



Class 315 on Bethnal Green bank on 5 February 2010. The two centre roads have been re-equipped with Furrer+Freymann equipment, the outer roads remain to be converted. Brian Morrison

# Olympian task: rewiring the GE

## New system will increase reliability for the Games

A £210million project to renew the overhead wiring on the Great Eastern main line out of London's Liverpool Street station is now well advanced. The project is seeing renewal of all the contact and catenary wire, cantilevers and small part steelwork. Overhead stanchions are being renewed as required – around 95% can be reused.

This is the first wholesale renewal of the equipment since the overhead wiring was installed over 60 years ago. The intention is to move the overhead away from a patch and mend regime to a performance improvement programme. This is in order to:

- meet the 2012 Olympics challenge;
- handle additional passengers at Stratford;
- remove the requirement for heat-related temporary speed restrictions in summer, caused by the current system design;
- cope with high usage of the line;
- have a lighter loading on structures, to reduce structural repairs;
- make maintenance and repair simpler and more cost-effective;

### ■ facilitate the seven-day railway.

The GE electrification was installed and modified over several decades. 'The wires have been up there so long and have been spliced into many times – so you have old and new bits of wire adjacent to one another and points of weakness where they join' says Patrick Hallgate, Network Rail's Programme Director – Signalling & Electrification.

For the project, the Great Eastern system has been divided in two, with Phase 1 covering the main line from Liverpool Street to Chelmsford and Phase 2 the branch from Shenfield to Southend Victoria. Phase 1 includes about a mile of the West Anglia route, extending about one mile 'round the corner' to Cambridge Heath. This section includes one of the sharpest electrified curves in the country, with stanchions every 10 or 15m. Phase 1 is due to be finished in 2014, with the key inner sections around Stratford to be done before the Olympics, while Phase 2 will follow from 2017 onwards, in the next Network Rail control period.

The line north of Chelmsford was electrified later than the section close to London and is not included in the current project.

### Swiss design

'A key objective of the GE renewal is to install a system that delivers a step change in performance' says Samantha Wadsworth, Network Rail's Programme Manager on the GE project. 'The system we have chosen from Furrer+Freymann of Switzerland provides this, offering significant innovation in UK terms.'

The Furrer+Freymann design is based on a proven system used in Switzerland and elsewhere in Europe. Network Rail says it offers a step-change improvement compared to current UK system design, due to the low number of components and simple assemblies that it uses. 'It is simpler and quicker to install, with minimum maintenance, is easily adjustable and offers higher reliability than historic systems' says Ms Wadsworth. One important advantage is an auto-tensioning system that allows the tension of the wire to adjust automatically to changes in temperature: this should help prevent dewirements and train delays during hot spells in the summer.

The low maintenance requirement is part of Network Rail's strategy for migrating to a seven-day railway.

### Possessions

The new equipment is being installed in a series of four-track possessions. There are a number of reasons why all four tracks are required:

- new stanchions require all four tracks;
- staff are not allowed to work within nine feet of a live wire, so all four tracks are required to work on the middle lines;
- four lines are required for any work requiring crossovers at junctions;
- the old GE 'Y' frames are within the roadway, therefore the nine foot rule would be broken

## Piecemeal electrification

**1930s:** London & North Eastern Railway commenced electrification of the Liverpool Street – Shenfield line, aiming to replace the intensive 'jazz' steam operation with clean electric trains; work interrupted by World War 2

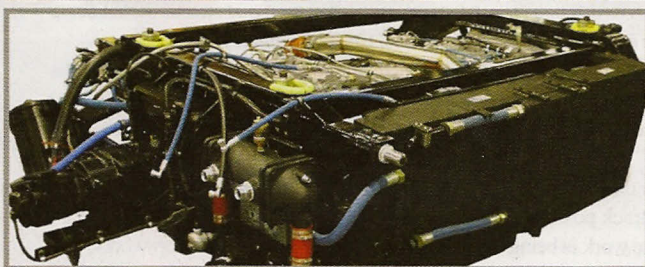
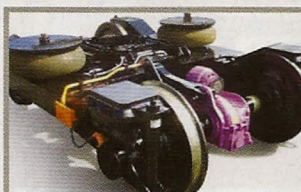
**1949:** electrification to Shenfield on the 1.5kV DC overhead system completed

**1956:** wiring extended to Chelmsford and Southend Victoria

**1962:** route converted to 25kV AC, with the exception of the Southend branch, where restricted clearances under bridges dictated voltage at 6.25kV AC

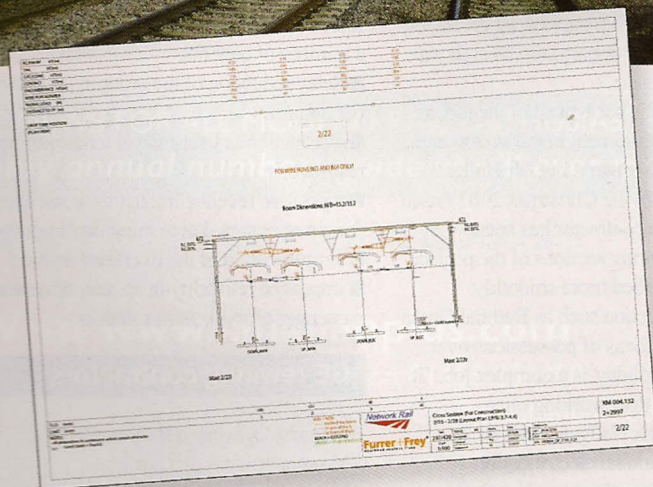
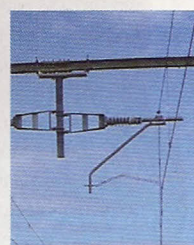
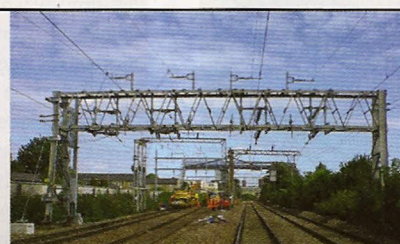
**1980s:** technology advances allowed the section with restricted clearances to be upgraded to 25kV AC





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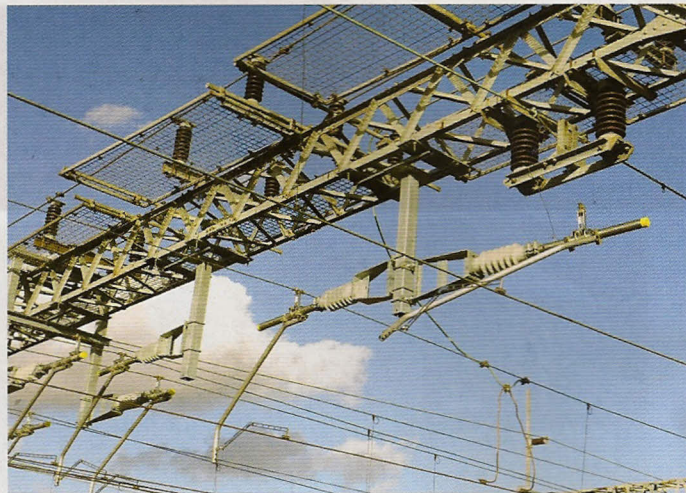
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It has mostly been possible to reuse existing overhead structures, but some new stanchions have been required. Locating suitable foundations in the hemmed-in urban area, such as here at Bethnal Green, can be tricky: on the left is the upright of a new stanchion that is founded below the viaduct, in an area containing artefacts from the old Liverpool Street station. Brian Morrison



Lightweight Furrer+Frei components suspended from pre-existing overhead structure. Brian Morrison

when dismantling existing equipment without a four-track possession.

The work is being done in a mixture of possessions over midweek nights, 27-hour weekends and occasional longer 54-hour holiday weekends.

A midweek night offers a possession of approximately five hours, during which time prep work is undertaken, including laying of the structure legs and replacing the existing registration equipment.

A 27-hour weekend might be used for:

- foundation installation;

- structure legs installation;
- structure portal boom installation;
- prep works;
- rewiring, excluding any structure or registration installation.

Installation of the longest wire runs and work to junctions are jobs reserved for 54-hour weekends.

#### Working out from London

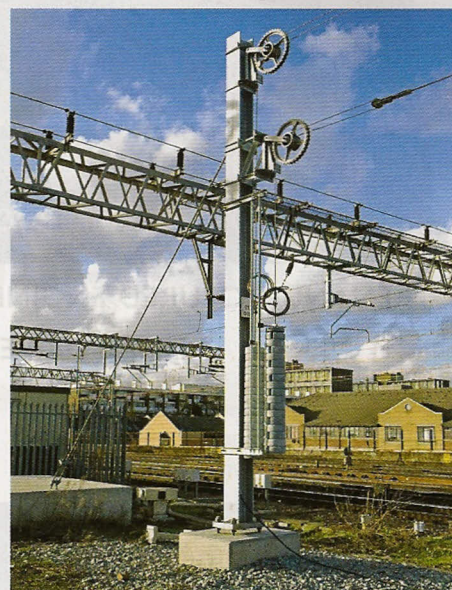
'We are doing the difficult bits first, prior to the Olympics' reports Mr Hallgate, with the aim of avoiding temporary speed restrictions during the key fortnight in August 2012.

One of the most difficult bits of all, the complex layout in Liverpool Street station itself, was tackled first, in a blockade that went disastrously wrong over Christmas 2007 – the possession over-run (coupled with similar incidents at Rugby and Glasgow) saw NR attract the scorn of the media.

Mr Hallgate accepts that it might have been prudent for the engineering teams to have eased their way into the job on a less high-profile section, but the company had little choice but to start at Liverpool Street. The Christmas 2007 closure was part of a wider programme of work needed to keep to the Olympic timetable. Transport for London was using the blockade so that an old bridge over the Great Eastern main line could be replaced, which was required in order to keep the upgrading of the East London line on track for the Games. 'You only get the opportunity for a total blockade like that once every decade or so, so we had to take the opportunity when it was offered' says Mr Hallgate.

Liverpool Street was not typical of the job, as there is much fixed equipment in the station area. Planning went seriously awry, but Mr Hallgate insists the lessons from the Christmas 2007 fiasco have been learnt. The contractor has been changed for the following sections of the project and these have proceeded more smoothly.

Rewiring a busy section such as Bethnal Green bank, which was the focus of possessions over the Christmas 2009 holiday, is a complex job. 'It is a lot more difficult than working on a greenfield site' says Mr Hallgate, who is responsible for the national electrification programme and is currently preparing for the wiring of the Great Western main line and the



The new system auto-tensions, preventing the wires from sagging in summer heat. Brian Morrison

lines in the North West recently sanctioned for electrification by the Government. 'On the GE, some wiring runs are fixed on one side of a stanchion and slack on the other, whereas on a greenfield site you would put all the wiring up and then tension it all together.'

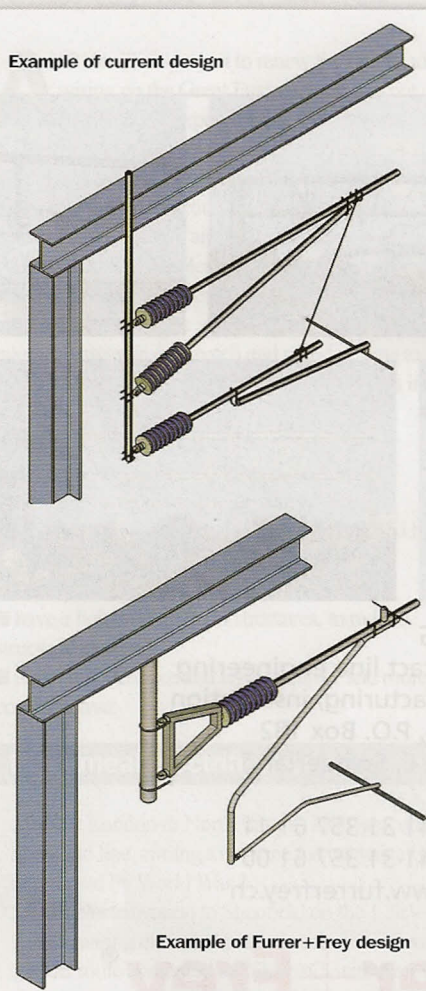
#### Benefits

Network Rail says the Great Eastern re-electrification programme will deliver a number of benefits:

- delay reduction of the order of 35,000 minutes per annum;
- a reduction in heat-related temporary speed restrictions;
- a positive revenue impact for passenger and freight operators due to reliability improvements;
- simplification of the overhead layout;
- improved reliability in an area of continued passenger growth. James Abbott

#### GE rewiring contractors

Preparatory works Balfour Beatty  
Main contractor Carillion  
Equipment supply Furrer+Frei AG



The Furrer+Frei design saves weight compared to existing structures.