TECHNICAL ARTICLE

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PLEASE NOTE THE OPINIONS EXPRESSED IN THIS JOURNAL ARE NOT NECESSARILY THOSE OF THE EDITOR OR OF THE INSTITUTION AS A BODY.
Simon Maple, Director Route Sponsorship, Network Rail, delivered the Keynote Address to open the seminar.

PRESENTATION 1

TURNOUTS: HOW DIFFICULT CAN THEY BE?

PETER DEARMAN BECHTEL

As an engineer with a lifetime spent in OLE engineering, Peter commenced with a straw poll of his audience. A third of the audience declared a permanent way background and about a quarter OLE.

Elaborating on the Chairman’s opening comment of the PWI interest in all infrastructure between the fences, Peter reiterated that there was clearly an opportunity for the OLE discipline to be encompassed within the PWI.

OLE engineers tend to have civil or mechanical engineering backgrounds and few have an electrical background.

The PWI offers the opportunity for electrification engineers to become recognised and to develop a professional standing with the other disciplines through being properly qualified.

Reviewing Simon Maple’s comment of feast and famine in Rail Electrification, Peter recalled the optimistic plans of 1978 that were scrapped by Margaret Thatcher after 1979. The East Coast main line was the only scheme to be authorised in the 1980s.

Electrification surfaced again in the new century but the plans were not translated into reality and then really fell out of favour before returning in 2009 with bi-mode traction as a new feature to venture beyond the wires. Peter reminded his audience that bi-modes dated from 1974 or earlier when electro-diesels had been used on the Southern Region.

The current electrification programme was built on a business case of passenger benefit but Peter believes that electrification is more important for sustainability. Bi-modes need diesel and even if reprieved by government policy will be using expensive fuel in future. Hydrogen fuel is currently even more expensive and suffers from having an energy density that is 20% that of diesel.

In conclusion Peter introduced the title of his presentation talking turnouts. To the track engineer turnouts are a challenge and similarly to the electrification engineer.

In summary, the challenge is to keep two wires 5m above the track in position whilst a ‘coathanger’ passes at 125mph. “They work together above and below” was Steve Featherstone’s comment as he took to the rostrum to wrap up the presentation.
TECHNICAL

PRESENTATION 2

DESIGNING OLE AT TURNOUTS

GARRY KEENOR
SANCHAY SINGHAL
ATKINS
MEMBER OF THE SNC LAVALIN GROUP

In a double act of speakers from Atkins, member of the SNC Lavalin group, Garry Keenor outlined the basics of OLE design and Sanchay Singhal described the steps taken in an example of an actual wiring.

Garry started by stating some facts relating to the windblown wobbly wire that moves up and down as a pantograph passes underneath. Between the masts the wire is in a nominal straight line whereas the permanent way can be straight or curved.

With stagger to avoid pantograph wear the wire should not deviate more than 400mm from track centre line and this sets the mast support spacing.

Wire height varies between 4.2m and 6.2m at tight bridges and level crossings. OLE elasticity and the pantograph dynamics have many determinants but the pantograph requires constant contact force; static, dynamic and aerodynamic whilst being capable of multiple pantograph operations of a train with maximum of three pantographs in contact at 110mph and two pantographs at 125mph.

Failure to keep wires over the pantograph causes ‘hookover risk’ and fitting free zones exist out of the contact area where converging contact wires are to be avoided.

Turnouts require the introduction of the turnout OLE wire and two philosophies exist. Garry explained that the current UK practice, where practical, was tangential wiring where wires do not cross in the contact zone.

To maintain stability this requires cross dropper support. Older systems used cross contact but with higher fatigue on the wire.

Sanjay then elaborated on these parameters with a worked example of overhead design and the control structures required to avoid hookover danger.

PRESENTATION 3

SERIES ONE OLE SYSTEM

ROB DAFFERN
FURRER+FREY

From maintenance engineer to manufacturer’s representative Rob commenced his presentation by recalling the Bow dewirement of 2005 where a 1930’s design caused chaos in East London. The Mk3 design also had reliability issues and the introduction of TSIs warranted changes resulting in the Series One system.

Any new system requires backward compatibility with legacy pantographs as well as current and future developments. Thus the Series 1 is designed for 140mph operation with two pantographs on legacy infrastructure where a level contact wire is not achievable. Series 1 is also designed with ease of installation in mind.

Drop in and pin, land and leave being buzz words together with the use of twin track cantilevers on quadrupled railway for less disruptive and quicker installation.

Rob then went on to discuss the installation of crossed contact and tangential junction wiring and the toe opening dimension where the OLE contact diverges.

The rising wires of tangential crossovers are easier to control on a crossover comprising 5 spans over previous 3 span designs which had greater hook over risk.

As in the previous presentation the fitting free zone was discussed with the established preference to stagger towards the diverging wire and both wires to be to one side of the centre line to avoid pantograph headroll.

Consideration of maintenance, reliability and resilience favour tangential junction wiring but the speaker stressed that if this did not appear suitable then alternative solutions may be appropriate. The simplest solution is normally the best and the cheapest.
PRESENTATION 4

APPLYING SERIES ONE TO THE GW DESIGN

GARRY KEENOR
SANCHAY SINGHAL
ATKINS
MEMBER OF THE SNC
LAVALIN GROUP

Garry and Sanchay returned to the rostrum to discuss the scheme being implemented directly outside the seminar venue and hinted at some of the challenges of the programme.

Crucially the use of high output plant was considered from the outset of design and production line techniques were to be employed to implement the project.

The design process starts by considering the wire pantograph interface and ends with mast foundation design from survey and geotech information.

Design was routinely carried out using LiDAR surveys taken by helicopter with 75mm accuracy. Foundation location longitudinally may be varied by up to ±5m in some locations and a certain amount of risk was passed to the installer. Since the system design was behind schedule some installation was carried out with piles later found to be in the wrong place. With hindsight currently an IDC approval regime is required for pile location.

Track design for GW electrification is a legacy of the 1970’s high speed programme. Some S&C renewals were planned but not coordinated with OLE design. If this had been possible some mast rationalisation and other inefficiencies would have been possible. The speakers noted specifically that ideally there should have been clear separation of the OLE between facing and trailing junctions.

OLE designers were then informed from the floor that track engineers had switch geometry from drawings but Garry said that this interdisciplinary coordination was not always possible. OLE setting out could be determined by coordinates on site but access safety issues meant that this was not always possible.

Designers like to complete the design 2 years before physical works but the build up to GW had been so rapid that this was not possible.

Whilst still not perfect, recent design systems on the MML scheme were much improved.

Summing up programme issues, Garry commented that funding and project announcements made for good publicity but scheme development and supply chain issues required to be resolved after very brief political sound bites were made and the media cameras had moved on.

Returning to technical matters there was discussion of minimum bridge clearances and the positioning of neutral sections at these locations which was possible but highly undesirable being akin to gapping on 3rd rail systems.

PRESENTATION 5

CONSTRUCTION OF OLE AT TURNOUTS

GRAHAM STUBBINGS
NETWORK RAIL

The afternoon sessions started with the description of construction and maintenance of OLE. Graham concentrated on the erection of the control structures at turnouts.

Critical to construction methodology is accurate positioning within the predefined tolerances particularly at S&C control structures which made these best suited to conventional plant.

Open line minor changes of ±1m along and ±0.5m across track were acceptable construction tolerances but at turnouts this was reduced to ±75mm to achieve a compliant point opening. Allocation or system redesign including to adjacent OLE spans to achieve point opening causes rework and increases time to completion when outside limits.

Graham explained the setting out criteria and the deemed need on GW for trial holes and the need to achieve the design position from detailed setting out in collaboration of GPS data. Actual foundations then needed to be surveyed against design for compliance or redesign before steelwork installation.

There was a discussion of special cases which could lead to mitigation due to permanent speed restrictions or require the evaluation of special design features. The speaker stressed the need for clear agreement between client, designer and contractor on limits, specifications and maximum tolerances to avoid the need for abortive work.

Due to their complexity, OLE S&C layouts should be designed as a priority over open lines and verification of site works by joint site visits were vital to project achievement.

Finally Graham illustrated the problem of buried services with illustrations of cables buried below other cables and of culvert damage during piling which underlined the importance of surveying for services.
PRESENTATION 6

A WIRING ENGINEER’S VIEW: PETER HAZARD TSO

PETER DEARMAN BECHTEL

Peter Dearman returned to the rostrum due to Peter Hazard not being available and presented this paper.

Panning of the overhead line refers to getting the wire to pantograph interface to optimum contact. Peter started by giving a general overview of panning on open route and through crossovers.

This requires considering contact under all uplift conditions, wind and temperature, inspection for kinks twists and faulty connections with the resulting adjustments and repairs becoming a key part of the handover and acceptance process.

Carried out from a high level platform, it requires a test pantograph that can simulate uplift and demonstrate clearances under these conditions. An interesting series of slides demonstrated to the audience open line challenges including insulated and non insulated overlaps and section insulators before discussing crossovers. At crossovers the first priority should be smooth panning of the main line wire before considering the panning contact of the turnout wire.

The turnout wire should contact the carbon strip from above even after considering uplift forces. This helps avoid hook up or rapid wire wear from repeated horn contact but in some situations compromise is required.

The presentation concluded with a plea from the author for new recruits to the OLE panning fraternity.

PRESENTATION 7

MAINTAINING THE OVERHEAD

NICK MILLINGTON NETWORK RAIL

The final speaker of the day took a light hearted but nevertheless serious view of the total infrastructure during electrification.

Nick Matthews works as Head of Maintenance Delivery for Western Route. Nick reminded his audience that during the electrification works the railway was expected to work faultlessly and if it didn’t then eyes were on him.

Reading track unit had been 14% down on targets due to backlogs in maintenance attributed to non availability of the facility to attend to faults due to OLE works taking up the work programme with little flexibility. Spikes in maintenance backlog were continuing to rise due to commissioning activity.

Nick recounted the tale of the elusive faulty track circuit PHL which resulted in 20,000 delay minutes in 3 months due to an intermittent bonding fault involving a track stress transfer block at S&C.

Forty other sites in the area (50% of total) were then discovered to have the same potential fault. Concentration on the top 21 KPIs was Nick’s adopted strategy to a reasonably happy and stress free life.

Maintenance renewals involving high output equipment were less than 50% of planned renewals in 2017/8 with a renewal of S&C at Southall (electrified for Hex) deferred a number of times.

This had led to special measures to restore differential line speed to an EROS (Emergency restriction of speed).

The new trains had also been a challenge with OLE commissioning and night parking of stock hindering overnight S&T work.

New train EMI (electro-magnetic interference) was the wrong type of noise to some axle counters leaving this and other electronic noise issues to be rectified. New faults could sometimes identified as unintended consequences by analysis of changes to the system.

One annoying feature of all the ongoing works were the 50 occasions of points left in manual and the risk of run through or worse. Nick’s main concern is the lead time required to obtain and install the new switch and who is financially responsible.

OLE influence on track quality was illustrated by track lowering under bridges and the consequences to track stiffness and drainage and the deterioration in ⅛mile reports which would not have happened if bridge lifting or reconstruction had been possible.

Nick concluded by sharing his to do list as maintenance encompassed OLE: chief of which was thanking and looking after the teams that made it possible and the customers who would benefit.
Q & A SESSION 4 AND CLOSING COMMENTS

Since the final session contained only one paper, Nick Millington was the sole representative to answer questions on the stage.

To the question of how to keep sane in a fast moving 24/7 industry Nick informed his audience that a 7 till 7 email embargo allowed staff some out of office peace and quiet and time card checks prevented excessive hours. Obtaining maintenance time on track was always a challenge with turnouts maintenance being a prime candidate.

In the future, interaction with OLE requirements would make maintenance more challenging and with the Crossrail operator proposing to run services on Boxing Day this would only increase that challenge.

Steve Featherstone, PWI President and seminar Chairman wrapped up the seminar by expressing the consensus that everyone had learnt lots of new things and that the day had only allowed investigation of a thin slice of this topical subject.

More seminars on ‘upstairs with the knitting’ were clearly required.

One discipline helps another and the Permanent Way Institution was very willing to encourage overhead line engineers to be included within the PWI’s stated guardianship of infrastructure between the fences.

As President and Chairman of the seminar he was keen to promote the PWI accreditation with the Engineering Council for the Professional Registration of Engineers.

The PWI enjoyed access to the key engineering decision makers within the industry. To assist in the development of young and new entrants to rail infrastructure the PWI now offered free membership to students and apprentices.

Steve then wrapped up the day by thanking all the speakers for their papers, to the sponsors and corporate members for their support and to the delegates for making the day such a success.

Presentations from this seminar can be viewed in the PWI Technical Hub.

www.thepwi.org/technical_hub/presentations