DELIVERING THAMESLINK
MAJOR PROJECT REPORT

09|2010

UNDER CONSTRUCTION
THE £5.5BN SCHEME IS UNDERWAY. THE ROUTE, THE MAJOR STATIONS AND THE BENEFITS EXPLAINED
Delivering Thameslink

By the summer of 2012, before the Olympic Games, London will have a new landmark. Stretching across the Thames will be the glass canopy of the new Blackfriars station, providing for the first time a national rail station that links the river’s north and south banks.

The new station forms a key part of the Thameslink Programme, the government funded £5.5bn upgrade of one of the rail network’s busiest routes. Rolling stock and, crucially, this programme is improving the frequency and capacity of services running north-south through the heart of the capital from Bedford to Brighton.

It is one of the most important civil engineering projects in the country and for Network Rail it is very much a flagship project, a scheme that will have a massive impact on the capacity and flexibility of the rail network.

The Thameslink Programme is being delivered in stages. Currently platforms along the northern part of the route are being lengthened to cater for trains increasing from 8-car to 12-car. Blackfriars station is not only being lengthened – out over the river – it’s also being cleverly widened to cope with the extra passengers expected.

Farringdon – where the Thameslink and London Underground platforms sit side by side – is being turned into what will be one of the capital’s most important interchanges.

“We are working extremely hard on innovative design at London Bridge to avoid cost and disruption”
Simon Kirby, Network Rail

That’s thanks to the station’s future role as the crossover point with Crossrail, with work already underway to accommodate the station and tunnelling needs of the new east-west route across the capital.

But it is London Bridge that is the lynchpin. This is where the pieces of the puzzle come together, where the biggest bottlenecks need to be unlocked and where the potential for growth is absolutely enormous.

Over 42M people use the station that sits on a viaduct every year. And Southern, Southeastern and Thameslink operator First Capital Connect are all competing to squeeze their services onto the limited number of tracks. So busy is the station, in fact, that at peak times Thameslink services have to be diverted around it.

Network Rail’s dramatic plans for

2 BLACKFRIARS

The first station to span the Thames will be housed within an iconic glass structure that is set to become a new London landmark. A 120-year-old bridge is being widened on both sides to enable new dedicated Thameslink tracks to be installed and platforms built to accommodate 12-car trains.

For the first time there will be station entrances on both sides of the river.

1 FARRINGDON

Farringdon is set to be a new transport hub once Crossrail is built and the Thameslink improvements bring more passengers to this strategic station on the edge of the City. Platforms are being extended within an existing rail cutting littered with obstacles, including historic brick arches and the old River Fleet. A new ticket hall will be shared with Crossrail, and existing Grade II-listed buildings refurbished.
London Bridge promise to make life better for passengers and locals alike – creating dedicated through tracks for Thameslink trains, providing more space with reprofiled platforms and with a brand new concourse integrated with the beautiful new ‘Shard of Glass’ skyscraper currently being constructed right beside the current station.

The new station will relieve pressure on the London Underground network too, in particular the Northern Line, as Thameslink services expand in numbers, and to new destinations both north and south of the capital. All of this providing a huge boost to the economy in London and far beyond – and it’s the economic case that’s the key: “The issue from the economic point of view is that Thameslink doesn’t deliver its business case without the increased frequency of trains delivered by the work at London Bridge,” explains Network Rail investment projects director Simon Kirby.

Added to this, the signalling at London Bridge will be life expired by 2021 and will need to be replaced. That would be no easy task and would involve picking apart the station in the next few years to bring equipment up to modern regulations by that date.

Network Rail has opted to include the re-signalling in the next stage of Thameslink – it accounts for a significant part of the budget set aside for London Bridge – thereby disrupting services only once but getting double the benefit.

“It’s vital of course, particularly in the current climate, that we deliver on value for money for the last phase of the Thameslink programme,” Kirby says. “We are working extremely hard on innovative design at London Bridge to avoid cost and disruption.”

Benefits of Thameslink will not be confined to the central and south eastern part of the rail network. New rolling stock for the 12 car/up to 24 trains per hour (in each direction) service will free up other modern trains that can be re-used around the country.

The investment at London Bridge falls into the next stage of funding for the project after 2012 – known as Key Output2 (KO2).

Network Rail is keen to stress the importance of KO2. Kirby states: “We believe that continuing with KO2 should remain a priority for investment even in the current economic climate since this delivers considerable benefit for both rail users and for the economy. While we recognise that difficult choices will need to be made, the importance of this sort of investment..."
has recently been reinforced in comments from the wider business community.”

Those comments include statements from influential business lobby London First, which has stated: “To maintain London’s economic growth and competitiveness, it is vital that … Network Rail’s investment programmes are maintained.” This, they said, included very definitely, Thameslink.

And in June new Transport Secretary Phillip Hammond agreed. “Crossrail and Thameslink can be growth generators, not only for London, but for the South East and the whole of the UK,” he said.

First Capital Connect – the company that operates the Thameslink trains – is very clear about the benefits the upgraded route will bring.

Its project director David Statham explains: “At the moment we can’t stop at London Bridge during the peak hour and a half because of congestion on the lines and at the station. By the time the London Bridge part of the project is finished there will be 18 Thameslink trains an hour stopping at the station, the vast majority 12-car. It’s going to be a huge relief for the Northern Line.”

For customers there will be obvious advantages. “When work at Blackfriars is finished we can offer an extra 2,000 seats on our trains on a service that carries 150,000 passengers a day. By the time we finish London Bridge there will be 60,000 additional seats,” says First Capital Connect customer services director Michelle Smart. “It’s transformational for the company and for people’s journeys,” she says.

“Thameslink… is going to be a huge relief for the Northern Line”

David Statham, First Capital Connect

**Time savers:** Up to 24 trains an hour will depart from London’s redeveloped Blackfriars Station

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**Thameslink: Background**

Thameslink is one of the busiest rail routes in the UK and currently carries 90M passengers a year.

The £5.5bn investment plan to increase capacity and frequency of services has been underway since 2007. It is intended to cope with predicted passenger increases of 22% by 2014 and addresses the fact that half of the present users say the trains are sometimes so full they cannot get on.

The programme will provide a main line rail service operating at metro like frequencies of a train every two or three minutes. The investment will provide relief to some of London’s most overcrowded Tube lines, and new connections east-west all the way to Heathrow via a link with Crossrail at Farringdon.

At London Bridge the investment will prise open a crippling bottleneck that has curtailed growth of the entire southeast network.

The route between Bedford and Brighton was opened in 1988 using the long disused Snow Hill tunnel near Smithfield to link the suburban services on the Midland Main Line with the Brighton Line and a second branch serving the Wimbledon loop.

There are 50 stations on the 225km long route, which provides a north-south link through central London and connects some of the country’s busiest transport hubs including Gatwick and Luton airports, St Pancras International in north London and London Bridge main line stations. There are also interchanges with seven London Underground lines.

The initial eight trains per hour in the peak were soon horribly overcrowded and, since 2009 and delivery of the first stage of the Thameslink investment programme, the frequency of trains between Farringdon and Blackfriars has increased to 15 trains an hour at peak.

By December 2011, 50% longer 12-car trains will be operating on the whole route, with 16 trains an hour in the centre at peak.

Upon completion, up to 24 trains an hour will be taking people north to south, from the Midlands to Sussex and the stops in between, driving economic investment along the route and providing new travel possibilities for people around the UK.

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**Thameslink: Key Outputs**

**Key Output 0:** Fifteen, eight-car trains an hour through the core central section from St Pancras to Blackfriars. Works include the closure of Blackfriars station bay platforms and the closure of the Moorgate branch. Delivered March 2009.

**Key Output 1 (part 1):** To allow 12-car trains to operate between Bedford and Brighton with up to 16 trains an hour through the core central section. Major works include the rebuilding of Blackfriars and Farringdon stations, platform extensions at outer area stations the resignalling of the core area. To be delivered by December 2011.

**Key Output 1 (part 2):** Re-opening the Blackfriars bay platforms and substantial completion of the station works at Blackfriars and Farringdon. Delivery by summer 2012 (ahead of the Olympic Games).

**Key Output 2:** Will allow 24 trains an hour to operate through the heart of London. Major works are the redevelopment and re-signalling of London Bridge and the fit-out and opening of the Canal Tunnels, which will provide a link to the East Coast Main Line.
Completing a critical timetable

Jim Crawford
Interview by Margo Cole

Responsibility for delivering the Thameslink project for Network Rail lies with Jim Crawford, who was appointed in 2009 as programme director.

One of his first initiatives was to move the programme office into a refurbished building at the north end of Blackfriars Bridge – directly overlooking the construction works.

“A lot of people in this office are not directly involved with the construction, but I wanted them to be on a live construction site so they could really see what it’s all about,” he says.

“Everything we are designing is fundamentally around providing longer trains and more of them. If you look at how you build the programme, the key components of Key Output 1 are at Blackfriars – where to be long enough for 12-car trains the station has to sit on the bridge – and similarly at Farringdon, where we need to cater for more, longer trains but with the extra dynamic that it is a hub for Crossrail. That gave us two large projects that we needed to design and construct.

“Then we needed to look at the infrastructure from Brighton to Bedford and reconfigure it to take 12-car units.”

If 24 trains are to run every hour in each direction, they will have to be much closer together than they are now, so the entire signalling system must be changed to create shorter sections between signals. “You are starting to get heavy rail running to a metro level of service,” says Crawford.

Key Output 2 will also add automatic train operation (ATO) to help get the required throughput.

Longer, more frequent trains are also more power-hungry, so the electricity supply is being beefed up – including construction of a new substation beneath Ludgate in central London. This means big civils contracts – Farringdon won by Costain and Blackfriars won by Balfour Beatty – and a raft of railway systems contracts for the power and signalling. “Because it’s so big we have to break it down into packages we can plan and manage,” says Crawford.

Crawford has a team of programme managers dedicated to managing the outputs, work identification and delivery structure of the project as a whole, as well as individual teams embedded with the contractors on site. The site teams are currently working towards the two major milestones of Key Output 1 – delivering 12-car functionality by December 2011, and then finishing all the work on site by summer 2012, in time for the Olympics when the Thameslink stations are set to be vital for accessing the Games’ sites. Immediately after that, work is due to start on Key Output 2 – rebuilding and remodelling London Bridge station and the rail infrastructure around it to enable 24 trains an hour to run through the core of the Thameslink system.

The contractors for the larger station projects are incentivised through risk/reward contracts and are encouraged to come up with savings.

Although the project has been split into different contracts and phases, Crawford says the “core section has been designed and built as single section – to create a high performance railway capable of running 24 trains an hour”. He adds: “Some of the existing infrastructure has been here for 150 years, and we are building this with the view that we’re not coming back to replace it for a long time.”

60,000 extra seats each day on Thameslink by 2017

140 trains per hour stopping at Farringdon when Crossrail opens

2,000 lorries off London roads by using barges to deliver to the Blackfriars site

1846 the year a Royal Commission created a ‘no go zone’ to stop overground trains passing straight through London

3 international connections on the Thameslink route (Gatwick and Luton airports and Eurostar at St Pancras International)

1:29 the gradient of the track north of Farringdon, the steepest on the rail network

“Some of the existing infrastructure has been here for 150 years, and we are building this with the view that we’re not coming back to replace it for a long time” Jim Crawford, Network Rail
A clever mix of extensions, innovation, structural improvement and new infrastructure is needed to draw out the potential of the tightly constrained Farringdon station.

Farringdon station, which sits on the edge of the City of London close to Fleet Street and Smithfield meat market, has become increasingly important in recent years with a big increase in offices, banks, restaurants and shops.

Now, with its London Underground (LU) and much enhanced Thameslink services set to be supplemented by a new Crossrail connection, Farringdon will also become a major central London interchange.

The existing four-platform station cannot handle much greater passenger flows than those already jamming the stairs to its single street exit in rush hour peaks. But adding capacity has meant some complex design and construction. This is because the station is tightly constrained in a long cutting next to the Farringdon Road, with Thameslink lines disappearing underneath buildings into tunnels as they head south and the Tube lines curving off to one side to Moorgate. In between the national rail network and Tube lines are three more short tracks, used for LU train stabling.

All of these rail lines are at natural ground level in the old Fleet River valley, explains Network Rail senior programme manager Richard Walker.

“Like most of the work, piling is done at night and weekend possessions and is out of sight and notice of passengers. It is incremental improvement by stealth”

Richard Walker, Network Rail

In 1855 the river was diverted into a large brick sewer tunnel and the valley was built up with a mass of complicated arches, brick retaining walls and iron and steel bridge structures carrying the station entrance building and the road outside. As a result, many buildings running either side of the tracks have double layer basements.

To extend the station in this space has meant constantly juggling design and construction sequences, not least because both Tube and railway must remain in use throughout.

Within this context, the “easiest”
part of the job has been constructing a new ticket hall on a site opposite the existing entrance where a short branch line previously ran out to Moorgate. Meanwhile, the original Victorian ticket hall and entrance and its 1920s façade – both Grade II listed – are being renovated and reshaped inside.

Further capacity is being added by creating a second concourse using a long narrow space formerly occupied by a small terrace of shops on Turnmill Street, which bounds one side of the station cutting. Passengers from this side concourse will arrive at an entrance halfway along the cutting, connected to platforms by a new steel footbridge.

The footbridge was one of the first new components of the station upgrade to be delivered, and was installed in March 2009 using an 800t crane. The bridge is already in use with a temporary entrance to relieve the main stairway and entrance during the construction.

Still to come is a new steel and glass roof, on steel columns, to cover the currently open air sections of the platforms where they extend northwards beyond an existing Victorian train shed roof.

All of these activities have their own complications.

The new ticket hall, for example, requires some complex phased demolition of old brick walls and basement structures, including structural walls that held up the now demolished Cardinal Tower office block. The job is made more difficult by the presence of a power substation within the site boundary that must go, but cannot be taken out until a replacement is connected nearby.

In addition, support walls alongside the branch line tracks – which have now been demolished – were the...
fixing point for rail overhead power lines, so these have had to be reconfigured and supported elsewhere. Interactions with the operating railway are constant, says Walker: “Altogether, we have to move overhead lines and reposition them in nine phases.” The Thameslink tracks running out on one side of the site also had to be supported with minipiling along each side before the wall was demolished.

Originally the new ticket hall was to be a curving, convex building over the Thameslink tracks and alongside Cardinal Tower. But with the go-ahead for Crossrail, plans have evolved — meaning a neater and better value engineering solution.

Now the new ticket hall will house both Thameslink and Crossrail services, with construction able to take place on a larger site extending all the way to Farringdon Road.

Once the ticket hall is open for Thameslink services, work on the Crossrail platforms will continue unobtrusively behind a temporary wall, ready for 2017.

Network Rail will be delivering much of the initial work for Crossrail at Farringdon, including the challenge of installing piling among the tight constraints set by the new tunnels.

None of the 2.1m diameter piles for the new buildings — and the eventual redevelopment of high rise above — can interfere at all with the new running tunnels below, nor the historic Fleet sewer, which means the piles have to be placed in a rather unconventional configuration.

“The pilecaps have some very high bending forces to deal with as a result,” says Walker.

Piles also have to be double sleeved and painted with bitumen to prevent any movement from the settlement induced by the Crossrail tunnelling activities. Therefore, most of their work

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**Once the ticket hall is open for Thameslink services, work on the Crossrail platforms will continue unobtrusively behind a temporary wall, ready for 2017**

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**View looking west: New Thameslink and Crossrail integrated ticket hall worksite**

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**Work in progress: View towards Charterhouse Street and steel access ramp for delivery vehicles**
is done by skin friction below the Crossrail tunnels and end bearing in chalk 40m below ground level. Above it, they pass through mixed ground of alluvial silts and clays.

Site access has required significant work, with a butcher's shop demolished on Charterhouse Street, above the site, to make an entrance for a steel framed concrete ramp. Even this 90m long access is cramped, and a special steel turntable is being made at the bottom so concrete and delivery trucks can be turned round to leave again.

Farringdon's platforms are being extended southwards to take 12-car trains. The extension work has to be done at this location because northwards the track declines steeply for the St Pancras tunnel on a 1:29 gradient – the steepest on the network. But to the south is a clutter of arches and supports for five different bridge structures that form the base of the station and hold up the road outside. The new lines must pass through these supports.

Four of the five bridges have to be removed and rebuilt to make space, with the extended platforms taking a split path around widened brick arch abutments. The work is being done in two phases, reducing the road access above firstly by 60% and then 40%. The platform extensions will cut across the points for the old Moorgate branch line, which is why the line has had to be closed.

Basement station accommodation, including the station manager’s office, also has to be relocated to make way for the widened and lengthened platforms. Initially a high grade temporary facility will be built one level up on the station concourse, followed eventually by a permanent new office. Ticketing has also been moved into a temporary building outside.

The new side concourse is being built over arched brick buttresses that make up a big Victorian retaining wall along the old valley side, supporting the road at the top.

“Like most of the work, this is done at night and weekend possessions and is out of sight and notice of passengers,” says Walker. “It is incremental improvement by stealth.”

Minipile rigs are used for the pile installation, tracking in across a temporary deck formed from polystyrene blocks with a rolled steel decking mat on top. “The blocks can be cut with notches to fit over the track and power rails and are light enough not to need any plant to put them in during a possession,” explains Walker.

The new steel frame and glass roof has also been value engineered “to reduce the size of its bays”, says Walker, which means its prefabricated sections will require smaller crane lifts when it is assembled.

It was far from easy to locate the big crane that lifted the footbridge into position in the narrow Turnmill Street, particularly when it came to finding firm points to position the outriggers. So many bridge and basement structures exist in the area that every heavy plant move has to be checked carefully for ground bearing.

For that crane some permanent foundations, to be used later, were built up further with temporary piers to take the outriggers.

The project designer is Atkins and the contractor Costain. Monthly spending has risen to £10M as the peak of the work was reached this summer. Substantial completion will be in December 2011 at a total cost of about £250M. Crossrail, and the eventual redevelopment of the office space above, means activity alongside will go on for some time yet.
Blackfriars: Spanning the Thames

Thameslink central section
Profile by Adrian Greeman

Work at Blackfriars is cleverly using abandoned bridge piers to create a wide new cross river station.

Blackfriars is one of half a dozen Victorian railway bridges over the Thames, no more noticeable than most among London’s multiple crossings.

Its five span, wrought iron, shallow arches are pleasing enough, and match the road bridge nearby, but the station, which sits on the north bank end, is an unassuming structure.

Not any more. When work on the second of Thameslink’s three phases is completed next year, the bridge will be a landmark sight on the river, transformed into a spectacular transparent steel and glass rectangle stretching from bank to bank.

The bridge has always been part station, with platforms stretching from the north bank across the embankment road and river shore onto the first couple of spans. Three lines terminate there and since the Snow Hill tunnel was reinstated in the 1980s, two are for through trains north to Farringdon.

Platforms on the bridge are being completely reconfigured to enable the operation of new 12-car trains across its five spans by the end of 2011. The whole structure will be enclosed by 50 repeating north light roof panels set in a saw tooth arrangement, with glass side-walls. A modernistic entrance building, shared with the London Underground station below, will form

LANDMARK STATION
A multi million pound redevelopment to create a landmark station that spans the River Thames with two station entrances, north and south, giving improved access and interchange to an upgraded London Underground station.

BRIDGE WIDENED
Columns and capital of the innermost disused bridge piers demolished down to the base. Piers then to be rebuilt to accommodate the new arch structures.

TYPICAL SECTION

Delivering Thameslink in association with Network Rail
The north end, and a new “pavilion” entrance on the south embankment will give access from this side of the river for the first time.

To cope with the new dead loads, and new trains, the main bridge has to be strengthened and renovated. At the same time it is being widened by 6m along most of its length. The work is also dealing with the general decay and corrosion of the 1886 ironwork.

The existing five span bridge comprises a wrought iron deck supported by spandrels rising from longitudinal rib arches springing between piers in the river.

Lead designer is Jacobs Engineering, supported by Tony Gee & Partners for the main bridge works. Work is being overseen by Blackfriars project director Lindsay Vamplew.

The work entails a partial rebuild, with each of the five main spans stripped down to 57m long supporting wrought iron arches, which spring from the main piers in the river.

The new track configuration means trains from the south can still terminate at Blackfriars while the dedicated Thameslink tracks will handle up to 24 trains an hour in each direction.

Glazed roof extension gives capacity to cater for 12 car train services, allowing longer trains to use the station, meaning more seats and better journeys for passengers.
Delivering Thameslink

Upstream, the project makes imaginative use of piers from an old freight rail bridge, the deck of which was taken off in the 1980s to save on maintenance.

rivets,” says Network Rail senior programme manager Laurence Whitbourn.

Around 8,000t of scrap is being craned out to be taken away by river barge, and 14,000t of new material is delivered in the same way, an environmental benefit saving the congestion of 2,000 lorry journeys in the busy local City streets. New steel is being fabricated by Watson Steel and barge loaded downstream at Greenwich.

Arches are carefully inspected for corrosion, especially where the ironwork has been inaccessible in the past.

Tony Gee has specified four generic repair types for different levels of damage, mostly involving bolting on additional steel plate. Engineers make inspections to decide which option contractor Balfour Beatty should adopt.

Finally, new post supports are attached with modern tension controlled bolts in the old rivet holes, and the new deck fitted.

Additional arches for the widening are being added alongside the originals in most of the spans. There will be one additional arch on the east side and three additional arches on the western side of the bridge in four out of the five spans. These will be fabricated from modern steel to the same shape.

To fit these in means extending the bridge substructure, which on the downstream, eastern, side of the bridge has required additions to the original piers.

The 6.2m wide piers were extended using precast concrete collars with a concrete infill, built up from the original and cantilevering outwards 45° to add an extra 1.5m. A special floating access platform was devised to install the units, which were cast on the bridge deck above.

There is strength to spare in the old granite and gritstone faced piers. In fact, breaking down the Victorian masonry and an early form of concrete infill, to fit the new collars, took far longer than expected.

“It was exceptionally hard,” says Whitbourn, adding that the contractor had to diamond drill cores from some of the piers to do it.

Upstream, the project makes imaginative use of piers from an old freight rail bridge, the deck of which was taken off in the 1980s to save on maintenance. Triplets of red painted iron columns have remained in the river for years, like some esoteric sculpture from the Tate Modern gallery just downstream.

These match the positions of the station bridge and allow the nearest of each triple group, 5m away to be incorporated into the new station. The old ironwork will be removed and replaced with concrete columns and the pier bases built up to carry new arch members.

That activity comes later, when the second of two activity phases begins early next year. Renovation is being done two tracks at a time, so that the station can remain operational. Working just metres from the live tracks is one of the challenges of the job for the contractor, though with no night trains there can be overnight track possessions.

In November this year, an eight-week station closure will take place when the two lines for the through trains, which are currently on the west side of the bridge, will be slewed to the east side of the bridge, freeing up the west side of the bridge for the widening works when the station comes back into public use in January 2011. This activity represents the revised and final track layout for the new station.

“In three years of rebuilding the station it will only have been shut to weekday commuters for eight weeks,” says Whitbourn.

Although the station will be closed to passengers during this time, trains will continue to run through Blackfriars to their onward destinations.

Preparing for the track switch has been a significant part of works at either end of the bridge to date. On the north side, among demolition and clearing of the old station entrance building, there was a significant bridge slide that took place at Christmas 2009, a major project in its
During a five-day possession the four sections of the old bridge were taken out and replaced by a 22m span 350t, concrete and steel bridge section constructed on site alongside the original and slid into position with hydraulic rams on Christmas Day.

All this had to fit into a bustle of 24/7 major works around it. The biggest part is reconstruction of the London Underground station for the District Line, which runs along the river's north side. The station below is being completely rebuilt inside two large excavations either side of the LU tracks.

These 5m to 6m deep cavities are inside secant pile walls, and will make space for new office and station facilities for LU and for remodelled platforms, entrances and exits. Everything here takes place with trains still running, although the tubes do not stop at Blackfriars at present.

To protect the Tube trains, a steel box enclosure has been erected around the tracks built from sections which were lowered in to the station through an existing vent shaft.

“We intend to take them out the same way,” says Whitbourn, “and are trying to decide how late to leave it.” The later they go, the smaller the pieces they will have to be cut into.

An element of the work has been the demolition of part of a Network Rail office building, leaving a hair-raising partial void beneath upper floors. This will be restored eventually as the new common entrance building rises alongside. The building will have joint ticketing and concourse for the Tube and railway, stairs and escalators.

Further work has been underway on the south end where part of the brick viaduct approach is being demolished to make way for a new pavilion entrance. Piled walls will support a heavy concrete slab which will carry the re-routed track, while a ticket hall and stairs go below. Once trains shift over, the other half will be done.

English Heritage had to approve the south bank work, one of a dozen agencies and authorities involved on the project.

Coordinating works with others has been a critical part of the whole job, says Whitbourn. “We couldn’t have done it without help.” This has included ensuring river clearance of the main channels for deliveries with the Port of London Authority, and arranging road diversions with Transport for London and the Department for Transport, to interactions with the London Underground, various historical bodies, utilities and the train operating companies.
Borough Viaduct & London Bridge: The keys to opening capacity

The key to fulfilling the full potential of the Thameslink project involves a massive rebuilding project at London Bridge.

In simple terms the Thameslink project is about delivering two things: longer trains, and more of them. The work being done at Blackfriars, Farringdon and the outer stations is mainly designed to facilitate the arrival of the longer, 12-car trains. But there is one big hurdle to overcome before trains can run at the desired frequency – London Bridge station, which represents a major bottleneck in the system.

At the moment, London Bridge, the capital’s oldest railway terminus, has 15 platforms and handles 250,000 commuters a day, with three different train operating companies (TOCs) bringing them in from Kent, Sussex and outer London. Of those 15 platforms, nine terminate at the station, while six of the lines continue through the station to Cannon Street, Charing Cross or Blackfriars.

In the peak rush hours, 86 trains an hour in each direction stop at or pass through London Bridge, but only one of these is a Thameslink train, indicating the scale of the problem Network Rail has if it is to meet its challenge of 18 trains an hour in each direction stopping at the station.

“There is only one Thameslink train per hour in each direction because of competition for space and train paths with all the other trains coming in and out,” explains Network Rail project director for KO2 developments Martin Jurkowski, adding that the route the Thameslink trains currently have to take crosses the path of many of the...
The solution is to provide two dedicated tracks for Thameslink trains, so they can stop at London Bridge and then continue onto Blackfriars and through London, a proposal that involves building a new grade separated crossing south of the station; constructing a new 300m long viaduct through Borough Market to create the space for two more tracks; and completely reconstructing London Bridge station in an entirely new configuration – all without unduly inconveniencing the commuters and train operators that use this section of the line.

Work is already under way to build the new Borough Viaduct, but it will be 2012 before construction starts at London Bridge station itself. “This is a very sensitive location to work in, and to actually do what we’re proposing to do there is extremely testing,” says Jurkowski.

The station scheme involves totally remodelling the station so that it will have nine through lines and six terminating platforms. Two of these through platforms will service the Thameslink trains, four will be for the Charing Cross trains and three for Cannon Street.

The platforms themselves will also be widened as much as possible because, as Jurkowski explains, the new layout is not being built purely to improve Thameslink services. “One of the challenges we’re facing is that passenger growth is increasing year on year at London Bridge – even during the recession – and the station is close to not being able to cope with the number of passengers.”

Numbers are currently increasing at a rate of about 4% a year, and the other two TOCs at the station – Southern and Southeastern Trains – are also planning to introduce 12-car trains, capable of bringing in even more passengers to London Bridge. Network Rail’s plans should be able to accommodate growth of about 50% on today’s numbers, mainly by creating the new concourse area and widening platforms. But space is extremely limited, and the work must be done within the existing station footprint, hence the location of the new 70m wide concourse underneath the rail lines themselves. It will be formed by opening up the vaults that support the entire station and its rail lines at the moment, some of which date back to the station’s original construction in 1836.

The biggest challenge is how to totally reconstruct the station – and the associated rail infrastructure – while keeping trains running in and out of

“...
Delivering Thameslink

London Bridge. It has been described at Network Rail as “like performing open heart surgery while the patient’s awake”.

“We know that what we do has an impact on the railway network in the South East,” Jurkowski adds. “If we shut London Bridge, London would notice and the economy would notice, so we’re devising approaches that will still allow all of these commuters to access London.

“There has to be a trade-off between value for money construction and maintaining capacity on the railway through the worksites,” explains Jurkowski. “We’ve spent 12 months working with the train operating companies and the Department for Transport to develop an appropriate approach.”

Since planning started for London Bridge reconstruction, a new neighbour has arrived in the area in the form of the Shard development, London’s latest iconic tower, which is currently under construction on a site adjacent to the station. With work at London Bridge station not set to start until after the Olympics in 2012, the timing has been fortuitous, as it would have been impossible for both projects to be under way at the same time. But the Shard has influenced the station’s conceptual design resulting in some changes.

However, Network Rail is working closely with the Shard project team, and learning from its experience of building in such a tight, congested part of London, especially when it comes to the logistics of getting materials in and out.

With work set to start on the station design in the next few months, and a contractor due to be appointed at the end of 2011, Network Rail plans to hit the ground running on the scheme straight after the Olympics.

Once completed and the bottleneck is finally opened up, Network Rail will be able to deliver the full benefits of all its investment in the Thameslink project.

The current signalling system around London Bridge will have to be replaced by 2021 and other renewal work is desperately needed.

As Network Rail investment projects director Simon Kirby explains: “We’re talking about a once in a generation opportunity. Network Rail’s plans will transform London Bridge station and remove the bottlenecks around it once and for all — within the agreed budget.

“The alternative is to spend £1bn anyway, only to lock commuters into another 40 years of congestion.”

BOROUGH VIADUCT

Key to unlocking capacity at London Bridge is the project to widen Borough Viaduct, which takes trains west of the station towards both Charing Cross and Blackfriars. “If you get one train stuck on that, everything backs up all the way down to Kent,” says Network Rail senior programme manager Graeme Campbell. “We’re taking out a massive, massive pinch point.”

The widening will double capacity on the viaduct from two to four tracks, allowing the original tracks to be dedicated to Thameslink trains and the new pair to carry the Kent trains into Charing Cross.

Borough is a historic area of south London that is home to many businesses and attracts large numbers of visitors, not least to its renowned food market. Threading a new 300m long rail viaduct through and above existing buildings is far from easy, but Network Rail has been keen to keep disruption to an absolute minimum.

“**If we shut London Bridge, London would notice and the economy would notice**”

Martin Jurkowski, Network Rail

**Congested:** The current configuration of London Bridge station with through platforms to the bottom of the picture
Right from the start the company adopted a targeted demolition policy, so that only buildings that were right in the path of the new structure have been taken down. And when the viaduct is complete, new buildings are to go back into the vacant spaces, so there will be no unsightly gaps in the urban landscape.

Negotiating with the traders at Borough Market has been an important aspect of the job, as a 120m section of the new viaduct runs right through the area used by traders. They have been temporarily relocated, and the original Victorian cast iron and glass roof has been taken down, stored and refurbished. “In the new design the roof will go back in a slightly different place,” explains Campbell. “We have spent a lot of money trying to retain the cultural identity of this place.”

The market section of the viaduct is one of four distinct elements that make up the new structure. From the west they are the Park Street/Hop Exchange, where the new viaduct ties in to the existing structure; the market viaduct; Borough High Street bridge; and the railway approach, where it heads into London Bridge station. Of these, the most eye-catching element is the Borough High Street bridge, a trapezoidal girder bridge that will span 70m over the busy main road.

“We were originally going to build it in our yard and take it down the road,” says Campbell, adding that shallow services and Jubilee Line Tube infrastructure beneath the road made this option impractical. Instead, the team will build the 1,200t bridge on top of the market viaduct, which is currently under construction. It will then be pushed out over the road, and supported by transporters at road level as it is manoeuvred into position.

“Our expectation is that it will go across the highway in one weekend and then be jacked down into position the next weekend,” explains Campbell. Piling for the market viaduct has just finished and the 1.8m diameter circular columns that will support the new steel girders and precast concrete deck are currently being built.

Exciting though Borough High Street bridge will be, it is not necessarily the biggest challenge on the job, according to Skanska project manager Susan Fitzpatrick. “The bridge is the glamorous, big section that will grab everybody’s attention,” she says. “I’m very excited by it and I’m looking forward to it, but what will keep me awake at night is the cantilever section,” she says.

This is a small, tricky piece of the job that is all but hidden from view, but enables the new viaduct to tie into the existing structure at the west end of the job. Here the contractor has only the tightest of spaces in which to build a wedge-shaped section of deck, and must build suspended falsework out over the roof of an existing property in order to be able to cast the concrete.

The other section likely to cause sleepless nights is the railway approach, where the new viaduct will link into the new infrastructure that will eventually be built at London Bridge. Here piles must be sunk through a double layer of vaults that currently support the road to the station, many of which have been filled or part-filled with everything from rubble to solid concrete in the intervening years.

Like many other sections of the job, the railway approach is bound to be of interest to the 30 archaeologists from the Museum of London who have been active on the site since work began. “This area is very important historically, because for centuries London Bridge was the only bridge over the river,” says Campbell. “Anywhere we’re putting in a pile the archaeologists will do an investigation.” Important finds on the job so far include some distinctive 17th century Southwark delware pottery and 300 skeletons from a burial ground, which are being re-interred under the guidance of nearby Southwark Cathedral.

History aside, Fitzpatrick says the biggest challenge on the job is not the complex engineering but “constructing a major building and civil engineering project in this area without anyone really knowing we’re here”. Ten years ago local residents and traders had to put up with years of disruption while the Jubilee Line was being built in the area, so it is not surprising that they may have been wary when the Thameslink work started.

“I think we’re growing on them now, and I think people recognise that we’re trying really, really hard,” says Fitzpatrick, explaining that Borough Market is a thriving wholesale market at night, attracting up to 40 articulated lorries between 2am and 8am.

“We know that if we shut a road off overnight and their customers can’t get in, then they won’t come back, so we try to work around them,” she says. Despite these complications, Fitzpatrick says she prefers this job to building on a greenfield site. “This will look amazing. You can really see it coming up and fitting together like a jigsaw,” she says.

“Everyone’s engaging with the project and at some stage we all have our moments of feeling like a little kid and remembering why we joined the industry.”

“We’re talking about a once in a generation opportunity” Simon Kirby, Network Rail

Redevelopment: The revamped Borough Market and new bridge

Market forces: Work progresses on the site next to Borough Market

“Everyone’s engaging with the project and at some stage we all have our moments of feeling like a little kid and remembering why we joined the industry.” Susan Fitzpatrick, Skanska
Delivering Thameslink

Outward bound

Outer stations
By Margo Cole

Long before the Thameslink programme is complete passengers will start to benefit from longer trains, which requires a major programme of platform extensions at outlying stations.

While the more glamorous Thameslink projects at Blackfriars, Farringdon and London Bridge get most of the attention, the main concern for many commuters north of London is simply getting a seat on a train. Platforms at so-called “outer” stations, like St Albans, Luton and West Hampstead, are only long enough for a maximum train length of eight cars, so passengers are often squeezed onto trains at peak times.

Now, as part of the £5.5bn Thameslink programme, platforms are being extended at key outer stations so they will be long enough for 12-car trains to stop.

Thameslink programme manager Damien Gent says: “The vast majority of this work isn’t particularly glamorous or sexy, but it is essential to give passengers north of St Pancras more capacity. Thameslink has had a huge amount of passenger growth,” he adds. “Communities south of the river have always had other alternatives because of the number of different rail routes, but north of the river they didn’t really have anywhere else to go.”

While 12-car trains can already run on the southern section of the Thameslink network, this has not been possible north of the Thames because of the shorter platform lengths. Platforms have not previously been extended because of the scale of money, time and effort required. Now, with improvements being made to increase capacity elsewhere on the network – particularly at London Bridge – platform extension becomes viable as part of the larger project.

To fit the longer trains in, platforms must be extended by up to 80m, with a total of almost 4km going in at stations from West Hampstead to Bedford. This is far from simple, as almost every station has bridges, gantries, overhead lines or signals that are in the way of the new platforms.

“I would love there to be a standard format for these platforms, but actually it is completely driven by the constraints of each site,” explains Gent. “Our focus is on releasing the constraints so that we can get on with building those platforms.”

The first platform extension to be completed, in December 2008, was Luton Airport Parkway. This was fairly straightforward, as the station was only built 10 years ago, and, although the platforms were constructed for eight-car trains, the rail systems were in the right place for longer trains, so it was just a case of extending the four platforms by 80m.

Since then, work has been somewhat trickier, and it all has to be done during rail possessions. “It has always been one of our key drivers to minimise impact on the travelling public, and, where possible, we’ve worked at evenings and weekends so there’s no disruption in the busiest times of the week,” explains Gent. “One of biggest issues is phasing the work,” he adds. “We couldn’t do all 12 stations in parallel, so we’ve sequenced them out to build two or three per year. We’ve just come off the peak of that workload, and we’re over half way through.”

According to Gent the biggest challenge so far has been extending

Power hungry

Cabling: New route from Elstree

It is not just longer platforms that are needed to run longer trains more frequently. Often invisible to rail users is the essential work to bolster power supplies and improve signalling capacity.

These improvements include a new auto-transformer system and a 400kV supply from the Elstree Grid. Between Farringdon and City Thameslink, the overhead lines have been extended, and there have been upgrades to the third-rail DC system south of the river Thames.

At the same time, improvements are being made to the West Hampstead and Victoria signalling centres to increase capacity and reliability in advance of the timetabling change.
the platforms at the station in the centre of Luton. The main constraint was a bridge at the north end of the station that acted as a pinch point for the tracks, giving no width for the extended platforms. The only way around this was to widen the bridge.

Last Easter the team had a four-day track possession, took out three existing bridge decks and replaced them with realigned new deck. This provided additional width to allow the platform extensions to be constructed. Throughout the work, the adjacent Midland Main Line fast tracks kept running.

Preparation for that weekend began in November 2009 with work to build new abutments and strengthen sections of the existing structure. Then, in the New Year, fabrication of the new steel decks began. At that stage the team – including Network Rail, main contractor Carillion and various specialist subcontractors – started building up an hour-by-hour plan for the weekend’s activities.

The new bridge decks were delivered to site three weeks before Easter, when the team started having what Gent describes as “significant” integration workshops to talk through the plans, sequencing, plant, materials, labour patterns and shifts for the weekend possession. When the time came, the old decks were cut away and lifted out, and the new, wider, structure – weighing 160t – was rolled into place using special transporters designed for heavy loads.

Overhead wires also had to be moved, and the new track, laid before the line could reopen.

Throughout the weekend more than 250 people were on site, with shifts covering 24-hour working. Gent has nothing but praise for the exercise. “It is complex weekends like this that really test the professionalism of the industry,” he says.

Much of the focus now is at West Hampstead, where a new footbridge has already been constructed to give step-free access to all platforms, and a new station building is planned on an adjacent road.

“This is an area where we are anticipating many more passengers once the work is completed,” explains Gent. The station gives passengers access to the Tube network, but at the moment that requires some tricky road crossing, which will be reduced when the new station opens, making it a more attractive proposition for commuters.

Again the work is far from straightforward. The project involves building a major embankment for the new station, while the new footbridge had to be lifted in using a 500t crane, which needed significant temporary works – including a sheet piled wall – to create a stable platform on which it could be set up.

Not all of the outer stations are having their platforms extended. For example, Kentish Town has road bridges at each end which cannot be moved, so there just isn’t space to fit them in.

Meanwhile passenger numbers at Cricklewood and Hendon are not high enough to warrant 12-car trains calling there, so platforms will not be extended either. Shorter trains will continue to run throughout the day so that these stations will not lose out.

Work on the outer stations is on schedule for 12-car trains to start running right through the network from December 2011. Gent says the success of the project so far is due in part to the strength of the people around him. “I’ve built a very specific team of 28 people to deliver these stations,” he says.

“It’s a dynamic, multidisciplinary, integrated team. We’ve co-located with a number of our contractors to create a collaborative approach to design and programme development.”

Gent was attracted to the role because he says the project will deliver “real, tangible benefits”. “What’s absolutely key is finding like-minded people who are passionate and committed,” he says. “You can take a complex footbridge from design to installation in 120 days if you have that. “It’s an amazing team,” he adds.

“We all took the attitude that we’ve got 12 of these stations to do by 2011, so we’d better get on with it. There are people from the team with all sorts of backgrounds, because project delivery is a portable skill. But if you take those skills and link them up with the engineering skills, then you’ve got a successful mix of people.”

Thameslink’s key suppliers

- Balfour Beatty
- Costain
- Skanska Construction UK
- Invensys Rail
- EDF Energy Contracting
- Jacobs Engineering UK
- Atkins
- Mallia Rail
- Giffen Group
- Carillion Construction
- Telent Technology Services
- Tony Gee & Partners
IMPROVING LONDON JOURNEYS

It is not just Thameslink that is vital for the future of London and its economy. Network Rail is delivering a number of schemes that will improve journeys for passengers, whilst boosting employment and the construction industry. Work is underway now on projects that will help businesses thrive and keep London competitive.

THAMESLINK
A government funded £5.5bn upgrade of infrastructure and rolling stock on one of the rail networks busiest routes, which is improving the frequency and capacity of services running north-south through the heart of the capital from Bedford to Brighton. It is one of the most important civil engineering projects in the country and a scheme that will have a massive impact on the capacity and flexibility of the rail network.

KING’S CROSS
At King’s Cross Network Rail is blending old with new. Preserving the past but bringing the station into the 21st Century through bold new design and the creation of a new public space the size of Leicester Square. There are already early signs of transformation. With improved Tube access already delivered, the station itself is taking shape. By 2013 a new King’s Cross will sit alongside its landmark neighbour, St Pancras.

CROSSRAIL
Network Rail supports Crossrail as a full partner. As well as delivering all of the work outside the central tunnel and timetable modelling work it has the massive responsibility of integrating Crossrail with the railway to the east and west of London, and is delivering and financing £2.3bn of the work. Furthermore, Network Rail will maintain the entire infrastructure apart from stations including the tunnel. Crossrail will carry 200M passengers a year when it opens.

VICTORIA
Network Rail has ambitious plans to transform Victoria station, creating more space and offering a better range of shops and facilities for passengers. Its plans will also see improved connections for people travelling beyond Victoria by tube, coach or bus. At present, the track operator is restoring the historic Grade II listed roof of the station. It is re-glazing the 150 year-old roof to create a lighter, brighter environment for the millions of people who use Victoria every year.

CANNON STREET
Improvement to the station is sorely needed – it is amongst the top 10 busiest in the country, serving 95,000 City workers each day. Network Rail has secured £20M of private investment to improve facilities for passengers as part of a deal with the developer Hines to construct an eight-storey, 400,000 sq ft office building above a new railway concourse and Tube station entrance. Every private investment saves the tax payer money and helps keep fares down.

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