The Bakerloo at North Wembley. The temporary footbridge was in place earlier this year to allow replacement of the main footbridge as part of an upgrade in preparation for Olympic events at the nearby stadium. Kim Rennie

Extending the Bakerloo

Tube line could reach Hayes

Jonathan Roberts of JRC writes about the prospects for Bakerloo Line extensions in the next two decades. He has recently advised Lewisham Council on the prospects of a South East Extension

The Bakerloo Line is a paradox. It reaches way out into the suburbs, as far as Wembley and Harrow, in the northwesterly direction. However, its southeasterly route terminates abruptly at Elephant & Castle (now the edge of Oyster Zone 1), just as it did in 1906.

Ideas and formal proposals have kept on emerging for extensions beyond Elephant, in the decades from the 1920s onwards. A Camberwell extension was desired from the 1920s and made it to the tube map in 1949, but affordability and a poor business case stopped the scheme in 1950 before major works began.

Specific business case assessments of Bakerloo extensions to South London (1957), Peckham (1960-70s) and Docklands (1988 Canary Wharf option) were unfavourable, once detailed costings, affordability and value for money criteria were applied.

Is there enough that is new and different about the economic and transport situation in the 2010s – and foreseeable into the 2020s and 2030s – to make a more favourable case for new extensions beyond the Elephant, and possibly also to the northwest? The case is not automatically made and while very 'nice to have', there are real challenges of affordability and project priority to be overcome, apart from local choices of routing.

Bakerloo on the starting grid

There is a need to modernise the existing Bakerloo Line and make it fit for purpose through the 2020s to 2040s. It makes economic sense to plan for any extensions at the same time, even if they are built at a later stage. Having two separate goes on power supply, signalling, line capacity and station capacity, possibly within a decade, would make little sense.

It follows that clarity, about what Bakerloo extensions to do when, is important by the time detailed planning begins on the upgrade project. The Northern and Piccadilly modernisations are ahead of the Bakerloo in the investment queue: serious planning (if not yet powers), would be required in the second half of the decade for the Bakerloo extensions. This would fit with a 2016 national Spending Review (led by the Government elected in May 2015), and overseen by the Mayor of London elected in 2016. So there are another five years or so to refine the ideas about Bakerloo extensions.

The sort of core Bakerloo tube that emerges in the future could influence the shape of any extensions. Should the upgraded Bakerloo be a modernised 'classic' tube, like the Central Line, or more like the 'Metéor' (Paris driverless Line 14) look-alike which is being considered for several Crossrail 2 options?

Automation could preclude through operation beyond Queens Park unless the trains also included standard driving controls for use when required, or unless the Watford line was wholly automated from that point – and possibly back towards Euston. Any completely automated southeastwards extension would likely be exclusive to its own tracks, ruling out sharing with national rail routes.

Irrespective of automation, wouldn't the requirements of the disabilities Acts prohibit more compromise height platforms from 2021, if you tried to mix Bakerloo and Southeastern trains in the same way as Bakerloo and Overground trains mix on the Watford line?

Route options

There has been an official study recently by Transport for London (TfL), reporting in 2010. This was restated in Network Rail's July 2011 London & South East Route Utilisation Study. My own company, JRC, also reported its own assessment to Lewisham Council's Sustainable Development Select Committee in September 2010.

The purpose of the JRC report was to brief Lewisham councillors on the general background to tube extensions and the specific issues likely to be faced by a Bakerloo extension into southeast London.

Five main route options were suggested. All began at Elephant Castle.

- B1: a Jubilee Line relief railway to Canary Wharf via Old Kent Road and Surrey Quays, ca £1.6billion.
- B2: an inner London tube to Canada Water (Jubilee interchange) and then taking over part of the North Kent line via Deptford and Greenwich to Charlton, ca £1.9billion.
- B3: a direct tube to Lewisham via Old Kent Road and the New Cross area, ca £1.9billion.
- B4: to Lewisham via a direct tube to Peckham and then via New Cross or Nunhead, ca £2.1billion.
- B5: the historic route via Camberwell to Peckham and on to Lewisham, ca £2.3billion.

Extensions beyond Lewisham were considered towards Blackheath and the main line railway to Bexleyheath and Slade Green, or using the Hayes branch line by running via Catford to Beckenham Junction and Hayes (ca £1.3billion for either scheme). B4 or B5 might alternatively run direct to Catford from Peckham.

These options offered different combinations of improved accessibility for regeneration of inner London town centres, and capacity relief to the South Eastern national railways (including reduction of inner London train slots required through the awkward junctions at Lewisham where five lines converge).

Business case analysis was not undertaken in this report, which simply set out the likely scale of costs involved and the different benefits. In more recent work JRC has made a comparative assessment of projected passenger volumes on these options and contrasted these with the capital costs.

This shows the incremental change in capital cost per passenger between schemes and highlights why a Bakerloo extension hasn't been a priority for decades. There is a high per-passenger cost for a scheme even as far as Peckham. Broadly £1billion-plus buys you a tube as far as Peckham, £1.6billion to Canary Wharf, £2billion plus to Lewisham or Charlton and £3.2-3.6billion to outer London.

Financing

Pressures of affordability point to the possibility of a phased sequence for the project within different budget periods. Without new major economic growth centres in the middle and outer suburbs, the case for a lengthy extension may be critically dependent on the scale and value of inner suburban train slots released on mainline tracks, rather than just a conventional tube railway business case. An all-stations tube to outer London can also be less time efficient than a limited-stop main service. This is one of the reasons why a tube to central Bromley was not proposed as an option. TfL has also marked down such a scheme.

No one has yet invented a slot valuation mechanism or an equivalent formula for national rail authorities to contribute to tube capital costs, but something will be needed to help underpin the financing of a lengthy extension. Otherwise it will rely on a deal between the Department for Transport on behalf of national rail and the Mayor of London on behalf of TfL.

It will also be important for stakeholders and supporters along the route to set out their priorities for the next decade. At present there are stronger 'supporters clubs' for schemes such as Crossrail 2 and indeed elsewhere in Britain. A Bakerloo extension would achieve a major transformation in the accessibility of London south of the river, in the way that cross-river Docklands Light Railway, the Croydon Tramlink and the East London line have already done.

Any Bakerloo extension will have to compete in priority and affordability with other large schemes across the UK. Just within London, other priorities are already emerging such as extensions to Crossrail 1, early development of Crossrail 2, expansion of orbital capacity, accommodating High Speed 2 and more conventional mainline capacity. The TfL budget from 2015 and during the 2020s will need to balance all these pressures along with renewal of the existing networks. New methods of financing such as a permanent Supplementary Business Rate in London or Tax Increment Financing may prove necessary.

Mayor's Transport Strategy

Current official planning for a Bakerloo extension is set out in the Mayor's Transport Strategy (MTS) of May 2010 which is underpinned by assessment work by TfL. The latest proposals are set out in Network Rail's London and South East Route Utilisation Strategy (LSE RUS) published in July 2011.

The MTS makes it clear that major transport projects are to support economic development, population growth and enhance the quality of life in the capital, not just to improve transport opportunities. It proposed a Bakerloo Line tube upgrade to be complete by 2020, with lighter, more energy-efficient, higher-capacity Bakerloo trains and a higher service frequency. It identified an important north west-south east strategic role for the Bakerloo. It would serve regeneration zones including inner south east London, and would free up national rail capacity at London Bridge.

The MTS acknowledged that the project needed to be reviewed further as there was no funding identified or a specific timescale for extensions, although the MTS modelling took it into account for 2031 planning.

TfL has assessed various options for transport improvement in its South East London Rail Access Study. It tested three schemes:

- a DLR extension to Bromley North;

Bakerloo Line train at Charing Cross. Kim Rennie

Positive elements

Spare capacity on the Bakerloo:
- least heavily used of all the main tubes;
- only 2½ minute headways, 24 trains per hour;
- Jubilee Line relieved the Bakerloo's historical incubus of central London overcrowding.

Upgrade plans and London Plan support:
- Mayor's Transport Strategy (May 2010) supports Bakerloo modernisation and new high capacity trains, supposed to be achieved by 2020;
- it would make sense to define any upgrade to allow for future extensions, to minimise their additional costs and construction impact;
- the London Plan defines opportunity areas and growth zones needing better transport accessibility and capacity;
- MTS sees northwest - southeast strategic rôle for Bakerloo, with seven regeneration zones;
- MTS benefits from better transport accessibility, and from relief of London Bridge main line.

Travel growth now and in the future:
- booming Underground and rail travel – the former improves the business case, the latter incurs main line stress which a tube extension might relieve;
- Underground (and Overground) stimulate more local travel than main line marketing, so an extended tube could be better value for money.

Main line capacity reallocation:
- apart from freeing up main line seats and relieving PIXC (overcrowding) pressures, train paths could be released if a suburban branch was adapted for tube operation;
- Lewisham Junction handles five outer routes (part of North Kent, Bexleyheath, Sidcup, main line, Hayes) and two inner routes (via Peckham and via New Cross), so is a primary bottleneck;
- the Hayes or Bexleyheath lines have always been preferred for a tube extension as they can be segregated.

Tube extension relevant for inner London:
- with main line capacity at a premium, support for some regeneration zones and economic growth locations in inner London may be achieved more easily (though at a cost) by tube;
- at Camberwell there was scope for a new Thameslink station at a former station site to serve this inner London regeneration area within a rail 'desert' – however the Thameslink Project did not take up the opportunity, so the Bakerloo could fill a gap here.

Environmental and low carbon priorities:
- recent fuel price increases have already sent more travellers to rail and tube;
- while overall motoring costs may be more stable, the eventual arrival of road pricing (with costs perceived at point of use) and higher environmental standards in cities will influence further shift towards green travel and public transport.

The Bakerloo at South Kenton. Brian Morrison

- a bus link along the Hayes branch; or
- a Bakerloo extension to Bromley or Hayes.

TfL prefers a route for the Bakerloo to Beckenham Junction and Hayes via Camberwell, Peckham and Lewisham. This would cost £3.5-4billion and have a high level Benefit Cost Ratio (BCR) of 1.4:1. An option via the Old Kent Road offers a shorter journey time with a BCR of 1.9:1.

LSE RUS

The LSE RUS looks ahead to capacity problems on national rail in the London commuting area. It identifies that converting the Lewisham-Hayes branch for use by tube services 'could alleviate main line and suburban routes via London Bridge, with services on this line rerouted via a southern extension to the London Underground Bakerloo Line. Such a line would also provide additional capacity in inner South London, greatly improving travel opportunities for areas such as Denmark Hill and Camberwell. There may also be capacity relief to the Elephant & Castle corridor to Blackfriars, depending on the specific route chosen.'

Renewed interest in northwest London

Having lost its Stanmore branch to the Jubilee Line in 1979, the Bakerloo now has the ability to offer new northwest capacity in the next decades, once the central London route has been upgraded. The opportunities are beyond Paddington.

Much thought is being given to the future of the 'DC' route, between Euston and Watford. Options include more or fewer Overground services, the future of Euston as a terminus (linked to the HS2 scheme), and whether the Bakerloo should increase its service frequency or even re-extend as far as Watford.

Operationally, Queens Park, where the lines intersect, is not designed to reverse a high frequency tube service. More trains might need to continue to Willesden Junction as a minimum. Faced with a similar situation in the 1970s with the proposed Peckham extension, London Underground proposed a new reversing siding at Paddington to turn some trains back.

The major deprivation and regeneration priorities in inner northwest London, at north Kensington, north Hammersmith and Brent, may leverage a case for better services and more line capacity to this catchment. The large scale Park Royal City International Scheme now proposed by Hammersmith & Fulham Council would centre on Old Oak Common. A metropolitan-scale interchange is advocated in advance of HS2, with connections between Crossrail, orbital lines and nearby tubes. This scheme aims to secure 40,000 jobs and 10,000 homes, on an initial site which is larger than Canary Wharf. Bakerloo Line access would be available initially via Willesden Junction.

Overall a better Bakerloo service north west will need to be assessed alongside the LSE RUS's proposed recast of commuter services on the West Coast main line, where Crossrail might offer a new route via Old Oak to Harrow, Watford and Milton Keynes.

Building up the case

Bakerloo extensions are still on the starting grid for a major project. High level evidence is being assembled gradually. Upgrading of the existing Bakerloo tube is a fundamental opportunity to gear up for new capacity and accessibility in the south east and north west suburbs from the 2020s. Route 'optioneering' in southeast London will require further assessment and business case evaluation before budgets and timescales are defined.

The 1.4:1 BCR for TfL's currently preferred scheme to Lewisham and Hayes is barely 'fair' in DfT valuation and less than a direct line via Old Kent Road (1.9:1). Valuation of main line slots and the attributed benefits and costs of substituting a main line branch by a tube extension will need careful review.

There may be other capacity solutions for the Lewisham Junction bottleneck, while south Londoners may have concerns about services to multiple London termini being substituted by a single tube corridor. The JRC studies show there may be a better case in affordability terms for phased extensions.

Meanwhile train operations, economic growth and regeneration factors may support better Bakerloo services northwest of Paddington from the 2020s.

A full northwest - southeast strategic railway may need new sources of funding and strong stakeholder support if it is to be achieved by the current planning horizon of 2031. mr

Negative and uncertain elements

Affordability:

- forward Government finance (eg at Spending Review 2013) is looking less hopeful than was expected in 2010. Transport investment was largely protected in 2010, but affordability of new public schemes remains under pressure;
- any delays in the pipeline will grow the backlog of schemes, with consequences for later schemes such as the Bakerloo extension, unless there is a policy change about their priority;
- the 2010 Spending Review cut Transport for London's budget period from 2017/18 to March 2015. TfL doesn't have funding certainty for 16 years to 2031, the outer planning date for the Mayor's Transport Strategy and Network Rail's London & SE Route Utilisation Strategy;
- the Jubilee Line upgrade over-ran on time and costs. Works on the Northern and Piccadilly Lines come before the Bakerloo; this would lead to the Bakerloo upgrade finishing later than 2020.

Spending priorities:

- London has big spending projects eg Crossrail, Thameslink, with more to come. Emerging favourites through to the early 2020s are:

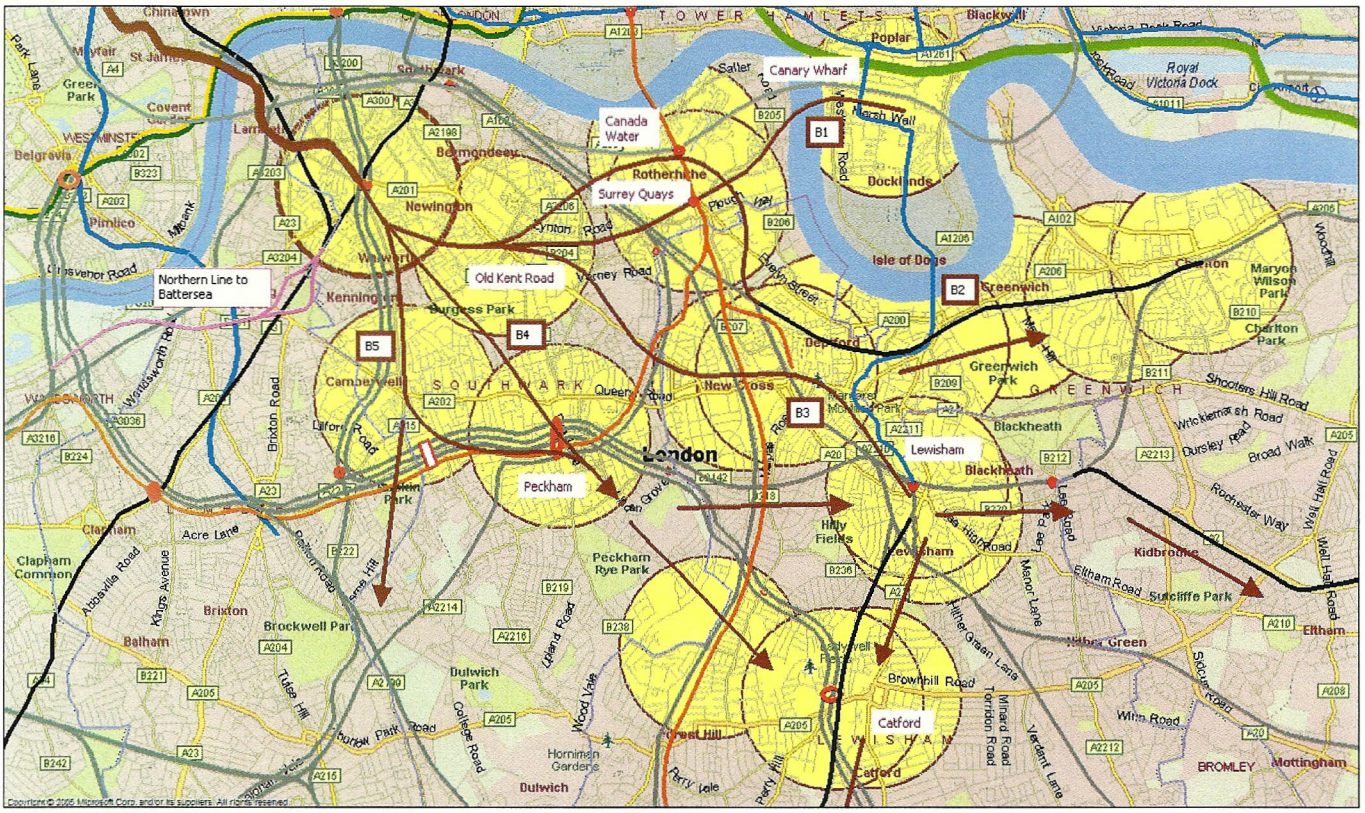
(1) demand and growth-driven investment: Crossrail 1 to Reading, a start on Crossrail 2 (Chelsea-Hackney), and TfL London Rail-backed projects from 2014 including better facilities for passengers, new interchanges and orbital and West Anglia investment.

(2) HS2-linked schemes: HS2 Phase 1, Crossrail-West Coast locals, a respecified HS2-HS1 link;

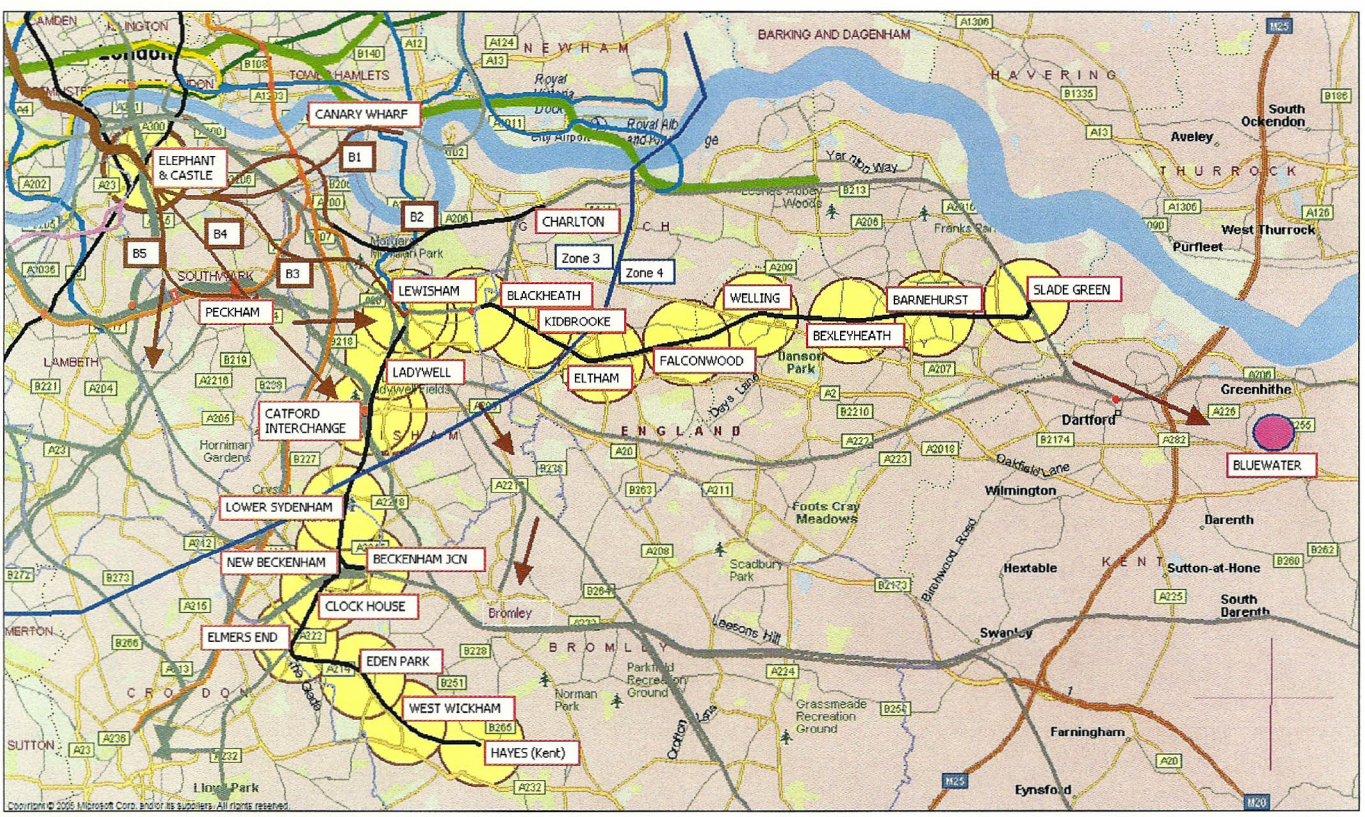
- there are major projects elsewhere in Britain competing for finance, not least the Northern Hub and later schemes from 2014 to the 2020s, electrification, Wales and Scotland investment, and more TOC-based investment once long-term franchises start;
- the MTS states a Bakerloo SE extension has no funding or committed timescale and will be reviewed further; London stakeholders have not yet pressed for it to precede other projects. Scale of outer London benefits, and substitution issues – 'a tube too far'?
- as part of proposals for HLOS2 investment priorities, TfL London Rail has undertaken a forward analysis of rail demand in London to 2031. This shows a 10-20% growth in residual demand at south and southeast London main line stations, after new Thameslink services are allowed for;
- looking just to 2021, high levels of passenger standing are primarily on outer suburban not inner suburban services (with the exception of the Overground extensions). The corridors with greatest pressure are from Bromley South via Herne Hill, and East Croydon to London Bridge, not via Lewisham or Peckham;
- the economics of replacing the seating capacity of one 12-car inner Southeastern train with two or three tube trains deserves further study;
- main line services in southeast London offer direct trains to multiple termini (eg City, West End and with growing choice to Docklands), while a Bakerloo extension to Hayes or Bexleyheath would focus on the West End only. It is not clear how an adequate replacement journey would be offered, eg for Hayes-City commuters;
- the specification for a tube service might offer slower journey times than currently offered on the main line, at least from terminus to suburb.

Value for money:

- London Underground's currently preferred project from Elephant via Camberwell, Peckham and Lewisham to Catford and Hayes takes a rather circuitous route and partly duplicates the new Thameslink Project services;
- it has an estimated Benefit Cost Ratio of 1.4 to 1, which is less than the DfT's baseline of 2:1 for new investment;
- JRC capital cost estimates put this version of Elephant to Hayes in the £3.6billion zone, and TfL has assessed it at £3½-4billion, so value for money needs to be addressed alongside affordability.



Possible Bakerloo Line extension:
inner-suburban options



Possible Bakerloo Line extension:
outer-suburban options