

Managing Overhead Line Equipment on Network Rail's Wales & Western region



Jai Parhar BEng – Asset Engineer (OLE Mtce support)

Darrel Tiddy – IEng IET – Senior Asset Engineer (OLE Mtce support)



Presentation agenda

- Overview of previous presentations
- Wales & Western OLE system overview
- Day to day challenges to performance
- New equipment / ways of working
- Future electrification
- Q&A



Overview of previous presentations



Brief overview of previous PWI presentations – 06/09/20

Great Western Electrification – entry into service dates

1997 – Paddington to Heathrow

July 2017 Platform 1 Paddington wired

January 2018 Platform 2 Paddington wired

May 2017 Stockley – Maidenhead (for EMUs only 110 Mph) **Mains & IEPs October 2017**

January 2018 to Didcot

October 2018 to Swindon

January 2019 to Bristol Parkway

January 2019 to Newbury

April 2019 to Chippenham

January 2020 to Cardiff

June 2020 through the Severn Tunnel

Brief overview of previous PWI presentations – 09/05/21

Rigid Overhead Line Conductor System (ROCS)





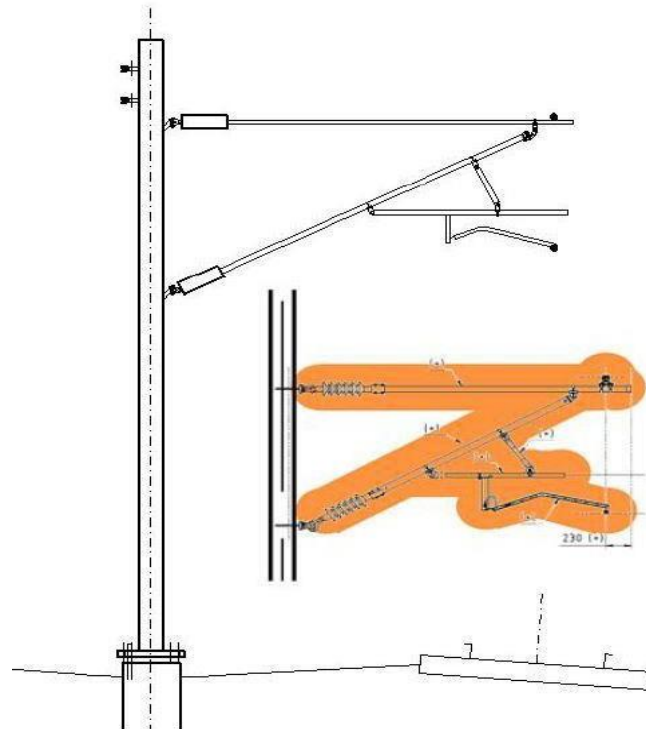
Wales and Western OLE Systems Overview



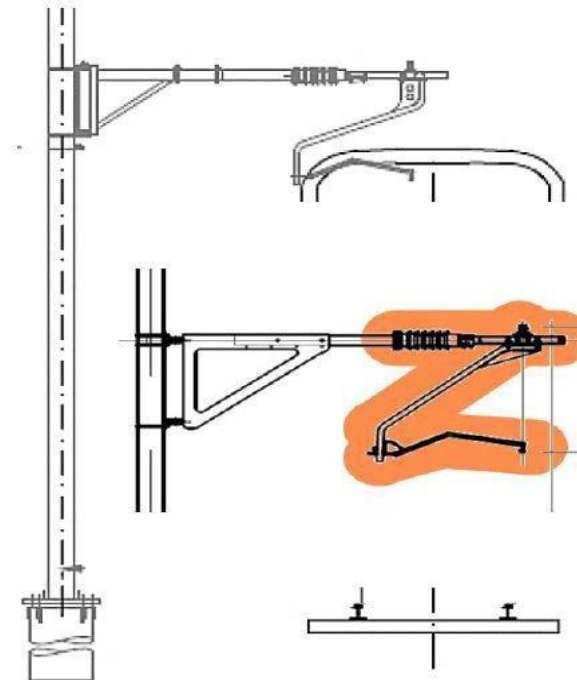
SERIES 1 Overview

Series 1 is the new overhead line equipment range which has been installed on the Great Western Railway.

The Series 1 system is a modern lightweight Auto Tension 25kV 50hz AC system for operation at train speeds of up to 225 km/h (140mph) with multiple pantographs.



Traditional single cantilever
with live envelope



Series 1 equivalent with
live envelope



Headspan - Mark 3b OLE equipment



A headspan structure is one where the support of OLE equipment is achieved solely by means of tensioned cables running between masts.

Headspans are significantly cheaper, however they are more difficult to adjust and subsequently they are not mechanically independent.

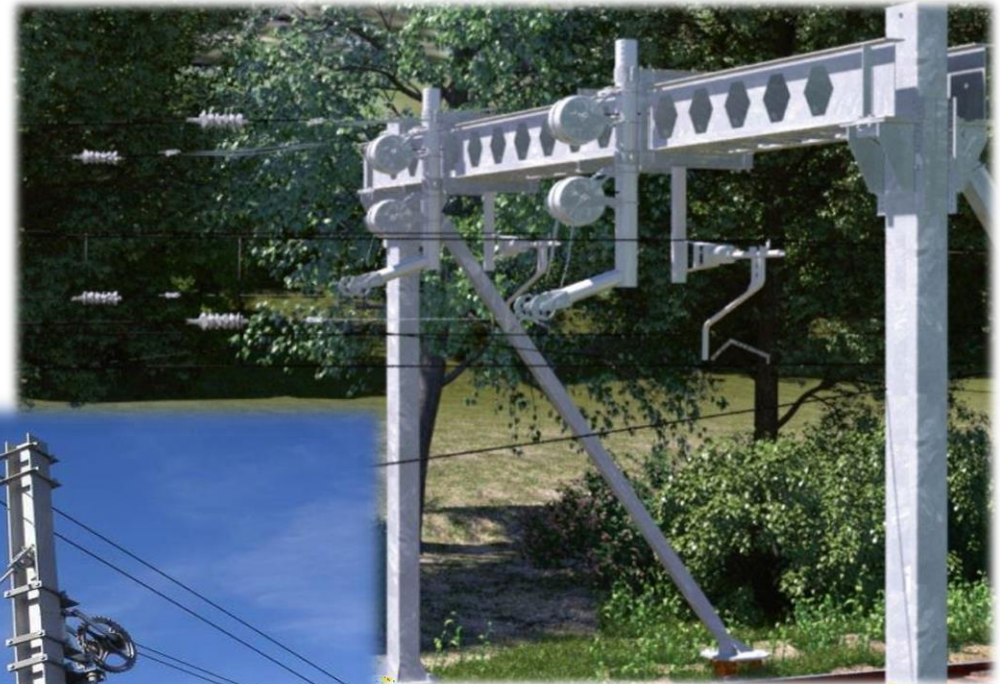
Series 1 tensioning system vs Traditional tensioning system

Modern systems are increasingly using spring tensioners (Tensorex C+) to achieve the required tension

The contact and catenary wires are independently tensioned

Allows the device to be placed over the track for ease of maintenance access

Eliminates the need for pulleys



Tensorex C+ on a monoboom anchor



Traditional Balance Weight Anchor

OLE Inspections

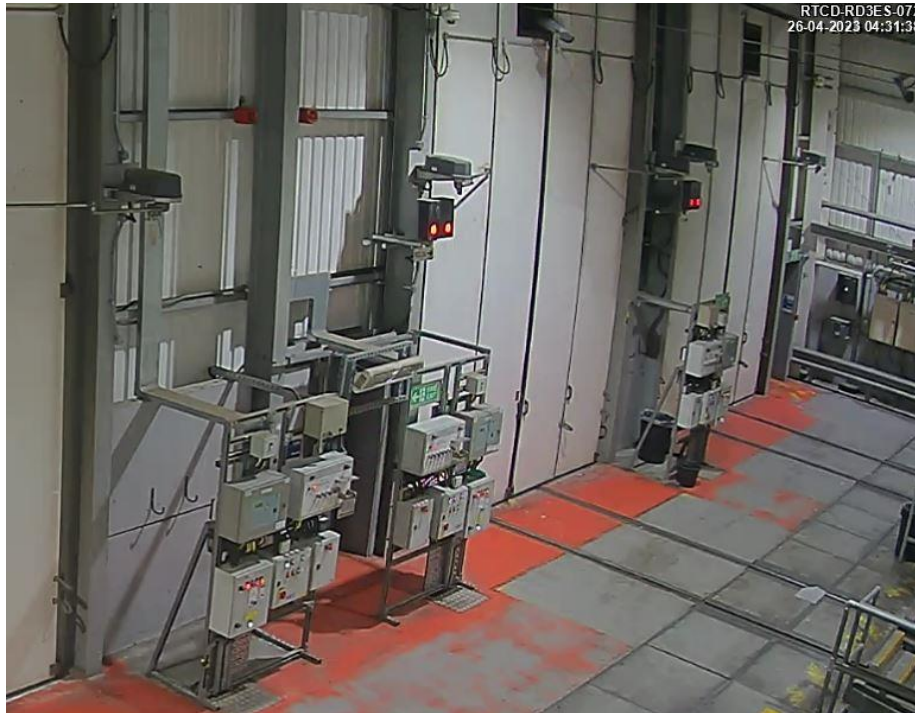
- Low level foot patrol (B01)
- High level intrusive inspections (B10s)
- High level early failure inspection (B11a)
- Asset condition inspections – wire wear (B13)
- Dynamic inspections – NMT & MENTOR inspection vehicles
- Thermal imaging / Corona camera inspections
- Cab rides & pantograph video footage review
- On site investigations following a short circuit (B05)
- OLE ancillary equipment, APC magnets, bonding inspections and Height & Stagger inspections



Day to day challenges
to OLE system performance



Bird strikes



Overhead line tripping – Reading Train Care Depot - April 2023

Bird strikes

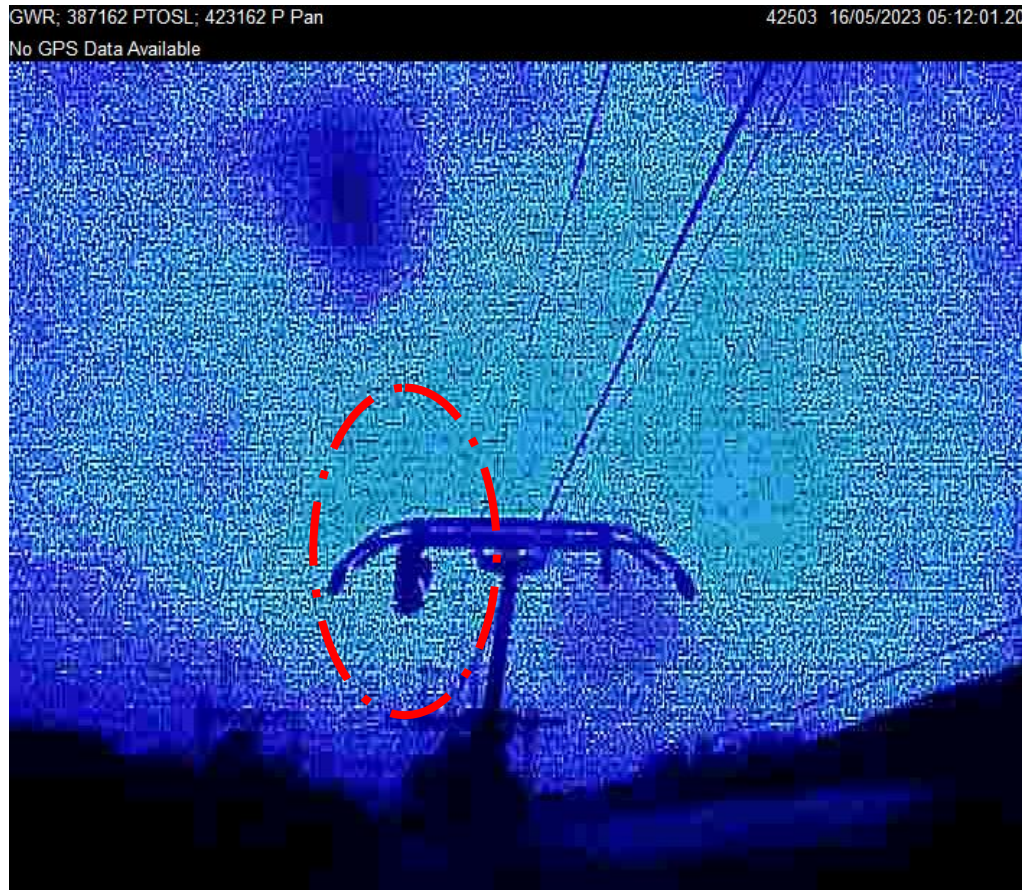


Repeat Tripping's - Twyford station – March 2023

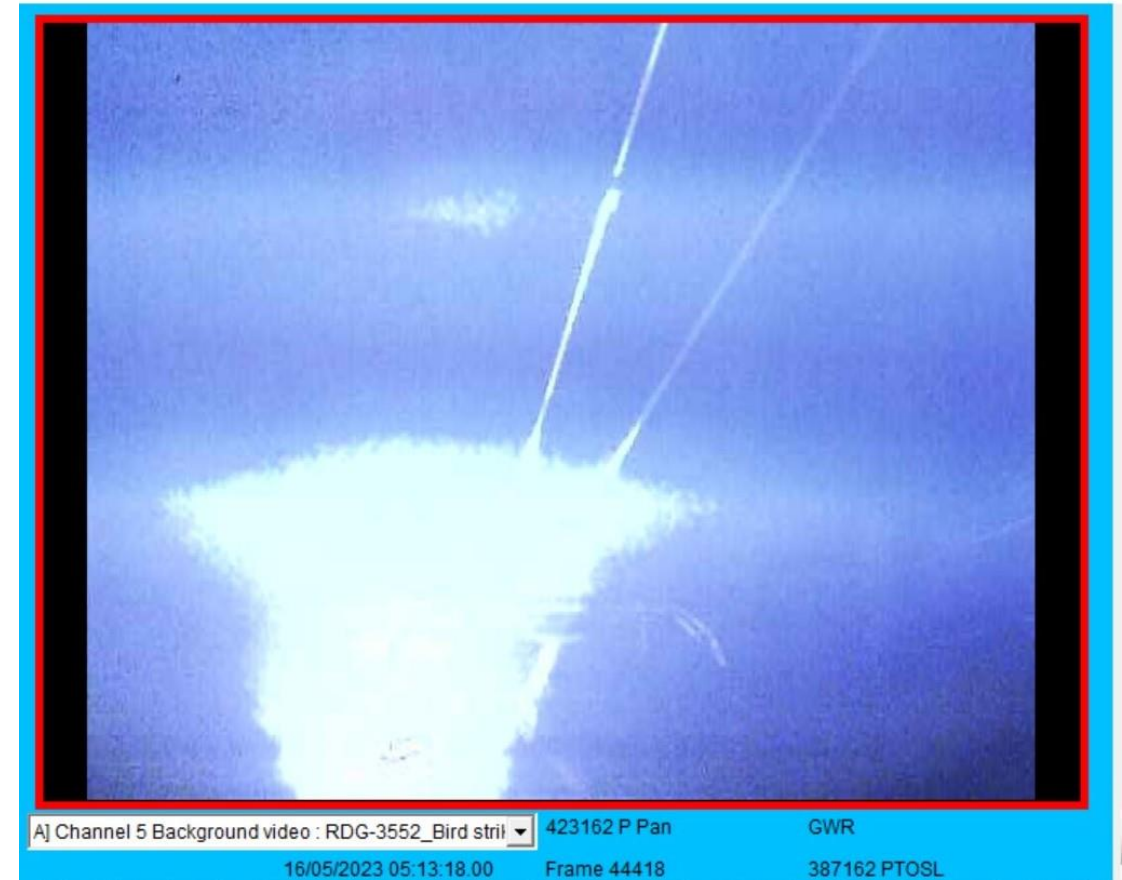


Line hose – secondary insulation

Bird strikes

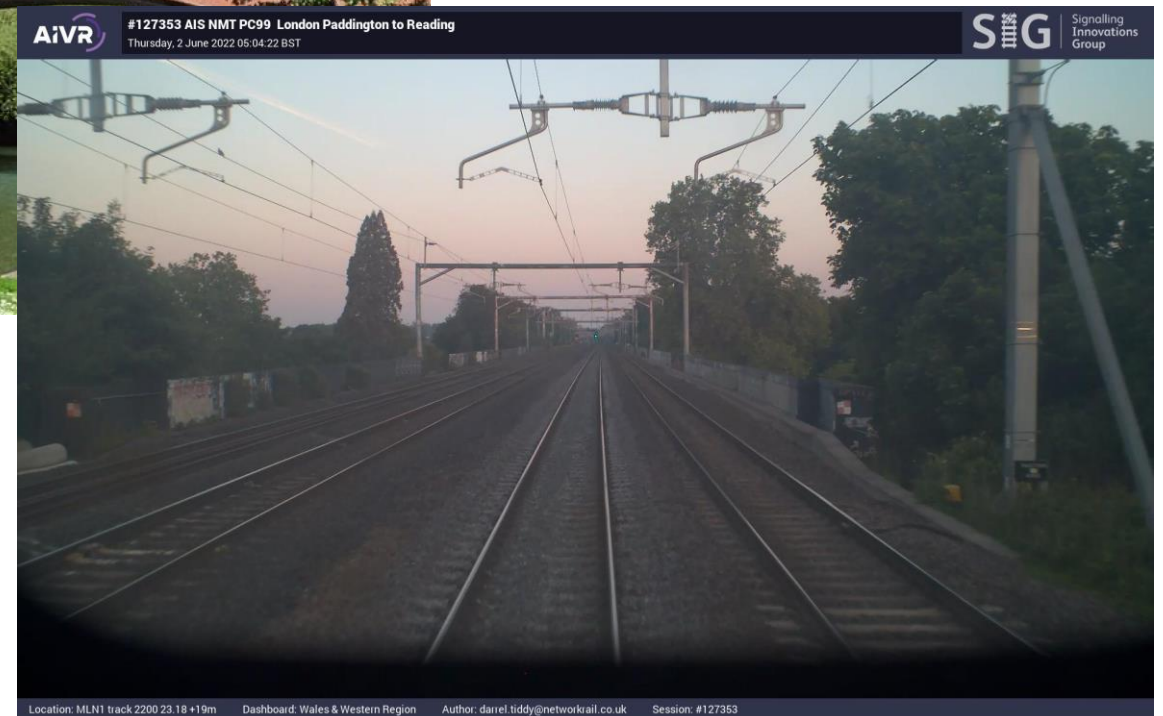
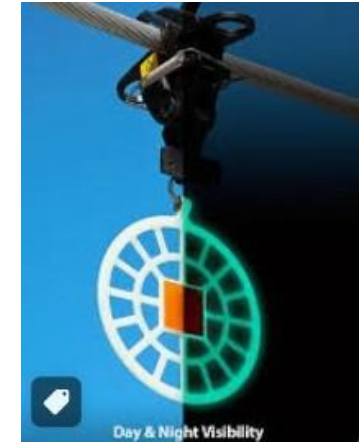
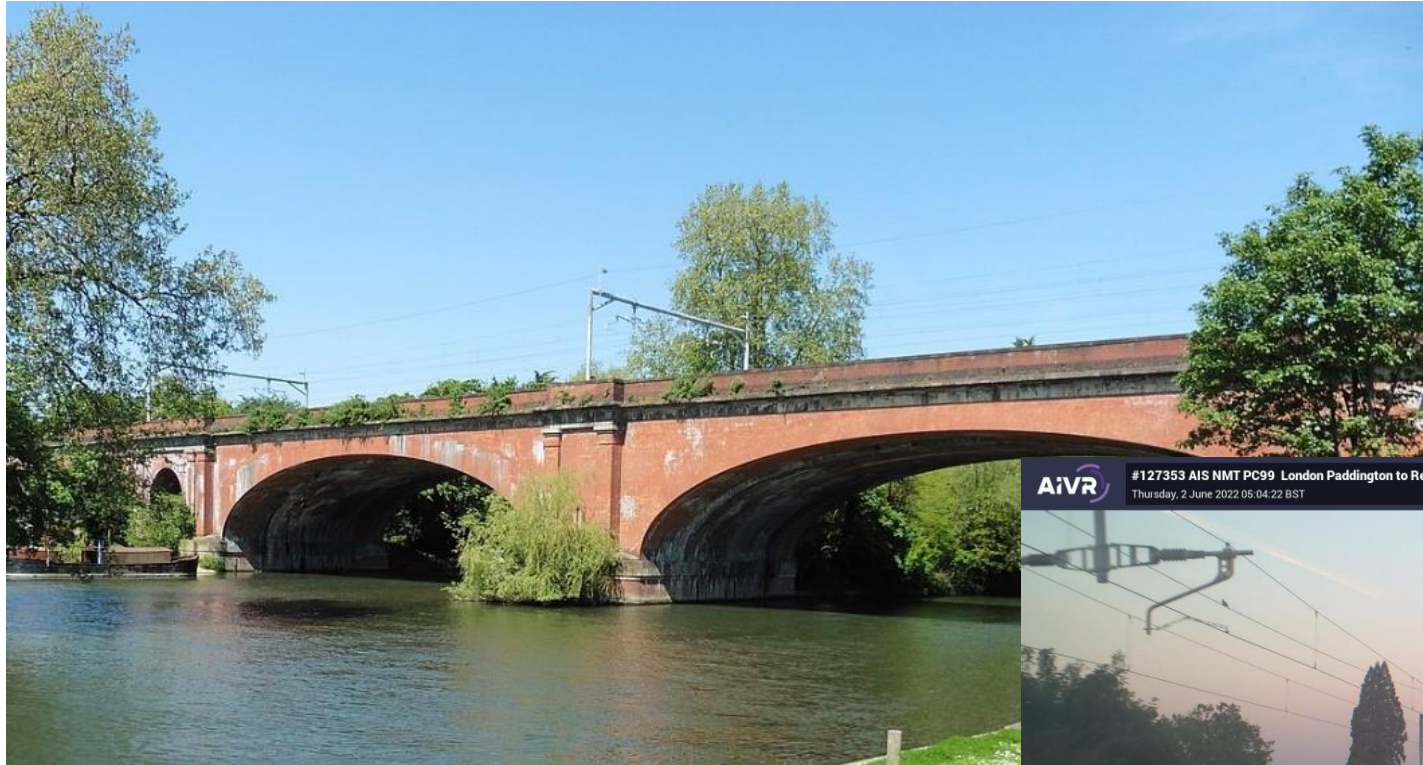


IDR_PLAYERFRAME

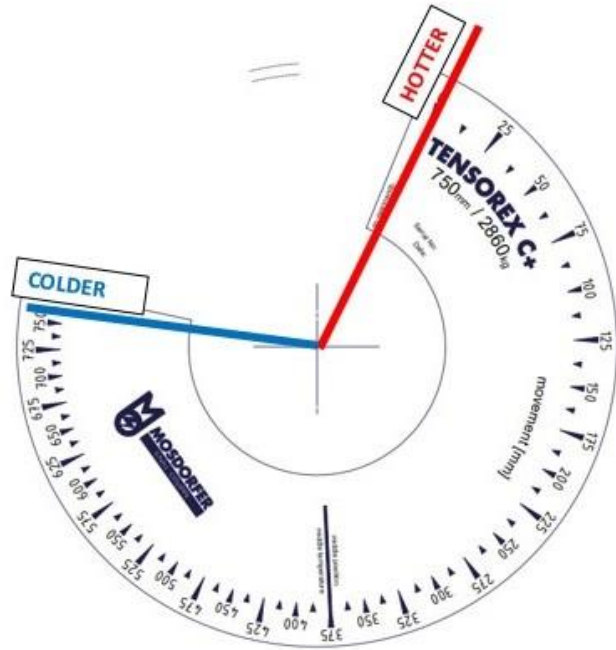


Overhead line tripping – Didcot area / A34 Bridge - May 2023

Bird strikes



Hot weather



System (s) operating range:

- Mk 3b operating range -18 to + 38 Deg C
- Series 1 - 18 to + 40 Deg C (Max 56 Deg C Current heating, solar heating and ambient)

Hot weather



Conductor beam misalignment – June 2023

Cold weather



Photos taken during winter 2022-2023

Cold weather

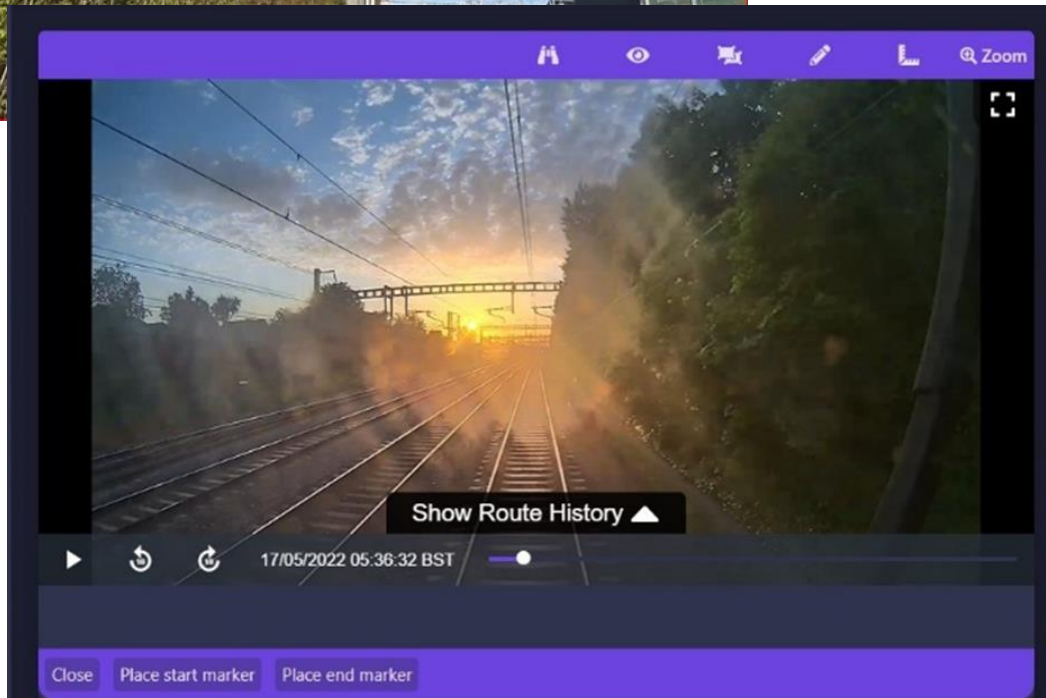
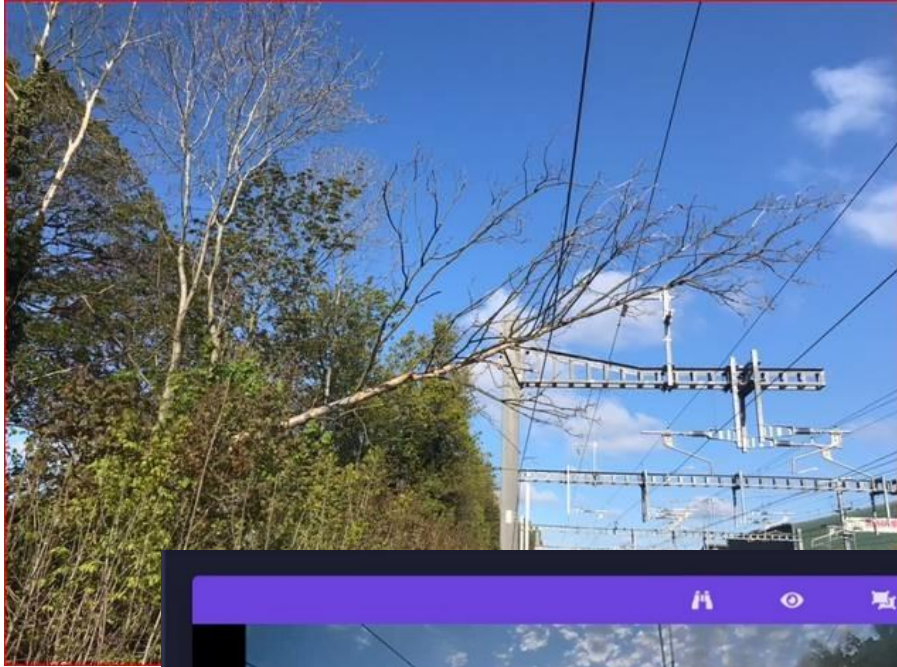


Photos taken during winter 2022-2023

Insulator pollution



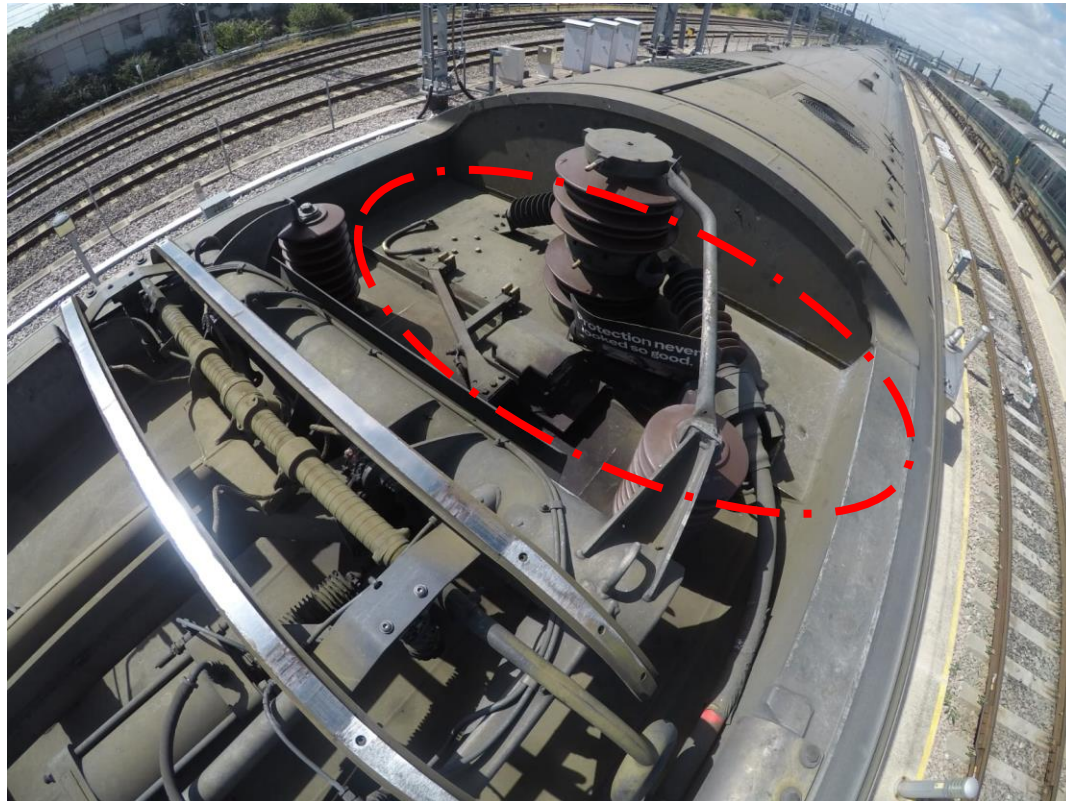
Vegetation



Vegetation



Vandalism



Construction issues



- Droppers (mishandle at time of installation)
- Droppers (saddles not installed)
- Jumpers (too short - hot weather issue)
- Earth wires (too tight - cold weather issue)
- Isolator setup (performance issue)

Other incidents



Several other OLE incidents caused by issues with pantographs

Above - Reading station – OLE tripping and dewirement caused by a helium balloon – November 2022.



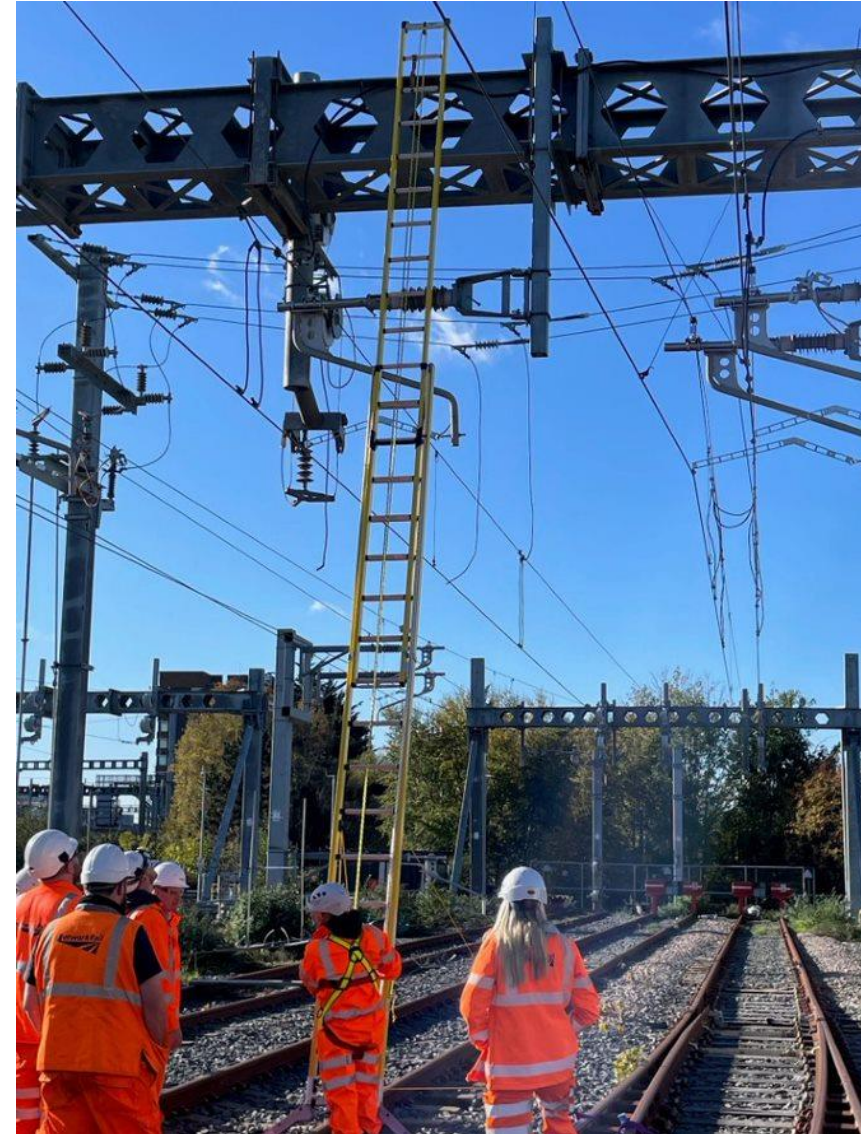
**New equipment and
ways of working**



High Level Access by High Stability Ladder



Ladder rail mounted
with adjustable feet



Ladder standing off
portal

Corona Camera

The 25kV OLE system in tunnels is susceptible to corona discharge due to insulators being affected by pollutants.

Insulators can fail and cause service affecting failures.

The corona camera allows intervention before failure by identifying electrically poor performing insulators.



INSULATOR ID	GAIN	COUNTING
194 – 706 DT	180	31510

A close-up image of an insulator. A red circle highlights a specific area on the insulator, likely indicating a point of interest or a defect. The image is framed by a red border. The top of the image shows a timestamp of 01:26 01/07/2021 and a gain value of 180. The bottom of the image shows a counting value of 31510.

Insulator Cleaning

1x 20L container
for Rivolta
cleaning
solution

1x 20L container for
water

Pole mounted
telescopic brush
with container
feed

Trolley with pump
and hose attached



Insulator Cleaning



Helicopter Imaging



Thermal image of an isolator taken from a helicopter



Image of an isolator taken from a helicopter

Drones/Camera on a pole



Hastec Wear Measurement



Other initiatives



Risk Based Maintenance

- **2016:** 0-12mp (Paddington to Airport Junction) RBM exercise undertaken with existing conservative frequencies kept in place due to Crossrail project.
- **2017-2020:** New Series 1 OLE system west of Airport Junction to Cardiff. Designer maintenance frequencies adopted.
- **2023:** In line with NR standard NR/L2/MTC/10662 the RBM exercise is being carried out for the entire region. This now uses 3-5 years of Series 1 maintenance history.



Pantograph Monitoring Systems



Pantobot

Designed to provide, in real time, pantograph condition monitoring and assists in the early identification of the root cause/location of damage to pantographs.

It allows a top-down look at the OLE-pantograph interface and will alert Network Rail and the TOCs to poorly performing pantographs.

Can identify:

- Missing or damaged horns
- Chipped carbon strip
- Objects in the Pan well
- Carbon strip wear
- Low or high uplift



Pantobot installation at Westbourne
Park

Pantobot locations on the Wales and Western Region

1. Westbourne Park
2. Southcote
3. Didcot
4. Bristol



These sites have been commissioned and are currently undergoing a period of soak testing to fine tune performance and the warning/alarm thresholds.

Other Pantobot systems are currently being installed nationally.

camlin rail Pantobot Pro								
Events Trains Stats Settings System Diagnostics								
Filters		S · RAP	Carriage Id	CA	D	Speed	Model	Capture time
Select a preset		Southcote - Down Westbury	423159		➔	56.1 mph		31/05/2023 16:21
		Didcot - Up Relief	-		➔	54.2 mph	HSP MK2	31/05/2023 15:56
		Badminton - Down	-		➔	57.5 mph	HSP MK2	31/05/2023 15:32
		Badminton - Down	-		➔	58.0 mph	HSP MK2	31/05/2023 15:32
		Didcot - Up Relief	423142		➔	62.1 mph	HSP MK2	31/05/2023 15:00
		Didcot - Up Relief	-		➔	60.6 mph	HSP MK2	31/05/2023 15:00
		Didcot - Up Relief	423167		➔	50.0 mph	HSP MK2	31/05/2023 13:57
		Didcot - Up Relief	423166		➔	48.0 mph	HSP MK2	31/05/2023 13:57
		Badminton - Down	-		➔	57.8 mph	HSP MK2	31/05/2023 13:13
		Badminton - Down	-		➔	58.0 mph	HSP MK2	31/05/2023 13:13
		Didcot - Up Relief	423142		➔	42.2 mph	HSP MK2	31/05/2023 13:02
		Didcot - Up Relief	-		➔	40.5 mph	HSP MK2	31/05/2023 13:02
		Didcot - Up Relief	-		➔	56.1 mph	HSP MK2	31/05/2023 11:55
		Didcot - Up Relief	-		➔	54.2 mph	HSP MK2	31/05/2023 11:55
		Didcot - Up Relief	-		➔	54.7 mph	HSP MK2	31/05/2023 10:59
		Didcot - Up Relief	-		➔	51.3 mph	HSP MK2	31/05/2023 10:59
		Didcot - Up Relief	423153		➔	53.6 mph	HSP MK2	31/05/2023 10:04
		Didcot - Up Relief	423144		➔	50.7 mph	HSP MK2	31/05/2023 10:04
		Southcote - Up Westbury	423167		➔	52.8 mph	HSP MK2	31/05/2023 09:51
		Southcote - Up Westbury	423166		➔	53.3 mph	HSP MK2	31/05/2023 09:51
		Badminton - Up	-		➔	75.7 mph	HSP MK2	31/05/2023 09:01

Pantobot Dashboard


camlin rail

Pantobot Pro
Events
Trains
Stats
Settings
System Diagnostics
1
1

















Filters

Select a preset

RAPs
Select one or more RAP

Event status

✓

✓

✓

✓

✓

✓

Alert type
Select one or more alert type

Carriage association status

✓

✓

✓

✓

Carriage ID
Type a carriage ID

Train direction
Select train direction

Event Tags
Select event tags

Model
Select a pantograph

From date
Select a date ...

To date
Select a date ...


Southcote - Up Westbury
02/06/2023 · 09:48


Southcote - Down Westbury
02/06/2023 · 09:46


Southcote - Down Westbury
02/06/2023 · 09:46


Southcote - Up Westbury
02/06/2023 · 09:36


Southcote - Up Westbury
02/06/2023 · 09:36


Badminton - Down
02/06/2023 · 09:35


Badminton - Up
02/06/2023 · 09:17


Southcote - Down Westbury
02/06/2023 · 09:17


Didcot - Up Relief
02/06/2023 · 09:16


Didcot - Up Relief
02/06/2023 · 09:16


Didcot - Up Relief
02/06/2023 · 09:14


Didcot - Up Relief
02/06/2023 · 09:14


Southcote - Up


Southcote - Up Westbury

MODEL

HSP MK2

SPEED

→ 54.9 mph

CAPTURED

2 Jun 2023 09:48:53

EVENT TAGS

Select a tag

CARR. ID

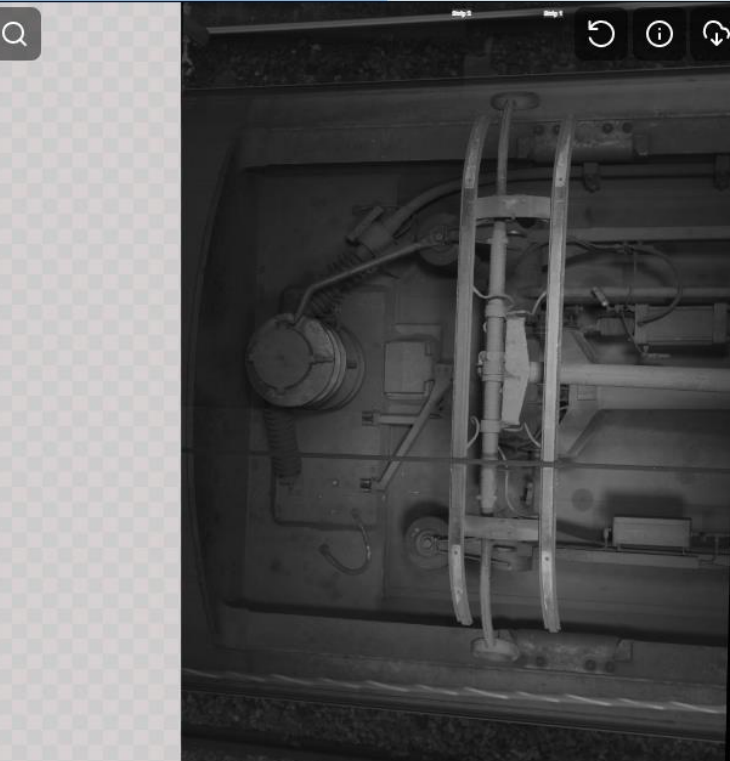
423166

UPLIFT

1.82 mm

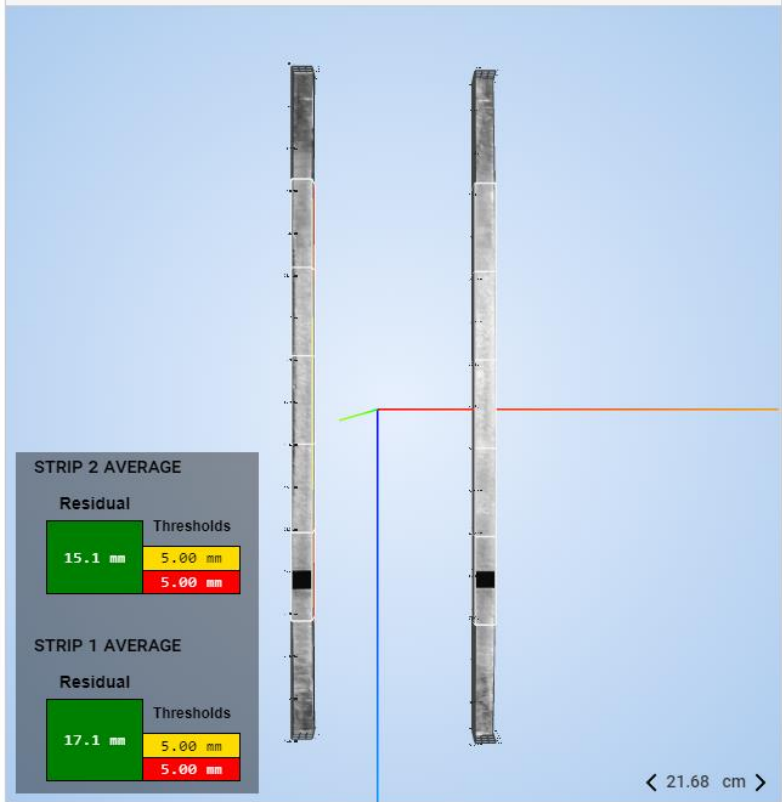
CAMERA PIC

DISPARITY MAP



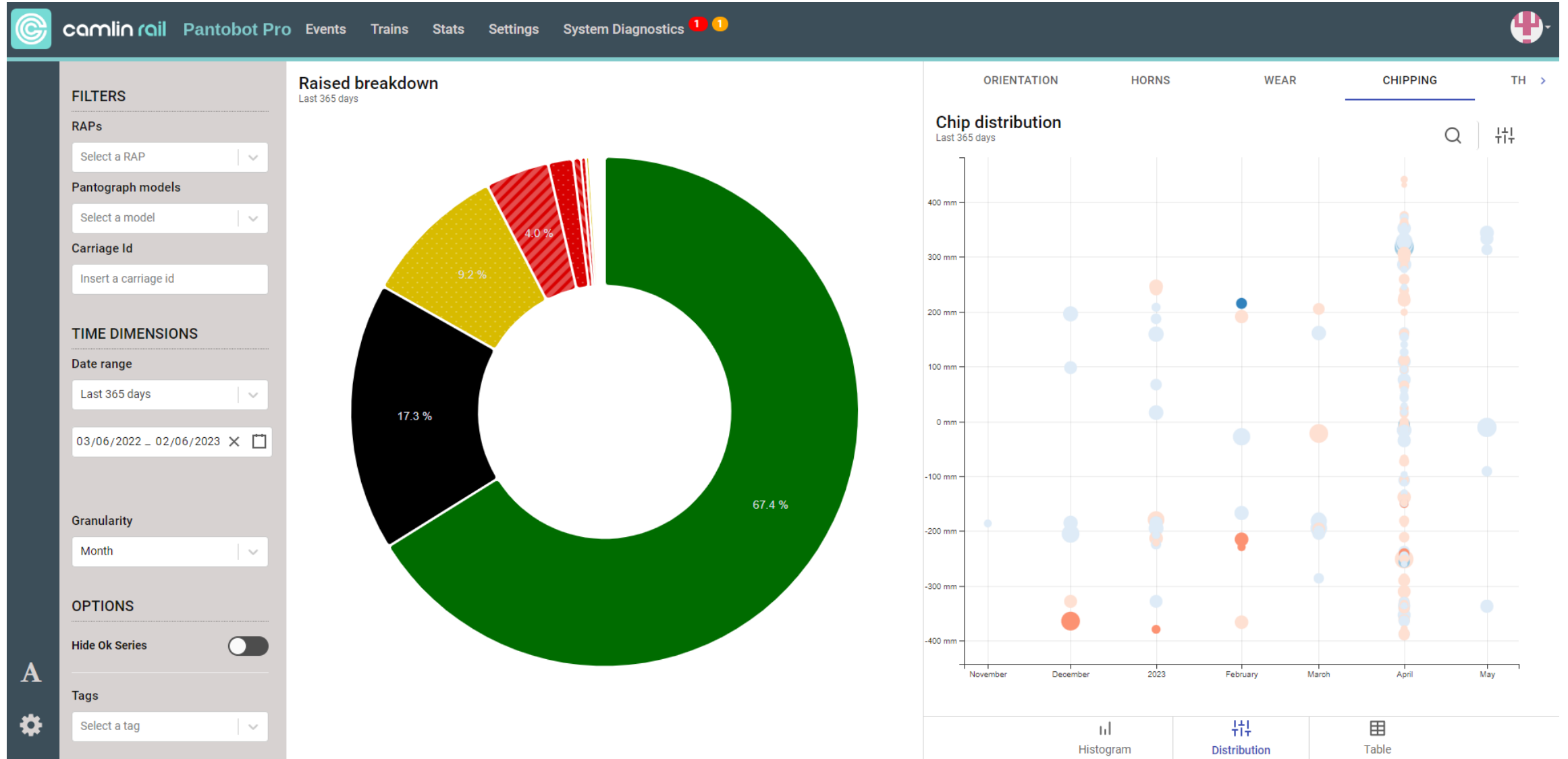
Strip 2

Strip 1

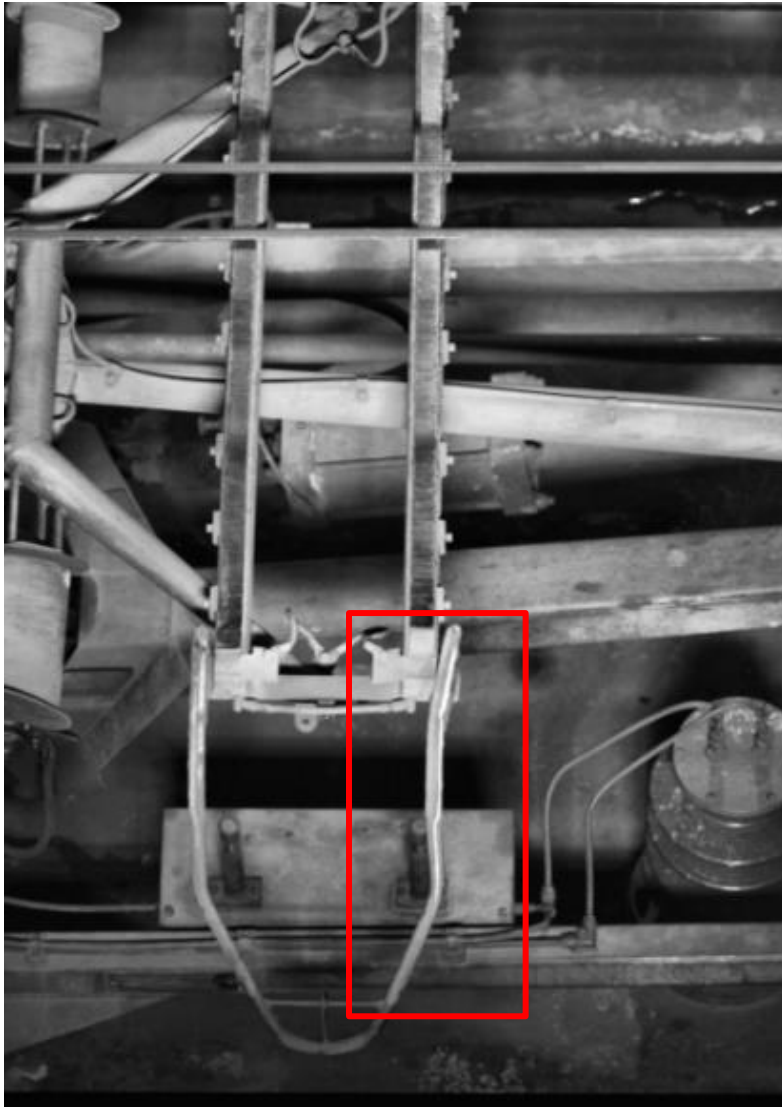


41

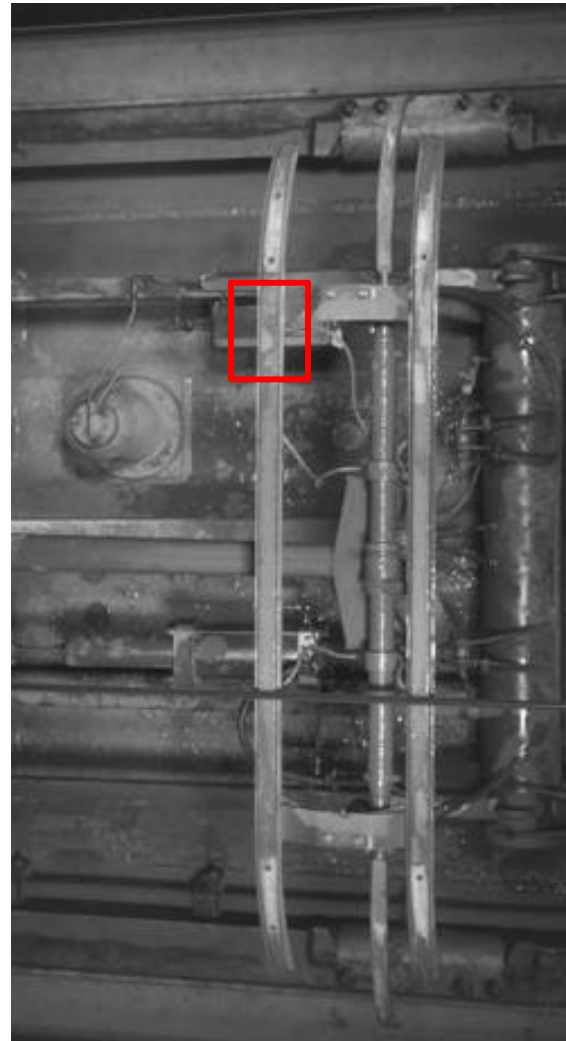
Pantobot Dashboard



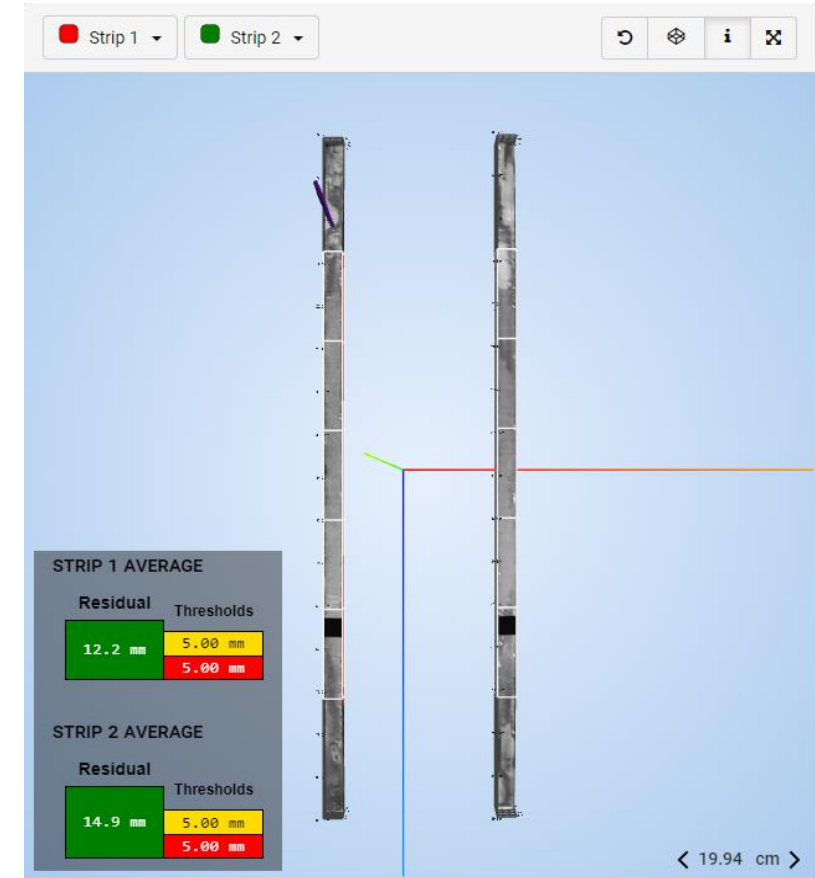
Pantograph defects identified by Pantobot



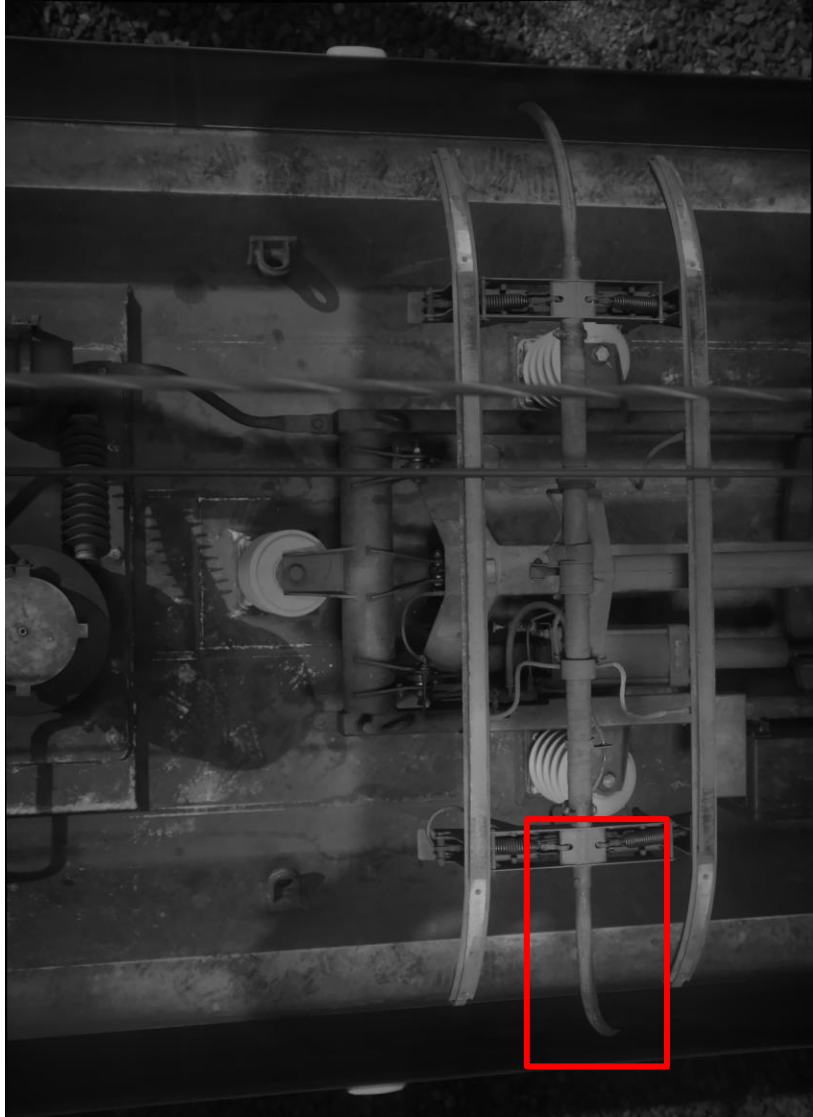
Horn damage identified by Pantobot at Heathrow



Pantograph alarmed on a carbon chip by Pantobot at Southcote

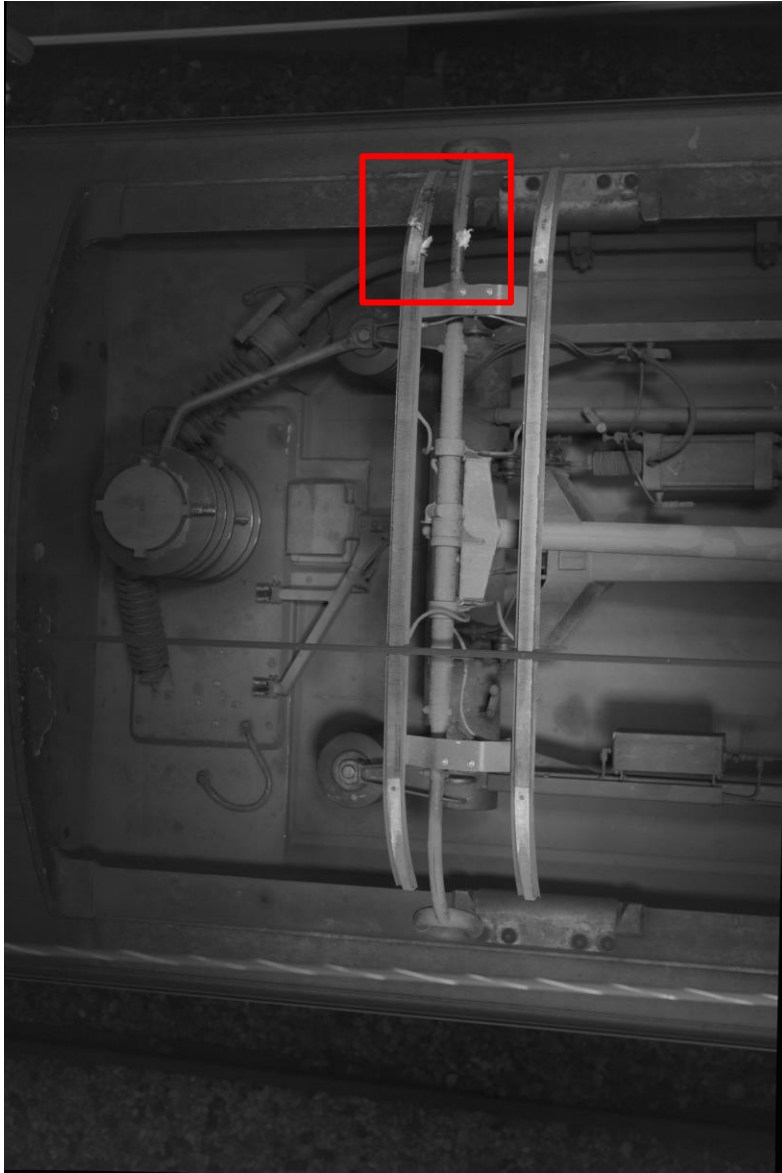


Pantograph defects identified by Pantobot



Rotated pantograph horn

Pantograph defects identified by Pantobot



Result of a bird strike

A stylized blue graphic of a railway track, consisting of two horizontal lines with vertical cross-ticks, positioned on the left side of the slide.

Electrification System developments

A stylized blue graphic of a railway track, consisting of two horizontal lines with vertical cross-ticks, positioned on the right side of the slide.

Electrification System R&D – Challenging the norm

- Voltage controlled clearances – Surge arresters, insulated coatings and secondary insulation.
- Longer span length – Circa 90m on UK Master series can give a 5-10% reduction in project construction costs.
- Optimised earthing / Single approach to isolations.
- University and engineering consultant research into OLE system wind loading, foundation and pile depth.
- Parapet risk assessment tool NR/L3/ELP/27717.

And much more!



Q & A