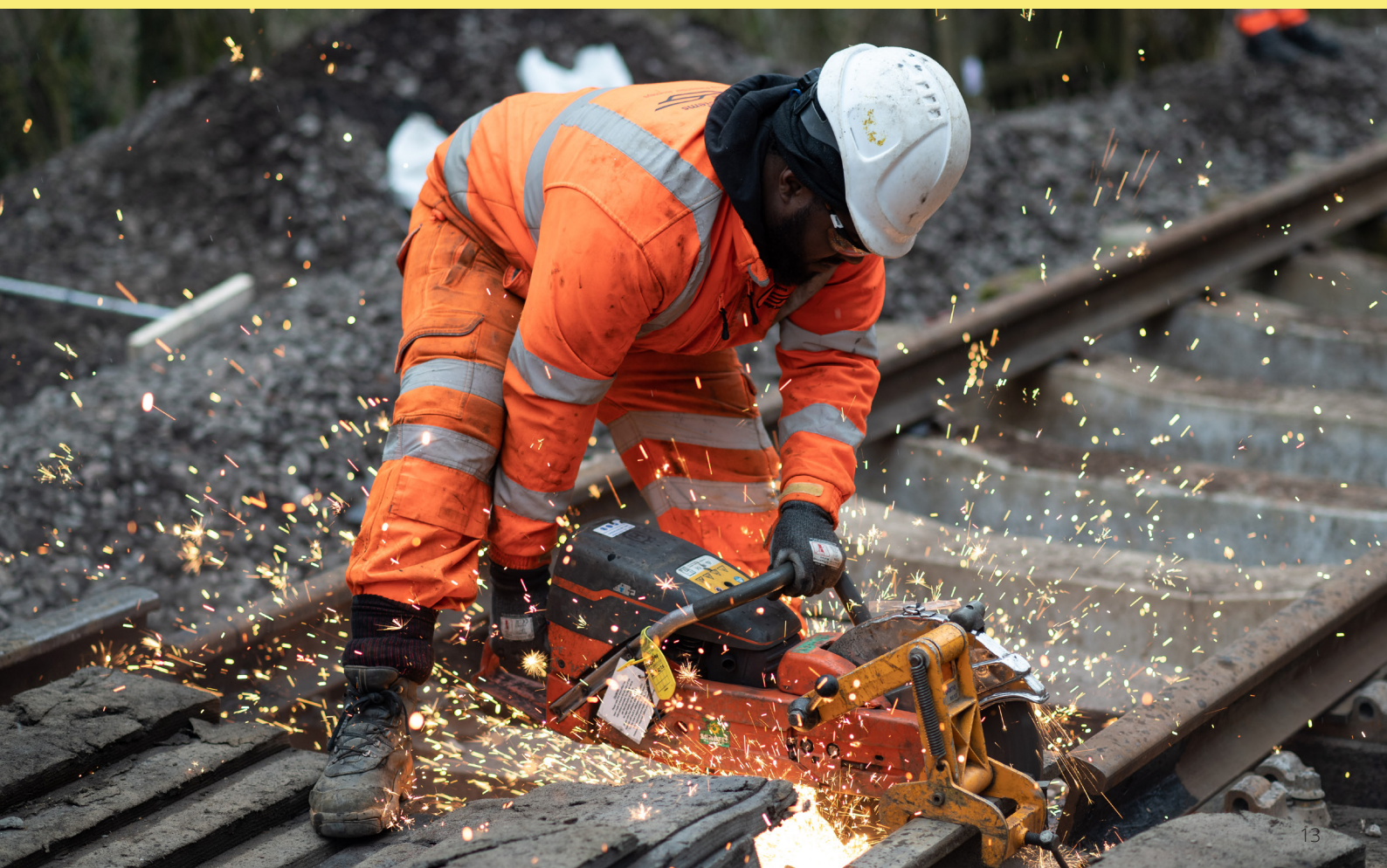
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A fantastic event!

Quite an achievement to bring together such a large and diverse group and introduce to them a wide range of processes, technology, and equipment.

Great to meet hugely knowledgeable and experienced professionals, and the chance to observe and contribute to an actual track replacement project - all in two days! Thanks again to all those involved, especially Richard our team leader.

DELEGATE FEEDBACK





It is important to state that the renewal although on a Heritage Rail site was still a live site, which carries the same inherent safety risks to our colleagues as when delivering a job on the open network. Operationally however the risks are far less, and this allows us to demonstrate the process and procedures used and also to allow delegates to get involved in the site works themselves, in a safe and controlled manner. Therefore, we planned to deliver this job as we are required to under law under the CDM 2015 regulations. That meant that the CVR acted as Client, and PWI corporate members Balfour Beatty and Mott MacDonald acted as Principal Contractor and Principal Designer respectively. The PWI were effectively the Scheme Project Managers.

Richard Spoors and Malcolm Pearce of the PWI acted as independent assessors of the event and also as "guides" to the groups moving around the site.

Balfour Beatty supplied site staff including, a track gang of 10 personnel together with a very experienced supervisor, Eugene Landells. They also provided Lewis Hattersley who was the Engineer in overall technical charge of the site. All staff going onto site had to register with the site access cabin provided by Sunbelt Rentals with on-site welfare provided by High Motive through James Read. Balfour Beatty also supplied the fantastic site installation technicians via TfL James Field, Amandip Singh Samra and James Lock.

To give the reader an idea of the logistics of this event, on the first day we had more than 70 staff, visitors and delegates on site in the

afternoon, with a similar amount on day two. Mott MacDonald provided design services and Sulaiman Bah and Noye Isahmah supplied the design drawings that we would work to over the course of the event.

Our plant was provided by ProRail Services, and Quattro, Cleshars and Robel were on hand to provide small tools and tuition under the expert gaze of super trainers Jon Winborne of Cleshars and Chris Dines of Robel. All machines were accompanied by Machine Controllers and POS representatives supplied by their parent companies.

KOREC provided surveying services and special thanks must be given to Matt Barwell, who repeatedly went out on site to just pick up a little more detail, and to add in some extra survey control as we planned the event along the way.

Nobody would have got to the site at all if it were not for ProRail Services providing the project with a Kubota Rail Personnel Carrier, and the genial Tudor Popescu who frequently ferried groups of up to 17 staff at a time between Froghall station and the worksite over the two days.

This event relies heavily on our Corporate Members very generously providing services free of charge, which is a substantial financial commitment in terms of both skilled personnel or machinery, and for that the PWI are very grateful indeed. The CVR were once again excellent hosts and their volunteer staff provided all the site staff and delegates with free food and drink over the course of the event.





Being able to ask questions in a site environment is rare. This was a great chance to gain a deeper insight.

I particularly enjoyed the variety of speakers when on site. There was a good mix of practical and theory across the two days.

It was clear the speakers were passionate about their work and helped everyone to stay engaged. Also, the track taxi/shuttle was really cool!





Being able to see things in real life which I design, will help me to visualise and understand more when designing.

DELEGATE FEEDBACK



Our plan for day one was to remove the track panels, with the RRV placing reusable top stone to the cess on the canal side, (before closure the cess had been the second track). Next, a laser-controlled dozer pushed the remaining spoil down the bank towards the river, leaving a 175mm ballast bed below new rail level and a crossfall towards the canal. It had been hoped to commence laying sleepers before the end of the day, however the work had taken a little longer than planned, so that was left for day two. The Balfour Beatty team provided an explanation of laser control of excavating machines and how the site beacon laser is set up from the design drawings. The track survey had been undertaken using a GEDO survey trolley kindly supplied by KOREC and operated by Matt Barwell with TfL technical staff providing the onsite design alignment delivery for installation and post tamp. The delegates were given the opportunity to take part in the work with hand tools when it was safe to do so.

The PWI had also invited a number of companies to either demonstrate their products and how they are used in track work or set up small instructional demonstrations whilst the delegates were on the railway. KOREC demonstrated the latest survey technology to each group of delegates in turn back at Froghall Station. Robel also demonstrated the latest battery technology for small hand powered plant alongside their more traditional tools. On day two Jonathan Graham of the RAIB gave an on-site explanation of accident investigation and derailment causes, using the track in the vicinity of Froghall station to provide a physical illustration of how an investigation is carried out.

The weather on day two reminded us that outdoor work, even in late March, can be like deepest winter with snow and a cold wind, but that did not daunt the enthusiasm of our young engineers who took turns with bars, rail setters and clip pullers to get the new track installed. Working on a long and narrow worksite also showed the importance of good planning and how road rail machines can have limitations on the activities they can perform. It demonstrated how, when there are two machines with different outputs, their working positions may need to be changed as the work progresses. One of the key safety features of being on site with these machines is learning about the role of the machine controller and how to safely walk past them. With one of ProRail's machines waiting at the north end of the site on the second day, all of the delegates had the opportunity to visit the machine and climb into the cab. What better way than this to learn about the restricted view the operator has of what is near to his machine, especially on the blind side, opposite the cab?

As the last panel was connected to the existing track it was time for the delegates leave and return to Froghall station.

After changing and returning their PPE to their bags, delegates gathered in the station buffet for a presentation of their PWI certificates by Edward Maloney the Joint Managing Director of ProRail Services, in the company of Stephen Barber, PWI CEO.

It was unfortunate that the final activities of the track renewal were not undertaken whilst the delegates were on site, however, later that afternoon the top ballast was unloaded by CVR

staff. Balfour Beatty staff boxed in the ballast and ensured it was fit, albeit with a speed restriction, for the start of passenger services the following Saturday. A CVR tamping shift is planned together with clearance of materials to complete the works.

A DELEGATE'S VIEW

NOYE ISAMAH
PERMANENT WAY ENGINEER
MOTT MACDONALD

For this Practical Trackwork Challenge once again the PWI enlisted the help of its corporate members to assist in maintaining this Heritage Railway and invited delegates to broaden their networks, improve their site awareness, and to learn from a range of their peers and experts. I was one of the delegates from Mott MacDonald.

The design was carried out and checked by delegates Sulaiman Bah and me, and supported by Chris Mannion. The design was an iterative process of communicating with the client to define requirements and available materials, informing the surveyor from Korec of the required design limits and topographical detail, and receiving feedback from the on-site contractors, Balfour Beatty Rail Systems, and plant operators from ProRail and Quattro on construction constraints.

The tamping design limits were restricted by the River Churnet underbridge at low mileage and extended beyond a series of short curves to reach a straight element at high mileage;

giving the final design length of 440m. The constrained area coupled with a lack of close-by access presented challenges at both the design and construction stages.

Horizontally, the design utilised multiple virtual transition elements to limit slues, and site preparation included cutting back the vegetation to create a laydown area.

The existing track was also significantly over-canted from having had the speed reduced over the years and ranged from approximately 80mm at low mileage to 20mm at high mileage. To address this while maintaining practical design limits, a cant transition was proposed extending over a virtual transition from 80mm to 50mm, and a physical transition was possible from 50mm to 20mm. Originally the design applied 35mm of cant; 50mm is still over-canted, but reduced the required amount of lifting and thus kept the design limits reasonable.

The vertical design also posed challenges of multiple short vertical curves and interactions with transitions. To smooth out the curves would have required more tamping than was appropriate for both the construction time and what the ballast could withstand.

Ultimately, the design involved a lot of compromise and the management of realistic expectations for a heritage line running heritage rolling stock at low speed. The frequent maintenance and stricter rules on Network Rail mean that fortunately sites of this complexity don't arise often.

With the design signed off and the site prepared, we were ready for the Trackwork Challenge. The evenings the delegates spent together at the hotel were a good opportunity to learn about the training schemes and work at other companies, and offered insight on the work of many different types of professionals involved in the railway beyond design and site engineers; such as manufacturers, regulators and plant operators.

The PWI volunteers also spent this time with us, and were an invaluable source of knowledge both in understanding processes that we had seen and been taught about, and sharing knowledge of how we got to where we are today and why.

Once things got moving on the first day on site, there was a lot to pay attention to and the necessity of experience and expertise quickly became apparent in even the simplest of decision-making exercises. The single track and lack of direct site access added complexity by making moving people, plant, and materials safely and efficiently quite difficult.

One such early decision was where the rails within the renewal limits were cut. I had assumed they would simply be cut at either end and then broken into manageable pieces. Instead, there was an assessment of the serviceability and rail in usable condition would have the bolts and fishplates removed, and the remainder were cut for easier removal of smaller pieces by plant. This is both a sustainable decision and cost effective.



I enjoyed the interaction with experienced engineers, being able to ask questions on site and point at physical objects rather than drawing diagrams on an office whiteboard.

DELEGATE FEEDBACK





The social aspect of the event was just as valuable - in the evenings with my team, learning about their companies and experiences.

DELEGATE FEEDBACK

After the rail and components had been removed from the renewal extents, the track bed was excavated to the top of the formation. At this point we discussed ballast memory and how, without doing a full dig, the new ballast laid would settle to reflect the compaction of the formation below it. This was part of the reason for the vertical alignment design to be similar to the existing condition, even though this resulted in multiple reverse grades.

We also had a demonstration of how laser receivers are used to check crossfall, and the exchange of data between the measurements and the digger which was used to do the initial formation and ballast laying work. Using the heavy plant to lay the ballast to the correct crossfall, (accounting for cant), meant that less runs of the tamper would be needed, and this would help preserve the quality of the ballast. This was an iterative process as the plant was only able to work with two dimensions of data – a centreline and height at each edge – whereas a faster and more accurate provision would have been a single height, a centreline and an angle as provided by the laser receiver.

We delegates were not left idle during this time and had many miniature 'workshops' to attend in addition to being able to speak with contractors on site. The workshops on the first day centred around tools such as the Trimble GEDO trolley system for topographic surveying, and the Sunbelt plant

hire and personnel management system. I was particularly engaged by the presentation of the Robel power tools which make improvement on traditional tools in terms of safety and sustainability. For example, using battery power as opposed to fuel and improved ergonomic design for long periods of use.

The main talk on the second day was from a representative of the RAIB, who presented the key risks that can lead to a derailment in service. These include obstructions on the track, wide gauge, wheel lift, (which can be due to lateral force, twisted rails which reduce the vertical load, rail wear or insufficient lubrication), and poorly maintained S&C.

A less common risk is cyclic top related to poor maintenance of jointed track, where dips at the joints can cause a train to 'jump'. Regular such jumps may cause train and rails to go into resonance, resulting in a large jump and subsequent derailment.

Although a derailment may usually not be due to the alignment design itself, I did take note that as a designer it is always worthwhile to be aware of where these risks are present and to consider mitigation such as an appropriate ballast shoulder or trap points.

Although the single track and narrow space had made movement on the first day a little awkward, the true inconvenience didn't

become apparent to me until day two when it was time to reinstate the track. The delays on the first day also meant that we were pressed for time. The first task was to lay the sleepers. The physical constraints imposed by the site meant that exclusion zones around the machines moving sleepers from the cess onto the formation had to be very carefully managed, with machine work stopped periodically to enable those on site to pass by safely. Having been allowed to sit in the cab of one of the RRVs in the morning, we were well aware of the limited visibility for the operators and our responsibility for our own safety.

Positioning the sleepers was achieved by measuring out to a false wooden rail from the cess and using a laser to set the height. A string line was then used to provide a guide for manually levering groups of sleepers into place. Doing this periodically was another measure to reduce the work left for the tamper.

Laying the rails had to be done consecutively so that the RRV could roll over the rails that had been laid and bolted. We pulled the Pandrol clips into place using Panpullers – somehow, I had not expected this to be done manually and I gained a level of respect for the amount of manual labour that can be necessary on site. It's certainly something I'll keep in mind if I'm on the fence about extending the length of a renewal in a design.

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We are very grateful to Churnet Valley Railway for hosting this year, and to the many companies who gave their time, resources and staff.

Thank you.

ALL AT THE PWI



To allow the plant to leave site on time, the decision was made to clip every fourth sleeper ahead of the RRV and to follow behind to clip the remainder. The final task was to lay and tamp the new ballast. Unfortunately, the day ended for delegates before this happened, but we were pleased to hear that it was successfully laid that day and trains were running by the weekend as planned.

I feel extremely fortunate to have taken part in the Trackwork Challenge. My greatest learning point was being able to witness in real time the sort of decisions that don't often occur to a young professional doing most of their learning in an office, and this helped me to see the value of even just observing a site.

The workshops were also an excellent opportunity to share knowledge, and I'm grateful to the volunteers and contractors who gladly shared with us as well.

Thank you to the PWI and all the corporate sponsors. And to anyone considering participation – I definitely recommend it.

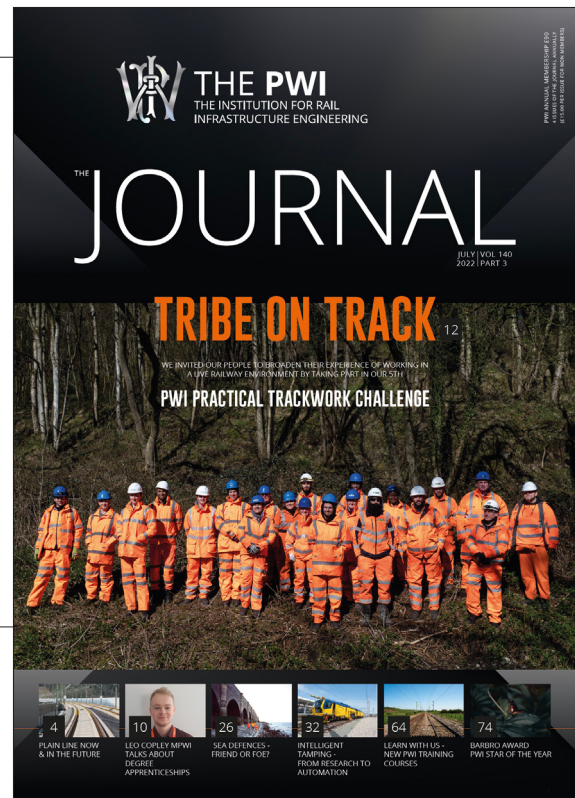


TECHNICAL ARTICLE

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