Series 1
The Great Western Railway Electrification Project

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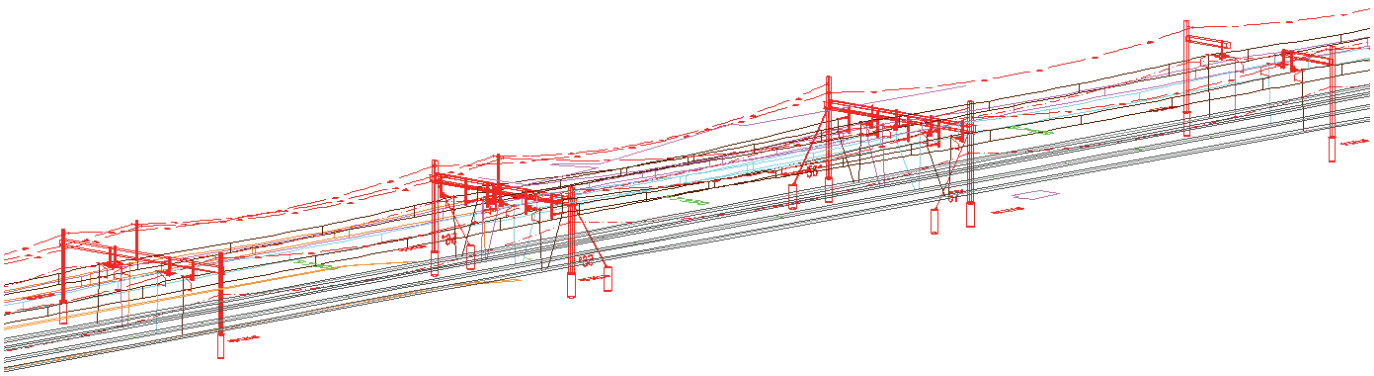
Overhead contact lines

What is Series 1?

Series 1 is the new overhead line equipment range for routes above 110 mph to be electrified. This is being implemented on Great Western Railway.

Network Rail's scope for the new system required the following:

- Compliance with applicable Technical Specifications for Interoperability (TSI) on a high speed TENS route
- A reduction in capital and whole life costs compared to other systems
- Creating a system that maximises safety by design
- Creating a system designed in conjunction with Network Rail's High Output Plant System (HOPS) in order to minimise installation times
- Increasing the design life compared to other systems
- Reducing the material supply chain complexity and achieving economy through standardisation
- Creating a system that maximises installation efficiency and minimises build quality issues
- Reduces maintenance requirements and the complexity of activities
- Create a system with improved electrical connections, for higher fault currents, as well as reliable mechanical connections



Why not use an existing system?

The inputs are getting more demanding – the operators want to run trains with more pantographs, it is no longer just one, now it is 2 or 3. They also want to run these at higher speeds.

The infrastructure remains the same – the tunnels are still too small, there are level crossings, there are even level crossings next to low bridges.

The standards are getting tougher – it needs to be more reliable, it needs to be easier to maintain, it needs to deal with everything the world can throw at it.

The possessions are getting shorter – everyone needs to be out there less, be it installing or maintaining. Also all track possessions are rare, so designs have to be installed and maintained with only a few lines in a possession.

It needs to be interoperable (TSI compliant) – It seems a crazy dream today, but our grandchildren might thank us one day.

The Railway is all about ensuring trains run; day and night, with minimal disruption resulting from installation, maintenance and repair, while at the same time ensuring maximum safety during those activities and for the travelling public. Looking at infrastructure restrictions, engineering and operational standards and the possession regime, existing OLE systems are no longer compatible.

Four key points that our remit from Network Rail requested

- No tail wires, anchoring over tracks
- Mechanically independent registration
- Constructability – High Output Plant System (HOPS) friendly
- Independently tensioned conductors

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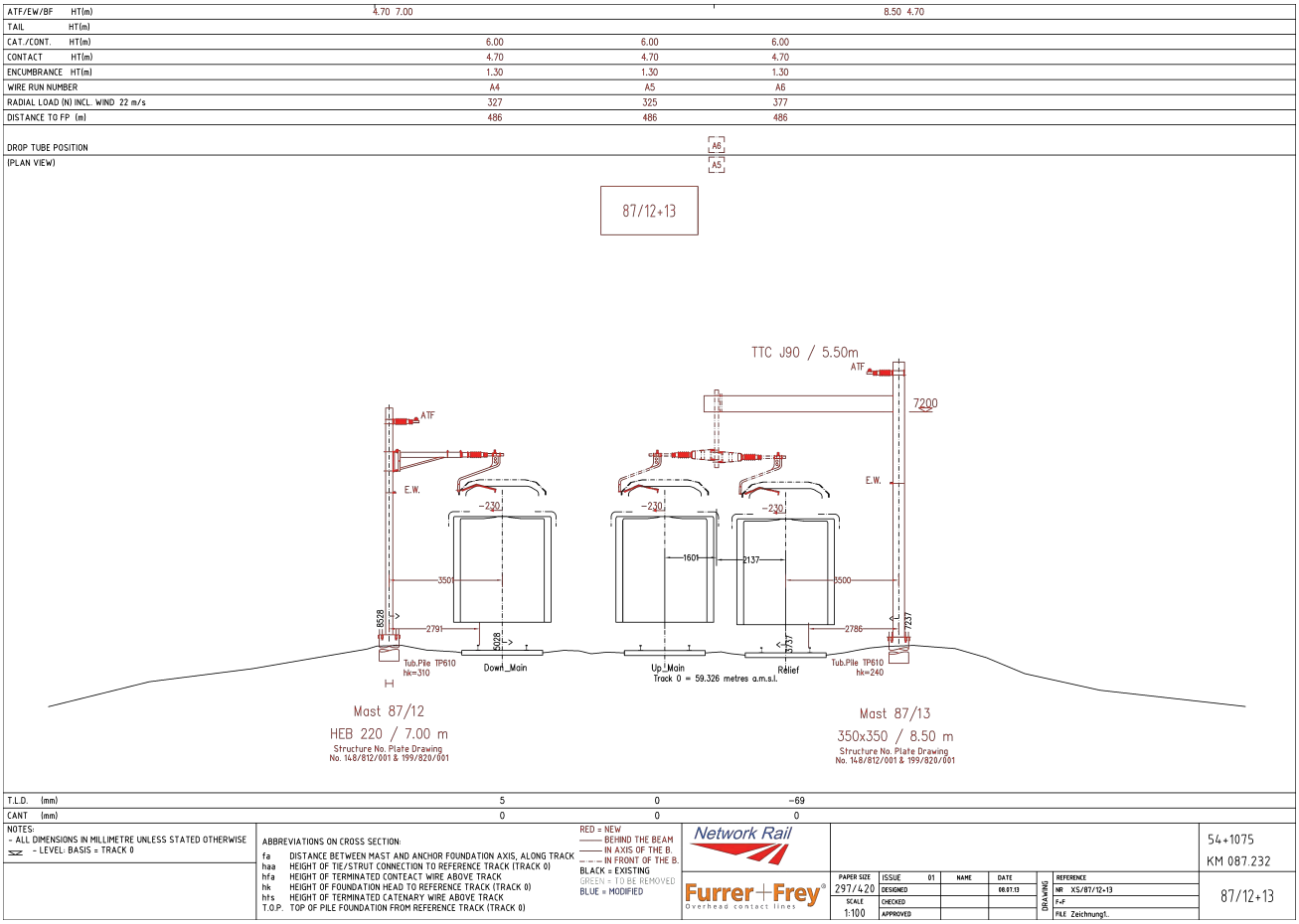
Two Track

This is what the typical two track assembly will look like, with its single insulator telescopic cantilever.

Where signal sighting issues preclude structures on one side of the track, Twin Track Cantilevers can be used.



Four Track

This is what the typical four track assembly will look like, with its back to back single insulator cantilevers on TTC's.

Single Insulator Cantilever design and benefits

Ease of installation - the SIC has been designed to be installed in the absolute minimum amount of time. For installation essentially the mast brackets can be pre-installed in the depot, and the SIC is pre-assembled and adjusted in the depot and then just mounted on two pins on site.

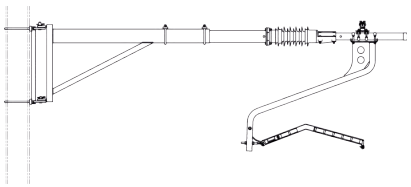
Safety by design - the electrical envelope of the SIC is substantially smaller than other cantilevers, also this moves the electrical envelope further away from the track.

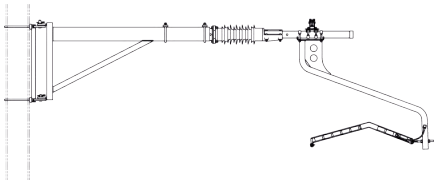
Ease of procurement - Network Rail can tender from multiple sources. Also there is a very small variety of SIC's, for an individual construction unit the SIC's would be identical and so churned out on a factory scale.

Fewer components - significantly fewer components than a traditional cantilever assembly. Meaning less for maintenance to store, replace and procure.

Ease of adjustment - change a whole system stagger from a single adjustment.

De-wirement scenarios - in a de-wirement scenario there is controlled dispersion of forces though the rotation of the SIC.





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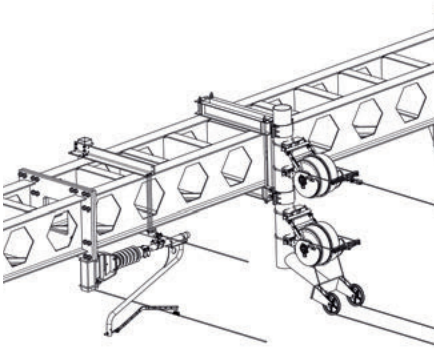
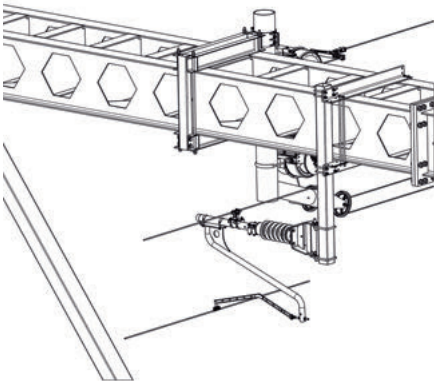
Monoboom Anchoring Arrangement

This is what the typical anchor arrangement looks like. It is made up of two Tensorex C+ spring tensioning devices, linked with a single unit of small part steel work.
Traditional anchoring on mast designs are also available within the Series 1 range.





Design and benefits

Quick installation - quicker to install and improved electrical clearances compared to twin boom anchor portal.

Less visual obstruction - than a twin boom anchor portal, which is good both for asthetic as well as for signal sighting reasons.

Easier installation - Tensorec C+ are lighter and much easier to install than standard Tensorex or balance weights. Subsequently a lower over all cost than with standard Tensorex or balance weight arrangement is achieved.

Tensioned above track - allows wire to be independently anchored above the track it serves without crossing or affecting other tracks. No damage incurred if the wire parts unlike balance weights which can fall to the ground.

No threading - eliminates the need to "flake" wires over the boom.

Entirely pre-assembled - the Tensorex C+ can entirely be pre-assembled off site and lifted in as one piece; this means cheaper, easier and safer installation.

Self-adjusting - in the wire direction angle. Easy visual inspection via scale and pointer on the casing of current "setup".

Overlaps

There are options for one and three span overlaps, the preference is for one span overlaps, its benefits are:

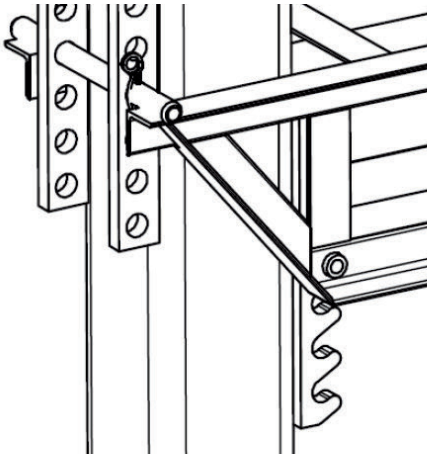
Proven - Series 1 one span overlaps have at least comparable dynamic performance to three span overlaps, even at higher speeds.

Cost efficient - one span overlaps are a more cost efficient design as it reduces the length of out-of-running conductors either side of an overlap.

Faster installation - one span overlaps utilising monoboom anchoring are faster to install than traditional designs.

TTC hooked connection

The hooked connection means very quick installation. In Network Rail's installation trials, the cantilever was installed in 2:40 min.



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Series I System Parameters		Standard
Max. Speed		140 mph
Contact Wire	Cross Sectional Area	120 mm^2
	Material	CuAg
	Tension	16.5 kN
Catenary	Cross Sectional Area	65 mm^2
	Material	BzII
	Tension	13 kN
General Arrangement	Max. Span Lengths	65 m
	Max. Wire Run Lengths	1500 m
	Short Circuit Fault Level	12 kA · 0.2 s^{-1}
	Ambient Temperature	-18°C – +40°C
	Max. Wire Temperature	+70°C (+56°C)
Auto-Transformer Feeder	Cross Sectional Area	263 mm^2
	Material	AAAC

The Future

After Great Western Series 1 will be incorporated into Network Rail's new UK Master Index for Overhead Line Equipment to be used on all future electrification projects in the UK.

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