

WIRING THE GO

PHILIP SHERRATT reports on the ongoing work to electrify an important link in north east London

The Gospel Oak to Barking line (GOBLIN) is a key London artery. But it has hitherto been something of a diesel island in the capital.

The line's passenger service has been transformed under the auspices of London Overground, such that the two-car DMUs on the route suffer from major overcrowding. But it is also an important route for cross-London freight traffic, and the inability to run electric freight on the route creates considerable operational headaches.

With the rediscovery of electrification over the past decade, the route seemed an obvious candidate for wiring. Several times the scheme has been sidelined due to concerns that the cost was too high, but in June 2013 the Government finally gave its backing, with Transport for London also making a financial contribution.

BLOCKADE

£133 million to electrify around 12 miles of double-track railway sounds on the face of it to be a high price to pay (the section between Barking and Woodgrange Park and the connection to the Great Eastern main line at Forest Gate is already wired, although the single line into the bay platform used by GOBLIN trains at Barking isn't). But the numbers highlight the inherent difficulties of wiring a railway which threads its way through densely populated areas of East London. The team delivering the scheme sees it not so much as an electrification project as a civil engineering one, given the need to lower track at four locations, rebuild four bridges and make alterations to a further six in order to create space for the overhead wires.

It is for these reasons that a blockade of the GOBLIN began on 4 June. The initial closure covers the stretch between Barking and South Tottenham (with the whole line shut at weekends), and from 24 September until early February next year the whole line will be closed throughout the week. After reopening, evening and weekend closures will allow for testing and commissioning of overhead line infrastructure, in time for the infrastructure ready date of June 2017. Under current plans, the new Bombardier-built Class 710 EMUs ordered by Transport for London for the GOBLIN and other London Overground lines will be delivered in 2018.

The original plan for the GOBLIN was to carry out works at weekends over a two-year



Plethora of bridges: loco No 66007 approaches Walthamstow Queens Road station on 24 May 2016 with working 6L26, the 14.45 Acton Yard – Dagenham Dock. It has just passed under five bridges and a pipe bridge, highlighting the challenges facing engineers on the project; the rail line in the foreground is London Overground's Chingford branch. Antony Guppy

GOBLIN

period, avoiding the need for a full blockade. However, the complexities of track lowering made this a challenge, and while the blockade is disruptive there is a good choice of alternative travel options for passengers.

TRACK LOWERING

Early plans for electrification envisaged 10 track lowering sites along the route, but value engineering has seen this reduced to four main sites. The first, a 200-metre section between Upper Holloway and Crouch Hill, was completed during a series of weekend closures in April and May, before the main blockade began. A 320-metre section which includes Crouch Hill tunnel (between Crouch Hill and Haringey Green Lanes) and a 160-metre stretch between Gospel Oak and Upper Holloway will be dealt with when the whole line blockade begins in September. There is also a 150-metre section of



Track lowering: in this view of 20 July the up line beneath Albert Road bridge (just south of Walthamstow Queens Road station) has been dug out and awaits the pouring of ballast. The tracks here are being lowered by 500mm. Philip Sherratt

track lowering on the Haringey curve, connecting the GOBLIN to the East Coast main line.

But the most challenging section, and the one which drives the requirement for engineering



Slab track installation: work in progress on the up line near Blackhorse Road on 18 July. Antony Guppy

access, is a 1,750-metre stretch between Blackhorse Road station and Yunus Khan Close (a short distance south of Walthamstow Queens Road station). In just over a mile there are 17 over line structures, with track lowering required by as much as 500mm at some locations.

It is for these reasons that the blockade is staggered; the full eight-month closure was needed for the complex works on this stretch, while the sections beyond South Tottenham should be more straightforward and can be completed during the shorter closure.

SLAB TRACK

One of the major challenges is the presence of underground obstructions, which mean that there is often limited space below the track. For example, at the Pretoria Avenue overbridge just east of Blackhorse Road station, a sewer runs 200mm below the existing rail level. With the track being lowered by 160mm to give the necessary clearances for the overhead wires, the tight gap underneath has necessitated the use of slab rather than ballasted track to ensure full fixity.

The initial plan was that the full 1,750-metre section from Blackhorse Road to Queens Road would utilise slab track, but again value engineering has been applied. Instead, two



Before the blockade: unit No 172007 arrives at Walthamstow Queens Road station with the 16.05 Gospel Oak – Barking service on 20 April 2016. Antony Guppy



250-metre sections at either end of the site which need the full fixity will utilise the slab track solution, with the remainder being standard ballasted track. Slab track has its benefits – it typically has a longer life (about 60 years), it is quicker and easier to install and the process is less labour-intensive, while off-site manufacture of the slabs ensures consistent quality. But the fly in the ointment is the initial financial outlay, which is around four and a half times that for ballasted track, hence the decision to apply value engineering.

The chosen slab track solution is Rhombberg's core slab, which is the same type used on the renewal in Glasgow Queen Street tunnel, which was completed in early August. Precast slabs, each weighing around five tonnes, are laid on top of lean mix concrete and lifted into place. The track is then levelled, curves and transition sections (where the line switches from slab track to ballast) are added before the sections are grouted in and the rails fed in and clipped up.

Slab track will also be installed in Crouch Hill tunnel once the second part of the blockade

begins. The tight bore of the tunnel limits the ability to lower the track, meaning fixity was also required here. The overhead wires in the tunnel will be hung from bridge arms – the conductor rail solution being used in the Severn Tunnel (p70, last month) will not be needed.

PLATFORMS

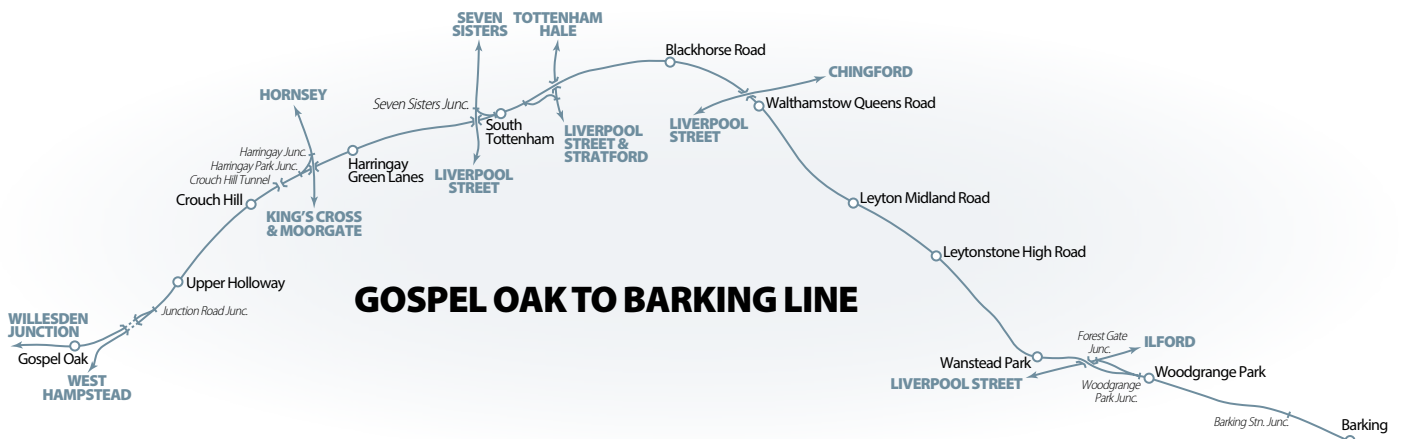
At the centre of the most challenging section is Walthamstow Queens Road station, which is surrounded by a plethora of bridges. This means the platforms here have to be lowered to match the new track level, while bridge foundations are being underpinned and new telecoms, lighting and CCTV are being installed. The platforms are also being lengthened to accommodate the four-car Class 710 EMUs which will replace the two-car Class 172 DMUs.

All 12 stations on the route require some work to platforms to enable the longer trains to operate. The work at Walthamstow Queens Road is being carried out by Network Rail in conjunction with the track lowering, with Transport for London taking responsibility for

lengthening at Harringay Green Lanes, South Tottenham and Gospel Oak stations. At the other eight stations the work is mostly reinstating disused sections of platform (some stations originally accommodated trains as long as 12 carriages, but operational lengths have since been shortened), and again TfL is completing this work.

PLANNING

In densely populated east London, access to work sites is clearly difficult, so materials are being brought in by engineering trains, avoiding the need to run lorries down narrow local roads. This means that one of the two tracks must always be in place to host these trains, so work has begun on lowering the up (northbound) track first of all with the down line left in situ; for pathing reasons the engineering trains mostly arrive and depart at night. Work is taking place 24 hours a day to condense operations, although noisy activities at unsociable hours are avoided where possible. Once lowering is completed on the up track and rails are in place, attention will turn to the down line.



Planning these activities is a complex process and has been assisted by the use of four-dimensional modelling. This is similar to the more widely used building information modelling (BIM) but adds in an extra dimension – time. The 4D software, supplied by Freeform, enables the impact of a delay or acceleration to any part of the programme to be easily seen. One of the most useful aspects of this is planning the scheduling of engineering trains, ensuring they are not causing an obstruction while the works take place, and having a blockade means rescheduling these is much easier. Four-dimensional modelling was utilised by London Underground in its renewal of the crossover outside Walthamstow Central station on the Victoria Line last summer, but it is a relatively new technique for heavy rail in the UK.

SIGNALLING

Amongst the other works required as part of the electrification has been signalling immunisation, with over six miles of new concrete troughing to lay. From a signalling perspective, the works have been relatively minor, with only two signals to be moved and one new banner repeater to install. To avoid signal sighting issues, the masts for the overhead electrification have been placed 2.5 metres from the running edge of the railway rather than the standard 1.6 metres. The overhead electrification equipment is of the Series 2 design, the same as that used on the Northern Hub project between Liverpool and Manchester.

Collaboration between the contractors involved is a key part of ensuring timely and efficient delivery of the works. It is for this reason that CPMS has been engaged to provide project management services, helping to co-ordinate activities. Network Rail has overall charge of the project, working with a range of subcontractors led by J. Murphy & Sons.

THE FUTURE

By 2018 services on the GOBLIN will be vastly improved with new longer electric

trains providing more capacity, bringing a further step change to a line which was once something of a 'Cinderella' route.

Looking further ahead, there are proposals to resignal the GOBLIN during Control Period 6 (2019-24), and the current scheme makes passive provision for this. A reduction in headways could allow a more frequent service to operate, with the potential for a simultaneous increase in linespeed.

And the GOBLIN looks set to grow in length as well, with TfL promoting a 4.5km extension from Barking to Barking Riverside, where up to 10,800 new homes could be built. Services would share tracks with c2c's Tilbury line for around 2km before diverging onto a new spur and heading south towards the development; GOBLIN trains would be diverted away from their current terminal platform at Barking station to those used by c2c services. Current plans envisage that the new-build section of this extension would utilise slab track throughout, and the installations taking place at Walthamstow present an exemplar of this method.

In March TfL submitted a Transport and Works Act Order application for the £263 million scheme, and in early August it placed a notice with the Official Journal of the European Union (OJEU) seeking expressions of interest to construct the extension. A formal invitation to tender is expected to be issued in 2017 following the completion of design work. If permission is granted, construction could begin in late 2017, with train services starting in 2021. 

MAIN GOBLIN CONTRACTORS

Network Rail	Delivery organisation
J. Murphy & Sons	Main contractor – track, civils, signalling, telecoms and bridges
AmeyInabensa	Overhead line equipment design and traction power
Aspins	Piling
Stobart Rail	Track renewal and slab track
CPMS	Project management



Work in progress: the station site at Walthamstow Queens Road on 20 July, where platforms are being lowered and lengthened. Philip Sherratt

Blockade: track lowering works on the up line between Blackhorse Road and Walthamstow Queens Road on 20 July. The barriers in the foreground mark the point where there will be a switch from slab track (nearer the camera) to ballasted. Philip Sherratt

