RailEI
Formerly known as the PWI
RAILWAY ENGINEERING INSTITUTION

THE JOURNAL

JANUARY 2026 | VOLUME 144 | PART 1

THE VOTE RESULT:

Rooted in our past. Fit for our future.

RAILWAY ENGINEERING INSTITUTION

EMPOWERING RAILWAY ENGINEERING

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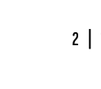

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THE JOURNAL

January 2026 | Volume 144 | Part 1

Article and advertising deadlines

April 2026	deadline - 27 February 2026
July 2026	deadline - 1 May 2026
October 2026	deadline - 3 August 2026
January 2027	deadline - 2 November 2026

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2026 RailEI ANNUAL SUBSCRIPTIONS

INDIVIDUAL MEMBERSHIP

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Members (68 or older on 01.01.26)	£49
EngTech Members*	£130
IEng Members*	£193
CEng Members*	£215
Fellow	£165
Fellow (68 or older on 01.01.26)	£63
EngTech Fellow*	£180
IEng Fellow*	£255
CEng Fellow*	£275

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PROFESSIONAL REGISTRATION

Application fee: New Registrant** **EngTech** £60 | **IEng** £225 | **CEng** £225
Application fee: Additional Membership **EngTech** £0 | **IEng** £90 | **CEng** £90
Engineering Council fee* **EngTech** £24.06 | **IEng** £41.97 | **CEng** £49.45

* If you are professionally registered through RailEI, we will collect your annual Engineering Council Registration fee along with your RailEI Membership fee and then pay the Engineering Council on your behalf. ** Includes the Engineering Council Registration entry fee.

ISSN 2057-2425
Publishing and layout by
Permanent Way Institution

CONTENTS

Journal 2025/10 Vol143 Pt4 ERRATUM

The photograph of the Royal Border Bridge at Berwick, used in the Technical Director's update on page 20 of the October Journal, was incorrectly credited to Network Rail. The image was taken by Bob Langford. We are pleased to correct the attribution and apologise for the oversight.

SUBMIT A JOURNAL ARTICLE

If you would like to share a project you've been working on within the Journal then please get in touch.

PRESENT A LUNCH & LEARN

If you would like to present a live Lunch & Learn session, please do let us know.

FROM THE CEO
WELCOME TO THE JANUARY JOURNAL

2026 - OUR NEXT CHAPTER'S OPENING LINES...

My best wishes for the New Year to all Institution Members.

I started my October 2025 Journal piece by stating that – through the vote on name change - the future of the Institution lay in Members' hands. I can only thank Members for taking me at my word and engaging, to an unprecedented degree, in the debate and decision over the Institution's future name. A turnout of just over 62% with many Members in favour of change means that the Companies Act 2006 75% hurdle for endorsement of the proposed change was met and as I write I am awaiting the Institution's revised certificate of incorporation in the name of **Railway Engineering Institution (Incorporated)**. Receipt will be followed by a period of intense administrative activity as business documentation is adjusted to reflect the change.

I CAN ONLY THANK MEMBERS FOR TAKING ME AT MY WORD AND ENGAGING, TO AN UNPRECEDENTED DEGREE, IN THE DEBATE AND DECISION OVER THE INSTITUTION'S FUTURE NAME.

I believe that 2026 will be a somewhat different year to 2025, at least for me and the Institution's executive team. The matter of the Institution's name having now been settled (though with work to do on translating that name into revised brand identity), through 2026 the broader elements of the Institution's strategy will come into sharper focus, notably:

- setting the direction and medium-term objectives for our growing technical education and training activities and how we use those to help more of our Members achieve professional recognition
- deepening and extending the range of technical support the Institution offers to Members: to those who the Institution has traditionally served, and particularly to those whose railway engineering-related disciplines currently have no obvious Institutional home
- providing Members with more opportunities to engage with the Institution in ways tailored both to their individual needs and aspirations, and to sharing their technical knowledge and experience – a founding principle of this Institution
- extending collaboration with other railway industry bodies and particularly with those professional bodies having a strong interest in advancing railway engineering
- further developing the Institution's structure, management processes, and supporting systems to facilitate growth both in supported activities and in membership.

Through the Autumn, several Institution Members expressed concerns regarding the risks of losing the PWI legacy, of an imagined move away from traditional permanent way and track disciplines, and of direct competition with other professional engineering institutions (PEIs). I can only again emphasise that the Institution's plans are: to build on and make even better use of the PWI's cultural and technical legacy; to maintain and further grow the support we offer to those practising in our traditional railway engineering disciplines; and to complement (not compete with) other well-established railway specialist PEIs. Our aim is to bring the benefits of PEI membership to more of those engaged in railway engineering-related activity, not to compete over those who already benefit from such membership.

GREAT BRITISH RAILWAYS – THE NEXT CHAPTER...

November 2025 brought the welcome news that the legislation required to establish Great British Railways (GBR) had been introduced to Parliament at Westminster. **The Railways Bill**[1] sets out the Government's intended legal framework within which GBR and interfacing organisations will operate, to deliver an integrated and optimised main line railway system for the UK. The Bill is currently in its Committee stage in the House of Commons (the Commons) where from 20 January to 12 February 2026 it, together with evidence submitted by industry experts and other interested parties, will be scrutinised by a Public Bill Committee composed of MPs.

That Bill Committee will report to the Commons on the outcome of its scrutiny, and at that point all MPs will have an opportunity to discuss, propose, and vote on further amendments. Presuming a successful third and final reading in the Commons, the Bill will then proceed to the House of Lords and progress through a similar process of further scrutiny and revision. Given reasonably smooth progress through Commons and Lords, we might expect the Bill to become law by the end of 2026 and for the implementation of GBR to start then and continue into 2027 (and perhaps beyond).

2027 sounds some way off, but the work on the Bill over the next three or four months is likely to set the ground rules through which an optimised railway is to be achieved - and maintained over time. The deliberations of the Public Bill Committee may offer a window on how the railway's societal benefit is to be assessed and measured, how use of route capacity is to be prioritised, and how current and investment spending is to be prioritised to deliver maximum benefit: all-in-all an interesting "space to watch"...

In the meantime, Government is working with Network Rail and those train operating companies now in public ownership to better integrate management and decision making across train operations and infrastructure – to achieve consequent benefits in performance and efficiency.

1 www.gov.uk/government/publications/railways-bill

THE PROBLEMS OF AGEING INFRASTRUCTURE – AND NOT JUST RAILWAYS...

December 10, 2025, saw the launch of the National Engineering Policy Centre's report **Reviving our ageing infrastructure**[2] at the Palace of Westminster. The 35-page report presents a wide-ranging cross-sector review of the UK's stock of ageing infrastructure assets, many dating from the 19th and early 20th centuries, and looks at how the problems of age are now being compounded by growing demand volumes, expectations of improved performance, and the impact of climate change. PWI Fellow, Alan Ross and PWI Board Member, Professor William Powrie brought their knowledge and experience to the Working Group which delivered the report and, unsurprisingly, railway examples feature heavily. The Report does however highlight the degree to which our industry's challenges are effectively replicated in the water supply, wastewater, flood defence, and road network sectors, and it points to the undoubted potential for cross-sector learning.

The Report's conclusions make sobering reading, particularly given the current pressure on the UK's public purse, but beyond finance the Report identifies issues within six other areas that need to be addressed if the UK is to effectively manage the risks to public health, safety, service delivery and economic growth presented by ageing assets. The seven areas, described (perhaps somewhat optimistically) as *enablers of change* are: strategy, regulation and standards; financing; skills and capabilities; data; innovation; societal awareness; and system coordination. For each area or "enabler" the Report sets out a checklist of "what good looks like" and identifies "urgent actions".

Whilst the Report appears primarily intended for politicians and policy makers, the cross-sector examples presented will be of interest to many railway engineers and they provide several pointers to good practices (and to some that should be avoided). The checklists provide a helpful mechanism for gauging the maturity of any engineering organisation tasked with managing significant volumes of ageing assets, and several of the actions can be addressed well below the level of national governments.

Given the current financial pressures within the UK railway industry and their inevitable impact on anticipated railway asset lives, those charged with asset management, engineering, and managing maintenance should find this report of considerable interest.

CLIMATE CHANGE – MEASURING OUR INDUSTRY'S CAPACITY TO ADAPT

Maintaining a climate change-related theme, in October 2025 the Railway Safety and Standards Board (RSSB) published the third in a series of annual reports which set out to evaluate and track the extent to which Great Britain's railway industry possesses the capacity to adapt to the climate change we are witnessing and that we anticipate. The **GB Rail Sector Adaptive Capacity Review 2025**[3] does not publish company-specific information but it does use a version of the now well-understood maturity level model (termed "response level" in this report) to look at the change in capacity to adapt within five subsectors of the UK railway transport industry, namely: infrastructure managers; passenger train operators; other train operators or providers; supply chain; and advisory/regulatory organisations.

The picture which emerges from the Report is of an industry in which awareness of climate change and willingness to face and address its associated challenges are steadily improving, with increasing numbers of organisations moving towards higher levels of adaptive capacity. Reflecting the well-publicised impact of climate change on railway networks in recent years, at least in subsector average terms, infrastructure managers sit at the top of the "response level" tree. It is however reassuring to see capacity levels increasing substantially in all subsectors.

The Report's assessment aligns with the conclusion in the **Climate Change Commission's April 2025 assessment of progress under the Third National Adaptation Programme**[4] where railway and road networks are two of only three areas where *policies and plans* are found to be "good", albeit the assessments of *delivery and implementation* remain "limited".

The final sections of the RSSB Report highlight several of the key factors driving that increased railway industry capability, including: unified scenarios for asset planning and design; the availability of common metrics and benchmarking tools; monitoring, evaluation, and learning supported by knowledge sharing and peer assessment; a common commitment to continuous improvement; and agreement on how responsibilities should be allocated and standards defined.

INTEGRATION AND COOPERATION

It is interesting to note the parallels between the integration and cooperation inherent to the intended structure of Great British Railways and the same themes visible both in the work to improve the management of ageing infrastructure and in the way our industry is growing its capability to meet the challenges presented by climate change. These themes also sit at the heart of proposals to better integrate transport more generally across modes in the UK and particularly within our larger cities.

I trust that 2026 will witness further progress in all these areas and that, through the support it offers to its Members, this Institution will play its part in facilitating that progress.

THINK ARTICLE

STEPHEN BARBER
CEO
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2 https://nepc.raeng.org.uk/media/r43jxf4l/nepc-reviving-ageing-infrastructure-final-report.pdf

3 https://www.rssb.co.uk/-/media/Project/RSSB/RssbWebsite/Documents/Public/Public-content/Sustainability/gb-rail-sector-adaptive-capacity-review-2025-full-report.pdf

4 https://www.theccc.org.uk/wp-content/uploads/2025/04/Progress-in-adapting-to-climate-change-2025-1.pdf

A LETTER FROM YOUR PRESIDENT

SEEING THE ROAD AHEAD: REFLECTIONS AT THE HALFWAY POINT

I stepped into the role of President in July 2025. Six months on, I find myself thinking a great deal about where we are heading - as an Institution and as a wider railway engineering community. At the beginning of my presidential year, I set out three themes to guide my focus: **Innovation, Change** and **The Skills Gap.** All three speak to the future of our sector and are closely linked to our **strategic goals for 2024–2028**.

These goals should feel familiar. They capture the conversations many of you have been part of in recent years and form the framework for the decisions we are taking - from clarifying our purpose and identity, to strengthening education, membership and governance. They describe the organisation we must continue becoming in order to serve the whole railway engineering community.

BUILDING INTELLIGENT INSPECTION ON HS1

Innovation is not just a theme of my presidential year; it is central to my day role at **Network Rail High Speed (NRHS)**, where we are responsible for inspecting and maintaining the HS1 route in ways that are **safer, smarter and more sustainable.**

A recent optioneering study, undertaken by PA Consulting, reviewed every inspection regime delivered on HS1. It confirmed what many of our teams already experience: manual visual inspections consume a significant proportion of resource and are increasingly challenging to sustain alongside routine maintenance demands. **Figure 1** illustrates this shift clearly, showing how train-mounted imaging systems capture high-resolution data while also highlighting the wider ecosystem of digital inspection tools - including Unmanned Aerial Vehicles (UAVs), fixed sensors and remote-monitoring devices - that together support a modern, low-exposure inspection regime.

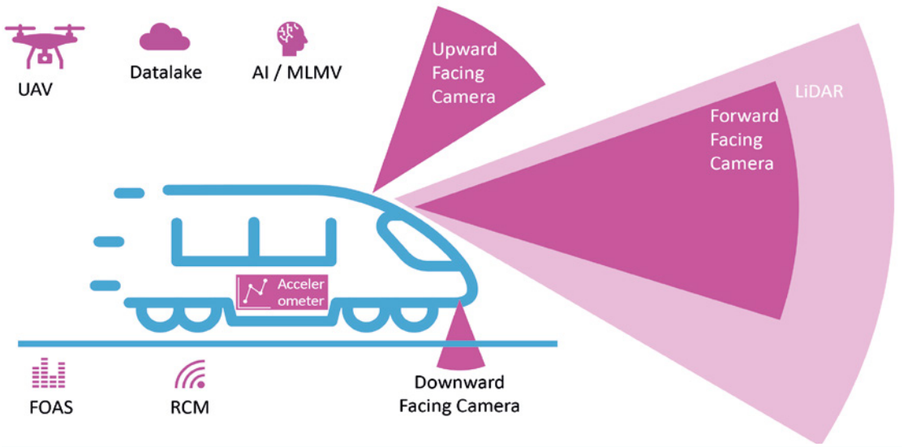
This creates a clear opportunity to modernise our approach. By capturing imagery from plant-mounted and trainborne cameras, we can significantly reduce the requirement for trackside presence. But the real transformation lies in the software - the machine-vision and machine-learning models that will learn to recognise HS1-specific assets and fault signatures automatically. The cameras generate the data; the intelligence interprets it.

Integrating this capability into day-to-day operations is the real challenge. It means new processes, updated work orders and enhanced competencies. Above all, it means building confidence - enabling teams to step back from manual inspections rather than layering new tasks on top. And while automation will reduce the volume of physical inspection, we will always retain, and continue developing, the specialist skills required where manual inspection remains essential.

DIGITAL EYES ON THE RAILWAY

As **Figure 1** shows, train-mounted cameras form just one part of a broader digital-inspection ecosystem now emerging across HS1. The same diagram icons that represent onboard imaging also depict **drones, fixed sensors and remote-condition-monitoring units**, all contributing to a more intelligent, integrated and data-rich approach to asset management.

We are introducing technologies that improve safety and efficiency in some of the most challenging sections of HS1. Certain areas sit in deep cuttings, on embankments or on viaduct structures, and today may require teams to work at height, abseil or enter confined spaces. **UAVs** offer a safer alternative. Modern platforms can maintain stable flight in narrow corridors, operate with high-zoom or thermal payloads, and replicate flight paths for consistent condition monitoring.



Acronyms

UAV: Unmanned Aerial Vehicles

AI: Artificial Intelligence

MLMV: Machine Learning Machine Vision

MVP: Minimum Viable Product

RCM: Remote condition monitoring

FOAS: Fibre Optic Acoustic Sensing

Figure 1: Multiple technologies on the market currently have potential to support and feed into the MVP (Image courtesy of PA Consulting).

The complexity is not the aircraft - it is operating them safely within a live, electrified, high-speed railway.

HS1's **25 kV overhead line equipment** and the aerodynamic pressures generated by high-speed trains create unique constraints. Current industry practice often requires OLE isolation when drones operate near the railway - impractical for routine use. Our work therefore focuses on safe operating envelopes, risk-based procedures and pilot competences that would enable UAVs to be deployed without compromising safety or performance.

Alongside UAVs, we are expanding the use of **Remote Condition Monitoring (RCM)** to reduce unnecessary callouts and build richer asset insight. Around St Pancras, for example, certain track circuits occasionally generate transient occupied indications. Instrumenting these assets and analysing voltage patterns, ballast impedance and environmental correlations helps us understand underlying causes rather than treating each event in isolation.

We continue exploring improved methods of capturing **static and dynamic overhead line measurements**, such as contact wire height, stagger and pantograph-interaction behaviour. While this work is early-stage, the direction is clear: moving from isolated snapshots to higher-frequency or continuous measurement, giving engineers earlier indications of degradation.

Across all these technologies, the principle remains consistent: tools alone do not improve safety or reliability. Value comes from integrating them with **people, processes and culture.** Technology does not replace engineering judgement, but it strengthens it through richer data, safer access methods and better insight.

LISTENING TO MEMBERS, LOOKING TO THE FUTURE

Throughout my presidential year, I have been struck by how deeply Members care about the future of our Institution and the identity we present to the industry. The conversation around the proposed name change revealed a wide range of feelings - from strong support, to heartfelt concern, to the many members simply seeking greater clarity before deciding how to vote.

I understand those emotions. The PWI has played a significant part in my own journey, and like many of you, I feel proud to be part of its heritage. I also recognise what this decision represents for members who have served the Institution for forty, fifty or sixty years.

But I keep returning to one simple idea:

THIS DECISION IS ULTIMATELY ABOUT THE PEOPLE WHO WILL COME AFTER US.

The apprentices, students and early-career engineers just beginning their journey. Our responsibility is to leave them a professional home that feels welcoming, inclusive and clearly understood across the whole of railway engineering.

OUR NEXT CHAPTER

With members having voted in favour of the special resolution, we move into 2026 with a new name and a familiar heart. As the **last President of the Permanent Way Institution** and the **first President of the Railway Engineering Institution**, I feel pride, responsibility and excitement.

The name change is not an end in itself. It supports our aim to present a clearer purpose and identity, reach every corner of railway engineering, and grow our impact across the industry and wider society. What will not change are our values, our commitment to technical excellence, and the community that makes this Institution special.

Most importantly, this decision reflects a willingness to look ahead and think boldly about the needs of future generations. A new name does not overwrite our heritage - it builds upon it.

This year has shown just how much progress we can make when we combine technical ambition with collective purpose. As we strengthen our identity and broaden our support for the whole railway engineering community, it is equally important to be clear about where our focus lies. We fully recognise and respect the specialist domains held by our partner institutions across the industry. The IRSE continues to be the definitive home for signalling expertise, just as the IMechE's Railway Division remains the specialist professional body for rolling stock engineering. With a renewed identity and new tools at our disposal, we are better positioned than ever to support the whole railway engineering community, while working collaboratively and respectfully with our fellow professional institutions. The work ahead is exciting, and I look forward to continuing that journey with you.

THINK ARTICLE

CHRISMA JAIN
PRESIDENT
president@thepwi.org

THE RESULTS ARE IN:

Rooted in our past. Fit for our future.

RAILWAY ENGINEERING INSTITUTION

EMPOWERING RAILWAY ENGINEERING

MEMBERS DECISION

#OurNextChapter: OUR NEW NAME

The results are in, and the Board has received a clear mandate from our Members who voted **in favour** of changing our name to the **Railway Engineering Institution (RailEI)**. It has been encouraging to see the level of debate and discussion throughout the process. Those conversations have shown just how much pride, care and commitment there is for the Institution and for the wider industry. This decision is a significant milestone in our 142-year journey. It reaffirms our commitment to represent and empower everyone involved in railway engineering today across the broad spectrum of disciplines and career stages.

Railway Engineering Institution...

With strong Member support behind this change, we can move forward with a name that strengthens our professional standing, better reflects the breadth of our work, and helps ensure the Institution remains relevant and inclusive for generations to come.

THE RESULTS

Voting took place between **18 November** and **16 December 2025**, administered independently by **Civica Election Services**.

- **Membership turnout:** 62.0%
- **Votes in favour:** 75.4%
- **Votes against:** 24.6%

Under the requirements of a Special Resolution, at least 75% of votes cast must be in favour for the change to be approved. Based on the percentage in favour, we confirm that the resolution **has passed**.

75.4% OF VOTES WERE **IN FAVOUR** OF THE **NAME CHANGE.**

THE MEMBERS HAVE **VOTED...**

WHAT HAPPENS NEXT?

Over the coming months, Members will begin to see the transition to the Railway Engineering Institution (RailEI) across all platforms and materials.

We will be using **'Formerly known as the PWI'.**

OUR 100 DAY PLAN

Update our website, email addresses and social channels. Inform our wider industry partners.

Introduce new post-nominals.

MRailEI, FRailEI, etc.

Roll out updated membership certificates and digital badges.

Involve Members in developing a new logo and brand palette.

A MESSAGE FROM THE BOARD

"We would like to thank every Member who took part in the debate on this question and in making the decision itself. Throughout, it has been inspiring to see so many share their views with such passion for and commitment to the future of railway engineering. The past months' discussions have been invaluable, and they have shown just how deeply our community cares about our Institution. Your engagement demonstrates the strength of this community and has provided a clear mandate for our Institution to move forward as the Railway Engineering Institution (RailEI)."

LOOKING AHEAD TO 2026 AND BEYOND

Moving forward as the Railway Engineering Institution (RailEI) marks the beginning of the next chapter in our 142-year history. It reflects the intent of our founders "to promote the general advancement of technical training in the art of maintaining the Way and Works of Railways", whilst ensuring our Institution remains visible, inclusive, and representative of the whole profession as it stands today – well-positioned to meet the challenges of the future.

While this is a moment of change, our heritage remains a source of pride and will continue to be recognised and celebrated as part of our identity. It is a continuation of everything that we are committed to: engineering excellence, preserving knowledge and skills, shared learning, and a commitment to the safety, performance and future of the railway.

We continue with our purpose of Empowering Railway Engineering and delivering our mission to educate, empower and connect people – sharing knowledge and experience, enriching careers and championing railway engineering.

The new name will help ensure that our Institution continues to be a trusted home for specialist knowledge, a gateway into Professional Registration, and remains a place where people involved with railway engineering in whatever capacity feel welcome and valued.

THINK ARTICLE

DR BRIAN COUNTER
TECHNICAL DIRECTOR
technicaldirector@thepwi.org

WITH OVER 200 YEARS OF UK RAILWAYS AND OVER 141 YEARS OF OUR INSTITUTION BEHIND US, RAILWAY ENGINEERS HAVE A LOT TO DO IN 2026!

We need to pass on more railway knowledge through enhanced collaboration between disciplines, train and educate people, and lead more people toward Professional Registration with the UK Engineering Council.

It is exciting and sometimes a bit scary to start a new year, especially when you are new and so my first task is to welcome all those to the railway community. You may be technician or degree apprentices, recent graduates or anyone who has made the decision to join this fantastic industry. The Institution provides lots of opportunities to find out what is going on, network and learn more about railways.

The Seminar in Birmingham was a great success with acknowledged technical expertise and industry recognition. This was followed by my personal highlight of the year, the Celebration event where we present awards and certificates for those achieving Professional Registration, passing courses and the Journal awards.

My priorities in 2026 are to provide more education and training and to promote Professional Registration, whilst enhancing multidisciplinary working on the railway. We want people to be confident in providing railways that are completely safe and perform well, whilst delivering essential upgrade projects on time and at an efficient cost.

An example of this is the major work on the historic railway viaduct at Chapel Milton in the Peak District to secure its future for freight trains serving four major quarries in Derbyshire (**Figure 1**).

Emma Thistlethwaite from Network Rail explained that in autumn 2025 teams from Network Rail and its contractor AmcoGiffen strengthened the 160-year-old 15-arch structure. It's one of two iconic structures which converge high above the hamlet of Chapel Milton is one of the region's most photographed railway viaducts. The £7.5m investment included filling voids, brickwork and parapet repairs, new waterproofing and drainage systems, installation of handrails and guardrails to improve the safety for workers and the track replaced and realigned. Altogether a system success for the railway!

Figure 1: Chapel Milton Viaduct Derbyshire (Photos courtesy of Network Rail).

Figure 2: Dr. Brian Counter with new students and staff at Coventry University (Photo courtesy of Ramy Shaltout).

LINKED EVENTS AND TECHNICAL ACTIVITY

It was good to attend the September Technical Board visit to the Cemex Factory near Rochester in Kent, to witness the manufacture of concrete sleepers with integrated undersleeper pads. Readers of my articles will be aware of my passion to use these to significantly extend the life of ballast.

The Railway Engineering Institution (RailEI) are part of the Joint Board of Moderators (JBM) who accredit University courses and I was pleased to present as part of the JBM team at the Association of Civil Engineering Departments (ACED) conference in Leeds. There was a focus on links with Universities, student membership, Professional Registration of staff and the challenges of AI in education. We discussed the new JBM curriculum guidelines which are expected to include transportation as a main subject.

I was also delighted to attend Loughborough and Coventry Universities in October to welcome new students to their Built Environment and Civil Engineering courses and obviously again promote railways and encourage students to be free RailEI student members (**Figure 2**).

PEOPLE

As I mentioned, it is great to see people starting their railway careers and the latest cohort of Network Rail graduates in Civils. E&P and Track were treated to a networking event whilst on the Diploma courses at Derby Conference Centre. Mona Sihota, PWI Past President, gave a talk and is pictured with PWI lecturers Pete Hazard, John Fry and Brian Parkinson (**Figure 3**).

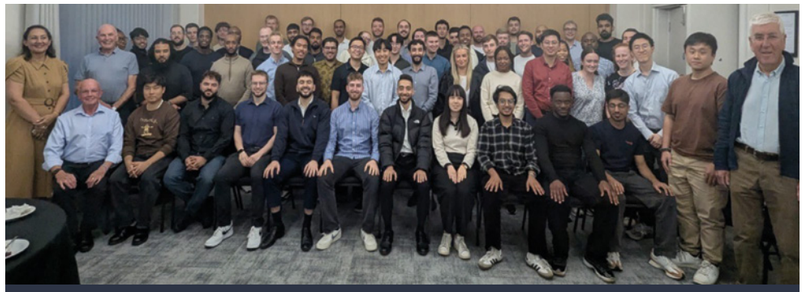


Figure 3: PWI Past President Mona Sihota, lecturers and Network Rail graduates at Derby (Photo courtesy of M. Dalton).

to the industry who will end up being Diploma holders with RailEI. We have seen further interest in S&C Refurbishment courses in Scotland, Anglia and the South, this does make sense as there has been a 25% cut in S&C renewals in Network Rail CP7. Further progress is also being made towards more courses with Irish Rail, Hong Kong MTR and Metrolinx Toronto in OLE, structures and derailment investigation.

Molly Dalton, myself and the team have challenged ourselves on behalf of members to further expand our education provision in 2026 in a number of strategic areas.

1. New Course Development in 2026 especially electrification, S&C and structures.
2. Development and recruitment of Lecturers.
3. Further review of content, relevance, and delivery methodology.
4. Moving towards research based learning involving UKRRIN.
5. Process and digital development for assessment marking and communication for delegates.
6. Marketing and communications of Courses.

PROFESSIONAL REGISTRATION IS STRONG, SO KEEP UP YOUR EFFORTS IN 2026 TO BECOME A PROFESSIONALLY QUALIFIED RAILWAY ENGINEER!

A good year for registration in 2025 with more plans in 2026 for liaison with companies. We will be working to get rail technician apprentices on their way towards EngTech. Our work with Sheffield Hallam and London South Bank Universities on degree apprenticeships and combined end point assessment and Incorporated Engineer is progressing well. We have now approved the access to IEng Experiential Learning from RailEI courses, the Advanced Track Technician Course and Track Engineering Diploma now together count as the equivalent of HNC. This will be extended to other RailEI courses.

The Annual Reviewers conference was held on 30 October at RSSB London and online with a very good turnout of active reviewers. The usual briefings on RailEI and Engineering Council issues and actions were carried out alongside some specific areas of training. Participants acted in teams to review UK SPEC levels and confirm that we are reviewing at the correct level as a workshop exercise which obviously created useful debate and clarified some issues.

RAILEI TECHNICAL EDUCATION AND TRAINING HAS GREAT PLANS FOR 2026!

We delivered a similar number of courses in 2025 as in the previous year, with the added extra that we delivered the pilot of our new course, Advanced S&C Systems Engineering. We had a good mixed cohort of 15 track and signalling engineers for the pilot and numbers are growing for the 2 week courses in 2026. There is a perceived great need for the multi-disciplinary aspects of points including signalling, and a lot of work is going in to actively market this course to both track and signalling engineers including specific liaison with the IRSE. We had a good mix of other courses including 3rd - 4th rail electrification, (**Figure 4**) it is good to see people from all disciplines, can you spot the track engineer?

We are looking forward towards the next round of Network Rail Graduate training, we are anticipating another 90+ new starters

Figure 4: 3rd - 4th Rail Electrification Course, London, Bob Hutchison and Tony Fella (Photo courtesy of B. Counter).

TECHNICAL AND SAFETY

As we enter 2026, I always like to look forward in a positive way to what we have achieved in terms of improving railway safety and technical excellence and align our future strategy to keeping "the balls in the air"! In the UK we are privileged to have many dedicated people as we now enter the 21st year of RAIB. At their seminar in October, they concentrated on the issues of human factors, asset risk and integrity, track and signal communications and climate change.

It is no surprise that the weather continues to hamper the railway and on 3 November, a passenger train travelling from Glasgow Central to London Euston derailed after striking a landslip around 3 miles (5 km) south of Shap, Cumbria. RAIB reported that the train was travelling at around 83 mph (134 km/h) when it struck debris that had been washed onto the track. This lifted the first bogie off the rails and to the right, where it ran derailed for around 560 metres. There were 9 staff and 86 passengers on board the train at the time of the collision. Four people were treated for minor injuries as a result of the accident, and damage was caused to the train and to railway infrastructure (**Figure 5**).

The landslip occurred during a period of heavy and sustained rainfall. RAIB's preliminary examination found that a drainage channel, which runs across the slope above the washed-out material, was unable to accommodate the volume of water which was present. This led to the slope material below becoming saturated, initiating the landslip.

There will be a full investigation and we will be sharing this information with our stakeholders and trainees including lessons learnt being incorporated into the RailEI course "Earthworks, Drainage and Off-Track Engineering".

Figure 5: A landslip caused a derailment of a high speed train at Shap in Cumbria (Photo courtesy of Network Rail and RAIB).


Roger Lewis
Professor of Mechanical Engineering, University of Sheffield


Thomas Butcher, Applications Engineer, LB Foster


Joseph Jaffé
PhD Researcher, University of Sheffield


Joseph Lanigan
Research Scientist, University of Sheffield


Louis Schmandt
CEng IMechE
Technical Engineer, Chiltern Railways

Professor Roger Lewis has worked on all aspects of wheel/rail contact tribology for over twenty years, and his current focus is on understanding and modelling the fundamental mechanisms of low adhesion in the wheel/rail interface and developing new approaches to dealing with the problem.

Dr Thomas Butcher has a research background in rail tribology, specifically the formation and effects of low friction inducing leaf layers. As a Personal Track Safety (PTS) holder, his role includes working on track towards research and development, tribology measurement, product acceptance and maintenance. He has assisted with several other research projects, as well as the accident investigation of the Salisbury rail collision.

Dr Joseph Jaffé has just finished his PhD at the University of Sheffield. He is researching how changing conditions around the track create transience in adhesion level and the lifecycle of contaminant leaf layers. He has experience of assessing leaf low adhesion in the field as well as creating novel methods to investigate layers in the laboratory.

Dr Joseph Lanigan, currently training to be a SEND specialist science teacher with Red Kite teacher training, supported this work as an Academic Fellow in Tribology at the University of Sheffield. Previously, he has published several papers within the area of tribology. He has unique experience of testing cryogenic rail cleaning systems. He has tested cryogenic systems on the "running railway".

Louis is a Technical Engineer at Chiltern Railways, responsible for engineering change and the fleet maintenance plan. With extensive experience in rolling stock engineering and research into rail vehicle dynamics and vibration, he serves as a permanent member of the RSSB Adhesion Research Group. Louis has delivered several major projects, including a collaboration with Knorr-Bremse to develop a Class 165 WSP modification for real-time low-adhesion monitoring.

RESEARCH AND **STANDARDS:** HIGHLIGHTING RECENT DEVELOPMENTS

A NEW LOCATION BASED MODEL TO ASSESS LEAF INDUCED LOW ADHESION RISK: PART 1 – MODEL DEVELOPMENT

KNOWLEDGE 200 TRACK

KEYWORDS:

wheel/rail interface, low adhesion, predictive model, risk assessment

ABSTRACT

The rail industry in the UK and worldwide attempts to resolve leaf induced low adhesion through a variety of methods due to the impact on safety and train performance. Many stakeholders use an "adhesion index" to inform them of when leaf fall is likely and what the low adhesion risk is and use this information to dictate when mitigation techniques such as railhead treatment trains may need to be deployed on specific routes. However, this is relatively low resolution as currently used and does not account for factors impacting specific "low adhesion hotspots". To bridge this gap, a tool for site based low adhesion risk assessment is presented in this Part one paper, which was developed on one case study route. The outputs from this would be able to augment weather-based predictions for a greater accuracy in predicting low adhesion sites and in understanding possible causes. This will allow stakeholders to more proactively plan around sites predicted to be low adhesion hotspots and tailor mitigation solutions more accurately and effectively on a site-specific basis. In Part 2, which will be published in the RailEI Journal April 2026, a case study application and further model development is presented allowing forward facing images to be used as inputs to increase resolution.

1. INTRODUCTION

Leaves that fall on or near railway lines are known to form tenacious, low friction layers that negatively affect safety aspects of the railway when crushed on the railhead by passing trains [1]. When formed, the layers are known causes of low adhesion which affect braking and traction of trains [2-4].

Leaf induced low adhesion in Autumn can reduce braking effectiveness and lead to Signals Passed at Danger (SPADs), station overruns and collisions. Examples are covered in Rail Accident Investigation Branch (RAIB) reports from an incident at Chester Station [5] as well as the recent collision between passenger trains at Salisbury Tunnel Junction [6] and Talerddig [7]. Loss of traction also affects performance leading to delays.

Rail companies design their low adhesion management strategies to mitigate the effects of leaf fall, such as vegetation management, railhead cleaning, on-train equipment (e.g. sanders) and operational practices.

An "adhesion index" (www.metoffice.gov.uk/services/insights/low-adhesion-forecasting) is provided through the Met Office [8]. This is based on weather forecasts, nearby leaf-fall observations and rail temperature. This information can be used to estimate when leaf fall season is most likely to negatively affect passenger and freight traffic to help plan mitigation and possible timetable changes. However, this is relatively low resolution as currently used, working mainly at a geographic/regional level. Without also incorporating site-specific data, many local factors such as terrain and tree coverage that may only affect one area of track are missed.

As a result, a model was needed that can incorporate the physical track and vegetation parameters and that can provide rail operators with more detail on where and why a particular level low adhesion will be present. It was also important that it could be used by anyone, although it is anticipated that it would mainly be used by those managing seasonal effects on routes and train operators.

This paper describes the development of a model for predicting low adhesion risk at specific locations that includes site-specific information that, when combined with weather data, should enhance prediction accuracy, as well as be open to use by other stakeholders. The initial basis came from a case study of train Wheel Slide Prevention (WSP) activation data linked to a measurable delay or reported safety concern supplied by the Chiltern Railways Company Limited (CRCL), a UK based train operator, for their routes which was used to initially rank station sites for low adhesion risk and inform model development and validation. The inputs for the model consisted of field vegetation surveys, mapping imagery as well as track and train operation information.

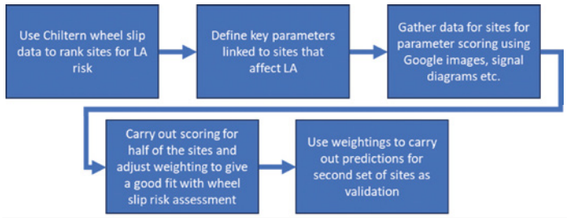


Figure 1: Flow chart of key stages in the model development.

The model is designed to be modular, and to complement other existing models or tools, to build on the understanding of leaf induced low adhesion risk. The end users of the model will be able to make small adjustments to fit their site-specific needs where necessary.

The aim was to ensure that model outputs could be displayed using an easily accessible and understandable interface, such as Microsoft Excel, and to allow the information generated to be displayed on a live heat map with colour coded areas indicating the severity of risk.

2. MODEL DEVELOPMENT

The stages describing the model development from receiving the raw WSP data from CRCL, to the model validation are shown in **Figure 1**.

2.1. MODEL SPECIFICATION

The following requirements for the model were defined to ensure ease of model use, application and modification:

- Rely on easily accessible input information.
- Allow end users to easily input location scores as new data is collected.
- Ensure low adhesion risk is easily calculated.
- Have a modular design to allow it to be incorporated into other autumn tools/plans.

The model utilises specific physical parameters along with a mathematically determined scoring mechanism to assess low adhesion risk. The parameters are either fixed (such as track gradient) or vary temporally (e.g. vegetation levels). It should be noted that the model is not currently set-up directly for accommodating temporal changes, but data from different time points could be collected to see what changes have occurred in the risk. There is also scope for automating model inputs in future, should live real-time data streams be accessible in future (e.g. on-train low adhesion measurement, or forward facing images from trains that measure tree coverage etc.).

All the parameters are expected to contribute to black leaf layer formation and therefore the increased risk of potentially wheel slip occurrence. More details on these are given in Section 2.4.

2.2. OVERVIEW OF CRCL

CRCL is a relatively small UK based Train Operating Company (TOC), that operates inter-city and regional stopping services (see **Figure 2**). The route was chosen on their network for the case study as it covers a range of rural and urban environments, with a range of vegetation coverage levels, all while being relatively small and easier to manage when compared to other routes. WSP activation data was available, and used to indicate where and when low adhesion occurred.

CRCL WSP data collected using 'COMPASS' incident management software and On Train Data Recorders (OTDRs) was analysed to organise locations based on the frequency of incidents. WSP activations are manually recorded within COMPASS whenever they cause a measurable delay or reportable safety concern. The corresponding OTDR data is then uploaded for analysis and investigation.

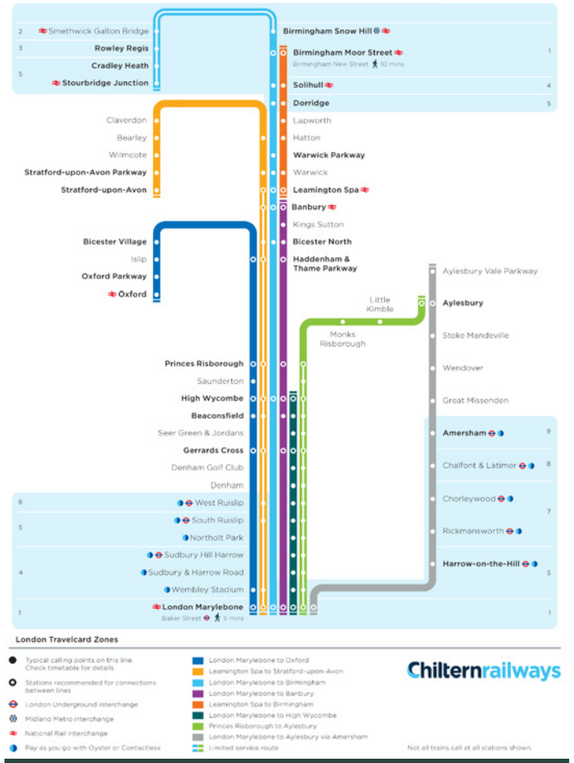


Figure 2: CRCL network map [9]
(Image courtesy of Chiltern Railway Company Limited).

Each WSP report in COMPASS is classified as either 'Good', 'Expected' or 'Reportable', using the CRCL definitions described in **Table 1**.

Level	Definition	Action to be taken
Good	Rail adhesion conditions are good.	None required
Expected	Rail adhesion is no worse than expected for the location and environmental conditions.	Drive according to conditions, no need to report to signaller
Reportable	Rail adhesion is worse than expected for location and environmental conditions.	Immediately report conditions to the signaller.

Table 1: WSP report Adhesion prediction classifications used in COMPASS [10].

2.3. WHEEL SLIP DATA ANALYSIS

The dataset used for the model development consisted of 109 instances of WSP activation starting in January 2018 and ending in October 2020. The relatively small number for WSP activation across a whole fleet is due to the size of the TOC. The data was assessed to find trends depending on location, date and time of day. The location data was used to rank the locations based on reported WSP frequency and then organise them into three groups based on the observations of low adhesion. This enabled higher risk locations to be identified for more focussed analysis. The time information could be used separately to aid in the Rail Head Treatment Train (RHTT) timetabling where possible.

Delay severity was initially considered, where the cost and duration of the delay were combined to form a severity rating, however, this ultimately proved to overcomplicate the model, without providing any

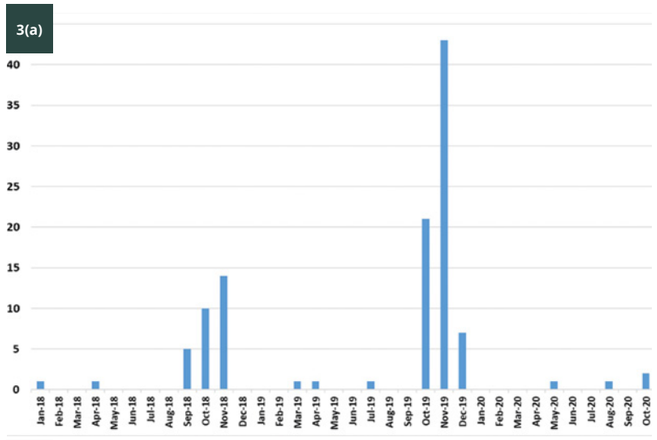
significant improvement or outcome. This was partially because of longer delays impacting subsequent services, and there being no breakdown of the attributed cost. This would be more complex on other networks where more track sharing between operators occurs. Therefore, only the frequency of WSP activation was used for this model as it provided enough usable information. Delay duration and/or cost could be incorporated into the model in the future, should the need arise.

Figure 3(a) shows the distribution of WSP activation per month from January 2018 to October 2020. The most notable peaks are seen in September, October and November 2018 and October, November and December 2019 with the largest being in November 2019 where 43 WSP incidents were recorded. This information indicated that the risk of leaf layer formation leading to reduced adhesion is more prevalent between September and December. This is in line with expectations with a higher frequency of WSP activations during the Autumn, with November often seeing highest leaf fall.

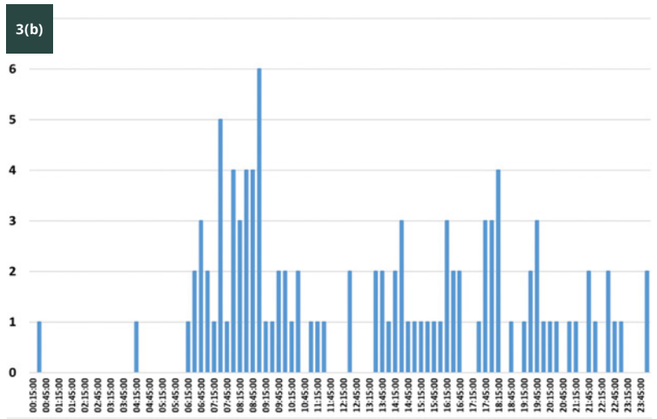
Figure 3(b) shows the frequency of WSP activation broken into 15-minute segments throughout the day. Notable peaks between can be observed between 6:45 and 9:00am, which coincide with trends in delay data seen in the literature [11]. These smaller, less prominent peaks are seen in the afternoon/evening and occur between approximately 14:30 to 19:45. These are due to dew formation where small amounts of moisture contribute to low adhesion conditions due to "wet-rail" [12] or lower shear leaf layers.

Locations were initially sorted by the number of WSP activation events, (see **Figure 3**(c)) and split into low (0-2), medium (3-6) and high (7+).

3(a)



3(b)



3(c)

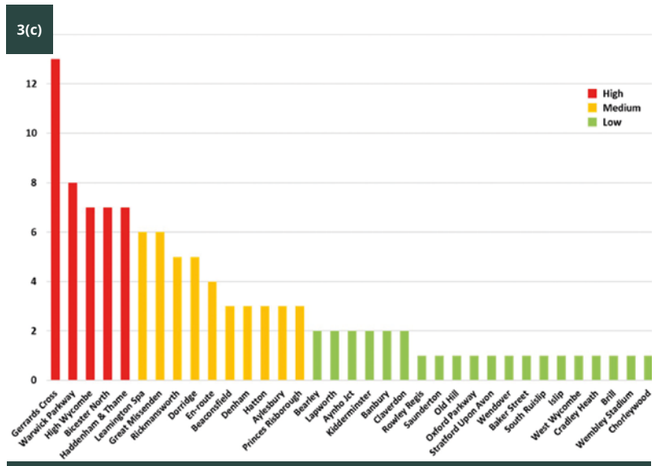


Figure 3: WSP and delay data: (a) Number of reported WSP activations in COMPASS in each month in the time period considered; (b) Time period during which reported WSP activations occurred; (c) Total number of reported WSP activations per location.

2.4. PARAMETER SELECTION AND SITE DATA GATHERING

The model calculates low adhesion risk against specific parameters for each site, using a dedicated scoring mechanism. The parameters were selected through feedback from industry stakeholders including infrastructure owners (such as Network Rail) and train operators as well as discussions at Rail Safety and Standards Board Adhesion Research Group meetings. It is acknowledged that many other parameters exist that could have been considered. Those listed below though were deemed the most influential in this case and easy to assess for each site. The parameters were split into fixed or temporal where fixed parameters are not expected to change between assessments, these include:

Local terrain:

- Embankment/flat/cutting-shallow sides/cutting-steep sides.

Key track features:

- Gradient (including direction)
- Train speed limit, especially changes in speed limits (which determines local acceleration/braking profiles)

Service:

- Number of lines running through the location (affecting service impact of low adhesion delays)
- Service frequency (affecting service impact of low adhesion delays)
- Effect of mixed traffic (affecting service impact of low adhesion delays)

Local area:

- Rural/urban

Temporal parameters are expected to change over time, and include:

Tree coverage:

- Tree species
- Overhanging the line (overhanging/not overhanging)
- Linear spread (or density) along the line (packed or spread)
- Distance from track in metres
- Depth of trees (away from track)

It should be noted that the temporal factors were only considered at a single time for the purposes of model development. In the future they could be assessed at different time points to see how changes have affected the low adhesion risk.

Each parameter is expected to play a contributing role in the presence of leaf induced low adhesion incidents and therefore wheel slip events. However, the relative magnitude and relationships between parameters is still largely unknown. As the model is developed with more data sources, it could be possible that stronger trends between parameters and WSP frequency are revealed.

Temporal vegetation parameters were chosen based in part on observations of rail track and surroundings from field testing, vegetation surveys and site visits, alongside the trackside vegetation standards described in the Varley report [13].

2.5. INITIAL SCORING AND WEIGHTING

The locations analysed were initially organised by frequency of WSP activation, and split into high, medium and low categories (as shown previously in **Figure 3**(c)). These were then divided into two groups (group 1 and group 2) with a close to even split of high, medium and low frequency locations per group. The group 1 locations were used to tune the model, where the aim was to make the WSP frequency score match the model prediction. Group 2 locations were then assessed using the tuned model as validation.

All locations were initially investigated using Google Maps and Street view, and where possible, site visits were carried out to undertake vegetation surveys. These surveys were then used as input parameters for the model. The surveys consisted of recording images and estimations of the number of leaves on the ground, species present, density and position of vegetation as well as any notable features such as tunnels, bridges and crossings. Tree species were compared to those listed in Adhesion Research Groups (ARG) adhesion manual 'troublesome tree chart' [14].

4(a)

Parameter		Range				Weighting
		3	2	1	0	
WSP activation frequency						
Tree coverage	Tree species	-	-	Problematic species present	Problematic species not present	5
	Overhanging the line (overhanging/not overhanging)	-	-	overhanging	not overhanging	3
	Linear spread (or density) along the line (packed or spread)	high	medium	low	no trees	10
	Distance from track in m	less than 3m	between 3m and 5m	between 5m and 10m	over 10m	6
	Depth of trees (away from track)	over 10m	between 3m and 10m	less than 3m or single tree depth	no trees	9
Local terrain	Embankment/flat/cutting-shallow sides/cutting-steep sides	steep, high cutting	medium cutting	flat, no cutting	track is raised	8
Key track features	Gradient	1/265 or steeper	between 1/265 and 1/429	less steep than 1/429	flat	7
	Train speed limits	100 or greater	99 - 75	74 - 60	59 or less	2
Service	No. of lines running through station	4	3	2	1	1
Local area	Rural or urban	-	-	Rural	Urban	4
Total						

4(b)

Case Study Sites

Row labels: <= 49; between 50 101; >= 102

1 - Gerrards Cross	2 - High Wycombe	3 - Beaconsfield	4 - Great Missenden	5 - Princes Risborough	6 - Claverdon	7 - Leamington Spa	8 - Brearley	9 - Hatton
3	3	2	2	2	2	2	2	2
1	1	1	1	1	1	1	1	1
1	1	1	1	0	1	1	1	0
3	3	2	3	1	1	1	1	1
3	3	3	3	2	3	2	3	2
3	1	2	1	1	1	1	1	2
3	3	3	2	1	1	1	1	1
3	1	3	1	3	0	3	0	0
3	2	3	2	2	3	2	1	2
3	3	3	0	3	0	2	0	2
0	0	0	1	1	1	0	1	1
137	103	118	96	76	63	74	59	63

10 - Old Hill	11 - Chorleywood	12 - Lapworth	13 - Wembley Stadium	14 - Rowley Regis	15 - Wendover	16 - Islip	17 - Kidderminster	18 - Oxford Parkway
1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1
1	1	0	0	1	0	1	0	0
2	2	2	2	2	1	1	2	1
3	3	2	2	3	3	3	2	2
2	2	3	2	1	1	2	1	1
2	1	2	2	1	1	1	2	1
3	3	1	3	3	3	0	0	0
0	1	3	3	0	2	3	0	0
1	0	1	3	0	0	0	0	0
0	1	1	0	0	1	1	1	1
102	99	98	101	84	79	72	66	48

Figure 4: Model Scoring: (a) Scoring mechanism and parameters of the model; (b) Group 1 locations with scores.

Signal diagrams were used for some of the operational parameters and were provided by CRCL. They contain information on the permanent track features that were included in the model, like gradients, speed limits and number of platforms. Signal diagrams for all but three locations were available. For the unavailable locations, an educated estimation was used with a tendency towards a higher risk score. Signal diagrams provided invaluable information that would otherwise be difficult to obtain. More details of selected sites are given in Section 2.6. This information can also be sourced from the Network Rail Sectional Appendix (in the UK).

This information was used to score each location against the criteria listed in Section 2.4. Each was scored as shown in **Figure 4**(a). These scores were then multiplied by a "weighting" factor calculated using the scores across all the sites to determine the most influential parameters. The thresholds between the different risk values (high, medium and low), shown in the coloured cells in **Figure 4**(b) were then tuned to adjust the model outcomes to match the risk values determined from the wheel slide information, with a bias toward over-prediction as a safety precaution. **Figure 4** shows the final outcomes scores for the group 1 locations. The wheel slide risk factors are shown in the top row and the model predictions in the bottom row. One anomaly was Old Hill, where the model risk was high, but the WSP activation frequency was low. This could be because of some unique site attributes that were not captured in the model parameters or that the site imagery was not current.

Multiple mathematical approaches were trialled for ranking the weighting factors. The approach that worked best, however, is shown below:

1. Parameter = Tree species
2. Sum of 'high' frequency locations = 2
3. Sum of 'medium' frequency locations = 7
4. Sum of 'low' frequency locations = 9
5. Sum of 'high' frequency locations/ sum of 'medium' frequency locations = 2/7 = 0.29
6. Sum of 'medium' frequency locations/ sum of 'low' frequency locations = 7/9 = 0.78
7. 0.29-0.78 = 0.49
8. When compared to the other parameters, 0.49 came 5th out of 10

This method was used on all the parameters and their scores were ranked in integers from 1 to 10, with 10 being the most influential and 1 being the least (see **Table 2** for full list). The 'no. of lines running through station' was scored 1 meaning it had the least influence on the risk score, while the 'linear spread/density along the line (packed or spread)' was scored 10 meaning it had the largest influence. As can be seen, it is the criteria related to trees that have the strongest influence on the risk assessment. These weightings are ready to be used for other routes so the model user does not need to re-evaluate.

Rank	Parameter
10	Linear spread/density along the line (packed/spread)
9	Embankment/flat/cutting-shallow sides/cutting-steep sides
8	Depth of trees (away from track)
7	Gradient
6	Rural or urban
5	Distance from track in m
4	Tree species
3	Train speed limits
2	Overhanging the line (overhanging/not overhanging)
1	No. of lines running through the location

Table 2: Parameters with ranked weighting factors

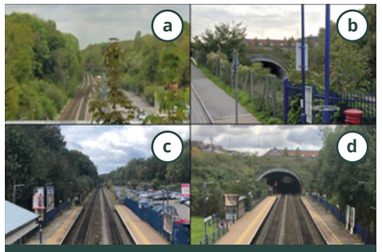


Figure 5: Gerrards Cross station vegetation survey and Google Maps (October 2023) [15] and Google Street View (October 2023) [16] images.

Figure 6: Leamington Spa station vegetation survey and Google Maps images [15].

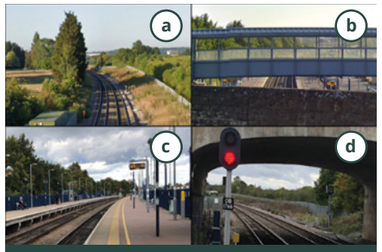


Figure 7: Oxford Parkway station vegetation survey and Google Maps images (October 2023) [15].

2.6. LOCATION SCORING EXAMPLES

In the sub-sections below examples of data collected for several locations is shown to illustrate the process used and how scores were assessed.

Gerrards Cross

The location with the highest number of WSP activation was Gerrards Cross with 13 and is shown above in **Figure 5**, with (a) and (b) taken from Google Maps [15] and Google Street view for stations with public roads adjacent (c) and (d) [16]. This location was given a frequency score of 3, putting it in the highest category.

The trees seen in the Google Maps images were mostly unidentifiable and an in-person assessment was needed to identify present tree species. The vegetation survey revealed that large mature Sycamore trees were present either side of the line and at some points overhanging or within 3m of the line. Meanwhile, within the actual station, trees only covered one side of the line, rising to a height of over 15m due to an embankment which led to a tunnel on the up-line (South, towards London) end of the station. Other tree species were present, but the majority were not considered "problematic" species. The track gradient is 1/264 on either side of the station and has a speed limit of over 100mph.

Overall, Gerrards Cross received the highest risk score at 137, placing it at the top of the high risk category.

Leamington Spa

The location shown in **Figure 6** is Leamington Spa where WSP was activated 7 times in the dataset placing it in the medium category with a frequency score of 2. Again, images in Figure 6 (a) and (b) were taken from Google Maps [15] while (c) and (d) came from the vegetation survey undertaken during a site visit.

The mapping images did not show any trees in the station with some just outside the station in both directions (see Figure 6 (a) and (b)).

The vegetation survey revealed that "problematic" species were present and at points were overhanging the line and were between 3 and 5m from the track. The line gradient is level on one side and 1/112 on the other, with the speed limit between 100 and 75mph.

Leamington Spa received a moderate risk rating score of 74, placing it in the medium category.

Oxford Parkway

One location with the joint lowest number of WSP activation was Oxford Parkway with 1 and is shown above in **Figure 7**, with (a) and (b) taken from Google Maps and (c) and (d) [15]. This location was given a frequency score of 1, putting it in the low category.

The image analysis showed trees lining one side of the track at the station, but on both sides of the track outside of the station, with the depth of the treeline only being 1 or 2 trees deep.

The vegetation survey found that "problematic" species were present, with none overhanging the line. The treeline was between 3m and 5m from the outside rail, with a low linear density.

The line is level and has a speed limit of less than 59mph. Oxford Parkway was seen as a location with one of the lowest overall risk scores at 48, placing it squarely in the low category.

2.7. VALIDATION AND SECOND SET OF SITES

Figure 8 shows the group 2 locations that were used for the validation part of the model development. The same scoring approach and thresholds were used for group 1. Every location, except Warwick Parkway had a matching or higher risk rating than delay frequency rating (as illustrated in **Figure 9**), possibly caused by out of date vegetation information as the site was not visited during the vegetation survey. The model is designed to give a risk rating that is equal to or higher than the frequency rating to act as a safety precaution.

8												Row labels	<=	49
													between	50 101
													>=	102
West Wycombe	Cradley Heath	Stratford Upon Avon	Brill	Aylesbury	Bicester North	Rickmansworth	Saunderton	South Ruslip	Haddenham & Thame	Warwick Parkway	Banbury	Denham	Dorridge	Aynho Jct
1	1	1	1	2	3	2	1	1	3	3	2	2	2	2
1	1	1	0	1	1	1	1	1	1	1	1	1	1	1
1	0	1	0	1	0	0	1	0	1	1	1	1	1	1
2	0	2	2	1	3	1	1	1	3	2	2	3	1	1
3	2	3	2	3	3	2	2	3	3	3	3	3	3	3
1	1	2	1	1	2	1	1	1	2	1	1	3	1	1
1	1	2	1	1	1	1	1	1	2	1	1	1	1	1
1	3	0	3	0	3	3	3	0	0	3	2	3	2	2
1	1	0	3	0	3	0	3	3	3	0	3	3	1	2
1	1	2	1	2	1	1	1	3	2	1	2	2	3	3
1	1	0	1	0	0	0	1	0	1	1	0	1	0	1
77	62	82	81	55	107	66	79	59	102	89	85	124	72	78

Figure 8: Group 2 locations with scores.

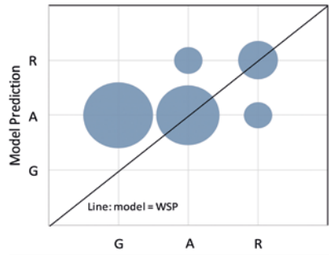


Figure 9: Model prediction versus WSP activation data (bubble size proportional to data point numbers).

3. DISCUSSION

3.1. MODELLING OUTCOMES

A low adhesion assessment model has been compiled and validated against historical WSP data for the CRCL route, with the focus being to improve low adhesion performance during the Autumn season, across the UK rail industry.

The location with the highest frequency of WSP activation was Gerrards Cross, suggesting it is likely a low adhesion hotspot with Chorleywood in the lowest frequency group. The station at Gerrards Cross has a tunnel close by, likely to alter various environmental effects. Railway tunnels have been shown to affect aerodynamics [17] as well as 'moisture level, shading and temperature of the railhead' [18]. These factors could all be considered influential on the local environment, regarding leaf fall and subsequent leaf film formation and on their own affect friction. Additionally, large trees are present above the line, increasing local leaf fall rates.

For Chorleywood, where WSP activation is joint lowest, there are no features like railway tunnels, relatively smaller tree density next to the station and the surrounding area is flatter and more urbanised with a concreted car park, preventing trees infringing close to the line. It should also be noted that there are a number of low adhesion mitigations in place at Chorleywood that would also influence the degree of WSP activity.

Figure 8 shows how the model fits the group 2 locations, where all but one location gives the same or higher risk ranking when compared to the delay frequency. Warwick Parkway is an anomaly with a delay frequency score of 3-high, but a risk score of 86, which is in the medium category. This is likely due to Warwick Parkway was not being visited in the vegetation survey and instead relied on imaging that could be out of date. Wheel slides here may have had non leaf causes but not been filtered out due to the limited information.

3.2. MODEL ASSUMPTIONS

Assumptions had to be made where the research team did not have enough information, which placed potential limitation on the accuracy of the model. Some other limitations were self-imposed to ensure that the model was simple to use at this stage. The assumptions and limitations are listed below:

- Each reported WSP activation is linked to a station and so it was assumed to have occurred nearest to that station
- Not all wheel slip events will have resulted from low adhesion caused by leaf layers. Efforts were made to identify and remove non leaf events but with the limited by the quality of information
- It was assumed vegetation levels were similar across the data time period. Vegetation surveys were conducted in 2021 but the WSP data is from 2018-2020 so there may have been differences
- All of the parameters were analysed using the same method, regardless of score range. The use of fuzzy logic is actively being trialled to improve the accuracy of the results.
- WSP reports from 'COMPASS' only account for activations that have been manually reported by drivers or operational staff because they have either caused a delay, performance or safety concern. There may be uncaptured low adhesion events. Work is active within ARG to give real time WSP data which could help develop this model in the future
- Other factors contribute to low adhesion such as weather, other railhead contaminants and pollution. This model only addresses the risk from leaf layers
- There are currently no clear definitions for 'high', 'medium' and 'low' density for things like linear spread, though this could be changed in the future by providing example images for the end user to reference.

3.3. NEXT STEPS FOR MODEL

To improve the model and overcome some of the issues listed above work has continued to increase the resolution through the use of forward facing images taken from onboard trains. Application of this approach to a case study route is presented in Part 2 of this paper [19].

4. CONCLUSIONS

The validated low adhesion assessment model presented, based on the CRCL network will help to build upon the prediction services and models already in use by the railway industry as it is rolled out to other routes and networks. Weather data can now be combined with site-specific data, to enhance the accuracy and understanding of leaf fall trends and subsequent low adhesion events. The methodology for assessing sites can be taken forward by stakeholders to produce more accurate prediction models for their areas of interest, combining this with weather data to generate improved low adhesion predictions. This will enable more focussed planning of mitigation strategies for problem areas attacking the causes highlighted in the model outcomes.

5. ACKNOWLEDGEMENTS

The authors would wish to acknowledge RSSB for initial project funding through project COF-ITR-03.

The work was also supported by the EPSRC Programme Grant "Friction: The Tribology Enigma" (EP/R001766/1).

6. CONFLICT OF INTEREST

The authors have no conflict of interests.

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In Part 2, a case study application and further model development will be presented, which will be published in the RailEI Journal in April 2026.

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Lisa has managed the delivery of the northwest transport hub in Derry Londonderry which included the refurbishment of a grade one listed building and associated railway systems. Lisa's current role is on Belfast transport hub where she oversaw the construction phase of the new permanent way works, signalling & telecoms and the first phase of northern Ireland railway operating centre in 2024.

Andy Fynn is a Principal Engineer with Babcock Rail and is a Chartered Engineer and a Member of the IRSE. Andy has over 40 years industry experience in signalling and telecommunications across main line, light and metro rail environments. With Babcock he leads multi-disciplinary engineering teams in delivery and integration of projects including working on Belfast Grand Central Station and NIROC since 2017.

Grand Central Station is the visible centre, less obvious is the railway system work delivered by Babcock through a collaborative integrated project team with Translink and Farrans Sacyr. This article aims to shed some light on that.

Malcolm Swan is a Permanent Way Construction Manager and a Member of the RailEI. Malcolm has over 42 years railway experience in permanent way design, construction and maintenance working for British Rail, Jarvis and First Engineering, before moving to Network Rail as Regional D&C Engineer and then Programme Engineering Manager. In this role he led the engineering delivery of S&C, Plain Line and High Output renewals and several major enhancement projects across Scotland, LNW, LNE and East Midlands.

Malcolm was CEM (P Way) for the Belfast Grand Central project, joining Babcock in 2022 until project completion.

NATIONAL RAIL AWARDS 2025 - BELFAST GRAND CENTRAL STATION PROJECT WINS NATIONAL RAIL AWARDS MAJOR PROJECT OF THE YEAR
'Completed on time, within budget and to excellent safety standards, this project enhances economic, social and environmental outcomes across Northern Ireland, supporting up to 20 million annual journeys by 2040' - National Rail Awards

BELFAST GRAND CENTRAL STATION:
PART 2 – CONSTRUCTION AND COMMISSIONING

KNOWLEDGE 200

PROJECT INTRODUCTION

We left Part 1 with the disruptive access identified as part of the project construction staging. Part 2 deals with the Babcock construction work and final commissioning following a broadly chronological order but some overlap is inevitable.

SIGNALLING & TELECOMMS (S&T) CONSTRUCTION SEQUENCE

The project signalling control changes extend as far South as Hilden and the fringe to Portadown Signal Box (SB) as shown in **Figure 1**.

The S&T construction works were divided into 3 areas;

- in the brownfield site where the new station and approaches were being constructed
- in the triangle area where the major permanent way changes to existing infrastructure were required
- those on or adjacent to the remainder of the existing railway corridor.

Space in the brownfield area and in the general railway corridor being at a premium, S&T compounds were created at Translink's yard at Lislea, just South of Adelaide, and adjacent to Lanyon Place station.

Construction commenced with ancillary civil works in the existing railway corridor which provided over 10km of new cable routes and 11 new cable Under Track Crossings (UTXs) along with bases for signals and equipment housings. This was followed by completion of the compound, bases, and cable routes in the brownfield area for the new Relay Room, Principal Supply Point (PSP), Distribution Kiosk and Telecom Equipment Room. Completion of these allowed the rooms to be delivered to site.

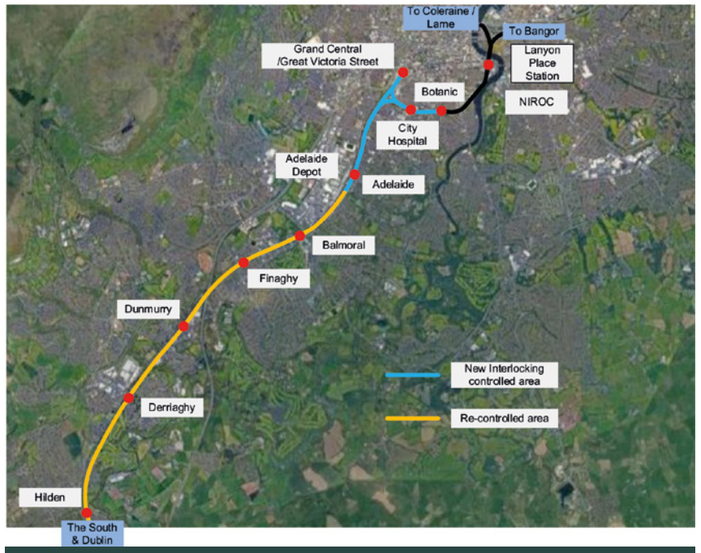

Figure 1: Extent of the S&T Works (Photo courtesy of the Authors).

A new Distribution Network Operator (DNO) intake was provided by Northern Ireland Electricity (NIE) for the North area of the new station. This intake provided power for a number of other facilities and the demand necessitated a new High Voltage supply requiring significant road works through the centre of Belfast. Completion of the intake allowed the new PSP to be commissioned.

Installation and initial testing work had been undertaken within the new Relay Room while the DNO supply was completed. Once the new power supplies to the signalling relay room were commissioned testing of the new interlocking began. To support this, the new Siemens Time Division Multiplex (TDM) equipment and associated Relay Interlocking TDM Application (RITA) was installed.

Siemens also provided a temporary WestCAD for testing purposes. Two new Test Desks, to mimic the outside infrastructure still being constructed, were connected to the new interlocking allowing testing to the Control

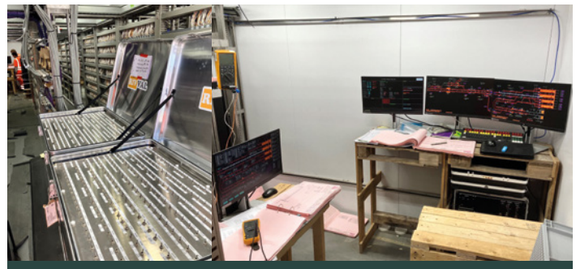

Figure 2: Grand Central Interlocking Test Westcad and Test Desks (Photo courtesy of the Authors).

Room to be replicated in advance of the telecoms system being available, see **Figure 2**.

In parallel, the main S&T cables were installed working out from the main control points to the extremities of the project at Dunmurry on the Dublin lines and to Northern Ireland Rail Operating Centre (NIROC) on the Central lines. All equipment housings had been prefabricated off site, these housings were delivered to site integrated with the cable installation programme so cable termination and testing could follow and be progressively tested back to the main equipment rooms.

Cables from the main equipment rooms to the railway corridor had to be routed via the triangle area to connect to the railway corridor. Where possible new routes were completed but, as much of the area was to be impacted by the permanent way works, the remainder of the cables were housed in temporary routes until the blockade. Once main cables were terminated lineside and track mounted equipment and signals were installed with new Insulated Block Joints (IBJs) installed by Babcock's permanent way team and bonded out.

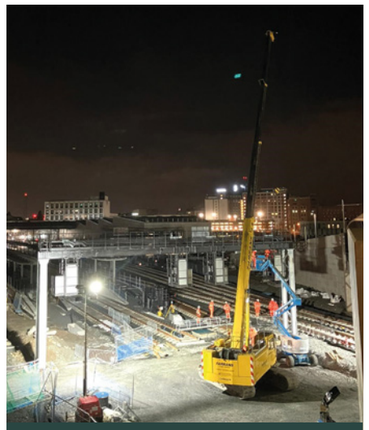

Figure 3: Platform 5 to 8 Gantry in Construction (Photo courtesy of the Authors).

The new S&T infrastructure in the brownfield and permanent way renewal area had to be installed around the new station, civil and permanent way works. Again, ancillary civil works were undertaken first including new cable routes, new location suites, 3 new UTXs and 16 augered piles and pile caps for the new gantry structures. As the new permanent way was completed S&T installation followed including the installation of the new gantries, **Figure 3**.

Translink had completed the fit out of the new NIROC facility at Lanyon Place which enabled the signalling control system to be installed. Once power became available following the NIROC power stage (see later) the new telecom core network was completed, and the control system progressively tested to the new Grand Central interlocking. The system was also connected to the TDMs at Adelaide and Dunmurry in preparation for re-control during the main blockade.

The last equipment to be installed was on the station itself. An integrated works sequence was developed with the Farrans / Sacyr JV who were installing cable routes and equipment bases on the platform for the S&T equipment. A dynamic CDM plan was developed and reviewed on a weekly basis to manage the interfaces between two Principal Contractors working in the same area.

Installation of equipment housings, cabling, and indicators on the station platforms and the remaining lineside and track mounted equipment were the final pieces of installation work prior to the blockade.

ENABLING STAGES

Power Stage 1 commissioned the new Grand Central PSP and feeder section towards Dunmurry replacing the existing feeder. The new power was commissioned on to new and existing locations and provided final power supplies to the new signalling, telecom and TDM equipment for pre-testing.

Power Stage 2 similarly commissioned the new feeder to Botanic.

NIROC Power Stage commissioned the new NIROC PSP, the supplies into the NIROC facility and Belfast Central signal box along with new lineside feeders. These were undertaken during a series of standard TIII possessions with power changeover at Belfast Central on a Saturday night requiring a possession of the whole Belfast Central SB control area.

Temporary wiring was installed at Dunmurry and Adelaide interlockings which would reduce the re-control works during the commissioning to little more than plug coupler changes.

All other disruptive enabling stages were undertaken around the P-Way works and are dealt with in the next section.

PERMANENT WAY CONSTRUCTION

Preparation

A significant challenge, and a key risk to the delivery of each permanent way stage, was maintaining consistent access and a regular flow of plant and materials to carry out works effectively and efficiently. In the brownfield area, locked between the operational railway, the main worksite, and maintaining an operational bus corridor, space was at a premium. The ongoing handling, sometimes multiple times, of permanent way materials proved to be very demanding.

It was identified very early that the project would benefit from rail strings being created and therefore an area was quarantined for the storage and handling of 60' rails and the subsequent welding into strings using a Flash Butt welding machine. Several small areas for the stockpiling of the new materials, ballast, sleepers, and rail required for the platform lines were identified near the East ramp adjacent to the busway bridge.

It was clear that other options for material storage and fabrication works had to be identified to deliver the remaining works.

Permanent Way fabrication sites clear of the operational railway were set up, one in the brownfield site and the other in the ambulance yard in the same locale but on the opposite side of the existing railway. These sites were the principal areas for the delivery and handling of loose materials prior to their fabrication into plain line track panels (for the Blythefield lines) and the new S&C units for Westlink Junction and City Junction.

Two compounds, one at the old BMX park (adjacent to the Down Dublin line between Central Junction and Westlink Junction) and another at the East Ramp adjacent to the new busway bridge, served as the main logistics hubs for the handling of old track, ballast and formation material that were being removed and the storing of new loose materials including sub-base, ballast, sleepers, rails, and geotextiles. Refer to **Figures 4** and **5** (overleaf).

A ballast stockpile, replenished daily during the works, was also set up on the brownfield site. Stores were set up for track components, small plant, and hand tools on site, at Translink's Lislea Yard and at the Babcock depot at Milewater Road. The main storage for the concrete sleepers was at a separate Translink site to the northeast of Belfast.

Two Road Rail Access Points (RRAPs) were installed, one to serve the BMX park and the other to serve the East Ramp compound.

Figure 4: Permanent Way Construction Compounds (Image © Google Earth / Google).

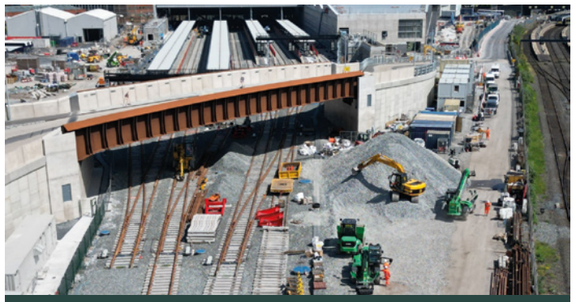

Figure 5: Permanent Way Construction Station Area and East Ramp (Photo courtesy of Babcock).

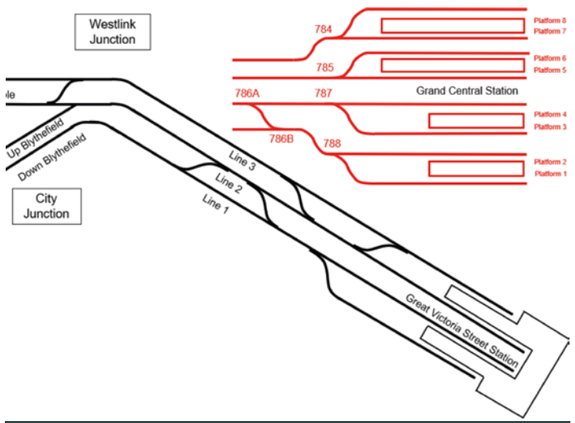

Figure 6: Brownfield permanent way construction by Christmas 2023 (Image courtesy of Babcock, Author's own illustration).

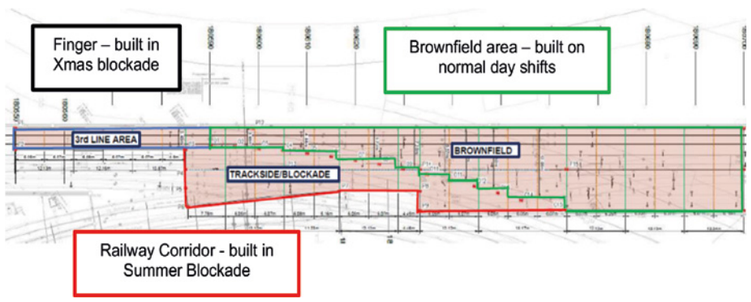

Figure 7: Transfer Slab Construction Sequence (Extract from ARUP drawing with Babcock Overlay).

Finally, working with Belfast City Council and Translink local adjustments to road use adjacent to the BMX park, through the Europa Bus Station and at the access point adject to the Busway Bridge laid the foundations for a workable, safe traffic management plan for the duration of the works.

The Brownfield Site

By August 2023 the track formation and drainage in the new station platform areas were nearing completion by the main works contractor, and the Babcock team were given access to platform 1 to commence the installation of the new platform lines. Each platform formation was subsequently released by the main works contractor in a staged manner with platform 8 finally being handed over in November 2023. The installation of all new ballast, sleepers and rail from the new buffer stops to clear of all 8 platform ramps was completed by mid-December 2023. Platforms were progressively handed back to the main works contractor for their finishing works, **Figure 6**.

As the plain line works in the platform areas progressed works began simultaneously on the ballasting for the new turnouts and crossovers in the station throat area. Work in this area proved slower than expected with the programme of works very much impacted by several factors including production rates in the platforms, S&C delivery dates to site, S&C fabrication areas, provision of suitable crane pad locations, all whilst accommodating other works taking place on site.

By Christmas 2023 all plain line for the platform lines and S&C works for 784, 785, 786A/B, 787 and 788 had been completed.

The Slab

The requirements for a new floating slab over the Belfast Sleech at Westlink Junction were discussed in Part 1, this slab being around 160m in length, up to 20m wide and requiring over 1000m^3 of concrete. The developed design allowed it to be constructed in 3 stages; The 'finger' area, the brownfield section and the remainder situated under the existing railway as shown in **Figure 7**.

A blockade at Christmas 2023 allowed for the installation of the 'finger' section that would accommodate the new third line. This required the installation of a track support / retention system. Sheet piling was not feasible given the restriction on access, Babcock therefore developed a solution using Legato Blocks (see **Figure 8**) that doubled up as Construction Site Environment (CSE) barrier and allowed construction of the slab in the brownfield site during normal railway operations.

Following the Christmas blockade, work on the slab extended the works beyond the finger section to the extension into the brownfield site. Material delivery for the upcoming works accelerated and the detailed planning for the Easter and Summer blockades later in the year continued.

Easter 2024 Blockade

A number of items of preparatory work were completed in advance of the blockade including;

- Extension of the CSE barrier adjacent to the Down Dublin between Central Junction and Westlink Junction. This allowed the preparation of the new formation for the new third line (Down Dublin Reversible) and also access from the BMX park to the Brownfield site.
- Strategic placement of S&C units in the BMX compound and rails, sleepers, and geotextile along the Dublin corridor.
- Installation of new IBJs associated with future signalling staging.

The blockade itself delivered the following works:

- Plain line renewal and slew - Up Dublin Reversible – 170m
- Plain line renewal and slew - Down Dublin Reversible – 185m
- New 778 points on the Down Dublin Reversible to the Future Down Dublin Reversible
- Installation of new Insulated Block Joints in the renewed area.

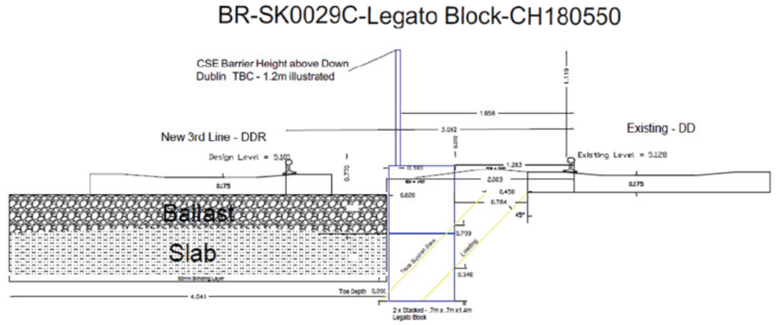

Figure 8: Track support / retention system with CSE barrier combined (Image courtesy of Babcock).

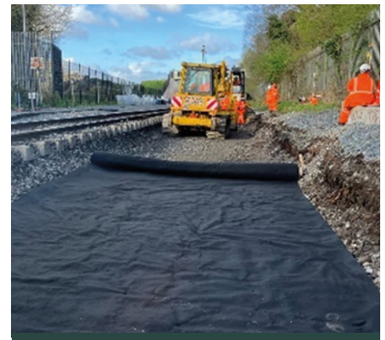

Figure 9: Stage C Formation works (Photo courtesy of the Authors).

Figure 10: Stage I installation of 778 points (Photo courtesy of the Authors).

Figure 11: Slab and permanent way construction works looking towards Westlink Junction (Photo courtesy of Babcock).

All 3 stages involved full track renewal, including formation works of both main lines, and a short section of the new 3rd line. See **Figures 9** and **10**. Note on **Figure 9** the apparent high cess levels adjacent to the formation works are due to not being able to install drainage run 14 or lower the cess in advance of the formation works at this location due to live operational cables (known and unknown) along the existing Up Dublin cess, however these works were undertaken post-blockade.

The introduction of 778 turnout in this blockade introduced facing points into the existing layout. As traffic would be running over these points they were clipped and the detection cut into the existing track circuit which minimised works to the existing signalling system, refer to **Figure 10**.

Brownfield works between Blockades

Following the Easter Blockade works continued to complete the permanent way in the brownfield area including;

- Completion of the brownfield section of the floating transfer slab, refer to **Figure 11**.
- Installation of formation works (Track Formation Design Solution E) between the slab and the main works contractor's site.
- Installation of the remaining formation, ballasting and track works associated with Stage J (781B, 782B, 783B) and associated plain line to tie in to previously completed works in the station throat area.

Summer Blockade

Preparatory works in advance of the blockade included;

- Fabrication of bespoke plain line track panels for the Down and Up Blythefield lines.
- Fabrication of the S&C layouts for the remainder of Westlink Junction (779A/B, 780, 781A, 782A and 783A).
- Preparation of the S&C panels for City Junction (790 and 791A/B).

The main blockade was divided into 3 parts. The first part of the blockade commenced with the application of a series of modifications to Great Victoria Street interlocking – Signalling stage 3 - which maintained train services to and from Lanyon Place to the South but closed Great Victoria Street to allow Westlink Junction to be re-built and the connections to be made to the new station.

Blockade Part 1 (refer to Figure 12)

During part 1 the railway remained operational between Lisburn and Lanyon Place. A number of worksite protection arrangements were put in place including signalling disconnections and securing of points at Central and City Junctions. Temporary protection arrangements clear of Central Junction on the Dublin lines and clear of City Junction on the Blythefield curve in the form of fencing, signage and track stops were also provided.

The existing boundary fencing adjacent to Weavers Cross was removed and an additional ballast RRAP installed to maximise the access to the Blythefield curve.

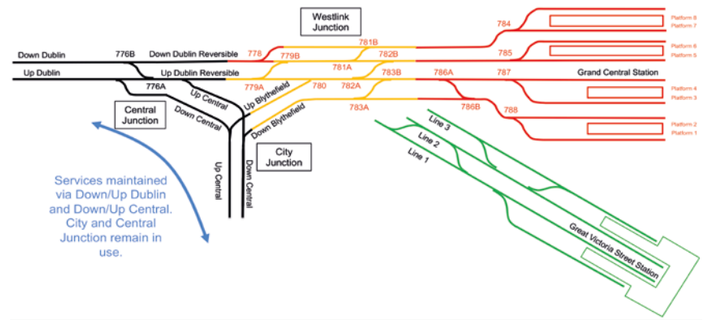

Figure 12: Sketch showing extent of works during Summer Blockade Part 1 (Image courtesy of Babcock).

Figure 13: Construction of the remaining part of the transfer slab (Photo courtesy of Babcock).

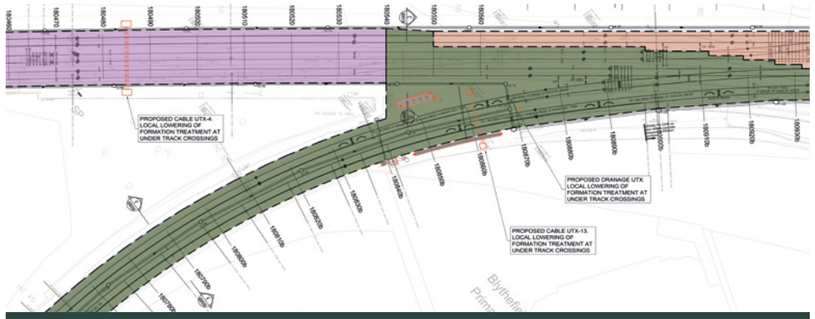

Figure 14: Formation works – general arrangement (Image courtesy of BL drawing).

Road access to the brownfield site was extended giving improved access for the slab construction works under the re-built Westlink Junction, refer to **Figure 13**. Completion of the slab was a critical activity as delays in completing this bottleneck would have had pushed out the subsequent installation of the formation and track and delayed linking the station to new Westlink Junction and the railway corridor.

The following stages were delivered in this part of the blockade:

- Stage J – Westlink Junction 780, 781A/B, 782A/B, 783A/B and associated 130m of plain line (following completion of the slab works).
- Stage K – 385m of plain line renewal of the Up & Dn Blythefield Curve.
- Stage M – 208m of plain line renewal of the Up Dublin Reversible, Dublin Reversible and Down Dublin Reversible and 779A/B points.

The extent of the formation works at Westlink Junction are shown in green (Track Formation Solution C) and in pink (Track Formation Solution B (floating slab)), see associated table and **Figure 14**.

The continuation of formation works on the Blythefield curves including the transition to 'Track Formation Solution D', see **Figure 15**.

Track Formation Solution	Capping Layer	Sub-ballast	Ballast	Geotextile
B	450mm reinforced concrete slab 50mm blinding above existing subgrade		300mm	N/A
C	450mm (6F4)	250mm	300mm	Terratex 4050, TX170, PW1
D	N/A	110mm	300mm	Terratex 4050, TX170, PW1

Figure 15: Formation works – general arrangement (Image courtesy of BL drawing).

Figure 16 taken during Summer Blockade part 1 shows the extent of slab works underway at Westlink Junction (middle of photo), ballasting of the Dublin lines (top) adjacent to the BMX park (top right), excavation of the Blythefield lines (top of left), the extent of the relaying works undertaken in the brownfield site (bottom right) and the recovery of the existing track going into the old station (bottom left). The relay room, PSP and Telecom equipment room are in the bottom right.

The Blythefield Curve

The P-Way design for the tight radius Blythefield Lines was jointed track construction with an accompanying check rail arrangement. This posed some factors to consider:

- Installation methodology:
- Loose build or panelised
- 'Pre-Cut' or 'Cut to Suit' rail lengths
- Consideration of check rail arrangements/check rail joints
- Consideration of the design gauge variation from 1600-1606mm
- Consideration of track layout including adjustment switch locations & IBJ types/locations
- Maintaining compliant rail lengths
- Considering differing temperatures during the construction phase and the effect on joint gap measurements.

After much thought, the chosen methodology was to panelise the layout. This involved:

- Ordering pre-curved rails/IBJ's – mixture of pre-determined rail lengths and Cut to Suit to allow for some constructibility tolerances.
- Going back to first principles to establish leads/lags – but using CAD to design each panel and ensure accuracy when constructing.
- Creating a panel schedule to ensure correct order of construction & installation.
- Deciding to use McCulloch Panel Lifters; installing both roads concurrently working back towards the compound (low to high chainage), see **Figures 17** and **18**.

Figure 16: Summer Blockade Part 1 – Aerial view (Photo courtesy of Babcock).

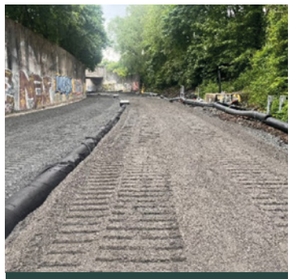

Figure 17: Summer Blockade Part 1 – prepared formation and new drainage on the Blythefield curve (Photo courtesy of Babcock).

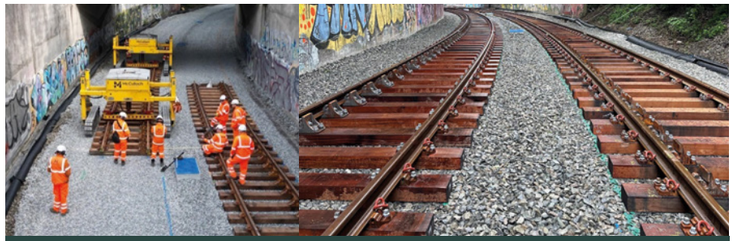

Figure 18: Blythefield Curve jointed track panel installation.

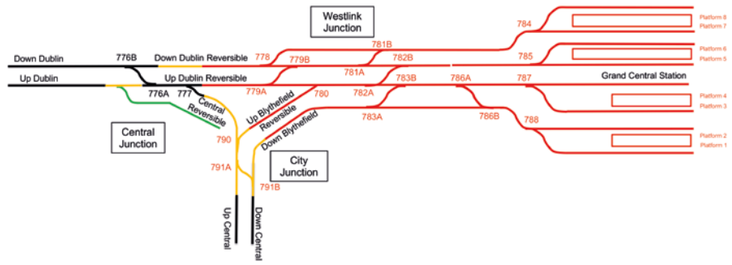

Figure 19: Sketch showing extent of works during Summer Blockade Part 2 (Image courtesy of Babcock).

Summer Blockade – Part 2

Part 2 saw the closure of the lines to services to and from the South and Lanyon Place to allow City and Central junctions to be re-built. This was enabled by further signalling alterations which decommissioned the existing Great Victoria Street (GVS) Interlocking while still allowing Translink to use Lanyon Place station for services to the North and East and to operate empty trains in and out of the South entrance of Adelaide depot.

Possession limits were extended to include the whole previous GVS interlocking area including Up & Down Dublin and Up & Down Central lines. The temporary protections arrangement on the Dublin and Blythefield lines respectively were removed which enabled open access to the whole triangle for the first time. See **Figure 19**.

The following permanent way stages were delivered in this part of the blockade:

- Stage L – 290m of plain renewal for the Central Reversible
- Stage N – Up and Down Central – S&C for 790 & 791A/B and 210m of associated plain line renewal.

Both stages involved full track renewal and re-modelling of the Central Reversible and Central lines at including the recovery of 775 points.

The formation solution for Central Junction, the new Central Reversible and City Junction were Track Formation Solution D, see earlier table. The existing Down Central was left in situ as a haul road as far as possible, see **Figures 20** and **21**.

Figure 20: Formation works on the Central Curve (Photo courtesy of Babcock).

Figure 21: Track construction for the Central Reversible (Photo courtesy of Babcock).

DRAINAGE CHALLENGES

During the formation works at City Junction drainage runs 12, 15, 16, 17 and 19 were installed in advance of the bottom ballasting operation where feasible, thereby reducing the volume of drainage to be installed post track installation.

The scope required all drainage to be installed in advance of formation works where possible which was largely achieved. Pre-existing embankment stability issues affected Run 16 along the Central Reversible at City Junction and prevented installation of new drainage assets ahead of the new track installation. In this location, existing gas and other services also necessitated a change in the drainage design, with the outfall from run 16 directed to run 17 (via the Blythefield Curve) instead of run 19 (towards City Hospital). All drainage design changes were managed via the client and designer as track and drainage construction continued with progressive assurance controls applied to ensure all works were installed to an accepted design and proven prior to entry into service.

The difficulties encountered installing a new drainage run through Donegal Road overbridge, the original design had the drain position in the sixfoot but this was not feasible due to the potential to undermine the central pier. The solution removed the existing down line track with the new drain installed in the centre of the 5 foot linked to the existing outfall at City Hospital station

PLANT AND LOGISTICS

The increase in distance from the BMX and East Ramp compounds led to a reduction in production rates for both material extraction and installation. Additional plant resources were deployed which were maximised by the completion of the Up Blythefield line to City Junction. This effectively created a haul road between City Junction and the Dublin main lines and access to both BMX and East Ramp compounds, while simultaneously utilising the route to and from the BMX park via Central Junction when appropriate.

The logistical challenges of the site were eased by maximising the use of the available plant. The introduction of the 'top and tail' Unimog and ballast box arrangement proved to be an excellent innovation leading to significant gains in the time taken to remove spoil and deliver top stone to the extremities of the site at City Junction.

Due to the access constraints, travelling over the formation could not be avoided. Tracked dumpers were the perfect machine to protect the formation. The dumpers were also capable of swivelling 360 degrees, eliminating any requirement for turning the machine when on the formation.

With limited space for material and with large volumes to remove, the GPS Excavators made this as efficient as possible. The GPS machine control files eliminated the chance of over digging during the excavations and creating drainage excavation files increased production rates hugely, **Figure 22**.

Figure 22: Unimog 'top and tail' with ballast boxes, 360º Dumper and GPS Excavator.

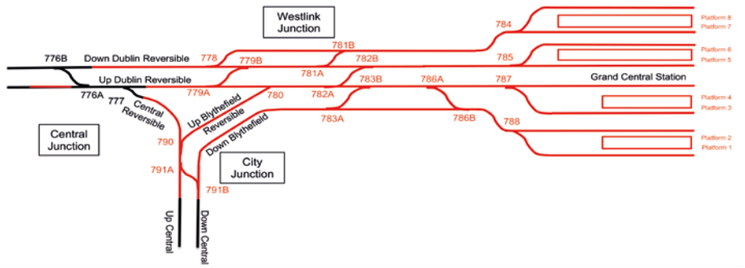

Figure 23: Signalling Stage 4: Commissioning (Image courtesy of Babcock).

Figure 24: First Service Train to Leave Grand Central Station: 08:05 to Dublin Connolly (Photo courtesy of the Authors).

S&T WORKS IN THE BLOCKADE

The new S&T infrastructure in the permanent way renewal area was progressively completed and tested following the sequence of civil and permanent way works. Close integration was maintained between the construction teams to ensure the programmes remained aligned and that works remained on schedule to meet the final stage of the blockade.

For the first time in the project all of the new lineside equipment was connected to the new interlocking and could be tested back to the new workstation at NIROC. These works were completed on programme to commence the third and final phase of the blockade, the main commissioning.

COMMISSIONING

The third and final part of the blockade closed the line between Lisburn and Lanyon Place to allow the final S&T works to be completed. Re-control of the Adelaide and Dunmurry interlockings was achieved through removing the temporary wiring and changing over to the new TDMs. The new signal sections on the Adelaide interlocking were completed once train movements ceased into Adelaide Depot, **Figure 23**.

The new rail infrastructure was signed into use on the evening of 11 August in advance of the planned first test train on the morning of 12 August.

Following the completion of the Operational Readiness stage for the new station and driver training the first passenger service train left Grand Central station on Sunday 13 October for Dublin Connolly, **Figure 24**.

LEGACY

Belfast Grand Central Station is a world-class facility situated at the heart of what will be the new Weavers Cross city neighbourhood bringing circa 1.5 million square feet of mixed-use space to a strategic location in the city.

As the largest transport-led regeneration project in Northern Ireland, it brings significant investment opportunities and is set to be a key economic driver for Belfast and for Northern Ireland - a hugely important NI Executive Flagship Project delivering on the ambitions of the Programme for Government.

Since opening Autumn 2024, Belfast Grand Central Station has become a vital hub for integrated travel, connecting passengers across bus, coach, rail, and active travel networks. With a 96% user satisfaction rating and an almost 40% increase in Enterprise cross-border journeys since the hourly services commenced, the station plays a pivotal role in strengthening the Dublin-Belfast Economic Corridor.

In its first year since opening, the station welcomed over 8 million people and its success contributed to more than 4 million additional journeys across the wider public transport network, reflecting a significant modal shift.

The project has rightly been awarded a number of awards including Major Project of the Year at the 2025 National Rail Awards.

THINK ARTICLE

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HONOURING LIFELONG DEDICATION AND INDUSTRY LEADERSHIP AT THE 52ND PWI NSW CONFERENCE

The 52nd Permanent Way Institution (PWI NSW) Annual Conference celebrated connection, collaboration, and the lasting strength of Australia's rail community. Each year, this event gathers professionals shaping the future of rail, and this year's gathering was no different, highlighting those whose lifelong commitment and leadership have made a lasting impact on the industry. This year the theme was Rail Crossroads: The Freight v Passenger Debate. The convention started with a train laid on for delegates between Sydney and Newcastle before a site visit to the local ARTC Provisioning Centre. The next day started with our inaugural Women in Engineering breakfast (presented by Jacqueline Linke, TfNSW), followed by our key note speaker Wayne Johnson (ARTC CEO) who set the scene for the need to increase freight transport by rail.

A memorable highlight was the presentation of PWI Life Memberships to Julian Sharp CPB, Daniel Collison BG&E, Mark Butler WSP, Scott Chapman ARTC, and Patrick Man John Holland. These distinguished members have each dedicated decades of service, passion, and technical excellence across the rail sector. Their leadership and influence span projects, organisations, and generations - from advancing infrastructure to mentoring the next wave of engineers and maintainers.

Left to right: Howard Collins OBE; Mark Harris PWI-NSW President; Matt Longland.

Collectively, their efforts embody what the PWI stands for: professionalism, collaboration, and a steadfast commitment to continuous improvement. Whether through on-the-ground innovation, managing complex programs, or advocating for safety and standards, each Life Member has contributed uniquely and enduringly to the strength of the Institution and the rail industry.

This year's conference also recognised Howard Collins OBE TfNSW and Matt Longland from Sydney Trains with Honorary Fellowships. Honorary Fellowship is a new grade of membership which is extended to senior leaders in recognition of their contributions. Their leadership and dedication continue to inspire across the transport sector. Both have demonstrated a steadfast commitment to excellence and to enhancing rail in New South Wales, embodying the values of integrity, vision, and service that define the PWI.

The recognition of these individuals, both Life Members and Honorary Fellows, underscores the PWI's dedication to celebrating those who lead by example and devote their careers to improving the way we build, operate, and maintain our rail networks.

Looking ahead, the achievements of this year's awardees serve as a reminder that rail is built on people, those who innovate, teach, and lead with purpose. Their contributions form the backbone of an Institution that continues to grow, evolve, and inspire.

Left to right: Dan Collison; Patrick Man; Mark Harris; Scott Chapman; Julian Sharp; Mark Butler.

PRACTICAL TRACKWORK CHALLENGE

LLANELLI & MYNYDD MAWR RAILWAY, 24-25 SEPTEMBER 2025

THINK ARTICLE

STUART MURPHY
TECHNICAL MANAGER
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In September we held our eighth Practical Trackwork Challenge (PTC). The event was hosted by the Llanelli & Mynydd Mawr heritage railway (L&MM) and was by invitation to all our Corporate Members who nominated employees who are not, in general, familiar with working on track. In addition, we were delighted to be joined by 3 rail PhD students from the Technical University of Graz in Austria.

As the industry works ever harder to reduce workforce exposure to operational railway risk, it is difficult for many people engaged in railway engineering to gain experience of working on track. However, no matter what your role, it is evident that you will perform better if you have a good grasp of the challenges that practical track work presents.

We are grateful for the help of L&MM in enabling us to run this year's Challenge. In designing the event, we took on board feedback from previous challenges and consequently shifted the emphasis of the event from the more mechanised elements of track renewal where, due to the risks inherent in using large yellow plant, delegates could often "see" but not "do" and focused on more activities in which delegates could directly participate. This year's Challenge enabled delegates to get their gloves dirty by undertaking basic trackwork activities under experienced supervision. The environment at L&MM proved an ideal location to host this more hands-on event.

The 2025 PTC had three broad objectives:

- An opportunity for delegates to take part in trackwork in a safe, protected and low-stress environment.
- An opportunity for delegate personal development, understanding and learning.
- An opportunity to support a heritage railway by undertaking some much-needed maintenance and further their aspirations to extend the bullhead track along the original Cynheidre colliery route.

The event saw the participants split into 4 groups to tackle 4 activities:

1. Spot re-sleepering.
2. Loose sleeper relay extension to the existing main line.
3. Track and platform setting out and gauging.
4. Maintenance of rail joints and main line snagging.

The PTC could not have taken place without support from our Corporate members who provided their expertise and workforce to mentor the 24 delegates.

Colas Rail undertook the role of both Principal Designer and Principal Contractor under the Construction (Design and Management) Regulations 2015 as well as supplying the majority of the workforce.

Network Rail were primarily involved in the line extension works on the bullhead main line and comprised members of the local Track Maintenance Team, using their volunteer days.

KGJ Price, a local track consulting, installation and maintenance corporate member, provided staff with surveying and setting out expertise as well as supplying a gang to assist with the line extension.

We were also delighted to have the Confidential Incident Reporting and Analysis Service (CIRAS) at the event where they were able to explain the origins and objectives of the confidential safety hotline originally set up by the Rail Safety and Standards Board (RSSB).

Delegates were drawn from the following organisations:

Progress Rail	Systra	Murphy Group
Sicut	ORR	Technical University of Graz
Swietelsky	RSSB	
D/GAUGE	AtkinsRéalis	
One Big Circle	Konux	

As the delegates arrived ahead of the event, they were greeted by a weather forecast indicating two full days of dry sunny weather. It was hard to believe that had we held this event one week earlier, the L&MM car park would have been under approximately 12 inches of water. Of course, the delegates came prepared with Personal Protective Equipment (PPE) more suited to rain than to glorious sunshine. Thankfully a constant supply of water was available from the L&MM canteen. This newly opened facility is fashioned from the donated shell of a single car SuperSprinter unit and was wonderfully staffed by the L&MM volunteers.

Image courtesy of Llanelli & Mynydd Mawr heritage railway

Stuart Murphy leads the day 1 review (left); Nick Millington outlines Wales & Borders route challenges (right).

The Llanelli & Mynydd Mawr hosts.

Delegates measuring the track curvature.

It was very pleasing to see from the outset that the delegates were keen to get involved in the activities, learning as much as they could about working on track. Equally pleasing was witnessing a workforce of experienced rail staff enjoying the event and keen to help the delegates by sharing their knowledge and experience. As the groups rotated around the four activities, they were accompanied by an experienced chaperone – Andy Franklin, Bob Langford, Joss Apps and Andrew Wilson. The four chaperones have collectively circa 200 years of track experience and encouraged a wide range of questions from the delegates covering all aspects of track engineering. One example of these discussions resulted in Bob giving an impromptu lecture to two of the groups on curve radius calculation using versines. Bob used the side of one of the site skips in lieu of a blackboard and the groups were then able to carry out measurement on the main line to determine the curvature. A somewhat different way of delivering part of the Track Engineering Diploma that Bob would normally convey more conventionally in a classroom!

To supplement the physical demands of the two-day event, we were fortunate to have two distinguished speakers. Firstly, Professor Stuart Cole CBE Emeritus Professor of Transport at the University of South Wales took the delegates through the evolution of the Llanelli & Mynydd Mawr railway and its context in the local rail network. Our second speaker was Nick Millington MBE, Route Director of Network Rail Wales and Borders. Nick laid out the challenges faced with running the current NR Route on a day-to-day basis. Both insights were greatly appreciated by the delegates.

As the event drew to a close, the combined teams of volunteers and delegates had delivered the following for L&MM:

- Replacement of 67 timber sleepers.
- 40 permanent joints successfully lubricated and the main line snagged.
- 109m of bull head track extension added to the main line.

All in all, a very successful two days meeting all the objectives identified at the outset. A huge thanks to everyone involved and especially to the team at L&MM who allowed us to use their railway and were fantastic hosts.

Curve radius calculation with Bob Langford.

MAIN SUPPORTING COMPANIES

PARTICIPATING DELEGATES COMPANIES

Joel Lintern MPhys MPWI IEng
Design Engineer (Track)
Engineering Services - Design Delivery
Network Rail Route Services

Adam Holyoake BSc
Design Engineer (Track)
Engineering Services - Design Delivery
Network Rail Route Services

Joel is a Track Designer with over 20 years railway experience including working in Renewals, Maintenance, Surveying, Track Bed Investigation, Risk & Value and Absolute Track Geometry. He spends much of his time in Track Maintenance depots upskilling Insight users and receiving feedback on how to make Insight even better.

Adam is a Track Designer with 9 years railway experience including working in Track Bed Investigation and Rail Operating Centre. Previous to working in the rail industry he spent 14 years working within aviation. He now delivers training and upskilling to Insight users in Track Maintenance depots and gathering feedback.

INSIGHT: A MODERN DATA-DRIVEN APPROACH TO RAILWAY ASSET MANAGEMENT

KNOWLEDGE 200 TRACK

WHAT IS INSIGHT?

Insight is a modern computer application designed, built and patented by Network Rail (NR) to increase the data available about railway assets. This article will focus on the Track assets though Insight also contains data related to Signalling assets. Overhead Electrical equipment and Civils data is also starting to be included with Critical Rail Temperature and Stress Free Temperature intended to be added early in 2026.

WHAT DATA DOES IT USE AND WHERE DOES IT COME FROM?

The principal source of track related data comes from measurement trains. Measurement trains run over the vast majority of the railway network at intervals usually between monthly and six monthly depending on track category and speed of the line. The data these trains collect is used by NR Track Maintenance to identify track defects that require intervention.

The trains provide data from sensors relating to track geometry and visible defects using Plain Line Pattern Recognition (PLPR). Track geometry defects include twists, non-standard gauge, dips where rails join together, poor top, poor alignment and cyclic top which is where rail level dips on a wavelength that causes a build-up of energy in train suspension causing this wavelength to then propagate further over time. PLPR will identify missing rail clips, broken sleepers, visible rail defects and voiding or slurried beds.

Track geometry defects have historically been managed in a system called Track Integrated Geometry Engineers' Reports (TIGER) which is linked to Ellipse (the work management system used by NR Maintenance) and PLPR has been managed on PDF documents downloaded from the Patrol Coverage Tool (PCT). Insight improves upon both of these systems in different ways.

TRACK GEOMETRY DEFECTS - LIFECYCLE AND PREDICTIONS

Insight's advantage over TIGER is that historic track data for a defect can be quickly and easily accessed as shown in **Figure 1**.

The reason it is able to do this is because, where TIGER identifies any defect found as a new defect, Insight will check a detected defect's location against previous runs and if a defect of the same type has been previously detected there it will assign this as an updated occurrence of that defect. This is called persistence logic. This has been difficult to automate in the past because the accuracy of mileage from the measurement train is sometimes not precise enough; Insight makes it possible by comparing the new trace to previous runs to improve the relative accuracy. Defects often go through a lifecycle from Pre-Alert to Alert Level (AL) then to an actionable Intervention Level (IL). A defect number is assigned to a defect at its first occurrence in this life cycle and keeps the same value until it is closed within Insight.

Because historic data points for a defect are readily accessible within Insight, predictions are made for a defect for when it will become an

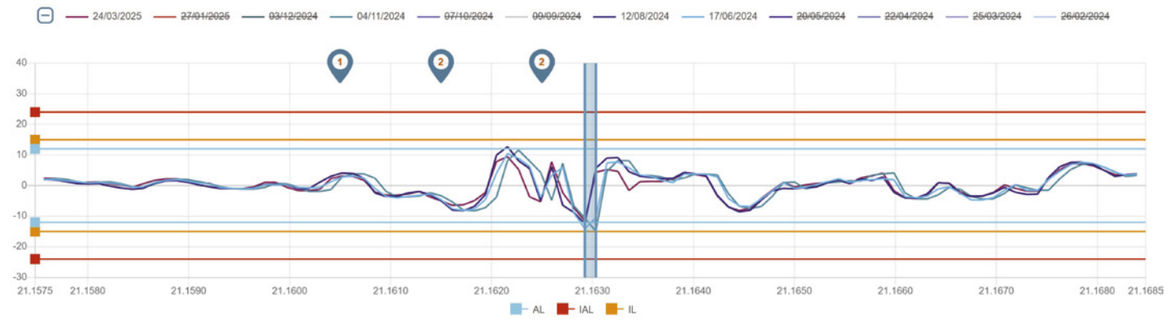


Figure 1: This shows the most recent recorded data and historic data for comparison. The lines show thresholds for defect severities with different timescales for rectification. Map pins show numbers of other nearby defects.

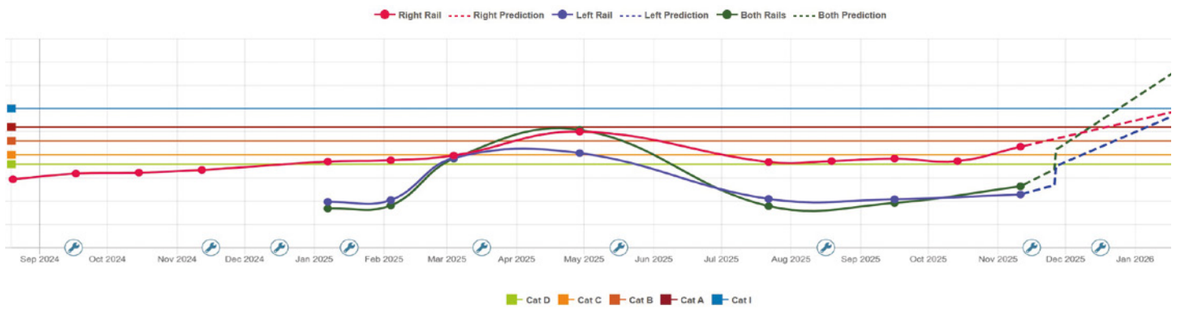


Figure 2: This shows the trace over time for a CT fault. The dotted lines show predictions; these are often stepped for CT faults as small changes lead to sudden defect development. Spanners show historic and planned interventions based upon work orders in Ellipse.

SEVERITY	RBM	ALERT	INTERVENTION	IMMEDIATE	RISK SCORE	REOCCURRENCE
IL	N/A	17/03/2025	17/03/2025		89.7	8
IL	N/A	03/12/2024	03/12/2024		121.6	7
IL	N/A	09/12/2024	09/12/2024	N/A	120.5	7

Figure 3: Three defects with the date each of them became IL defects. The reoccurence count shows how many times each defect has been closed and then been found again – the high number in these cases suggests normal maintenance intervention alone is not capable of fixing these defects.

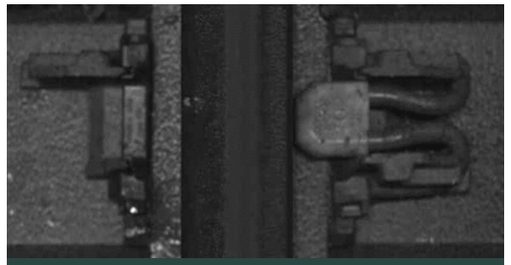


Figure 4: A missing fast clip along with a broken housing.

IL, as shown in **Figure 2** for cyclic top (CT) faults. These predictions are based on relatively simple linear regression models but there is potential to enhance these to consider various factors such as seasonal variations or even to reflect upon previous events and use weather forecasts to predict where intervention may be required following a severe weather event.

ELLIPSE INTEGRATION - INSIGHT AS A DEFECT MANAGEMENT TOOL

Insight went live in June 2022 but was limited to use as an analysis tool rather than a defect management tool. This changed in April 2024 when Ellipse Integration meant work orders could be created within Insight and added to the Ellipse workbank. These work orders then can be sent directly to the handheld tablets that the Maintenance teams use on site so defect details can be checked on site and the work order can be closed. The work order closure can be seen in Insight and the defect can be closed as rectified completing the defect lifecycle.

Insight is also able to identify, as shown in **Figure 3**, if the defect has occurred previously (Reoccurrence) within the last 450 days at a location which can help to make the case for a defect that has become "baked into" the track and may require a tamper, stoneblower or even a renewal to fix an underlying condition.

PLPR

Managing PLPR defects on PDF documents involves manual comparison with the Ellipse workbank to verify if any of the detected visual defects already have work planned to remedy them. Because these records are pen and ink on paper there is little scope to automate this process. As a result, it takes a significant time for a Track Section Manager (TSM) and a Section Planner to work through a patrol. The Maintenance teams are under considerable time pressures so being able to streamline this process is highly desirable.

Because Insight groups the multiple recordings of a defect into a single record, when a work order created in Insight is linked to a defect it is very easy to confirm that a work order is already planned to fix that defect. Insight won't include a defect in the list of actionable defects if a work order is planned which meets the assigned rectification timescale. Insight will alert you if the defect has worsened meaning the current timescale may no longer be suitable. The user can then arrange for the work to be carried out sooner.

The images that are available on the computer printout are small thumbnails whilst Insight displays the full images captured by the PLPR cameras. **Figure 4** shows the high definition captured in PLPR images; these images are collected by trains running at linespeed. In Insight the images can be made full screen and even zoomed in on. The picture quality assisted in a recent planning session to identify that what appeared to only be a missing track clip was actually broken housing.

The removal of the requirement to print out multiple sheets of paper to carry out the PLPR analysis exercise using PCT may have sustainability benefits as well.

RISK BASED MAINTENANCE (RBM)

As well as measurement trains, foot patrols are carried out on the network. In low-risk areas, especially if paired with difficult track access conditions such as long tunnels, an RBM regime may be implemented. This means that the foot patrol will not be required as frequently but intervention will be required at a lower threshold than the IL defect threshold.

Under TIGER, maintenance teams were required to manually compare defect details with the rules defined within local regime documents to identify what remedial actions are required and by when. Insight allows users to add the local regime rules so that RBM defects are automatically identified, and the actions presented to the users.

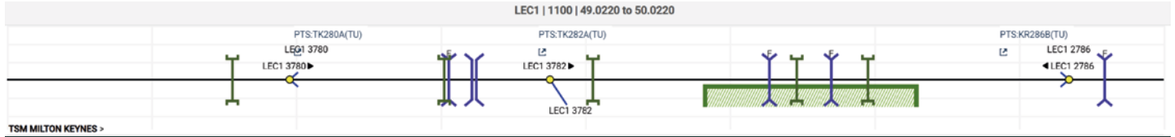


Figure 5: The asset schematic showing several lineside structures. Hyperlinks associated with S&C units allow viewing of that asset's Ellipse data.

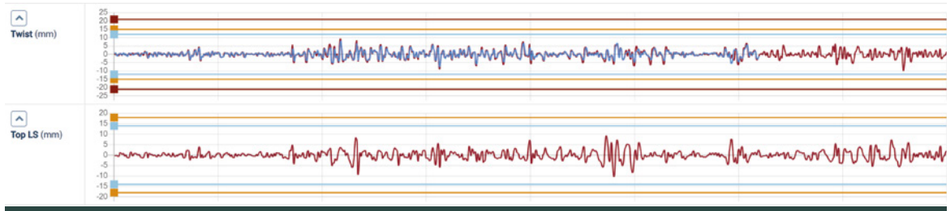


Figure 6: Different colour traces indicating different measurement dates.

LINEAR VIEWER & TRACE REVIEW

An aspect introduced in the last year is the Linear Viewer. This gives a visual representation of a wide array of railway data sources to assist in decision making. This provides many of the features that were within the Linear Asset Decision Support (LADS) tool. An asset schematic, as shown in **Figure 5**, is included which allows a user to orientate themselves with structures, earthworks and switches and crossings (S&C).

Multi-channel traces over multiple measurement train runs are available in-line with that schematic to allow analysis of changing conditions over time. This is shown in **Figure 6**. Users can add annotations either at a mileage or attached to a particular measurement run allowing decisions or considerations to be easily seen when reviewing these.

These annotations have the capacity to be incredibly useful to track designers for understanding the challenges that the track maintainer faces with a site which they have been given to design - these comprehensive thought processes and recurring themes associated with a site have been difficult to tap into unless a close relationship with the maintainer exists.

Track componentry, rail weight and age, track category and ballast age are included alongside the traces, as shown in **Figure 7**. In practice, these are not always the most accurate but having such a simple jumping off point can be a good indicator of whether accurate data exists or not.

TSMs and Track Maintenance Engineers (TMEs) are required to review their traces on a regular basis. Auditable trace review capability is available in Insight and is being improved based upon user feedback. Currently, users notice that extra data in Insight slows Trace Review sessions compared to paper-based sessions, but most agree it leads to better-informed decisions. The Insight team is working to speed up the data transfer with methods such as loading a smaller number of runs and only loading other runs on demand and allowing buffering of the next page's traces so moving from page to page is more seamless.

THE FUTURE OF INSIGHT

Listening to and responding to user feedback has been a core component of how Insight has been implemented. This is part of the reason track engineers, rather than IT professionals, have been used to roll Insight out in Maintenance depots.

Recent enhancements which are being adopted include Query Builder which is a powerful tool which will interrogate multiple databases and Core which gives a user-friendly interface to extracting information about Ellipse assets and incidents.

Further in the future is the Intervention Decision Support tool which will link to external systems to provide forward facing video and geospatial visualisations as well as measures of the effectiveness of previous interventions on a particular site.

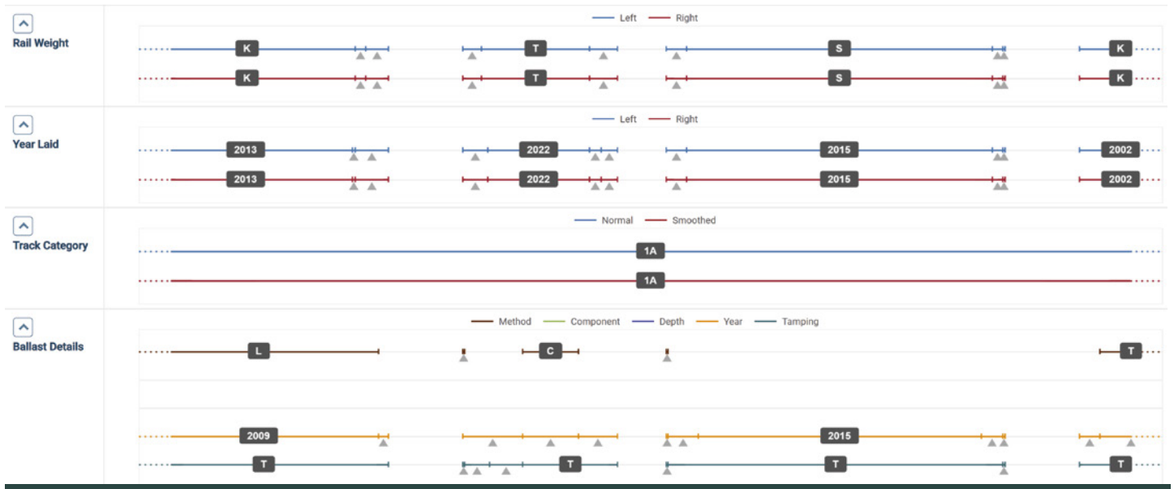
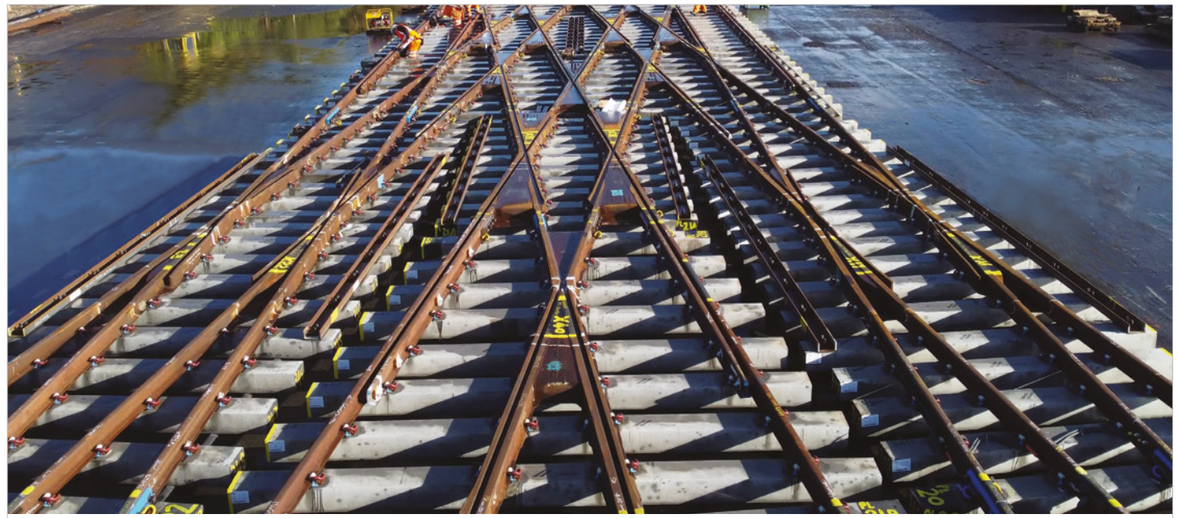


Figure 7: A selection of some of the other data available in Insight's Linear Viewer.



John Merriman
RailEI Technical Manager, Electrification

THE PRACTICAL ELECTRIFICATION CHALLENGE

OCTOBER 2025

KNOWLEDGE 200 ELECTRIFICATION & PLANT

We held our third Practical Electrification Challenge between the 7-9 October 2025 at the Network Rail Jane Austin Training Centre, Swindon, and once again we were blessed without rain, and a bit of autumn sun.

Attendance at this event is offered free to Corporate members who can send up to two attendees each to a maximum attendance of 28. The challenge is designed for staff who work within the rail industry but whom have little site experience, on this challenge they can gain some real appreciation of the conditions, equipment and processes that the teams face delivering Overhead Line (OLE) work on site.

We delivered the challenge with the support of key sponsors, supporters and volunteers who we thank for their continuing support...

AtkinsRéalis: Technical support and challenge lead Garry Keenor.

Aureos: Providing contact wire and supporting with Supervisors; Sean Ralphs and Carl Dawson.

Furrer + Frey: Providing the Design, materials and technical support on site with Noel Dolphin and Rob Daffern.

Network Rail: The use of the outstanding facilities at the Network Rail Jane Austin Training Centre, Swindon.

SPL Powerlines: Acting as Principal Contractor, providing materials and the principle point of contact Brian Gillespie who was supported by Supervisors Liam Allport and Andy Westwood.

DAY ONE

Day one started as the delegates gathered at the hotel in the evening with an introduction session, an evening meal, followed by a safety presentation given by Paula Hilliard, Engagement Manager from Network Rail. Paula took the attendees through a safety hour presentation covering working near OLE Electrified Areas on the theme of ASK, CHECK, CHALLENGE, and provided an excellent introduction into the challenging environment facing teams working within an electrified rail corridor.

DAY TWO

Day two began when we took the delegates to the Network Rail Jane Austin Training Centre. We started with a short session in the classroom with presentations on an overview of overhead line electrification, and a short crash course on how to read design drawings. The group were then passed to the Principal Contractor who provided a full briefing and an explanation in the taking of an isolation and the use of a form C. The attendees were then split into four groups of seven, with each group supported with a supervisor and a chaperone. Each group was tasked to build a cantilever at low level, and once that was complete the delegates ran in the catenary wire. This was great experience for gaining familiarisation with the tools, materials and processes needed to deliver OLE equipment in the safety of the Training Centre.

In the afternoon we had additional demonstrations that the attendees took an active part in, covering height and stagger measurement, a neutral section and section insulator briefing, switching and feeding track side, and rigging up to take tension out of a contact wire.

After completing on site we returned to the hotel for an evening meal followed by a presentation from Garry Keenor Vice President of the RailEI, on Electrification lessons learned and the financial case for future electrification. This was followed by a presentation from Professor Andy Doherty, Chief Technical Officer for the Global Centre for Rail Excellence (GCRE). Andy discussed how GCRE came into being, the challenges it faces, and what benefits a high speed test loop can offer a modern rail industry.

DAY THREE

Day three and we returned to the Network Rail Jane Austin Training Centre, to complete our wire run by running in the contact wire, installing droppers, and cutting in insulation.

In the afternoon we were supported by manufacturers who allowed the delegates to gain experience working with their systems:

Cembre Julian Singh and Reece Brenchley provided a demonstration on their earthing and bonding products with their demonstration vehicle, which is fitted out with the latest cutting, crimping and die tooling. Whilst on-site Reece demonstrated drilling a rail and fitting a track bond, the lightweight battery powered LD-16BRE rail drill used, showed how fast a strong and low resistive connection can be made to a remote rail. Julian also demonstrated crimping best practice using a matched-based system and the importance of preparing cables to the correct standard.

Gripple provided a demonstration of their SwiftLine Rail Dropper, SwiftLine Jumper and their SwiftLine Forked Collar, with the opportunity for attendees to fit the dropper on a low-level OLE system proving very popular. Representing Gripple and demonstrating the equipment was Paul Whittle and Stephane Demoutiers.

Mosdorfer Rail are a manufacturer and supplier of overhead line catenary solutions for high-speed, conventional and light rail systems. Supplying into global railway markets, their supply portfolio of a complete railway catenary system includes the patented Tensorex C+ spring tensioning device. For the event they demonstrated how their Tensorex C+ tensioning device is installed and operated, with a stand displaying an example of the product that the attendees could view close-up.

In addition, the attendees were also shown a balance weight auto tensioning system so that they could understand the differences between the technologies and the advantages of the Tensorex C+ system. The event was supported by Rob Renshaw (Commercial Sales Manager), Sean Corcoran (Senior Product Manager) and Lee Ford (Engineer).

Penta Electrical Safety Products UKI Tim Harris demonstrated their range of products, such as live line tester and earth kits, the Connected Tensiometer Set (CTS) that allow measurement of the mechanical tension of contact cables and wires from the ground. The Contact Wire Measurement by Laser Profilometry equipment, that allows the contact wire profile to be measured from the ground, and of particular interest was the DEP Short reflective rail earth connector. This innovative product is in use within Transport for Wales (TfW) infrastructure and is waiting for product approval on Network Rail infrastructure. The product has a reflective band on the cable which makes it highly visible at night, a simple but effective modification.

We finished the day with a recap of the challenge content in the classroom and offering our thanks to the volunteers, sponsors and supporters who made the event possible.

We wish to offer special thanks to our chaperone volunteers, Stuart Murphy, Stephen Barber, Jamie Barrett and James Hutt whose experience helped greatly throughout, and to our two key evening speakers Paula Hilliard, Engagement Manager from Network Rail and Professor Andy Doherty, Chief Technical Officer for the Global Centre for Rail Excellence (GCRE).

Attendees came from the following companies:

AtkinsRéalis, Aureos, Babcock Rail, Balfour Beatty, Furrer + Frey, Mott MacDonald, OCU Group, One Big Circle, ORR, RSSB, SPL Powerlines, Systra, Transport for Wales, Volker Rail.

The Institution would like to thank the attendees for the positive and enthusiastic approach they had to the course!

FEEDBACK FROM ATTENDEES RECEIVED FROM THE DAY:

- *"The H&S talk was really eye opening. Enjoyed the GCRE talk! Good split of activities/split of groups. All engaging. Great culture."*
- *"The challenge allowed me to better understand the difficulty of OLE construction and some aspects are beneficial to take back into the design world."*
- *"Enjoyed doing work ourselves rather than watching someone else do it."*
- *"Being office based meant that this was an eye opening experience of the difficulties on site."*
- *"Very well thought out and informative, thank you all."*
- *"Supervisors gave real world knowledge and let us do lots."*

All photos courtesy of John Merriman.

CORPORATE COMPANIES

AUREOS, AtkinsRéalis, Furrer+Frey Overhead contact lines, NetworkRail, SPL POWERLINES

SUPPORTING MANUFACTURERS

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STRUCTURAL FAULTS + REPAIR–2026

EUROPEAN BRIDGE CONFERENCE–2026

Conference & Exhibition
Royal Society of Edinburgh, Scotland
8–11 June 2026

Extended Abstract Deadline: 31 March 2026
www.structuralfaultsandrepair.com

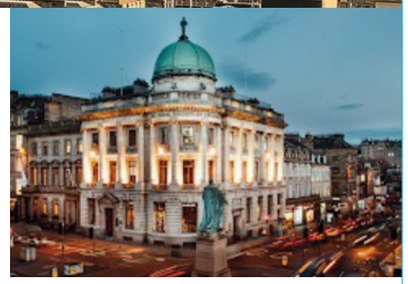
Themes of Conferences

Structural Faults + Repair

#1: Extending the Life of Concrete
#2: CFRP & GFRP for repair
#3: Corrosion/cathodic protection
#4: SHM & Digital Twins
#5: NDT & AE of concrete
#6: NDT Moonshot
#7: Building cladding issues
#8: Masonry structures
#9: AI and ML

European Bridge Conference

#1: extending the life of bridges
#2: investigation & repair
#3: NDT Moonshot
#4: P.T. bridges
#5: Cable bridges
#6: Concrete half joints
#7: Masonry arch bridges
#8: SHM & Digital Twins
#9: Scour



Venue:
Royal Society of Edinburgh
8–11 June 2026

8th June: Icebreaker & malt whisky tasting
9th June: Civic Reception & Awards Ceremony
10th June: (Optional) Conference Banquet

Extended Abstract Deadline: 31 March 2026
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THE UNIVERSITY OF EDINBURGH · RailEI Formerly known as the PWI RAILWAY ENGINEERING INSTITUTION · Bridge DESIGN & ENGINEERING · aci American Concrete Institute Always advancing

NEW BOOK RELEASE

DC ELECTRIFICATION FOR RAILWAYS: AN OVERVIEW

DC ELECTRIFICATION – THAT 'SPARKS EFFECT': FROM 1890 IT'S STILL 'SWIFTLY TAKING US HOME' ON OUR DC RAIL NETWORKS

From the early decades of the 20th century, several UK municipal area railways experienced the 'sparks effect', i.e. they were enhanced with the commercial and social benefits that an electrified railway may bring. Since the opening of the City and South London Tube in the1890's, DC Electrification has played a leading role in delivering that 'sparks effect'.

The Southern Railway Company progressively electrified using its DC 3rd rail system. As the railway publicised in 1932, it was taking you 'So Swiftly Home' by their Southern Electric.

Today, DC Electrification continues to swiftly move passengers on those same southern lines as it does on many other DC electrified rail networks in areas of the UK and in Dublin, and it will do so well into the future.

PUTTING DC ELECTRIFICATION INTO PERSPECTIVE

Approximately 42% of the UK's mainline railway is electrified, approximately two-thirds of which is by AC overhead line electrification (OLE). Surprisingly to many the remaining third is DC electrified. In fact, Network Rail's DC electrified system is the world's largest DC 3rd Rail network.

DC Electrification is not just limited to the UK's Southern mainlines, it is also used elsewhere by mainline, metros and light rail operations. Liverpool Merseyrail mainline and Glasgow subway are 3rd Rail, Docklands Light Railway, uses inverted 3rd Rail, London Underground's extensive network uses a 4th Rail variant.

DC supply can also be overhead i.e. DC OLE including Newcastle's Tyne & Wear Metro and all the light rail and tram systems in the UK.

In the Republic of Ireland, the Dublin Area Rapid Transit's (DART) also uses 1500V DC OLE Electrification.

Beyond the UK, In many other parts of the world also rely on DC Electrification for traction supply.

ABOUT THE BOOK

Bob Hutchison and Tony Fella, both members of the RailEI, have captured the spirit of this evolutionary DC story and its relevance and application to the modern railway, in their new guidance book ***DC Electrification for Railways – an overview***, which is due to be published by the RailEI later this year. Bob and Tony's book, written from their own perspective, shares their experiences and the empirical DC knowledge they both have gained: much of this knowledge so freely shared to them by so many of their peers and railway colleagues.

The book captures and shares Bob and Tony's gained knowledge with fellow engineers, railway professionals, students, and those who have an interest in the history or science of the electrified railways.

The book places the evolution DC Electrification into its historical context and documents how the DC electrical principles are applied to today's DC rail traction power systems.

THE BOOK CAPTURES AND SHARES BOB AND TONY'S GAINED KNOWLEDGE WITH FELLOW ENGINEERS, RAILWAY PROFESSIONALS, STUDENTS, AND THOSE WHO HAVE AN INTEREST IN THE HISTORY OR SCIENCE OF THE ELECTRIFIED RAILWAYS.

It describes the modern DC electrification supply arrangements and various configurations applied to DC powered mainline and metro systems in use today, in both the UK and the Republic of Ireland.

The book explains how high voltage AC is transmitted and distributed throughout the railway network to the substations where it is reconfigured into usable DC traction power.

It further describes how the DC is transmitted in track feeding sections to the contact conductor for train collection.

Relevant consideration is given to current UK system design arrangements and concludes with an overview of commissioning, testing, bringing into use, maintaining, operating, and disposal protocols of DC traction power assets.

ABOUT THE AUTHORS

BOB HUTCHISON
INDEPENDENT CONSULTANT AND PROFESSOR (HON) – UCL,
Chartered Engineer and Manager and a career railwayman with 55 years in the industry.

Interests and experience in Technical & Organisational Direction, Integrated Design Direction & Management, Systems Engineering, DC Electrification, Plant & Services Stations and Depots. Technical Director Atkins - Rail Solutions prior to being an independent consultant.

TONY FELLA
TECHNICAL AUTHORITY,
DC Traction Power Supply Systems,
Atkins Réalis

DC Traction Power Supply specialist with nearly 40 years in the rail industry. Particular areas of interest are traction power supply modelling, system design and ETE design. Network Rail CRE and Technical Advisor to TfL. Has been involved in DC Overhead and 3rd rail electrified railways in the UK and worldwide.

Razia Ali
Senior Asset Engineer (Drainage and Lineside)
Route Asset Management (RAM)

Razia brings over two decades of experience in the rail industry, with a strong focus on drainage and geotechnics. She began her career in consultancy as an Assistant Geotechnical Engineer shortly after graduating with an Honours degree in Environmental Civil Engineering in 1998. In 2002, she transitioned into the rail sector, where she has since played a key role in shaping and delivering innovative, efficient drainage solutions across Scotland's rail network. Her work has contributed significantly to enhancing climate resilience and expanding the drainage portfolio in alignment with evolving environmental challenges.

INTEGRATED DRAINAGE AND GEOTECHNICAL RESILIENCE AT CHARLESTON (HGL2)

KNOWLEDGE 200 EARTHWORKS & WATER MANAGEMENT

ABSTRACT

This article outlines the integrated geotechnical and drainage engineering response to recurring slope instability and flooding events at Charleston on the Highland Main Line. It highlights the evolution of asset management strategies, the development of a comprehensive remit, and the successful delivery of a joint geotechnical and drainage solution, including Scotland's first inverted syphon upgrade under the current asset management team.

HISTORY

The Highland Main Line (HGL) is a historic and scenic railway running through the central Highlands of Scotland (**Figure 1**) closely following the route of the A9 trunk road connecting Perth with Inverness.
The non-electrified line spans approximately 118 miles and 9 chains (191km) of predominantly single-track railway between Stanley Junction and Blair Atholl and between Dalwhinnie to Culloden, with double-track sections (approx. 37miles) between Perth to Stanley junction, Blair Atholl to Dalwhinnie and from Culloden to Inverness.

The line has historically supported the economic and social growth of rural Perthshire by enabling the movement of goods, timber, and people. Today, it is considered one of Britain's most scenic rail routes, passing through the Cairngorms National Park and providing links to tourist centres of Pitlochry, Dunkeld, and Blair Atholl.

Originally part of the Inverness & Perth Junction Railway, engineered by Joseph Mitchell, the line opened in stages between 1863 and 1865. Initially operated by the Highland Railway, the line later became part of the London, Midland and Scottish Railway (LMS) in 1923. After nationalisation in 1948, it came under British Railways, and today it is managed by Network Rail and served by ScotRail and other passenger and freight operators.

Figure 1: Scottish Railway Journeys map – extract from project mapping (Image courtesy of Scotrail).

The line carries around 1 million passengers annually, serving commuters, tourists, and long-distance travellers. The line includes 10 stations, with seasonal passenger peaks driven by tourism.

Figure 2: Dalguise Viaduct.

Figure 3: Culloden Viaduct (also known as Nairn Viaduct).

Figure 4: Drumochter Pass.

Figure 5: Slochd Summit.

ENGINEERING FEATURES

The line tackles steep gradients through the Grampian mountains, features notable engineering landmarks like the Dalguise Viaduct and Culloden Viaduct, and traverses two major summits, Drumochter (452m, the highest point in the UK rail network) and Slochd (401m) see **Figures 2-5**.

To enable trains to pass efficiently there are passing loops at key stations - Pitlochry, Aviemore, Kingussie, Dalwhinnie, and Carrbridge.

A £57 million investment, completed in March 2019, delivered:

- Improved signalling and station upgrades at Aviemore and Pitlochry to allow simultaneous arrivals and accommodate longer trains.
- Platform extensions, loop lengthening, and line speed improvements.
- Centralised signalling control and bi-directional signalling for freight continuity and
- Longer freight loops and removal of speed restrictions.

These engineering solutions were needed to deliver ScotRail and LNER InterCity trains, adding 2,500+ seats daily, with faster journey times: a target of 2 hours 45 mins to 3 hours, depending on stopping patterns.

In 2020 £5million was invested in earthworks and drainage at Slochd from 95 miles 0710 yards to 96 miles 0188 yards. This scheme was one of the first combined earthworks and drainage interventions on the highland mainline that delivered 947 metres of cess drainage, over 1300 meters of off-track drainage, a combination of earthworks interventions including cutting slope regrades, rock netting and embankment improvements.

With the volume of work undertaken to improve the line it was imperative that ageing drainage assets, increased surface runoff and increased risk of slope failures were also addressed to ensure long-term resilience and safety.

All images courtesy of Network Rail unless otherwise stated.

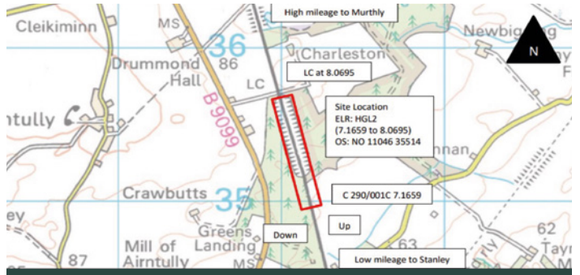


Figure 6: Extract from OS 1:50,000 scale map, with site location indicated in red.

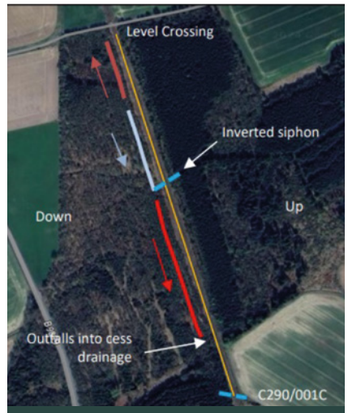


Figure 7: crest drainage schematic.

CHARLESTON WOOD BACKGROUND AND HISTORY

The section from Dunkeld to Pitlochry, which passes through Charleston Wood, opened on 1 June 1863. The site is located on a single bi-directional section of the track, with a maximum line speed of 80mph within an earthwork cutting between 7 miles 1659 yards and 8 miles 0690 yards.

Figure 6 shows the location of the site, bound by a level crossing to the north and by culvert 290/001C to the south. To the east and west lie ancient woodlands.

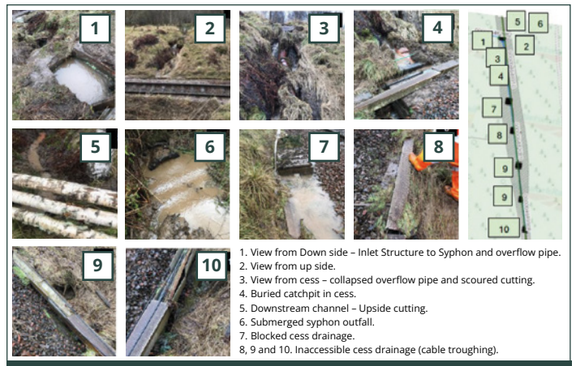
The earthwork soil cutting has a maximum height of 5m and an angle as steep as 40º, with the railway boundary on the crest of the cutting. Informal drainage ditches are located along the crest of the cutting on the Down side. The ditches can be split into three distinct sections (see **Figure 7**).

- the high mileage section of crest ditch, which flows to the north and discharges towards the level crossing (shown in burgundy).
- the middle section of crest ditch, which flows south and discharges into the siphon (shown in blue).
- the low mileage section (shown in red) which flows south and discharges into the existing cess drainage (shown in yellow).

The crest drainage system, located on third-party land, has historically been shallow and at a low gradient, out falling to the level crossing, syphon and track drainage. Since 2013, the site has required annual earthworks examinations due to persistent geotechnical concerns, including localised slumping, (when part of the slope rotates and slides down in a curved manner, often leaving a stepped or terraced appearance on the slope), stepped crest, marshy terrain, and frequent drainage blockages. These conditions led to slope washouts and track flooding.

INCIDENT INVESTIGATION AND RECOVERY

During the closure of the line in February 2021 due to Storm Darcy, flooding and slope washout was reported to Scotland's Railway's Integrated Control Centre following route proving by the maintenance route proving team. An initial desk top study followed by on-site



1. View from Down side – Inlet Structure to Syphon and overflow pipe.
2. View from up side.
3. View from cess – collapsed overflow pipe and scoured cutting.
4. Buried catchpit in cess.
5. Downstream channel – Upside cutting.
6. Submerged syphon outfall.
7. Blocked cess drainage.
8, 9 and 10. Inaccessible cess drainage (cable troughing).

Figure 8: February 2021 incident recovery on-site findings.

Figure 9: Typical arrangement for a syphon.

inspection uncovered the blocked syphon and a failed overflow pipe that caused a slope washout and damage to the cess drainage. (**Figure 8**).

Installed on rural lines in the Victorian era, a syphon is a U-shaped drain constructed in a cutting to take the flow under the track or other structure (see **Figure 9**). A syphon remains permanently surcharged to the outlet level as it transfers liquid, typically from a higher elevation to a lower one, using gravity and atmospheric pressure.

Once the pipe is filled and flow starts, gravity pulls the water down the lower leg, and atmospheric pressure pushes more water into the upper leg, keeping the flow going. Efficiency depends on it remaining free of accumulated silt, debris and rubbish.

RECOVERY

To enable the line to re-open and traffic to resume, the following interventions were undertaken:

- A connection from the syphon to track drainage was re-established.
- Jetting and reinstatement of track drainage to acceptable functionality.
- Jetting and CCTV inspection of syphon to establish service and condition.
- Increased inspection scheduling was implemented.
- System updates in Ellipse (digital platform used to manage infrastructure assets and maintenance activities) to reflect presence of syphon.

After the initial recovery, further investigations highlighted the limitations of the current drainage system, the inadequacy of the syphon due to changes in climate since its installation in Victorian era and the burden on maintenance to keep the system clear of silt and blockages.

In January 2024, minor shallow failures were noted along the Down side of the site. On-site examinations concluded that these had been

Figure 10: example of shallow failure on the HGL2 at approximately 8 miles 0670 yards, facing the Down side cutting face.

caused by water overtopping the crest drainage system. Hydrophilic plants (that thrive in or near water) were observed in several locations along the length of the cutting indicating the presence of surface and subsurface water. An example of a shallow failure noted via the earthwork's examination is shown in **Figure 10**.

The sequence of events revealed critical deficiencies in the existing drainage system, contributing to asset degradation and triggering a reassessment of network resilience and system performance.

DEVELOPMENT OF CP7 REMIT

Through interdisciplinary collaboration and in alignment with Network Rail's Water Management Strategy (version 1), a coordinated approach was adopted to address the identified issues and meet the requirements of both geotechnical and drainage engineering remits. The drainage mileages were extended to incorporate the geotechnical scope, promoting a whole system approach.

Geotechnical scope in-line with NR/L2/CIV/071:

- Stability assessment and localised slope repairs.
- Ground investigation to determine failure mechanisms.
- Whole earthworks approach to asset resilience.

Drainage scope in line with NR/L2/CIV/003:

- Full-system survey within NR boundary to understand existing capacity and condition.
- Catchment assessment and pluvial surface impact.
- Climate change allowance for flood risk assessments in land use planning, version 3, issue 4/0423.

DESIGN AND DELIVERY

The scope of works was to ultimately address drainage issues across the extents of the site which were leading to slope instability and track flooding. This required a wholesale assessment of the existing drainage system, including functionality of the syphon, to understand existing capacity whilst exploring the need to meet the climate of the future.

Figure 11a: The Warming Stripes - a visualisation of Scotland's warming climate. Each stripe represents the average temperature recorded each year since 1884 (left) to 2024 (right). Warmer colours indicate years with above average temperatures, whilst cooler colours indicate years with below average temperatures. *Source: Prof. Ef Hawkins (University of Reading) – show your stripes.*

Figure 11b: Scotland's Railway fluvial flooding – the diagram highlights the lengths of track exposed to a 1:200 fluvial flood events in the 2030s and then in the 2080s, showing a significant increase in track miles that will experience intense storm events.

The changing climate has an impact on the safe running of Scotland's railway. **Figure 11a** is a visualisation of Scotland's warming climate; average temperatures are increasing across all four seasons with summers becoming hotter and drier with more intense bursts of rainfall, and winters becoming warmer and wetter than they already are. **Figure 11b** shows an increase in the length of track miles that will be exposed to 1:200 flood events in the future, with the work site highlighted in red.

With the increase of intense rainfall bursts in the summer and the wetter winters it was important that the outputs of the design addressed the requirements of the future climate and operational aspirations.

ASSET CONDITION

The existing cess drainage along the Down side was formed from a combination of 190mm and 300mm diameter carrier pipes with a series of catchpits at 30m intervals. The existing drainage was not compliant with modern Network Rail standards, with a combination of catchpit spacings greater than 60m and cess pipes without perforations to allow for infiltration. CCTV survey of the drainage system encountered root ingress or material debris, misaligned joints with large sections unable to be surveyed due to blockages, and cess drainage runs without visible catchpits to aid in access.

The Down side cess flows towards low mileage, discharging into Culvert 290/001C, a 650/300mm stone culvert. The water then subsequently flows through a series of unnamed watercourses before discharging into the River Tay.

The syphon at 8 miles 363 yards, conveys water from a series of partially unlined ditches on the Down side to an unlined ditch on the Up side where it travels along a series of ditches before discharging into the River Tay. The syphon was formed of a 150mm internal diameter metal pipe, with a 450mm clay overflow pipe next to the syphon inlet connected to the cess drainage.

Slope instability was noted by a series of slumping and back scarring, as shown previously in **Figure 10**, along the mileage extents.

DESIGN

A Contracts Requirement Technical (CR-T) document was issued to the in-house Capital Delivery team, with the scope of works to address the issues leading to slope instability and flooding of the track whilst designing for future resilience.

River Basin Region	Total change to the year 2080 (%)
Argyll	46
Clyde	41
Forth	39
North-East Scotland	37
North Highland	42
Orkney	40
Shetland	Use Orkney peak rainfall allowance
Solway	38
Tay	39
Tweed	35
Western Isles	48
West Highland	48

Figure 12: Extracts from SEPA: Climate change allowances for flood risk assessment in land use planning, version 3.

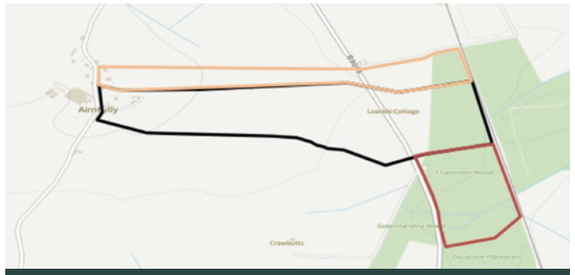


Figure 13: Catchment area, northern catchment of cess drainage (shown in orange) – 0.08km^2, Southern catchment area of cess drainage (shown in red) – 0.1km^2, and catchment for proposed syphon (shown in black) – 0.24km^2.

Return Period	Northern Catchment for Cess Drainage	Southern Catchment for Cess Drainage	Siphon Catchment
1 in 50 year	70 l/s	85 l/s	180 l/s
1 in 50 year + 20% Climate change	85 l/s	100 l/s	215 l/s
1 in 50 year + 39% Climate change	**95 l/s**	**115 l/s**	**250 l/s**
1 in 200 year + Climate change	275 l/s	330 l/s	720 l/s
1 in 500 year + Climate change	310 l/s	370 l/s	805 l/s

Figure 14: The drainage elements were designed to receive the above design run-off shown above in bold.

DRAINAGE DESIGN AND CONSIDERATIONS

A hydrological study was undertaken with the following characteristics:

Route classification - Secondary:
Return Period - 50 years.
Climate change allowance - + 39% as per SEPA guidance Ver. 3; (**Figure 12**)

Figure 13 shows the catchment area that flows towards the railway. The hydrological study demonstrated the existing cess drain was under capacity, requiring an upsizing of the full system to 450mm diameter pipes, which will intercept flows from the lined crest ditches. It also highlighted the existing syphon was undersized, with a capacity of approximately 42.52l/s against design runoff estimated at 247.77 l/s (**Figure 14**). With this in mind, and taking climate action and resilience into the design, the new inverted syphon was designed as twin-bore 450mm diameter pipes, each bore having the capacity of 291.93 l/s and allowing maintenance of one bore to be undertaken while maintaining the required flow.

The assessment outputs for the return periods are as follows:

An alternative to upgrading the syphon would be to divert the flows overland by a series of pipes, new culverts, and land purchase. This would have included a 410m crest drain, an under-track crossing (UTX), approximately 900m ditching and 1km of buried pipe. This approach would require wayleaves, land purchase, and costs for access and long-term maintenance (see **Figure 15**).

Figure 15: Alternative overland flows for syphon diversion.

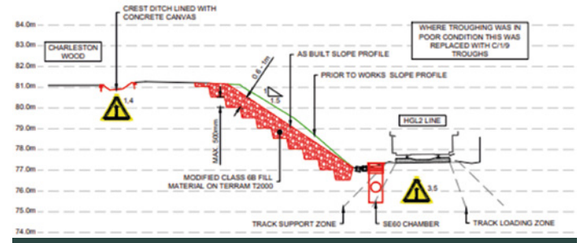


Figure 16: Section through rock grade (extract from NR 3376-MHB-DRG-3010).

GEOTECHNICAL DESIGN AND CONSIDERATIONS

Site investigation comprised of 10 window sample boreholes: 5 on the Down side crest of the cutting and 5 at mid-slope. No groundwater was encountered within any of these boreholes, however groundwater was encountered in 2 of the midslope boreholes indicating localised, shallow perched water, rather than a site wide high-water table. Further ground investigation was undertaken in July 2024, at the location of the proposed syphon which included 5no. hand dug trial pits and 8no. panda probes.

This informed the rock blanket regrades in accordance with the Network Rail Standard details and the gradient of the finished slope to be of maximum 1V:1.5H (**Figure 16**).

Rock blanket regrades were undertaken at the 7 locations on the Down side and 1 location on the Upside.

MINING

The site is not within the Coal Authority's Coal Mining Reporting Area and as such the risk from coal mining in relation to the proposed works was low. Given the anticipated geology, the risk from other types of mining was also considered low.

DESIGN OVERVIEW

The final design consisted of

Geotechnical:
- 140m of rockfill regrade

Drainage:
- Installation of twin-pipe inverted syphon
- 700m of upgraded track drainage (**Figure 17**, overleaf)
- 600m of lined crest ditches (**Figure 18**, overleaf)

INNOVATION: SCOTLAND'S FIRST INVERTED SYPHON UPGRADE

An inverted syphon is a closed conduit that carries water under an obstacle (such as a railway embankment, road, or valley) by flowing under pressure, rather than by gravity in an open channel. Unlike a normal siphon (which lifts water over a crest), an inverted syphon drops below the obstacle and then rises back up, maintaining flow continuity.

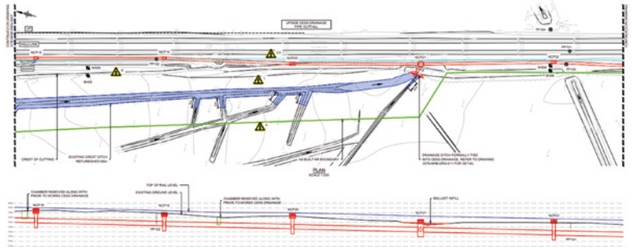


Figure 17: Longitudinal section showing crest and track drainage (extract from NR Doc. No.: 3376-MHB-REP-001).

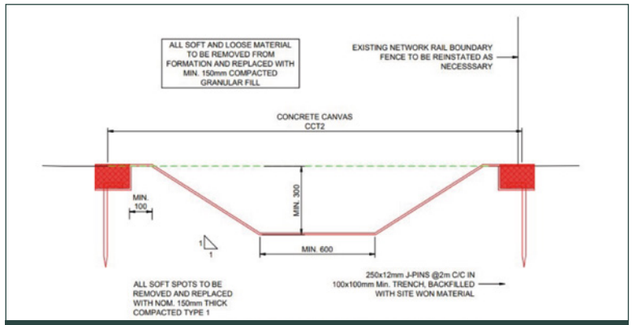


Figure 18: Typical section of concrete canvas lined crest ditch (extract from NR Doc. No.: 3376-MHB-REP-001).

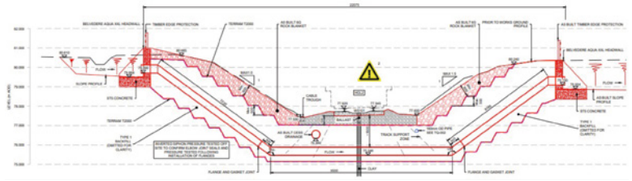


Figure 19: Section of syphon (extract from NR 3376-MHB-DRG-3012).

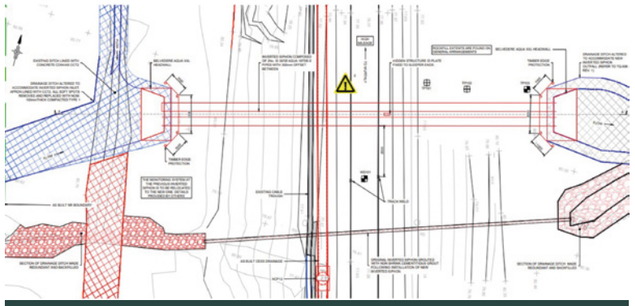


Figure 20: General arrangement plan of syphon (extract from NR 3376-MHB-DRG-3012).

Renewing the syphon and restoring the flow to its natural course was chosen over the alternative route shown in **Figure 15** because it delivered multiple benefits including:

Maintaining the existing hydraulic path: this preserves the natural or designed watercourse without major diversion. It also avoids altering upstream and downstream flow patterns, reducing flood risk and environmental impact.

Reduced land and civil works impact and is cost efficient: as re-routing would require land acquisition, installation of pipes, ditches and culverts that would require permits and disrupting the ecosystem, whilst the existing alignment minimizes disruption to surrounding infrastructure and habitat, it also avoids costs of additional features and environmental mitigation;

Reduced environmental and regularity complexity: by minimizing extensive environmental assessments and permits for altering watercourses, keeping the syphon avoids major hydrological changes, therefore simplifying compliance.

Operational reliability: installing a twin-bore to manage maintenance activities reduces long-term risk of overtopping and increases safety of conveying large flows beneath an operational railway.

Consideration was given to the maintenance of the syphon during the design phase as it requires regular inspection for sediment build-up and blockage. Access steps from the track were installed to undertake regular inspections of both inlet and outlet of the syphon.

The syphon was installed during a weekend blockade via an open-cut trench box excavation (**Figures 19** & **20**).

The programme was completed on time and within budget, including 2no 54-hour blockades and with the remainder of the works undertaken within Rules of the Route possessions. This marks a significant milestone in drainage asset management in Scotland.

CONCLUSION

The Charleston project exemplifies the benefits of interdisciplinary collaboration and whole-system thinking in railway asset management. By integrating geotechnical and drainage scopes, the team delivered a resilient, efficient solution that addresses both historical failures and future climate challenges as can be seen in **Figures 21-25**.

One of many benefits gained from this project included early engagement with the landowner which not only minimized disruption to the nearby ancient woods, but also facilitated discussion to purchase the strip of land utilised for site access which was seeded with wildflower meadow mix, benefiting the surrounding environment and the railway corridor.

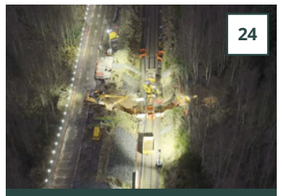
The asset management team showed early engagement, open discussions, and the willingness to move sites within the business plan can bring in efficiencies. A 19% in efficiencies across this project were achieved through the design and construction phase. A further benefit to this project is the ease of accessibility for maintenance and inspection across all drainage, lineside and earthworks assets. With the strip of land purchased along the length of the scheme, direct access to the assets without requiring special access arrangements further complemented by the access steps from the track side will bring long-term benefits in cost and time.

Having a common goal to making Scotland's Railway resilient for the changing climate and addressing drainage as a system brings long term benefits for both drainage and earthworks assets and for the management of the system.

Mileage 8m 0690yds – lined crest drainage intercepted by track drain at level crossing.

Mileage 8m 0540yds – lined crest drainage and rockfill regrade.

Mileage 8m 0370yds – lined crest drain, inlet, rockfill regrade (photo taken prior to access step installation).



Mileage 8m 0370yds – syphon install during 54-hour blockade.

REFERENCES

[1] Charleston cutting Drainage and Rock Grades Form A: Certificate of Approval in Principle Doc. No. 3376-MHB-REP-001

[2] Network Rail's Water Management Strategy – March 2023 (version 1)

[3] NR/L2/CIV/003 Dec 2023 Iss. 8 Engineering Assurance of Building and Civil

[4] NR/L2/CIV/005 Jun 2018 Iss. 1 Drainage Systems Manual and Drainage Design

[5] Prof. Ef Hawkins (University of Reading) – Show Your Stripes

[6] SEPA - Climate change allowances for flood risk assessment in land use planning, version 3

[7] https://scenicrailbritain.com/lines/highland-main-line

[8] https://www.highlandmainlinecrp.co.uk/history/

[9] https://www.Projectmapping.co.uk

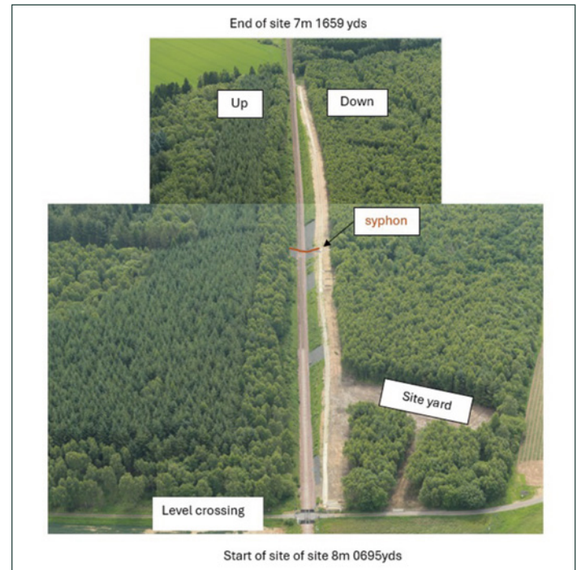


Figure 25: General arrangement plan of syphon (extract from NR Geotechnical Railway Infrastructure Network Model (GEO-RINM/Route View).

A CAREER IN DIGITAL & AI

KNOWLEDGE 200
DIGITAL & AI

Digital & AI technologies are transforming railway engineering by enabling smarter decision-making, predictive maintenance, and innovative design. Key areas include machine learning, mathematical modelling, generative AI, digital tools, and cybersecurity. These advancements drive efficiency, safety, and sustainability while securing the railway's digital infrastructure.

The integration of Digital & AI technologies is revolutionising railway engineering. From ensuring safer operations to optimising performance, these advanced tools and methods are propelling the industry into a new era. Whether you're starting your career in railway engineering or seeking to enhance your expertise, digital and AI understanding will increasingly become part of your competence toolkit.

Below, we've chosen three key resources and insights to stay ahead in this fast-evolving sector. If you'd like to dive deeper into the world of Digital & AI, our Knowledge Hub offers the tools you need to excel in this dynamic field. From technical guides to advanced training programmes, visit **www.thepwi.org/knowledge/** to learn more.

DEVELOPING NEW TECHNOLOGIES – ROBOTICS AND AI
SCAN TO READ ARTICLE

DEVELOPMENTS IN THE USE OF UGMS
SCAN TO READ ARTICLE

LUNCH & LEARN: THE FUTURE OF INFRASTRUCTURE MONITORING
SCAN TO READ ARTICLE

A CAREER IN EARTHWORKS & WATER MANAGEMENT

KNOWLEDGE 200
EARTHWORKS & WATER MANAGEMENT

Earthworks & Water Management shape the landscapes railways traverse, ensuring stable foundations and effective water flow. This discipline addresses challenges like building on soft soils, managing stormwater, and preventing erosion and landslides. By incorporating climate resilience and nature-based solutions, it supports sustainable railway infrastructure.

Earthworks & Water Management play a critical role in the safety, reliability, and longevity of railway infrastructure. From embankment stabilisation to drainage design, engineers working in this field address the complex geotechnical and hydrological challenges that impact day-to-day operations.

For professionals working in, or moving into this discipline, understanding current design approaches, monitoring techniques, and asset performance under extreme weather is essential.

Below, we've highlighted three essential resources from the Knowledge Hub to support your ongoing development. To explore further, visit our Knowledge Hub at **www.thepwi.org/knowledge/**. You'll find technical papers, webinars, and expert insights curated to keep you informed on the latest thinking and techniques in Earthworks & Water Management.

INNOVATION IN ASSET CONDITION TO DETECT PRESENCE OF GROUND WATER
SCAN TO READ ARTICLE

ENGINEERING RESILIENCE: ADAPTING RAILWAYS TO CLIMATE CHANGE AND THE UNEXPECTED
SCAN TO READ ARTICLE

LUNCH & LEARN: INFRASTRUCTURE UNDER PRESSURE: DESIGNING FOR DURABILITY AND ADAPTABILITY
SCAN TO READ ARTICLE

A CAREER IN ELECTRIFICATION & PLANT

KNOWLEDGE 200
ELECTRIFICATION & PLANT

Electrification & Plant focuses on the systems that power and control railways, enabling sustainable, efficient, and reliable operations. Key components include overhead lines, traction power, and distribution systems, as well as earthing, and bonding. This discipline is integral to supporting renewable energy, reducing carbon emissions, and ensuring long-term railway resilience.

Electrification & Plant is essential to modern infrastructure, driving the sustainable and efficient operation of transport systems, industries, and public utilities. This field includes a variety of critical components – such as overhead line systems, traction power and distribution networks, and 3rd & 4th rail systems (also known as ETE) – that power the electric trains. Fixed plant includes other power supplies for depots, stations, escalators, lifts, yards and terminals including fixed cranes. Heating, ventilation and air-conditioning for operational assets and signalling power supplies are all included in the fixed plant portfolio.

Here are three useful resources to support your professional development in this area. If you'd like to discover more, visit our Knowledge Hub at **www.thepwi.org/knowledge/**, where you can access specialist resources, on-demand learning, and expert perspectives covering both established practices and future developments in Electrification & Plant.

UPGRADING EXISTING ELECTRIFICATION TO MEET CUSTOMER NEEDS
SCAN TO READ ARTICLE

THE IMPACT OF ELECTRIFICATION ON THE HISTORIC ENVIRONMENT – TRU CASE STUDY
SCAN TO READ ARTICLE

CLC LINE OF ROUTE UPGRADE
SCAN TO READ ARTICLE

A CAREER IN TRACK

KNOWLEDGE 200
TRACK

Track Engineering is the foundation of railway infrastructure, involving the design, construction, and maintenance of track systems. Key areas include switches and crossings, rails and fastening systems, sleepers and ballast, and slab track solutions. By ensuring stability and safety, track engineering supports the smooth operation of modern rail networks.

Track Engineering sits at the heart of the railway – every train, every journey depends on it. Engineers in this field are responsible for maintaining the structural integrity of the track, understanding material behaviour under load, and applying design principles that optimise both performance and longevity.

As traffic volumes rise and performance expectations grow, there's an increasing focus on predictive maintenance, innovative materials, and data-informed asset strategies. Whether you're on site or in the office, working in track requires both detailed technical knowledge and a clear understanding of the bigger operational picture.

Below, you'll find three insightful resources to expand your knowledge and sharpen your practice in this essential area. To continue exploring, visit our Knowledge Hub at **www.thepwi.org/knowledge/** – a collection of technical content, training opportunities, and up-to-date insights focused on track design, maintenance, and innovation.

TMEs – OLD DOGS & NEW TRICKS
SCAN TO READ ARTICLE

MANAGING EXTREME WEATHER AND LOW ADHESION
SCAN TO READ ARTICLE

AFFORDABLE RENEWALS THROUGH SCOPING, COLLABORATION AND DESIGN
SCAN TO READ ARTICLE

RailEI
Formerly known as the PWI
RAILWAY ENGINEERING INSTITUTION

RailEI TECHNICAL SEMINAR

With sincere thanks to Bob Langford for providing this photograph and kindly granting us permission to use it.

MAKING A POINT: DEVELOPMENTS IN S&C DESIGN, INSTALLATION AND MAINTENANCE

18 MARCH 2026

KNOWLEDGE 200 TRACK

WHITWORTH HALL, UNIVERSITY OF MANCHESTER

The Railway Engineering Institution (RailEI) is delighted to invite you to its upcoming Technical Seminar, "Making a Point: Developments in S&C Design, Installation and Maintenance." This event brings together leading experts and practitioners to explore the complete lifecycle of Switch and Crossing (S&C) units - from initial design through to manufacturing, installation, and ongoing maintenance.

This Seminar will provide a comprehensive overview of the latest advancements, best practices, and research in S&C. Attendees will gain valuable insights into:

- **Design:** Innovations in S&C design, including technical authority perspectives.
- **Manufacturing:** Advances in manufacturing processes for S&C units.
- **Installation:** Practical approaches and case studies on S&C installation, including major projects and lessons learned.
- **Maintenance:** Strategies for effective asset management, reballasting, stressing, and long-term maintenance to ensure reliability and performance.

This Seminar features a diverse programme of technical presentations and interactive Q&A sessions, with contributions from: **Amey, Interflon, Network Rail, Progress Rail, Rail-ability, University of Huddersfield, voestalpine, Volker Rail.**

Alongside the technical sessions, the event offers opportunities to network with exhibitors and fellow professionals.

Scan to book

BOOK NOW:
www.thepwi.org

£97 MEMBER
£177 NON-MEMBER
£20 STUDENTS

SPONSORED BY:

Amey
RAILWAY SYSTEMS by voestalpine
Progress Rail A Caterpillar Company
getzner engineering a quiet future
INTERFLON

LIZ TURNER
REGISTRATION MANAGER
liz.turner@thepwi.org

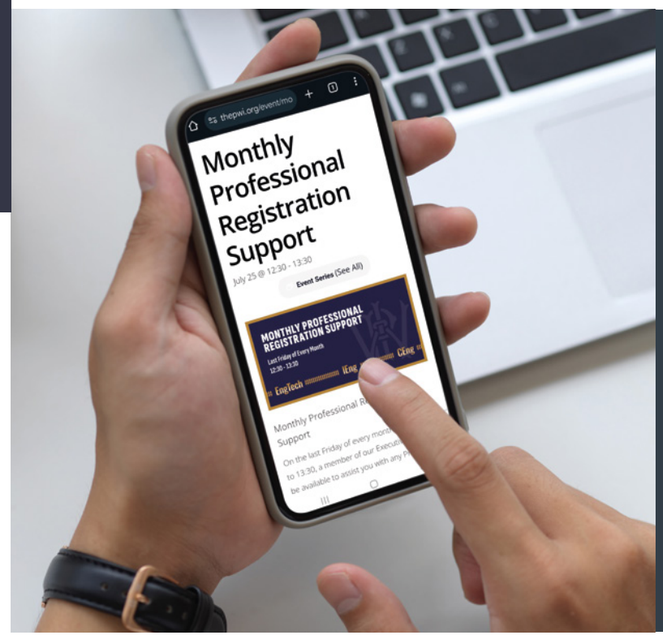
PROFESSIONAL REGISTRATION

NEW ROUTE TO IEng

The RailEI Advanced Track Technician Certificate plus RailEI Track or Electrification Engineering Diploma is equivalent to a Level 4 HNC. Holders of these qualifications are eligible to use Experiential Learning to meet the academic requirements for IEng registration (typically Level 6 learning), and can then progress to IEng professional review with the RailEI.

Want to learn more about the courses? Email **education@thepwi.org**

Hold both qualifications, and want to learn more about the route? Email **profeng@thepwi.org**



GET YOUR QUESTIONS ANSWERED

PROFESSIONAL REGISTRATION **MONTHLY SURGERY**

Get all your Professional Registration application questions answered

- 27 February 2026
- 27 March 2026
- 24 April 2026
- 22 May 2026
- 26 June 2026
- 31 July 2026

SCAN TO BOOK THE DATES IN YOUR DIARY

Add the dates to your diary and drop-in to any session and ask any questions you have with regards to your application. If you don't have any questions, you are still welcome to join and listen in to the guidance and advice being provided.

READY TO SUBMIT YOUR APPLICATION?

Remember: there are no deadlines for EngTech applications. Submit as soon as it is ready, and we will get a decision to you within six weeks.

INTERVIEW DATES

If you are going for IEng or CEng, use the submission deadlines – linked to our quarterly Professional Review Interview dates – to set your progress milestones.

SUBMISSION DEADLINE (at least six weeks prior to interview)	INTERVIEWS IN W/C (to be held remotely)
20 April 2026	1 June 2026
20 July 2026	14 September 2026
2 November 2026	14 December 2026

CONTINUING PROFESSIONAL DEVELOPMENT: WHY IT MATTERS

Continuing Professional Development (CPD) is an essential part of engineering good practice. As the railway industry continues to evolve – with new technologies, new delivery models and increasing system complexity – the need for structured, meaningful CPD becomes ever more important.

CPD KEEPS ENGINEERS **COMPETENT, CONFIDENT, CURRENT** AND **CONNECTED.**

For our Members and their employers alike, CPD is not just a requirement, it can provide a strategic advantage.

Professional Development is most effective when it is shared between the individual, their employer and their Professional Institution.

- All Members are responsible for maintaining and recording their own development.
- Employers create and support the environment for learning.
- The Institution provides the framework, resources and reassurance that development meets the standards expected of a modern engineer.

LOOKING AHEAD

As the railway continues to evolve, the skills needed to deliver safe, efficient and sustainable railways will evolve too. CPD ensures that every member of our community – from apprentices to Fellows – can adapt, lead and contribute to the future of our industry with confidence.

CPD is not just about learning. It is about staying relevant, staying safe and staying connected to a profession moving forward.

The Institution is here to support every Member on that journey.

WHY CPD MATTERS TO EMPLOYERS

High-performing organisations understand that performance and capability are not static. A well-structured CPD culture supports:

- Safer, more resilient engineering outcomes
- A workforce equipped for modern asset management and system challenges
- Greater consistency across teams and projects
- Improved staff retention and professional satisfaction
- Stronger succession planning and talent streams
- A visible commitment to competence for clients and regulators.

Employers who support CPD attract and retain the kind of engineers who want to grow – and who deliver strong engineering outcomes.

HOW THE INSTITUTION SUPPORTS CPD FOR EMPLOYERS

To support wider awareness of CPD's importance, we engage with employers through:

- Corporate Membership networks
- Direct CPD liaison with organisations
- Briefings and guidance materials for line managers
- Encouraging employers to align internal development programmes with our professional standards.

By working together, we can promote a culture where CPD is seen not as an obligation, but as an integral part of professional pride.

WHY CPD MATTERS TO INDIVIDUALS

Society relies on railway engineers who understand how all the assets interact and how standards continually evolve, to ensure safety, performance and reliability of the railway.

CPD is what keeps knowledge current and ensures that every engineer, technician and specialist maintains and develops the competence their role demands.

Good CPD helps Members to:

- **Maintain safe and professional practice**
- **Expand and build technical depth**
- **Strengthen cross-disciplinary understanding**
- **Keep up with innovation and standards**
- **Develop leadership, communication and ethical decision-making skills**
- **Prepare for career progression and professional registration.**

In short, CPD ensures that railway engineers remain safe. A safe engineer knows their limitations and when to consult or inform others. They are competent, confident, current and connected.

HOW RailEI SUPPORTS CPD FOR INDIVIDUALS

The Institution offers a wide range of opportunities that count towards a balanced CPD portfolio:

- **Technical Knowledge:** Our technical seminars and education courses provide up-to-date insight across all railway disciplines and the wider rail system. These events give Members access to expertise that is both current and applied.
- **Knowledge Hub and Publications:** The Journal, Section meetings, and Lunch & Learns offer structured learning materials to support independent study and reflection. These provide reliable reference points for all stages of development.
- **Professional Registration:** A structured development pathway is available for those pursuing EngTech, IEng or CEng, where UK-SPEC provides the framework for identifying development gaps and opportunities.
- **Community:** Section meetings, online forums, Technical Boards and volunteering opportunities provide a perfect way to engage with peers, share expertise or contribute to the Institution's work which develops communication, judgement and leadership – all recognised as essential CPD outcomes.

USEFUL RESOURCES

The website has a page dedicated to CPD. Find an example of completed records for each professional title, kindly shared by current registrants; historical annual CPD audit learnings; a list of examples of CPD activity; and more.

SCAN TO VIEW

CPD

PAUL MOUNTFORD
PDC DEPUTY CHAIR
profeng@thepwi.org

CPD: IT'S FOR ALL MEMBERS

LESSONS LEARNT FROM THE 2025 CPD AUDIT

As a licensed Professional Engineering Institution, we conduct an annual audit of CPD records from a representative sample of our membership. This process is overseen by the Professional Development Committee and fulfils the Engineering Council's requirement to audit at least 5% of registered members. In addition to this mandatory sample, we extend the opportunity to the wider membership, offering voluntary audits as a means of providing constructive feedback and guidance on CPD practices.

Audit Process Overview

As part of the CPD audit, members are asked to submit the following documents:

- CPD record
- Personal Development Plan (PDP)
- Up-to-date CV

These documents are reviewed collectively to assess alignment with the Engineering Council's CPD requirements, taking into account the context provided in the PDP and CV.

Participants in the audit process receive tailored feedback aimed at enhancing the quality and relevance of their CPD records. Broader insights and common themes identified during the audit are also shared with the wider membership to promote good practices as part of the Institution's shared learnings.

Characteristics of a Strong CPD Record

A strong CPD record goes beyond listing attended activities. It should demonstrate thoughtful engagement and strategic planning. Key elements include:

- Clear descriptions of the content and format of each CPD activity
- A diverse range of CPD experiences
- Personal reflections on the learning outcomes and their relevance to development goals
- Consideration of follow-up actions or future learning needs.

The CPD record should be complemented by a forward-looking PDP, which outlines the individual's development goals typically in a 12-month period, but further ahead (3 - 5 - 10 years) is encouraged. While not part of the CPD record itself, the PDP provides essential direction, helping to ensure that CPD activities are purposeful and aligned with long-term aspirations. There will of course be ad hoc / unplanned CPD activity though, that should also be recorded.

Key Findings from the Audit

The Committee was pleased to note that the overall quality of submissions in this year's audit was high, with most records demonstrating the core elements of effective CPD. However, two general areas were identified where there was opportunity for wider shared learning:

1. **Mentoring and Development of Others**
   Supporting the development of others is a fundamental responsibility outlined in the Engineering Council and RailEI Code of Conduct. While CVs often indicated involvement in mentoring or teaching, these activities were frequently absent from CPD logs. It is important to recognise that mentoring not only benefits the mentee but also contributes to the mentor's own professional development.

   Activities such as preparing learning materials and delivering training sessions should also be recorded as CPD, reflecting the skills and insights gained through the process.

2. **Depth and Scope of Personal Development Plans**

   The audit revealed that many PDPs focused primarily on short-term, employer-driven objectives. While these are valid, they may not fully reflect the individual's broader career ambitions.

   Ideally a PDP should include a mix of short, medium and long term goals. A well-rounded PDP enables more strategic planning of CPD activities, helping individuals stay focused on long-term career development while meeting immediate professional requirements along the way.

Every year, we randomly select 5% of members and invite them to participate. If you are interested in taking part in next year's audit to gain tailored insights into your CPD record, please look out for communications in June 2026, when the invitation to participate will be issued. We encourage all members, whether professionally registered or not, to consider engaging with the process and benefit from the support and guidance it offers.

SCAN TO READ MORE ABOUT WHAT GOOD CPD LOOKS LIKE.

FROM APPRENTICES TO FELLOWS, **CPD KEEPS RAILWAY ENGINEERS SAFE.**

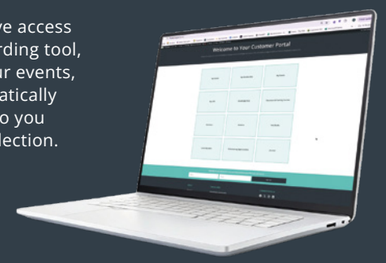
HELPING MEMBERS GET THE MOST FROM CPD

CPD is most valuable when it is planned and reflective. Members are encouraged to:

- Set annual development goals based on role needs and career aspirations
- Keep a record of activities and what was learned
- Build a balanced mix of technical and professional skills
- Reflect on learning, rather than simply list hours
- Use CPD conversations with mentors or line managers to shape future goals.

Members have exclusive access to the online CPD recording tool, **'My CPD'**. Book onto our events, and they will be automatically added to your record so you only need add your reflection.

Records can be easily exported and shared.



THINK ARTICLE

LIZ TURNER
REGISTRATION MANAGER
liz.turner@thepwi.org

CONGRATULATIONS

OUR ANNUAL CELEBRATION EVENT TOOK PLACE ON 5 NOVEMBER 2025 IN BIRMINGHAM WHICH, RATHER APPROPRIATELY, ALSO MARKED NATIONAL ENGINEERING DAY.

The Great Hall at University of Birmingham provided a fitting backdrop to the worthy celebration of hard effort by our individual members – whether as a professional registrant, Diploma or Certificate awardee, or winning contributor of a technical paper in our Journal. It was wonderful for our community to come together and celebrate its successes.

We had hoped to welcome **Sir Andrew Haines**, former CEO of Network Rail as our keynote speaker but, in an unfortunate twist of irony, he was unable to join us due to train delays. How fortunate we were then to have Past President **Peter Dearman** FREng with us, who, with just five minutes' notice, deftly stepped in to deliver the address with aplomb – earning himself another title of 'Super Sub'!

Peter recognised Andrew's focus on the customer which has grown passenger demand tremendously - requiring increased capacity to run the trains, to carry the people where they want to go.

He noted that the Railways Bill, to establish Great British Railways, had returned to Parliament that day. Its aim is to restore a sense of integration which has been missing since 1994 when work began to privatise British Rail. Bringing all railway disciplines back in one organisation, with one guiding mind, should secure the best railways.

Peter closed with a quote from the late Prince Philip: *"everything that wasn't invented by God was invented by an engineer."* He reminded us that we were there to celebrate the engineers who have put in a lot of effort because they want the best railways, too. They are the future: competent, confident and empowered – and it is to them that those who came before them now look, to carry our railway forward.

THIS YEAR'S AWARDS:

- Engineering Technician
- Incorporated Engineer
- Chartered Engineer
- Fellowship
- Track Engineering Diploma
- Electrification Engineering Diploma
- Advanced Track Technician Certificate
- Journal Awards

Scan to view more photos from our Celebration Event 2025

Congratulations to those in attendance:

ENGINEERING TECHNICIAN:
Lisa Secrett, Charlie Simmons, Daoud Hamdani, Kane Smith, Dominic Taylor, Callum Lawson, Shaun Hawkins

INCORPORATED ENGINEER:
Ibrahim Dipoti, Graham Makin, Daniel Baker

CHARTERED ENGINEER:
Simon Wu, Daniel Liddle, Javier Sanchez, Sukesh Ranjan Jena, Tofazzal Rashid, Mark O'Callaghan, Damian Jones, Ryan McCoy

FELLOW:
Mark O'Callaghan

TRACK ENGINEERING:
Arjun Banerji, Nikul Vakaria, Rhys Evans, Euan Stirling, David Drake-Sloane, Callum Sayer, Joseph Wambui, Jamie McMahon, Gad Wanjiru, Jack Matheson, Jacob Barnes, Brogan McGuire, Sarah Pennington, Manraj Bhogal (Best In Class), Ryan McCoy

ELECTRIFICATION ENGINEERING:
Jai Parhar, Joshua Ong, Rory Chiverton, Liam Spalding, Faizan Khan, Andy Franklin, Aaron Nowell, Paul Gray, Mitt Shiyani

ADVANCED TRACK TECHNICIAN:
Kane Smith

SILVER JOURNAL AWARD:
Karim El Laham

GOLD JOURNAL AWARD:
Bob Clarke

PRESIDENT'S JOURNAL AWARD:
Rob Carroll & Richard Briggs

JUDGE'S SPECIAL JOURNAL AWARD:
Morris Smith

MOLLY DALTON
HEAD OF TECHNICAL EDUCATION
molly.dalton@thepwi.org

UPDATE FROM OUR HEAD OF TECHNICAL EDUCATION:

EXCITING UPDATES FOR THE YEAR AHEAD

I'm delighted to share some exciting updates and plans for the year ahead. Our mission remains clear: to provide world-class Technical Education that supports the railway industry in delivering safely, efficiently, and innovatively. If you have any enquiries or are interested in joining our lecturing pool, or have any course enquiries for yourself or your team, please get in touch at **molly.dalton@thepwi.org**. We are always keen to welcome passionate professionals who want to share their expertise, and help shape the next generation of railway engineers.

LATEST UPDATE: NEW IEng PATHWAY

We are thrilled to announce that **Incorporated Engineer (IEng) registration is now accessible through our Experiential Learning pathway** for those who complete two of the following RailEI Courses:

- **Advanced Track Technician Course (ATTC)**
- **Track Engineering Diploma (TED)**
- **Electrical Engineering Diploma (EED)**

This new pathway offers a practical, industry-focused route for engineers who may not have followed a traditional academic route, but have significant hands-on experience, worthy of IEng recognition. It's a major step forward in making Professional Registration more inclusive and reflective of the needs of many within our industry. If you've been considering IEng status, now is the perfect time to explore this opportunity.

Please reach out to **Profeng@thepwi.org** if you would like to find out more.

S&C at Liverpool South Parkway (Photo courtesy of Bob Langford).

We are always looking to evolve our Technical Education offering to meet the ever-evolving needs of our complex industry, and would love to hear your opinions.

HAVE YOUR SAY

If you want to get in touch to see what courses could help you and your teams, please contact me directly on **molly.dalton@thepwi.org**

Thanks,

MOLLY DALTON
HEAD OF TECHNICAL EDUCATION
molly.dalton@thepwi.org

View from toes of Woodwalton 1158 points, a trial site for composite bearers on NR60 Mk2 S&C. (Photo courtesy of Dominic Meakin).

LEARN WITH US

TRAINING DELIVERED BY **INDUSTRY EXPERTS**

ADVANCED S&C SYSTEMS ENGINEERING COURSE

LEVEL 5 | IN-PERSON | DERBY

SO, WHAT IS THE COURSE?

You can expect a balanced curriculum: 60% track theory and 40% signalling theory. You'll gain hands-on experience in inspection, diagnostics, and planning, plus explore real-world case studies focused on planned preventative maintenance and failure mode analysis. The course also covers interfaces with electrification, drainage, structures, and more.

HOW WILL I LEARN?

Each module has balance between theory, and practical sessions where you can apply your learning in real-world scenarios. You'll also work through group and written assessments to earn a RailEI Certificate, which illustrates not only knowledge, but a commitment to your own CPD.

WHEN CAN I ATTEND?

We have multiple cohorts running into 2026 which you can book now:

Module 1: 13 – 17 Apr 2026, 22 – 26 Jun 2026, 21 – 25 Sep 2026

Module 2: 02 – 06 Feb 2026, 18 – 22 May 2026, 07 – 11 Sep 2026, 23 – 27 Nov 2026

WHAT IS THE COST?

£1295/module. Accommodation at Derby Conference Centre is **£545/module** and is highly recommended for evening networking with other S&C professionals.

HOW CAN I BOOK?

Visit the course page here, or if you have any further questions why not take a look at our dedicated FAQs.

SCAN TO SEE FAQS

ROUTE TO EngTech

ADVANCED TRACK TECHNICIAN COURSE

LEVEL 4 | IN-PERSON | DERBY

One course, three weeks.

The aim of this course is to give delegates advanced technical knowledge and understanding of track systems, and their associated methodologies and plant. It is comprised of three consecutive modules and involves 120 hours of taught study all mapped to HE Level 4.

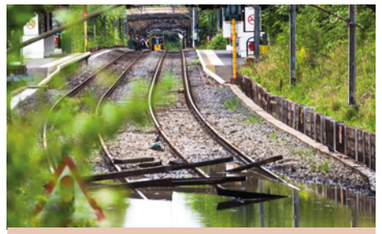
PROGRAMME AIM

Delegates learn how innovations in survey, design, maintenance, renewal, and project work can be harnessed to help make safe and efficient plans. Diversity and sustainability issues are explored, as are the interdependencies between the various engineering functions and train operations, so that key management skills including decision making, prioritisation, record keeping, data analysis, and report writing are developed. Practical skills are developed in plain line and S&C surveying and inspection, rail and rail defect management, mechanised alignment maintenance, and rail stressing.

WHO IS THIS COURSE FOR?

- Newly-qualified technician level technical staff
- Maintenance, renewals or project-based staff
- Good for people looking to increase site-based skills

SCAN TO SIGN UP



EARTHWORKS, DRAINAGE & OFF-TRACK ENGINEERING COURSE

LEVEL 5 | IN-PERSON | DERBY

One course, one week.

This course provides delegates with the knowledge, understanding, and insights necessary to manage the risks presented by earthworks, drainage and associated Off-Track railway infrastructure assets.

PROGRAMME AIM

Delegates will learn about track formation, earthworks, drainage and water management, vegetation, level crossings, line-side security, and their relationships with interfacing engineered systems such as track. Weather related effects are examined and the potential longer term impact of climate change explored.

Through theory, worked examples, case studies, and exercises, attendees will gain an appreciation of good practice in the design, installation, and ongoing safe management of critical Off-Track assets.

WHO IS THIS COURSE FOR?

- Anyone looking to learn more about Earthworks, Drainage and Off-Track
- Those who currently or previously work in these disciplines
- Those who work in Track/Civils looking for EDOT knowledge

SCAN TO SIGN UP

SCAN TO READ TUTOR BLOG

> **"I REALLY ENJOYED THE OPEN CONVERSATIONS BETWEEN EVERYONE ON THE ADVANCED S&C SYSTEMS ENGINEERING COURSE, AS WELL AS THE IN-DEPTH CASE STUDIES WITH GREAT DETAIL.**
>
> THE COURSE WAS RUN EXTREMELY WELL, WITH A LOT OF GREAT CONTENT AND A MIX OF LEARNING OPPORTUNITIES, WHICH WILL HELP ME FURTHER DEVELOP. IT WILL HELP WITH SPEAKING TO ENGINEERS IN THE RAILWAY INDUSTRY ABOUT S&C PROBLEMS, GIVING GUIDANCE AND SUPPORT WHILE SUPPORTING INTERFLON LUBRICATION PRACTICES."

Alan Wright
Senior Technical Rail Engineer, Interflon

2026 LOOKAHEAD

We have an ambitious and exciting programme of courses planned, and 2026 will see the launch of Module 2 of our **New Advanced Switch and Crossing Systems Engineering Course**. Why not scan the QR code below to explore more of our courses?

SCAN TO VIEW COURSES

TECHNICAL EDUCATION AND TRAINING PROGRAMMES: COURSES

A WARM WELCOME

We offer a warm welcome to our amazing new lecturers.

MORWENNA CORRY
GEOTECHNICAL ENGINEER
AT THE ORR

Morwenna is an incredibly knowledgeable Chartered Geologist, who has recently joined our Earthworks, Drainage and Offtrack Course lecturing pool, and

BEN PARKER
ENGINEERING MANAGER
AT TECS

Ben is an outstanding engineer who is supporting our track and S&C courses, and brings an unrivalled wealth of track experience to strengthen our team.

Both bring fresh perspectives that will enrich our courses and inspire our learners, and we are delighted to have them on board, and look forward to the contributions they will make to the RailEI Technical Education community.

"I REALLY ENJOYED THE CASE STUDIES PRESENTED DURING BOTH TRACK AND ELECTRIFICATION DIPLOMAS, WHICH HELPED BRING THE TECHNICAL CONCEPTS TO LIFE.

I BELIEVE THE COURSE WILL SIGNIFICANTLY SUPPORT MY ROLE AND DEVELOPMENT BY STRENGTHENING MY TECHNICAL KNOWLEDGE AND GIVING ME GREATER CONFIDENCE IN MAKING INFORMED ENGINEERING DECISIONS."

Darren White
Route Asset System Integration Manager (RASIM), Anglia, Eastern Region

S&C REFURBISHMENT COURSE

LEVEL 5 | IN-PERSON | DERBY

One course, one week.

This course provides the knowledge and skills needed to plan and deliver safe and effective S&C refurbishment. The processes for scoping, specification and quality assurance have been produced in conjunction with Network Rail and identify good-practice. The course is mapped to HE Level 5.

PROGRAMME AIM

Delegates will gain a comprehensive knowledge of S&C and how to undertake refurbishment safely, efficiently and to the required engineering quality. The course covers both the track assemblies and the trackbed under S&C. Participants undertake detailed analysis and inspection of layouts so they can scope and specify work to provide the necessary life extension of the layout. The course then ensures that delegates understand the various maintenance interventions suitable for S&C and its components and can plan those required in the correct sequence.

WHO IS THIS COURSE FOR?

- S&C Refurbishment
- Track engineers and managers

SCAN TO SIGN UP

DC 3rd – 4th RAIL ELECTRIFICATION COURSE

LEVEL 5 | IN-PERSON | DERBY

One course, one week.

In today's UK railway, DC 3rd – 4th Rail Electrification Systems still have a strategic part to play in the future of rail transport and the journey towards its sustainable future. This programme aims to give delegates an understanding of the electrification principles, their application and safe practices within the context of the integrated railway as a whole.

PROGRAMME AIM

Delegates will gain a comprehensive knowledge of DC 3rd – 4th railway electrification systems in their context; be able to describe the principal elements of the DC electrification system, from the supply of the bulk energy, its transmission and distribution along the rail route, to its conversion and feeding as usable power for train traction and other operational systems.

WHO IS THIS COURSE FOR?

- Both newly qualified and experienced engineers
- Electrification professionals

SCAN TO SIGN UP

TECHNICAL EDUCATION AND TRAINING PROGRAMMES: LEVEL 6 DIPLOMAS

TRAINING TO SUIT YOU

ROUTE TO IEng

TRACK ENGINEERING DIPLOMA

LEVEL 6 | IN-PERSON | DERBY | ONLINE

One Diploma, three modules.

Delegates are taught by experienced rail infrastructure engineers who share their wealth of experience. Attendees receive three technical textbooks, comprehensive course materials and coursebooks with worked examples to support their learning.

PROGRAMME AIM

Delegates gain an understanding of the principles of the theory and practise of track engineering in the UK. It is comprised of three consecutive modules and involves 100 hours of taught study all mapped to HE Level 6.

Upon successful completion of all three modular assessments, candidates are awarded the RailEI Diploma in Track Engineering. These courses are aimed at newly qualified and experienced engineers and gives delegates the knowledge and skills needed for professionals in track engineering.

WHO IS THIS COURSE FOR?

- Engineers looking for academic recognition of track knowledge, possibly to support registration
- Useful for people new to railways/ track engineering looking for CPD

SCAN TO SIGN UP

ROUTE TO IEng

ELECTRIFICATION ENGINEERING DIPLOMA

LEVEL 6 | IN-PERSON | DERBY | LONDON

One Diploma, three modules.

The Diploma is comprised of three consecutive modules involving 100 hours of taught study, all mapped to HE Level 6. Delegates receive a technical textbook and comprehensive course materials with worked examples to support their learning.

This course is aimed at newly qualified and experienced engineers and gives delegates the knowledge and skills needed for professionals in electrification engineering.

PROGRAMME AIM

Delegates gain an understanding of the principles of the theory and practice of Overhead Line Electrification engineering in the UK.

Upon successful completion of all three modular assessments, candidates are awarded the RailEI Diploma in Electrification Engineering. For further development we offer a stand-alone DC 3rd – 4th Rail Electrification Course.

WHO IS THIS COURSE FOR?

- Engineers looking for academic recognition of electrification knowledge, possibly to support registration
- Useful for people new to railways/ electrification looking for CPD

SCAN TO SIGN UP

SCAN TO READ TUTOR BLOG

"REALLY ENJOYED THE PASSION SHOWN BY ALL THE PRESENTERS AND THE ENGAGEMENT FROM THE AUDIENCE WAS GREAT!"

IEng

TOP-UP QUALIFICATION TO IEng

The RailEI Track and Electrification Engineering Diplomas are a form of further learning and, together with a short Supplementary Report, fill the academic gap to IEng for those with relevant HND or Foundation degree qualifications.

TECHNICAL BOARD UPDATE

The RailEI Technical Board is our forum for all Corporate Members to share knowledge and the latest developments in railway engineering.

The quarterly RailEI Technical Board met on Wednesday 10 December 2025. The Chair welcomed online and in-person attendees to the fourth and final RailEI Technical Board of 2025. The meeting was hosted by Rail Safety and Standards Board, London.

RSSB Introduction and Publications

Anup Chalisey, Professional Head of Infrastructure provided an overview of Rail Safety and Standards Board, their role within the railway industry and their liaisons with organisations within. **Toby Johnson, Principal Track Engineer** presented the new Rail Industry Standard RIS-2774-RST entitled Application of Probabilistic Gauging Methods. **John Thomas, Track Engineer** presented recently updated GIGN7608 Issue 3 Guidance on the Infrastructure National Technical Specification Notice (ING NTSN).

RAIB Update on Accidents / Incidents and Points of Interest

Jonathan Graham, Inspector presented his regular update which included the recent 20 year anniversary of the formation of the Rail Accident Investigation Branch being established by a recommendation in the Cullen report following the Ladbroke Grove rail crash in 1999. He also provided an update on reports and safety digests released, going on to share the list of current investigations explaining that the volume of work is higher than normal.

RailEI Corporate Membership 2026 Subscription rates

Stephen Barber, Chief Executive Officer proposed an increase in subscription rates for small, medium and large organisations which was fully supported by Corporate Members in attendance.

Introduction to GCRE testing facility

Prof. Andy Doherty, Chief Technical Adviser introduced the new Global Centre of Rail Excellence being built in Onllwn, Wales to become a through-life test facility. Andy outlined the planned scope of rolling stock and infrastructure testing including a plan to run a 'loaded' mule train in a 12 week pattern with 10 weeks continuous and a 2 week break for access to infrastructure on test. He encouraged all interested parties to support the facility and offered to host this meeting in 2026.

Education and Competency Activity update

Molly Dalton, Head of Technical Education introduced herself as new in this newly created role supporting the delivery of training provided by the Institution. Training course highlights for 2025 include; the completion of 41 training courses in UK, Ireland and Hong Kong, 100 Diplomas and Certificates awarded, and delivery of the first Advanced S&C Systems course. Professional Registration via the RailEI remains strong with Experiential Learning routes becoming more attractive. Student membership is currently over 900, many on integrated degrees and other apprenticeships.

Events, Articles and Publications

Joan Heery, Technical Services Director provided an update including supporting Network Rail in organising a seminar for their Track Maintenance Engineer's community, along with four RailEI seminars for 2026. The practical challenges remain popular, providing hands-on experience in Permanent Way and Electrification. A strong pipeline of articles for inclusion within the Journal is in place across all 2025 themes. In 2026 a new publication is expected, detailing DC traction supply in a similar format to the existing OLE book.

Group Discussion – What can RailEI do to support Corporate Members to develop younger employees?

Joss Apps, Technical Manager led this session with excellent engagement from all attending, plenty of ideas shared and for the RailEI Executive group to compile these and share back in early 2026. All Members are encouraged to share ideas arising after this meeting with Joss by email: joss.apps@thepwi.org.

Introducing Scott Parnell

Joe Smith, Specification Manager introduced Scott Parnell as a new Corporate Member and explained that whilst at their core the organisation is a merchant supplying materials to railways and other industries, they offer technical services including the practical application of products supplied, and drawing down material lists from scheme designs; even attending design reviews if required. Lineside drainage materials are in demand and continues to be core to their business. They have provided RailEI Section meeting and lunchtime lectures on these systems.

The meeting Chair concluded the meeting with a thank you to all those who support the Technical Board, and specifically to RSSB for hosting the meeting. The next Technical Board meeting will be on 4 March 2026 hosted by Bentley Systems.

JOSS APPS
TECHNICAL MANAGER
joss.apps@thepwi.org

The Global Centre of Rail Excellence (GCRE) (Photo courtesy of Andy Doherty, GCRE).

OUR CORPORATE MEMBERS

Corporate Members are fully involved in the development of the RailEI, ensuring that our products and services meet the needs of the rail industry for technical expertise.

For details of Corporate Membership please contact Joan Heery, Technical Services Director: joan.heery@thepwi.org

OUR HERITAGE MEMBERS

Heritage Members can benefit from the expertise the RailEI provide to help run their largely volunteer led organisations.

For details of Heritage Membership please contact secretary@thepwi.org

With sincere thanks to John Merriman for providing this photograph and kindly granting us permission to use it.

OUR COMMUNITY

NEW MEMBERS

We're honoured to have you on board and look forward to working with you. Watch out for us in your inbox, we don't want you to miss a thing! We're here to help, so if you have any questions, then get in touch!

Ashford: Douglas Innes, Jack Webb, Keiran Domingue, Conor Scott, Arron Hale, Will Hay

Birmingham: Stephen Franklin, Craig Sharp, Carl Foy, Louie Baggott, Qasim Hussain, Neil Parkes, Luca Stafioiu, Vineet Bhamra, Selina Atkinson, Kayn Duncan Matthews, Hassan Liravi, Lucas Simpson, Derval Steinbergen, Luke Arrowsmith, Shumon Das, Thomas Hilton, Chimeta Mulambia

Cheshire & North Wales: Denisa Balan, Aidan Croft, Graham Hall, Jackson Summers, Mark Thomas, Clayton Parker, Craig McGhee, Calum Thomas

Edinburgh: Ryan Stewart, Arifcan Yilmaz, Mackenzie Williamson, Aidan Fothergill

Glasgow: Kenneth Millin, Thomas Ridge, Hugh Williamson, Colin Robertson, Kevin Caldwell, Colin McAteer, Owen Crumlish, Declan McCormick, Larry Chirwa, Lewis Naylor-Sigston, Stuart Coulter, Donald MacDonald, Kenneth Stewart

International: Mehdi Maghfouri, Rameesa Jahan, Winfried Boesterling, Terence Johnson, Thandi Myers, Simon Duke, Kristoffer Gibson, Haoyu Wang, Pranav Srinivasan

Ireland: Iain Ó Coimín, Harry Carnduff, Harry O'Neill, Alan McKnight, Allan Stewart, Cian Brennan

Lancaster, Barrow & Carlisle: Matt Scott-Davies, Jeremy Simmons, Warren Rigby, Rachel Hiles

London: Joshua Coyle, Paul Mccracken, Tom Preece, Oscar Oulds, Alfie Williamson, Immie Harding, George Parker, Patrick Thomas, Keyaan Matin, Devesh Pathak, Joshua Hammond, Hoi Yin Eddie Wong, Abdur Rahman Nasiruddin, Sam Puxley, Oluwaseyi Michael Oyeleke, Paul Verghese, Sulaiman Binyiro Katuntu, Biranavan Suthaharan, Melad Ahmedi, Ridwan Adam, Gokul Kandel, Jack Kelly, Nathaniel Adedeji, Rageeb Mutimba, Lauren Bowdalo, Andrew Kwaku Owusu-Amoah, Nadeem Badat, Hayley Lam, Vilhelmas Rusakovas, River Jude, Oliver Hubbard, Rajendra Kelkar, Theodore Saville, Rowan Langley, Jamie Cubitt, Kaua Lacerda, Joseph Walshe, Satish Kumar, Steven Kendell, Ezekiel Romain, Ifeanyi Kelvin Edeh, Agaash Raveendran, Camarli Lee, Carls Sithole, Eva Higgins, Levi Campbell, Elizabeth Uyiekpen, Adrien Duran, Mohamed Musse, Ismail Ayroita, Toluwase Adisa-Kolawole, Nosherwan Chaudhry, Michael Akinpelumi, Boland Shalo, Maciej Rawski, Finn Brown, Benjamin Gulvin, Tallulah Gardner, Eddie Wilding

Manchester & Liverpool: Paul Shapland, Danish Sabir, Stephen Kearns, Daniel Hirst, Kieran Lea-Wood, Zac Suter, Jack Holland, Daniel Dickinson, Anneliese Heasman, Terence Moncrieff, Michael Black, Joshua Powell, Wilson Asogwam, Dale Marriott, Emlyn Donnelly, Andrei Wilkinson, Frederick Ruddick

Milton Keynes: Miles Shepherd, Abigail Richson, Max Soares, Alfie Hart

North East: Jack Meredith, Tom Millar, Sam Bloomfield, Ling Ling Chien, Jamie Gardner

Nottingham & Derby: Phillip Terry, Toby Mannall, Jack Mahaffey, Jason Coem, Daniel Behizad, Benjamin Young, Craig Harris, Cameron Bird, Hugo Coats, Jean-Baptiste Bonniot, Binesh Baby, Ben Mortlock, Ryan Mercer, Liam West, Lewis Dreuitt, Graham Bilbie, Hayden Cave, Nathaniel Means, Tyreeq Walker, Harry Luczko, Michael Papaioannou, Theo Hogan, Samuel Coleman, Anthony Goodwin, Josh Hadfield, Oliver Belson, Charlie Whittle, Ben Redpath, Ellie Chadburn-Tennyson, Sam Basudev, Kerry Burchnall

South & West Wales: Chris Saunders, Jordan Wong, Moses Babalola, Benjamin Cox, Elliott George, Jordan Blatchley, Jed Parsons, Luis Alejandro Diez, Taye Hassan, Gideon Smith, Ewan Keir, Daniel Delahaye, Catrin Herbert, Jake Owen, Izaak Howcroft, Ceian Whitehouse, Jonathan Martinez-Roberts, Kristian Wilkins, Lewis Powell

Thames Valley: Billy McNeill, Gabor Galyasz, Karishma Pathak, Edward Blunn

Wessex: Daniel Reaney, David Fry, Dale Haggett, Brett Lowrey, Josh Sullivan, Daniel Mullan

West of England: Simon Minikin, Jack Young, Tamsin Dangerfield, Bradley Llewellyn-Wilson, Harrison Jefferies, Robert Buckby, Ella Gould, Owen Mason, Cameron Morris, Tayanee Mvula White, Connor Rogers

Yorkshire: Ellis Bishop, Michael Foster, Jake Turner, Ibrahim Al Kalbani, Michael Butcher, John Lawrence, Amelia Thacker, Andrew Emmerson, Reham Alkadi, Alfie Watson, Oliver Tallent, Jack Thompson, Henry West, Michael Willis, Jack Holman, Nick Schofield, Ollie Medway Steel, Charlie Lawson, Owen Cawthorne

ENGINEERING TECHNICIAN:

Kristy Sze Ya Fok, Daniel Mitchell, James Fisher, Furquan Sayyed Muktakali, Lisa Secrett, Apoorva Rao, Daniel Leach, Tom Flannery (Additional)

INCORPORATED ENGINEER:

Craig Findlay

CHARTERED ENGINEER:

Simon Wu, Tofazzal Rashid, Chris Hussey, Daniel Liddle, Darren Stawarz, Charlotte Linn, Ryan McCoy (Additional)

FELLOWSHIPS:

James Ambler – London, Scott Mangnall – Yorkshire, Chris Heyes – Cheshire & North Wales, Shankar Chaudhari – London, Giana Patrascoiu – London, Ben Brooks - Yorkshire

TRACK ENGINEERING DIPLOMA:

Darren White

S&C REFURBISHMENT:

Cameron Bird, Micheal Emsley, Kane Smith, Jamie Morrissey, Giles Phillips, Gad Wanjiru, Joseph Wambui, Heribert Bauer, Alfie Walton, Matthew Crawford, Mervin Chong, Billy Simpson-Barnes, Ricky Prescott, Charlie Simmons, Shaun Hawkins, Richard Dunn, Ian Mackenzie, Steve Wright, Ivan Sanderson, Dominic Taylor, Paul Wilkinson, Scott McGrath, Ugne Mazety, Mark Rowland, Harry McGuire

ELECTRIFICATION ENGINEERING DIPLOMA:

Georgina Pinto, Ioannis Efthymiou, James Palmer, Matthew Griffiths, Jay Carroll, Antonio Gennaro, Phillip Terry, Ellie Smith, Lee George, Mark Treadwell, Joshua Watts, Frank Reilly, Bujar Grajqevci, James Breakey, Lee Evans, Arshad Ashraf, Joseph Futter, Andy Franklin

OBITUARY

Tribute to Kevin Niland

15/10/1930 - 16/09/2025

The Lancaster, Barrow and Carlisle Section have just heard that Kevin Niland died on 16 September 2025. Kevin will be remembered by older members as the driver who transported them home safely and speedily after a long weekend shift.

A Member since 1987 and regular attendee at Section meetings until later in life. Kevin was a keen fell runner and in retirement enjoyed running on the moors near his home in Darwen.

Our thoughts are with his family at this time.

UPCOMING SECTION MEETINGS
WINTER 2025/26/SPRING 2026

FEBRUARY 2026

ASHFORD SECTION
SEKISUI RAIL – POLYMER SOLUTIONS INCLUDING FFU SLEEPERS

17 February 16:00 - 17:00
Patrick Childs, Sales Manager, Sekisui-Rail, Sekisui Chemical GmbH

ONLINE

MILTON KEYES SECTION
NETWORK RAIL'S WELDING TECHNOLOGY

17 February 17:00 - 18:00
John Hempshall, Senior Engineer, Rail Management Team, Network Rail

ONLINE

WEST OF ENGLAND SECTION
PWI PRESIDENTIAL ADDRESS

19 February 13:00 - 14:00
Chrisma Jain, Head of High Speed Engineering, Innovation, Network Rail and President, RailEI

HYBRID

MANCHESTER & LIVERPOOL SECTION
INTELLIGENT TRACK RENEWALS

19 February 13:00 - 14:00
David Gordon, Senior Programme Manager, Network Rail

HYBRID

NOTTINGHAM & DERBY SECTION
INTRODUCTION TO LIGHT RAIL AND INTERNATIONAL DEVELOPMENTS

25 February 18:00 - 20:00
Part 1: Rob Carroll, Technical Principal Materials and Richard Briggs, Project Director, Mott MacDonald

Part 2: Edwin Barker, Technical Director, AECOM

IN-PERSON

MARCH 2026

YORKSHIRE SECTION
HUDDERSFIELD STATION LESSONS LEARNED

3 March 17:30 - 18:30
Spencer Williams, Engineering Lead, TRU West Alliance

HYBRID

THAMES VALLEY SECTION
HS2 CONSTRUCTION – FROM THE AIR

4 March 17:45 - 19:30
Richard Clifford, Information Technology Professional

HYBRID

LANCASTER, BARROW AND CARLISLE SECTION
LEARNING FROM THE GRANGE-OVER-SANDS DERAILMENT

10 March 16:30 - 18:00
Tony Butler, Inspector of Rail Accidents, Rail Accident Investigation Branch (RAIB)

IN-PERSON

LONDON SECTION
VOLK'S ELECTRIC RAILWAY

12 March 17:30 - 18:30
Ian Gledhill, Volk's Electric Railway

HYBRID

GLASGOW SECTION
ADVANCES IN POSSESSIONS MANAGEMENT TECHNOLOGY

18 March 17:30 - 19:00
Gerard Fitzsimmons, Railway Consultant, GF Rail Consultants Ltd

HYBRID

YORKSHIRE SECTION
RADLETT STRATEGIC RAIL FREIGHT INTERCHANGE

19 March 17:30 - 18:30
Simon Clark, Vextrix

HYBRID

APRIL 2026

LONDON SECTION
DLR PART 2 – BANK STATION AND CANARY WHARF

8 April 17:30 - 18:30
Paul Ebbutt, CEng, Honorary Life Member, RailEI

HYBRID

THAMES VALLEY SECTION
RailEI PRESIDENTIAL ADDRESS

8 April 17:45 - 19:30
Chrisma Jain, Head of High Speed Engineering, Innovation, Network Rail and President, RailEI

HYBRID

LANCASTER, BARROW AND CARLISLE SECTION
DEVELOPMENT OF PANDROL TRACK FASTENING PRODUCT RANGE

14 April 16:30 - 18:00
Steve Curphey, Sales Manager UK, Pandrol

IN-PERSON

JOINT GLASGOW AND EDINBURGH SECTIONS
RailEI PRESIDENTIAL ADDRESS

15 April 17:30 - 19:00
Chrisma Jain, Head of High Speed Engineering, Innovation, Network Rail and President, RailEI

HYBRID

BIRMINGHAM SECTION
FROM SHINKANSEN TO CASABLANCA – HIGH SPEED RAIL AROUND THE WORLD

16 April 12:15 - 13:30
Hudson Taivo, Engineering Management, Systra

ONLINE

YORKSHIRE SECTION
OPERATIONAL PRINCIPLES OF TAMPING MACHINES

16 April 17:30 - 18:30
Andy Batters, Senior Project Engineer, Aegis Engineering Systems Ltd

HYBRID

Please note: This information is correct at the time of going to print.

Please check for up-to-date information on the website, as on occasion topics, speakers, venues, times and dates may change: thepwi.org/whats-on/section-meetings

Journal 2025/10 Vol143 Pt4 Errata

We would like to clarify errors that appeared in the Thames Valley Section listings in the October Journal.

The November and December meeting dates were mislisted, and the report on the visit to Plasser UK was incorrectly attributed. The article was written by **Richard Antliff**, Thames Valley Section Secretary.

We apologise for these inaccuracies and for any confusion caused.

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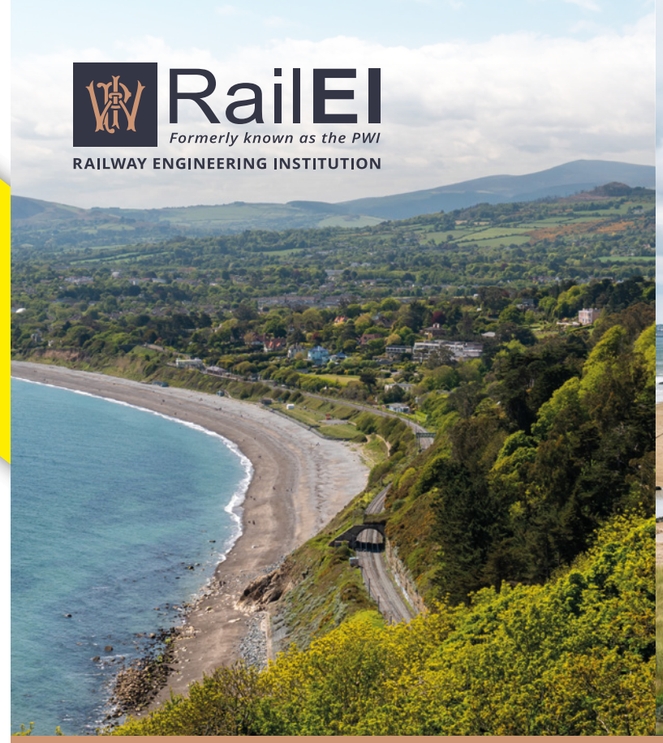

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RailEI TECHNICAL SEMINAR

RAILWAYS IN IRELAND: BUILDING RESILIENCE IN RAILWAY SYSTEMS AND INFRASTRUCTURE

29 OCTOBER 2026

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The Railway Engineering Institution (RailEI) held its first full day technical seminar in Ireland in May 2024 which was a resounding success. We are therefore planning a return visit and our next seminar will take place in Dublin this October.

Whilst the ambition for rail across the island of Ireland remains buoyant, the need for resiliency within all aspects of the current system is paramount. This Seminar will examine resiliency across all aspects of the operational railway – from the effects of climate change on existing infrastructure through to improved technological innovations helping to provide operational resiliency with ever increasing passenger demand.

You will hear from major stakeholders as they describe current and future plans for increasing the resiliency of the network, with insights into ongoing projects, plant improvements, technology and resources.

This Seminar contributes to CPD. Book now to advance your knowledge and understanding of the passion for rail across Ireland.

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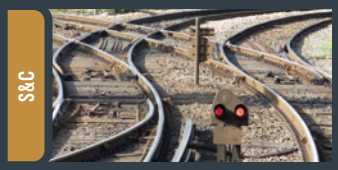

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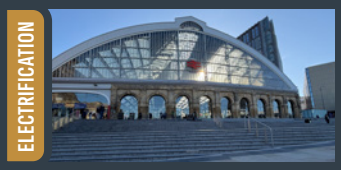

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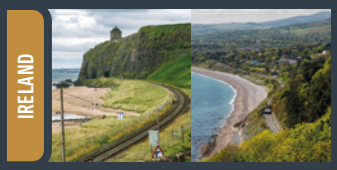

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14-17 September 2026
15-18 February 2027

Module 2
23-26 February 2026
27-30 April 2026
28 September-01 October 2026
07-10 December 2026
10-13 May 2027

Module 3
11-14 May 2026
13-16 July 2026
09-12 November 2026
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12-15 July 2027

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