Now for the Northern – Another Underground upgrade gets into its stride

By Piers Connor

With the automation of London Underground's Jubilee line finally in the bag and the Victoria line's new signalling due for completion early in 2012, now it's the Northern line's turn for conversion to automatic train control (ATC). Having in mind the traumatic times for Transport for London's (TfL) contractor Tube Lines during their installation of the Jubilee line ATC system, I went to find out from the Chief Executive Officer of Tube Lines, Jon Lamonte, how work is progressing on the Northern line's automation since work started in 2008 and what's been learned from the troubled Jubilee line conversion.

Northern Line Facts

Part of the City branch was the first proper deep level tube line opened in 1890 between King William Street (near Bank) and Stockwell.

The longest tunnel on the Underground, at 17¼ miles, is on the Northern line between Morden and East Finchley.

The Northern line has the deepest tunnel at 221 feet below Holly Bush Hill near Hampstead.

The line has 106 trains of 1995 Tube Stock. At present, 91 are used for the peak service. After the upgrade, this is planned to rise to 96. They were modified for CBTC at Edgware between February 2009 and January 2011. Each train had to have over 2000 new wiring links.

Newcomer

Jon Lamonte is a newcomer to the railway industry. An RAF sponsored graduate who rose to the rank of Air Vice Marshall, he was brought in to manage Tube Lines in March 2011, some nine months after TfL purchased the organisation.

Mr Lamonte was previously Director General, Finance for the £17billion annual budget for Defence Equipment & Support. During his time with the RAF, he commanded at Station and Squadron levels, including the largest UK airbase at Brize Norton; he's also a Chartered Mathematician, a Chartered Director and Fellow of the Institute of Directors. He's upbeat about his move into the railway sector, having "a passion in public service and in getting things right and I like working with people". He admits to finding "a mystique around the railway system and a weird set of acronyms but the sorts of control systems I saw in the RAF are not dissimilar to what you see on the railway". His focus is now on getting the Northern line upgrade completed on time with the minimum of disruption.

The Upgrade

The Northern line desperately needs its upgrade. It's the busiest line in terms of passenger numbers with over 750,000 journeys a day and a peak hour service of 91 trains spread over 36 miles of route that covers two central London branches, three suburban branches and a total of 50 stations. The overcrowding levels on the Bank branch are regularly the worst on the system and the complex junction arrangements at Kennington and Camden Town that provide the links to all routes make increasing the service levels very difficult without significant civil engineering works. So, as Mr Lamonte said, "One of the major benefits of the upgrade will be a 20% increase over the existing train service on both routes. There will also be an 18% reduction in end to end journey times".

The major part of the work consists of the replacement of the existing fixed block signalling by the Thales SelTrac S40 Communications Based Train Control (CBTC) system. This is the same system finally completed on the Jubilee line in July 2011 after years of delay and annoyingly regular weekend closures.

Closures

The issue of closures has given rise to a lot of criticism for Underground over the last few years. Widespread weekend closures plague the system. Travelling anywhere in London at weekends has become a traumatic experience for millions of visitors who aren't familiar with the city or its Underground system. Even regular travellers get confused and frustrated. Trains on the bits

that are open are overcrowded and stations are clogged with tourists and locals wandering around trying to decipher which parts of the network are still available to them and how they are to reorganise their journey. More long closures are inevitable, including large chunks of the system during the week between Christmas and New Year's Eve.

There has been a concerted effort to reduce closures for future upgrades but the Northern Line will still have eight complete weekend line closures up to the upgrade completion in 2014. Five will be in 2013 and three in 2014. As Mr Lamonte points out, "This is still a big improvement on the 65 closures needed for the Jubilee Line". There will be another eight weekend closures for sections of the line over the same period, plus the now obligatory Christmas and Easter closures lasting up to five days each. As if this wasn't enough, there are to be some closures of the Charing Cross branch to allow for Crossrail works at Tottenham Court Road and nineteen additional track renewal closures. Resignalling work will go on in parallel with the track renewal closures. Tube Lines will also get more possession time on Sunday mornings, when services will start later on some routes.

Price

The reduction in closures has come at a not insubstantial price. A project plan issued back in 2006 showed the Northern Line completion date as January 2012. There's no hope of that now and it's gone back to December 2014. Comparing the original plans with what's happened so far, shows that 18 months of the 3-year slippage can be laid at the door of the Jubilee line upgrade and most of the rest at the changes to the closure programme. With 35% of the programme complete, the Northern line target date looks achievable. Mr Lamonte was optimistic enough about progress and the lessons learned from the Jubilee line to suggest that commissioning might be completed as early as March 2014. Now that would be a first. Can anyone remember a resignalling project that finished early? I thought not.

Amongst all this programming lurks, dare I say, the dead hand of the Olympics. The pressure on the Underground to provide a reliable service for the duration of the event is now such that there is a blanket suspension of all non-essential upgrade work from 17 July 2012 until the conclusion of the Paralympics on 14 September 2012. Overnight maintenance work will continue as usual but there will not be any planned station or line closures for the duration in Greater London.

Lessons Learned

The Jubilee line upgrade provided some serious object lessons for anyone considering a high capacity railway system upgrade. As Mr Lamonte explained, "It took too long to come in and the project wasn't transparent to London Underground as the users. There was an adversarial atmosphere, both with LU and the contractors and there was a raft of issues around the systems and bringing them in."

Being able to get rid of the restrictions of the Public Private Partnership (PPP) arrangements when TfL purchased Tube Lines in June 2010 removed a lot of barriers. "It made such a difference to the relationships," says Mr Lamonte. "There is a collaborative approach now and people talk to each other all the time."

Technically, the Jubilee line upgrade was an on-going nightmare. The SelTrac S40 system as designed and validated wasn't geared up for some of LU's unique requirements, particularly the "route secure" system used to keep trains moving through routes under failure conditions. Meanwhile, the software was being designed in Canada, so the designers were largely remote from the sharp end of installation, testing and commissioning in London. On top of all this, most of Thales previous installation work had been on new routes, where keeping an existing service running wasn't an issue.

During testing, an interesting problem was found with the rolling stock. All trains had been modified for CBTC before the new signalling was commissioned but, when trains began to use the new system during testing weekends, many of them didn't respond properly. There were

bugs in the software and some latent faults. This extended the testing time and operators didn't get the experience they needed for full service operation. As Mr Lamonte pointed out to me, "Operator experience is crucial, both on the trains and in the control centre."

Wear Up

Another lesson being learned from the Jubilee line now is that the new control system is affecting wear rates on the rolling stock. This is partly due to the higher speeds now possible but the typical motor-brake-motor-brake pattern activated by the ATC system as the train bumps along against the line speed limit must lie behind some of it. The regenerative braking system has also had to have control modifications because of excessive heating and, travelling on the line, I wondered about a curious forward and aft oscillation during braking I felt on the trains. Doubtless other oddities will come to light as experience with the system grows.

Tube Lines is tackling the more obvious problems with software modifications and increased maintenance attention and, Mr Lamonte told me, "We're bringing forward an overhaul programme for the stock so we don't impact on performance during the Olympics".

Phases

Like the Jubilee line, the Northern line will see a phased introduction of its new train control system. The line is divided into five areas, each covered by a Vehicle Control Centre (VCC). The plan is that the upgrade will start with a "training section" between Highgate and High Barnet, which will be used at weekends to train drivers in how to drive under the protection the new system. They'll need this to develop new driving techniques using the cab displays instead of observing lineside signals.

Full conversion will then work north from Morden in stages, with the first section covering the line to Clapham North. At the same time, the first part of the new Highgate control centre will be commissioned for this area only, with the old Cobourg Street based control desk for the old signalling being de-commissioned. During the upgrade, the Highgate controllers will see the unconverted bits of the line using TrackerNet, LU's real time train location monitoring system. VCC areas will progressively switch over until the final one is transferred in December 2014.

Once the whole line is being driven in "protected manual" mode under the new control system, it is the intention that conversion to automatic operation will be done on the whole line over a single weekend.

Battersea Extension

Another project for the Northern line is the £350million, 3km extension from Kennington to Battersea via a station at Nine Elms. The line would be connected to the reversing loop south of Kennington station so all the Battersea trains would come from Charing Cross. Of course, the terminus at Battersea would have to be capable of eventually reversing a 30 tph service, something the Underground planning people will have insisted on – one hopes.

This is a privately funded proposal. The developer is Dublin based, Real Estate Opportunities (REO), a subsidiary of Treasury Holdings. REO paid £400million for the Battersea power station site back in 2006 at the height of the property boom and they have plans approved for a 900,000 square-metre mixed use development involving the building of thousands of homes, plus retail premises and office space.

Lots of figures have been bandied about but a figure of £5.5billion seems to be the most recent price tag for the whole project. Of course, the scheme will require Parliamentary approval with a Transport & Works Order. Tube Lines' Mr Lamonte expects a draft to be ready in the spring of 2012, providing finance is in place. Not surprisingly, with the ongoing recession in the property market, REO are struggling to find backers and, until they do, there is unlikely to be any progress on the tube extension.

Separation

One feature of the Northern line is its diverse service pattern, unique on the Underground. Trains can start from Morden in the south and go to Edgware, High Barnet or Mill Hill East via either Charing Cross or the Bank. While this pattern is beloved of the passengers, it represents a big problem for the operators. If anything goes wrong, the service quickly falls apart over the whole line. Even when it's running smoothly, having to work the various services through the junctions at Kennington and Camden Town at either end of the two central area branches limits the throughput of trains to 20 per hour on each branch. Once the new signalling is installed, this is expected to get up to 24 but, in its present form, it could never reach the 30 trains possible on other upgraded routes.

The ideal solution is seen in splitting the line into two parts, one covering Kennington and Edgware via Charing Cross, the other Morden to High Barnet and Mill Hill East via Bank. This would require changing trains for a large number of passengers at Kennington and Camden Town. Camden Town is particularly poor in this respect, with its tortuous connection passages between the two routes, small cramped booking hall and serious overcrowding with weekend tourist traffic to and from Camden Market leading to regular closures. Forced changes there would mean up to 400 passengers changing from each arriving train.

London Underground has long being trying to get together a £135million scheme for a complete rebuilding of the station both above and below ground but the local Nimbys have been out in force and, with the station in a "conservation" area, they have lots of ammunition. So far, a total of 16 schemes have been drafted and the two that got as far as planning permission have been thrown out by the local council. One even got as far as being refused an appeal to the Deputy Prime Minister.

But LU haven't given up and they made a start on service improvements in 2008, trying to tackle the problem by reducing some of the junction working at Camden Town during the morning peak hours. Northbound Charing Cross branch trains now terminate at Edgware while trains to High Barnet and Mill Hill East use the Bank branch. The scheme allowed an extra train per hour on each branch and has worked well over the last three years.

The next stage will see a complete separation at Kennington, where all trains on the Charing Cross branch will terminate. Morden trains will all go via Bank. It is expected this will take place only after all the new signalling has bedded in and it is hoped it will lift the throughput to 28 trains per hour (tph) on each branch. This would give a much-needed 25% improvement over the existing service on both the central area branches.

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Diagram caption for the Northern Line map:

The Underground's Northern line map, showing in colour the new Vehicle Control Computer (VCC) areas to be introduced with the Thales SelTrac S40 CBTC system.