



Electrification And Innovation: Rail's Path to Decarbonisation

Upgrading Existing Electrification to Meet Customer Needs

Midland Main Line OLE 125



THE PWI

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IMAGINE
CREATE
ACHIEVE
a sustainable future

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Background

The St Pancras – Bedford (BedPan) electrification project was the first to use the Mark 3B OLE system design. The route was energised in 1983 and was operated by 4 car Class 317 EMUs with a design speed of 100mph. At this time the ruling line speed was 90mph, this being the maximum speed of Class 45 and 46 Peak diesel locomotives.

With the introduction of HSTs in 1983 the ruling line speed on the Fast lines was increased to 110mph and subsequently the ruling line speed has been progressively increased to 125mph. The HSTs were replaced by Meridians post privatisation.

The Meridians are now to be replaced with Hitachi Class 810 Aurora bi-modes. The introduction of the Class 810s has generated the requirement for the OLE to be upgraded to 125mph twin pantograph operation.



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Feasibility Study

In 2019 the Network Rail OLE Route Engineer, Mark Davies, engaged OLE Limited to produce a feasibility study to investigate the upgrading Mark 3B OLE from 100mph to 125mph operation.

The scope of the study was for the operation of:–

- Class 810 bi-modes in single and twin 5 car formations at up to 125mph.
- Class 360 EMUs in 4, 8 and 12 car formations at up to 110mph.

The study found there to be 108 wire runs on the Fast lines which will experience line speeds greater than 100mph and that there are 11 interfacing wire runs on cross overs.

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Feasibility Study

The study identified a series of Core interventions:–

- Geometry compliance – Height, stagger, gradient and profiling
- Uplift provision
- Head roll compatibility / tangential staggering at junctions
- Dropper replacement
- Jumper replacement and reinforcement
- Replacement of ceramic insulators
- Independent bridge arms
- Replacement of Brown Boveri section insulators
- Replacement of contact wire overlap insulation
- Replacement of ceramic bead neutral sections
- Lightweight registration arms (subject to dynamic simulations)
- Contact wire supertensioning (subject to dynamic simulations)

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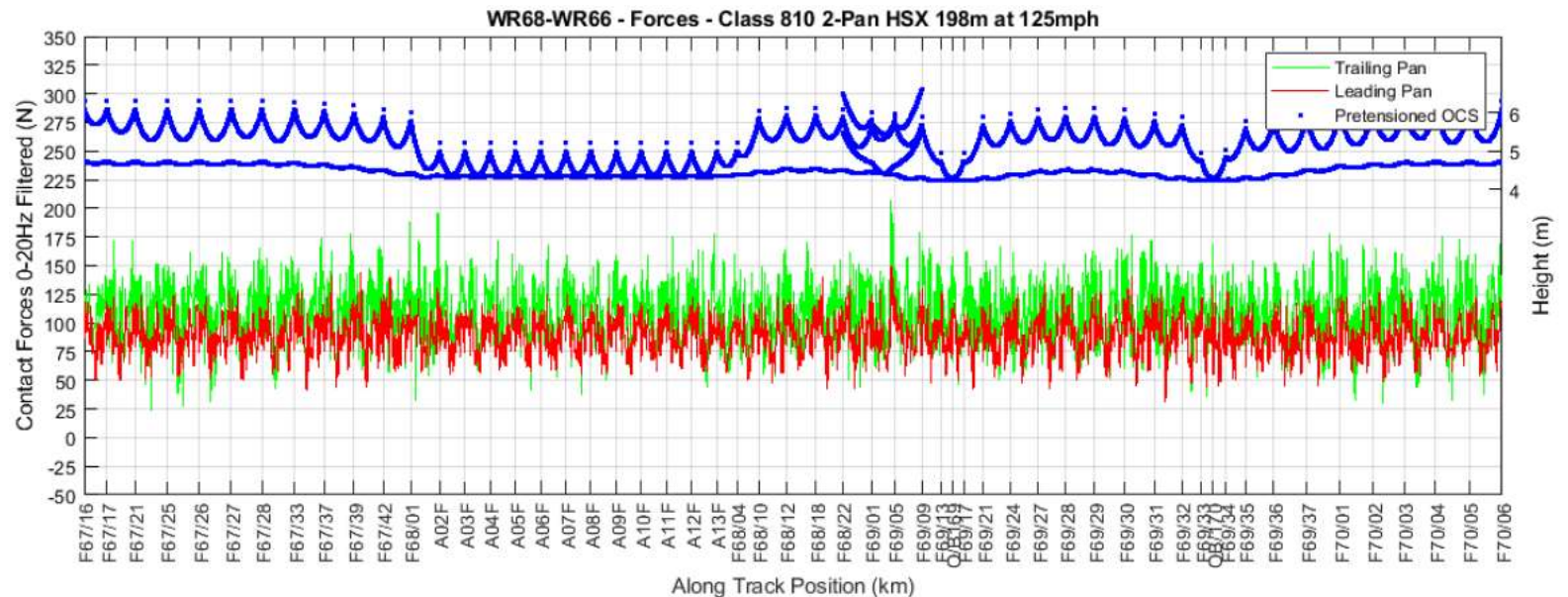
MK3B-05-AT-S

In 2022 OLE Limited were awarded a contract by SPL Powerlines, on behalf of Network Rail, to develop the findings of the feasibility study in to a new system design and a new basic design range.

A fundamental element of the system design development was the dynamic modelling. OLE Limited worked closely with T-RIS both to undertake the simulations. The objective was to achieve compliant dynamic performance with the minimum possible increase in total conductor tension.

Multiple simulations and sensitivity analyses were undertaken to optimise the conductor tensions to those shown in the table.

MK3B-05-AT-S	Contact Wire	Catenary
Size / Material	107mm ² HD Cu	7/3.95 AWAC
Tension	13kN	10.18kN



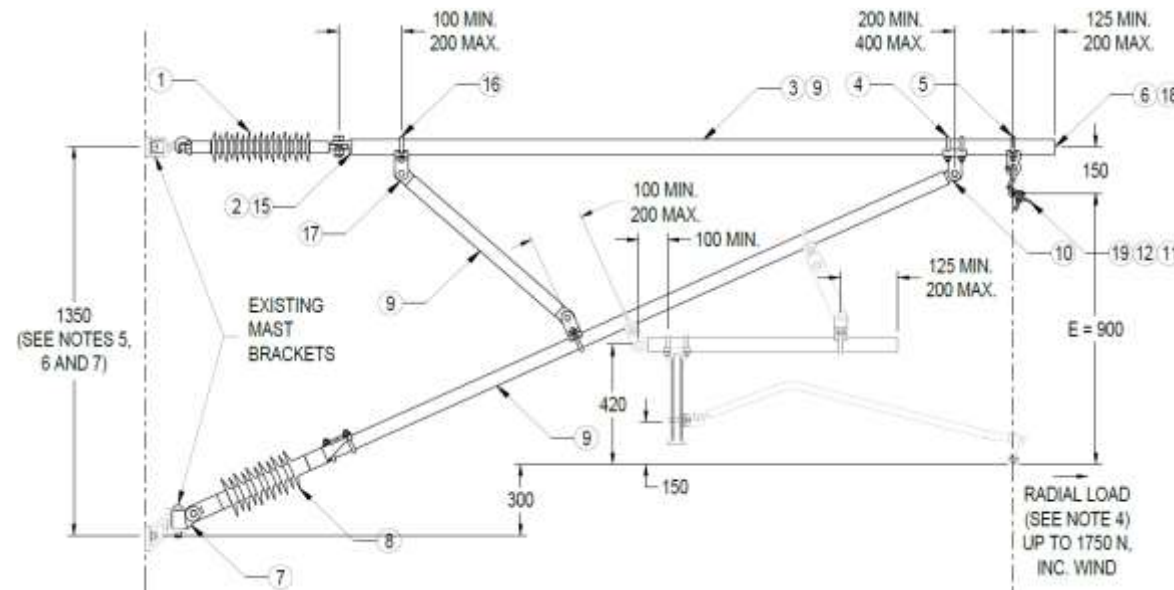
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In parallel with the dynamic simulations, all of the elements of the existing OLE were considered for suitability for reliable and resilient operation of two pantographs at 125mph along with the impact of the revised conductor tensions on structure capacity.

This exercise built on the initial feasibility study and developed the designs required for the route and the new 998 series system, technical parameter, component and allocation drawings were produced.

The allocation drawings, 998/500, include all of the dimensional information meaning that a separate set of GA drawings is not required.

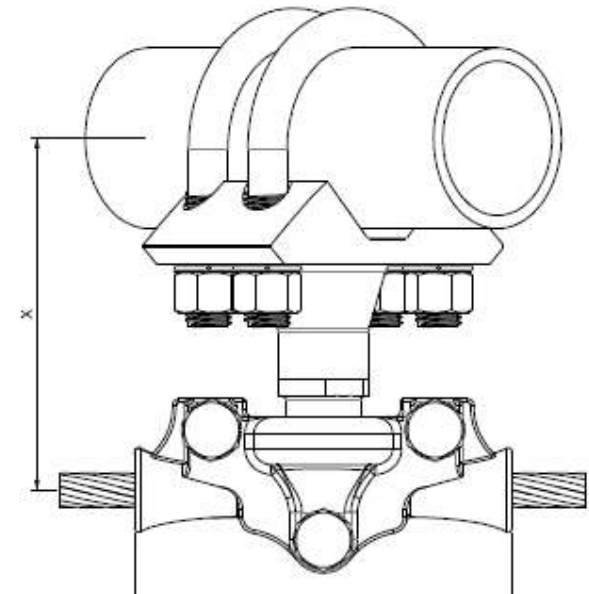
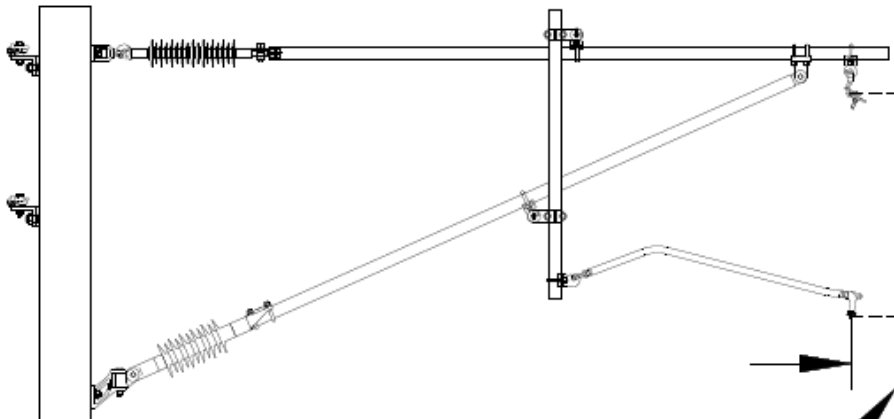


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The new drawings are mostly based on the OLEMI 199 series the following changes:–

- Crimped fittings in Ø48mm tubes now use the types which do not require sleeves
- Tube plugs have not been allocated in the lower end of inclined and vertical cantilever tubes and headspan and portal support and registration tubes to prevent water build up
- The new AUS clamp has been used for all tube to spanwire connections
- Forked collar sockets have been allocated for the contact wire terminations
- A short reach registration has been introduced
- Historic errors corrected

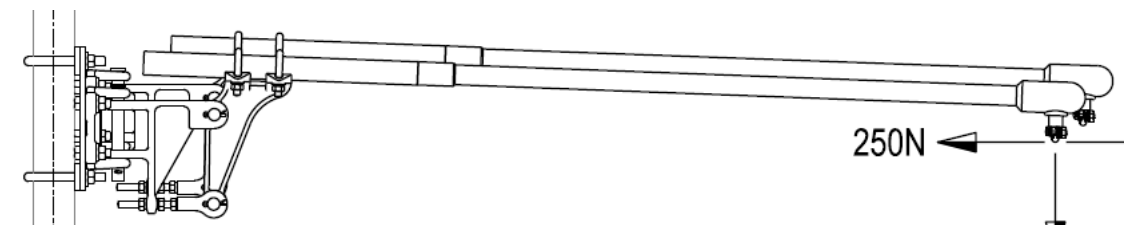
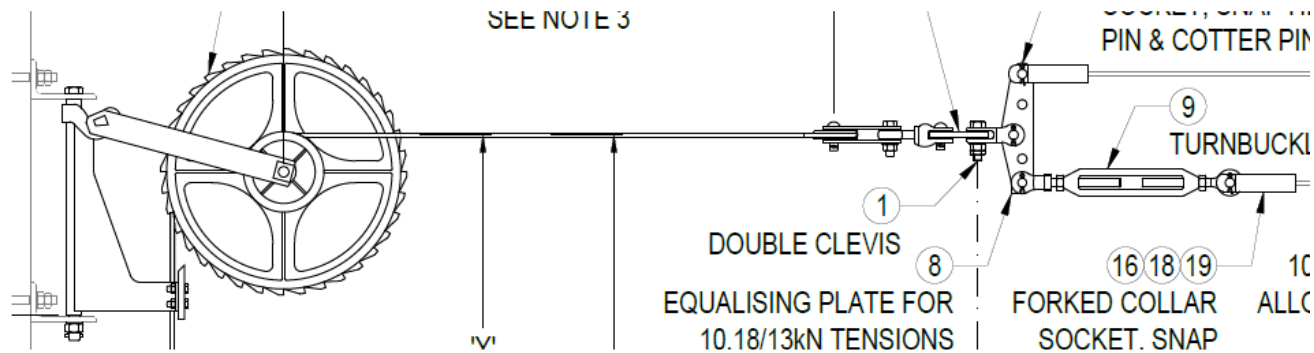
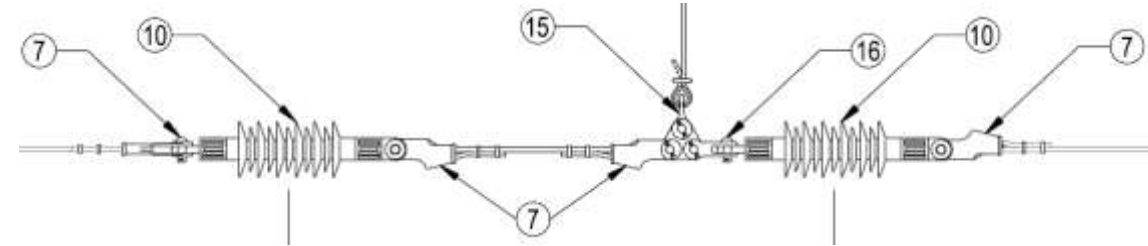


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The new drawings are mostly based on the OLEMI 199 series the following changes:-

- 19/2.1mm conductors are specified as Bzll
- Polymeric insulators are used throughout
- Anti fall tensioners are used
- Twin insulated head bridge arms with 10mm or 30mm encumbrance
- For headspans and spanwire portals the mast insulation has been moved in span and separation of 10 foot insulation increased



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Allocation Design

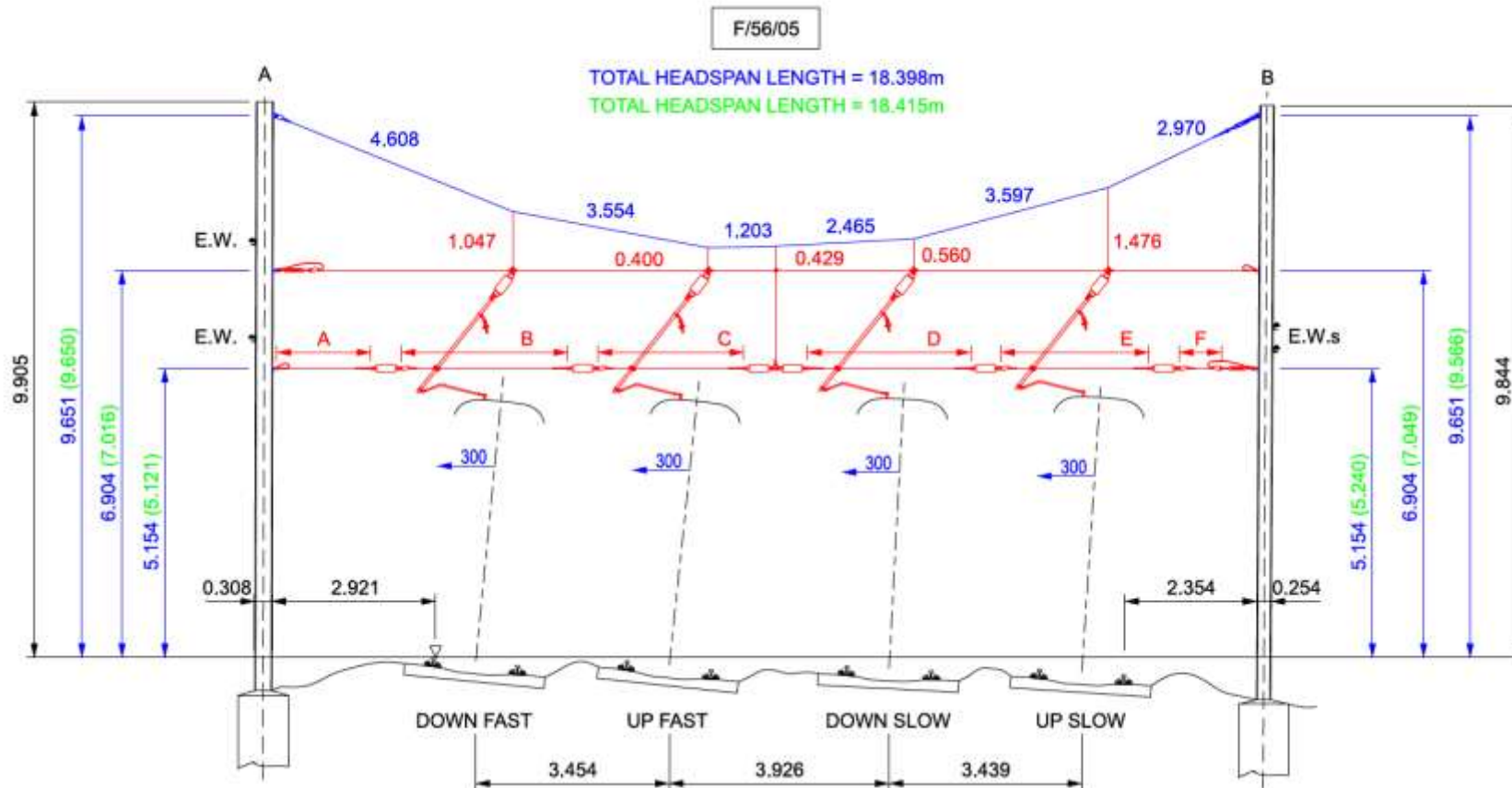
To achieve cost effective allocation design:–

- A generic Form B design report was produced for the project covering all generic items
- Individual Form B design reports were produced detailing any particular issues, removing duplication and simplifying acceptance
- Cross sections were only produced for headspans being replaced and for cantilevers and fitted bridges
- Adjustment schedules were used for other locations
- A single allocation schedule was produced for each design package
- Layout plans utilised the new 1:500 plans produced by the project

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Headspans

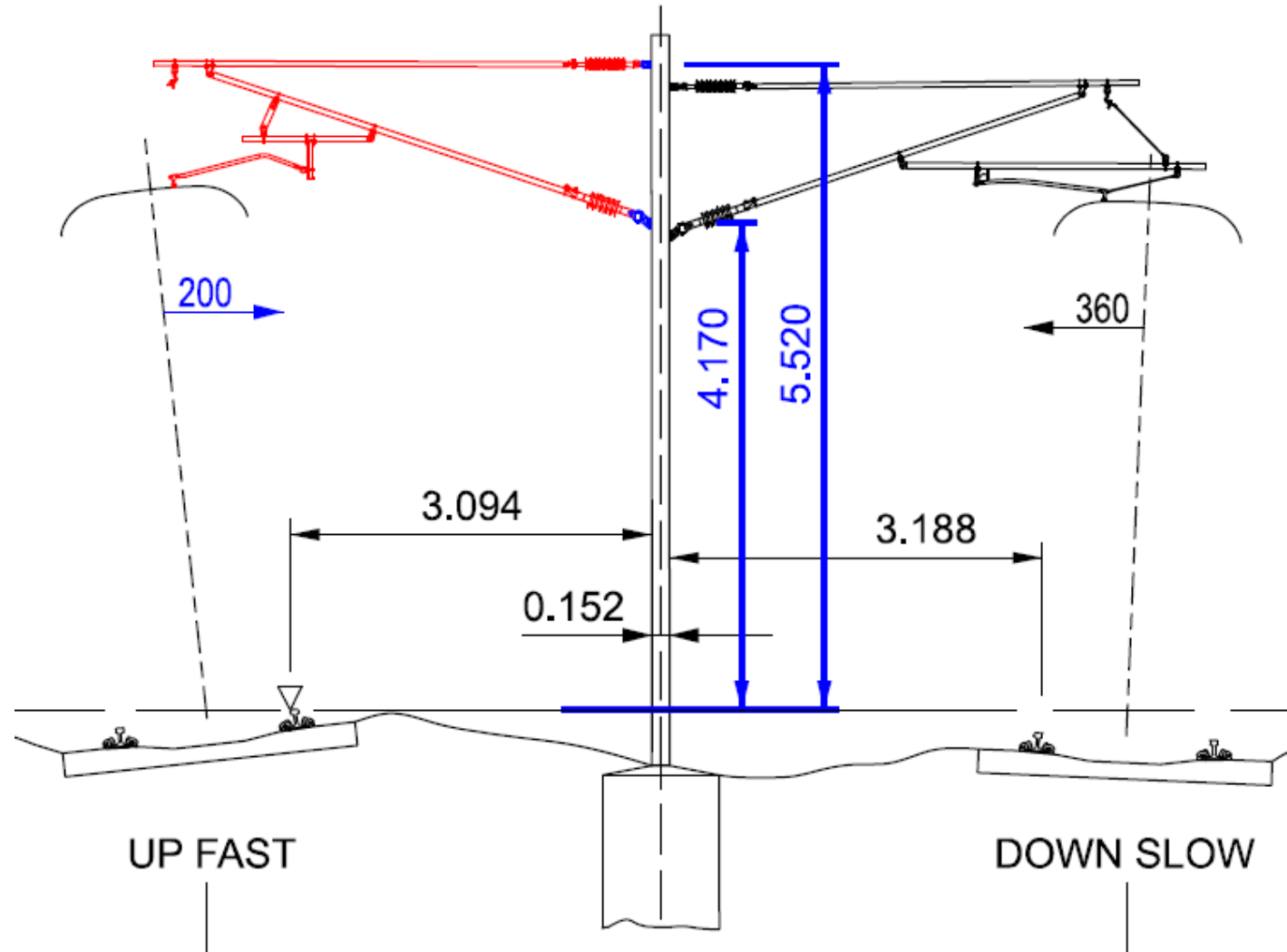
- Minor adjustments at circa 200 Headspans – detailed on adjustment schedules
- Circa 400 Headspans replaced where height adjustments of greater than 60mm required or due to poor condition



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Cantilevers

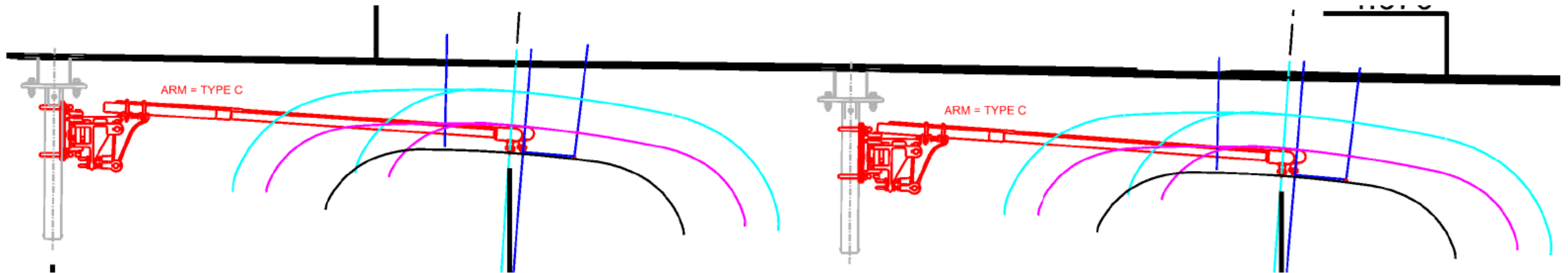
A total of 269 cantilevers replaced



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Fitted Bridges

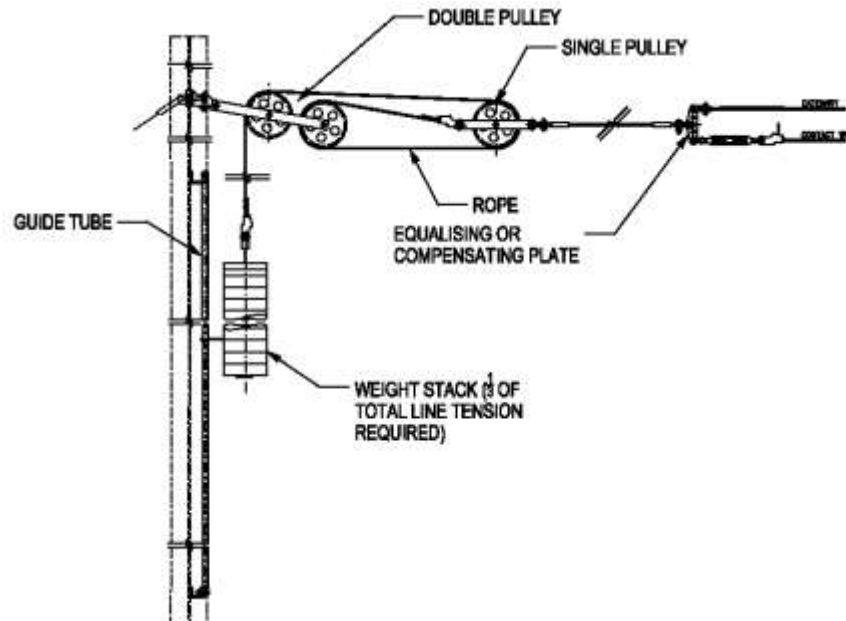
Replace existing twin contact wire bridge arm assemblies with twin arm assemblies providing independent support to the contact and contenary wires



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Upgrade of Tensioning Assembly

Upgrade existing 3-wheel pulley type BWA terminations to Siemens anti-fall type



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Summary

- MK3B-05-AT-S achieves compliant dynamic performance for:–
 - Class 810 bi-modes in single and twin 5 car formations at up to 125mph.
 - Class 360 EMUs in 4, 8 and 12 car formations at up to 110mph.
- OLE geometry compliant throughout
- All structures retained
- Resilience improved with use of anti-fall tensioners
- Catenary and contact wire tensions independent by using twin bridge arms
- Increased pantograph uplift

Future?

- The MK3B-05-AT-S design range is currently being expanded to include 19/2.1 Bz II catenary and 107mm² CuSn contact wire for the future rewiring of the Midland Main Line. This system will be suitable for use on WCML north of Weaver Junction, e.g. TriLink, and the ECML to provide compliant and reliable operation for multi-pantographs trains



Thank you for listening

Questions?