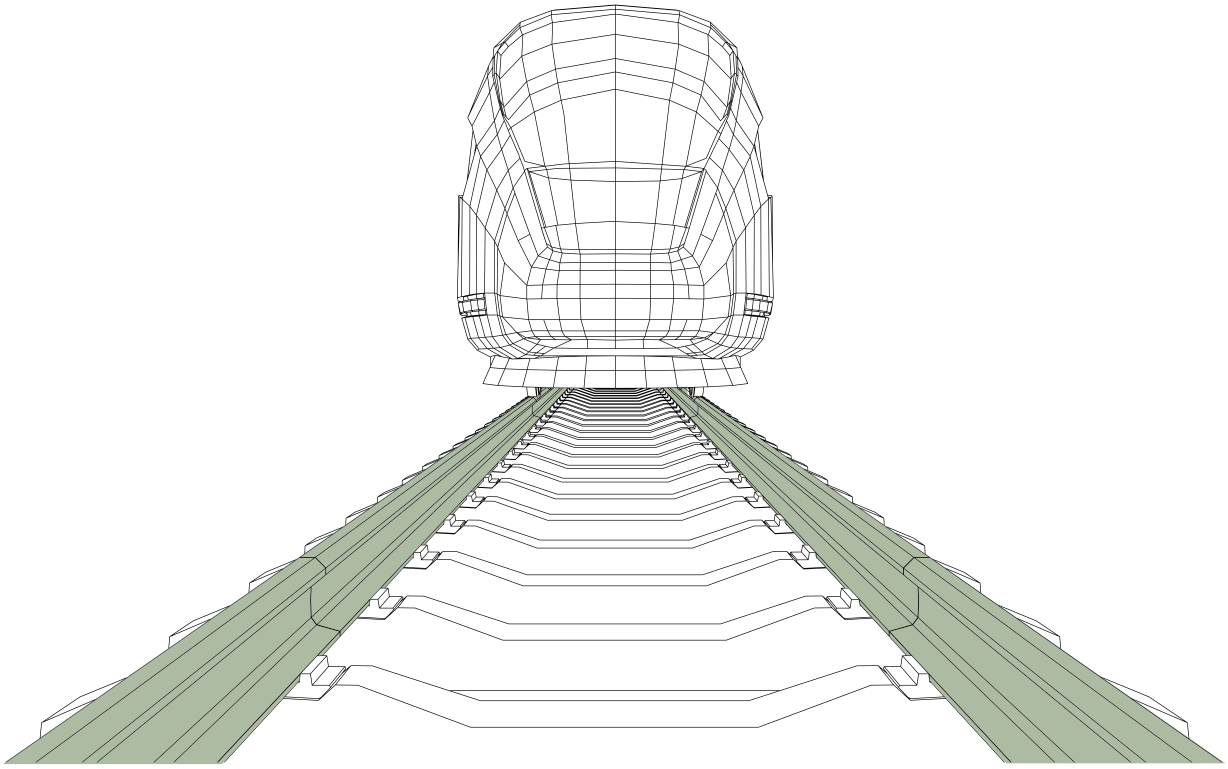
Crossrail 2

Can value for money be improved?



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TaxPayers' Alliance

POLICY RESEARCH SERIES

Crossrail 2: can value for money be improved?

May 2019

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Executive summary

Crossrail 2 is a transport project with potential to deliver substantial transport benefits to passengers across north east, central and south west London. But flawed consultation pressures have contributed to a bloated project scope, reducing the benefits while adding costs. Weaker passenger demand; delays and cost overruns with Crossrail 1; and mayoral policy decisions relating to Transport for London (TfL) have all harmed the business case for Crossrail 2.

TfL and the Department for Transport are the joint sponsors. They should prioritise reducing costs and enhancing affordability by removing items from the scope of the project where alternative projects can meet the objectives and achieve better value for money.

The key facts are:

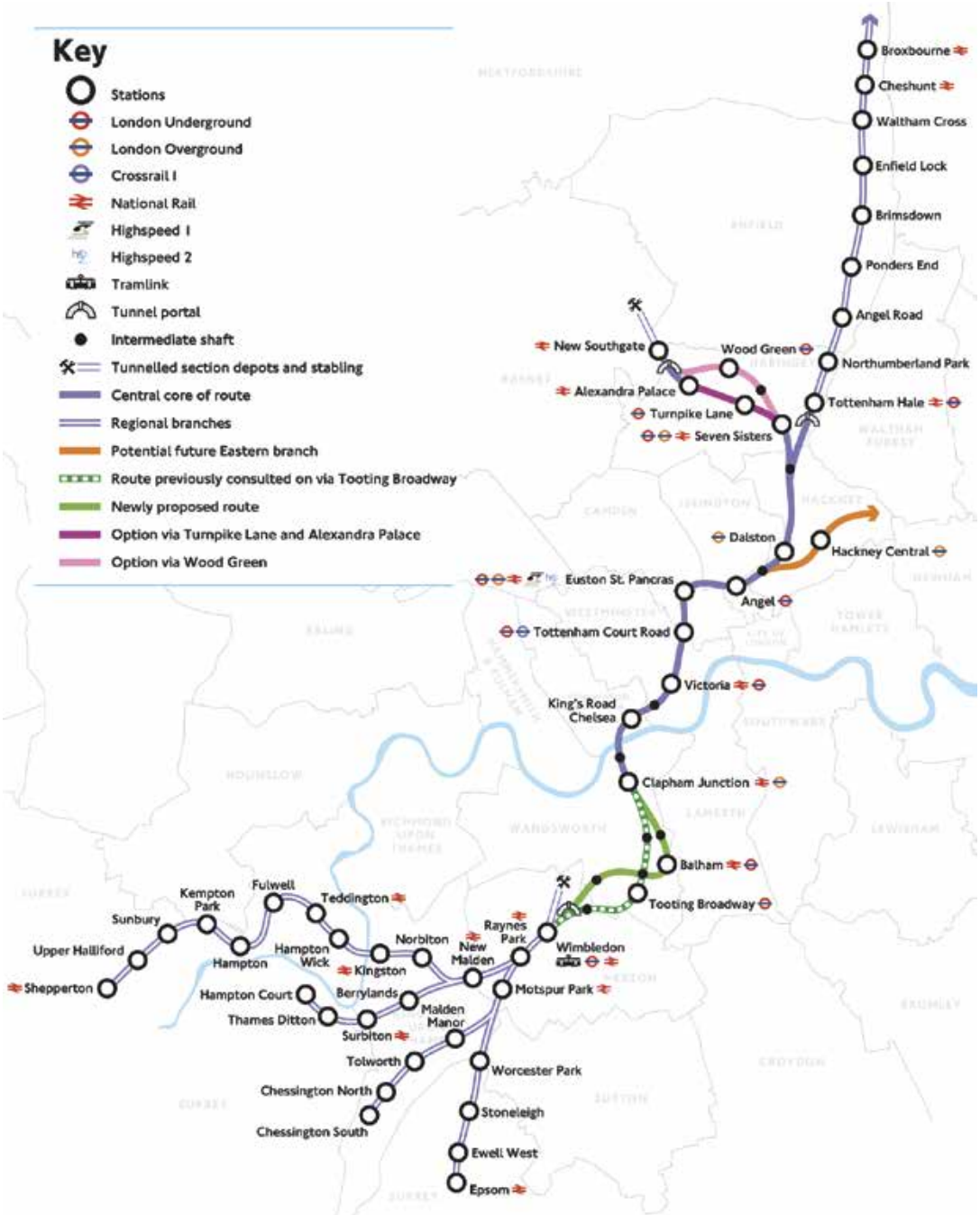
- Self-selecting consultation responders and the incomparability of alternative schemes within consultations favours overly complicated and expensive options.
- Even after adjusting for inflation, cost estimates have multiplied by 3.8 from £7.7 billion in 2000 to £35.6 billion for the latest attempt, in 2016.
- TfL finances are much weaker than expected at the time of the most recent consultation, thanks to a fares freeze policy, Crossrail 1 delays, the withdrawal of the grant from central government and weaker growth in passenger demand.
- £11 billion could be saved by cost reduction measures which could also reduce journey times by 5 minutes for journeys between Wimbledon and Dalston (where route alterations are suggested):
    - Cancelling the New Southgate spur could save £5.1 billion.
    - Rerouting the section between Victoria and Dalston via one of either Clerkenwell, Farringdon or City Thameslink could save money and deliver enhanced transport benefits.
        - Via Clerkenwell could save £1.4 billion and deliver enhanced transport benefits.
        - Via Farringdon and Old Street could save £1 billion and deliver enhanced transport benefits.
        - Via City Thameslink and Liverpool Street could save £104 million and deliver substantially enhanced transport benefits.
    - Removing the Chelsea station and rerouting the section between Clapham Junction and Victoria could save £1 billion and enhance transport benefits.
    - Rerouting the section between Wimbledon and Clapham Junction directly via Earlsfield could save another £2.3 billion and improve journeys.
    - Building Wimbledon station above ground, reallocating existing platforms and tracks to Crossrail 2 and tunnelling those instead could save £1.3 billion.
- Reintroducing fares escalation could transfer 20 per cent of the capital costs from taxpayers to passengers. Additionally, implementing a Crossrail 2 fares premium and exempting Crossrail 2 from concessionary fares policies could further transfer a similar share of capital costs.
- Separate, smaller projects could deliver some of Crossrail 2's objectives at better value for money, such as a new metro between Kentish Town and the City.

What is Crossrail 2?

Crossrail 2 is a project to link suburban National Rail services on the south western franchise to the east Anglia franchise. The 'core' of the project is a pair of tunnels from Wimbledon to Tottenham Hale through Clapham Junction, the West End and Dalston. From Wimbledon in the south west, the line will take over selected suburban south western National Rail routes which currently terminate at Waterloo. Similarly, in the north east, services from Broxbourne to Liverpool Street on the west Anglia line will be taken over and enter the tunnels near Tottenham Hale.

As well as providing improved connections to central London (and beyond), the project will leave space on the existing lines into Waterloo and Liverpool Street, allowing more capacity for transport into London from further afield to be added.

Figure 1: Crossrail 2 route map (2015)



What are the concerns?

There are three broad concerns about the soundness of the Crossrail 2 project: flawed consultations which lend themselves to favouring overly large and complex projects; a history of radical cost revisions; and a changed recent picture of transport demand trends.

Consultation flaws

In 2013, a Crossrail 2 consultation asked if respondents supported the scheme in principle, and whether they favoured a cheaper, smaller, self-contained 'metro' option or a larger, more costly, integrated 'regional' option. The metro option ran from Wimbledon to Alexandra Palace, entirely underground. The regional option contained an almost identical 'core' tunnelled section, but then rose above ground to take over some commuter rail lines in the south west beyond Wimbledon, and the north east beyond Tottenham Hale. As well as offering more distant stations direct connections to central London, the regional option would also free up space on the congested lines to Waterloo north of Wimbledon, and to Liverpool Street south of Broxbourne. The estimated costs were £9.4 billion for the metro option, and £12 billion for the regional option. With an 'optimism bias' added, the estimates would be £15.7 billion and £19.7 billion.

The responses received were overwhelmingly positive. Over 96 per cent of respondents supported the scheme and a larger proportion backed the regional option than the metro option.[1] Consequently, the regional option was taken forward.

A year later, a revised estimate of the cost of the regional option was given as between £27 billion and £32 billion, an increase of 57 per cent after adjusting for inflation.[2]

Two major flaws are apparent in the consultation method, however: self-selection and incomparability.

Consultations are widely publicised, at least within London and the areas along the route which are directly affected, but nonetheless only attract a tiny proportion of affected people to respond. Likely support from the Department of Transport mean that all UK taxpayers are affected, together with landowners along the route and public transport passengers both along the route and in areas which may be competing for departmental or TfL support. Despite this, the consultations conducted in 2013, 2014 and 2015 received just 13,767 responses, 5,181 responses and 20,917 responses respectively.[3]

The self-selecting nature of the consultations produces results skewed on many dimensions. Geographically, over a third (1,794 of the 5,181) of the 2014 consultation's respondents were from just two London boroughs: Kensington and Chelsea, and Hackney. Of the 20,917 respondents in the 2015 consultation, over two-fifths came from a different pair of London boroughs: Kensington and Chelsea, and Wandsworth. Adding a third, Merton, raises the total 53 per cent. The reason for this is not complicated. Potential users (or property owners) in locations near potential stations and tunnel shafts have a much stronger vested interest in altering the outcome of decisions than an ordinary taxpayer who lives far away from the route. A curious exception is Chelsea, however, where strong local opposition to the station exists alongside local support. In the 2015 consultation, 12,641 responses relating to the King's Road Chelsea station categorised as 'issues and concerns' were

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[1] TfL, *Crossrail 2 Consultation Report*, October 2013, consultations.tfl.gov.uk/crossrail/2-2013/user_uploads/crossrail-2-consultation-report-2013.pdf, (accessed 7 April 2019).

[2] TfL, *Crossrail 2 Consultation – Stage 2 Analysis Report*, September 2014, consultations.tfl.gov.uk/crossrail/2/user_uploads/crossrail-2-consultation-report-2014--published-.pdf, (accessed 7 April 2019).

[3] Ibid., and TfL, *Crossrail 2 Consultation Analysis,* March 2016, consultations.tfl.gov.uk/crossrail2/october2015/user_uploads/crossrail2autumn2015consultation.pdf, (accessed 7 April 2019).

received, compared to 1,605 supportive comments (including from the local authority and member of parliament).[4]

The prospect of improving the value for money of the scheme offers a very small private incentive for any individual taxpayer. By contrast, landowners near potential stations face the prospect of substantially enhancing their net wealth by increasing their property values. Similarly, the primary considerations for the value of the scheme to users (and therefore landowners) is whether the location of stations is nearby the property and nearby employment centres. The inclusion of an intermediate station between the home and workplace stations may slow down journey times, reducing the value of the scheme to potential users and by extension, reduce their property values. But this effect is far smaller than the effect of whether or not a station will be included near someone's own property at all.

It is therefore no surprise that the bulk of the responses came from respondents living in boroughs where the prospective inclusion of stations are actively in question.

Radical cost revisions

The estimated cost of Crossrail 2 has grown substantially. In November 2000, the Shadow Strategic Rail Authority published its London East-West study, which assessed three east-west routes for Crossrail. One, the Paddington to Liverpool Street route, was recommended to be taken forward as Crossrail line 1 while another, Wimbledon to Hackney, was recommended to be Crossrail line 2. The estimated cost of the Wimbledon to Hackney route was £5.3 billion.[5]

Twelve years later in May 2013 Transport for London published a summary of option development for the project. The estimate had swelled to £12 billion, or £19.7 billion to reflect the tendency of major works to go over their budgets. A cheaper 'metro' option was also proposed with a £9.4 billion estimate (or £15.7 billion after adding the 'optimism bias'). This cheaper option was rejected.

PwC were commissioned to report on the funding and financing of the scheme and in November 2014 they published their report. The estimated costs were stated as £16.6 billion for the full scheme and £12.3 billion for the metro scheme (or £27.5 billion and £20.5 billion respectively, with the optimism bias).

Fifteen months later, Transport for London's submission to the National Infrastructure Commission revealed an estimate of £31.8 billion in the (unpublished) Strategic Outline Business Case and a 'point' estimate of £20 billion (or £32.6 billion with a £12.6 billion contingency) in the submission document itself.

The phenomenal rise in estimates from £5.3 billion to £32.6 billion does not alter much after accounting for inflation. Expressed in 2019-20 prices, the 2000 estimate was £7.7 billion while the 2014 estimate was 3.8 times as large at £30 billion and the 2016 estimate 19 per cent larger than the 2014 estimate at £35.6 billion.

Before 2000, the Department for Transport, British Rail and London Regional Transport (the predecessor of TfL) published their study on central London rail in 1989, which estimated Crossrail 2 at £1.3 billion (£2.6 billion in 2019-20 prices). In 1992, the secretary of state for transport said that the estimate was by then £2 billion (£3.4 billion in 2019-20 prices).

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[4] TfL, *Crossrail 2 Consultation Analysis*, March 2016, consultations.tfl.gov.uk/crossrail2/october2015/user_uploads/crossrail2autumn2015consultation.pdf, (accessed 7 April 2019).

[5] Haylen, A., *Crossrail 2*, House of Commons Library Briefing Paper, CBP 8481, 23 January 2019, researchbriefings.files.parliament.uk/documents/CBP-8481/CBP-8481.pdf, (accessed 7 April 2019).

Table 1: selected Crossrail 2 cost estimates

	Cash (£ bn)	2019-20 prices (£ bn)
Central London Rail Study, 1989	1.3	2.6
Secretary of state for transport, 1992	2.0	3.4
Shadow Strategic Rail Authority, 2000	5.3	7.7
Transport for London, 2013 ('metro' option)	9.4	10.8
Transport for London, 2013	12.0	13.8
Transport for London, 2013 (including 'optimism bias')	19.7	22.6
PwC, 2014 (including 'optimism bias')	27.5	30.0
Transport for London, 2016 (including 'optimism bias')	32.6	35.6

Changing data on transport numbers

The rationale for Crossrail 2 is partly based on alleviating projected over-crowding on existing public transport services and satisfying the forecast rising demand for travel which occasioned the forecast overcrowding. But in the last few years, the trend of ever-rising demand has faltered.

During the great recession, Underground journey numbers fell by 1.8 per cent in 2009-10 compared to the previous year and only rose by 2.1 per cent in the following year.[6] But before the crash, numbers rose by 6.4 per cent in 2007-08 and 3.9 per cent in 2008-09. For the first few years afterwards growth was robust, too. In 2011-12 numbers grew by 5.7 and then 5.0 per cent. But then growth slowed somewhat during the next three years at an average of 3.2 per cent before stalling completely in the last three years. During the most recent three TfL 28-day accounting periods, 320 million Underground journeys were made, compared to 322 million in the equivalent periods three years ago. Journey numbers have shrunk since 2016-17 on the DLR and are still shrinking on trams. Even on the London Overground, previously TfL's fastest-growing network, numbers are falling. Last financial year they grew by just 0.7 per cent while so far this year numbers are down, by 0.7 per cent.

This is important for two reasons. First, TfL's finances have weakened compared to expectations as a result of the lower than expected fare revenue growth. Second, expected future growth of passenger demand, and therefore the value of revenue sources, is less certain now than it previously was. Both of these factors reduce the viability of an infrastructure project like Crossrail 2 because they have the potential to reduce the expected benefits of the scheme and weaken TfL's ability to contribute financing. This leads to the question of how long the weakness in the growth of demand for transport in London will last. The longer the weakness persists, the more serious the implications for TfL and Crossrail 2.

TfL plans predict passenger journeys across its businesses will rise slowly from a forecast 4 billion this year to 4.2 billion in 2023-24, after having fallen from 4.1 billion in 2015-16.[7] While they predict growing Underground, Crossrail 1 and TfL Rail volumes, they expect bus passenger numbers to continue to shrink, from 2.2 billion this year to 2 billion in 2023-24.

[6] TfL, *Public Transport Journeys* by Type of Transport, March 2019, data.london.gov.uk/dataset/public-transport-journeys-type-transport, (accessed 31 March 2019).

[7] TfL, *Business Plan 2019/20 to 2023/24*, December 2018, content.tfl.gov.uk/tfl-business-plan-2019-24.pdf, (accessed 7 April 2019).

Factors which may explain the fall in the number of trips made per Londoner include the ageing demographic profile of the city, the greater use of flexible working patterns, slower population growth in London, wider participation in cycling and walking, and the growth of online shopping.

It is difficult to predict the overall population growth of London in the future, although the ONS projections expect growth slowing from 1 per cent this year to 0.6 per cent in 2025 and then 0.5 per cent from 2032.[8] But although they project the overall population to rise by a total of 8 per cent in the ten years to 2028, they project growth of just 2 per cent among those aged 20-59. Among those aged 20-39, the population is projected to shrink by 5 per cent. The demographic driving the projected growth in population is the over 60s, who are expected to expand by 29 per cent, from 1.4 million to 1.8 million.

Single fares have been frozen since 2016 while the price of travelcards, partly determined by national policy regarding rail fares, have risen. This has reduced their relative appeal compared to 'pay as you go' fares, as passengers have to make a larger number of trips before marginal trips become free (total pay as you go fares are capped at travelcard rates, unless paid using cash) which in turn encourages flexible working and internet shopping. Both trends show no signs of slowing or reversing and TfL plans to increase the number of cycling trips by 2026 to 1.5 million a day, up from 600,000 in 2012.[9]

Transport in London is already congested, and expected future employment growth, particularly in the central activity zone, is expected to continue along with population growth. Nonetheless, recent weakness in the growth of trip numbers and fare revenues can only increase the pressure on Crossrail 2 to ensure that its costs are kept as low as possible to maximise value for money and minimise the risk to taxpayers in the event of passenger numbers failing to meet expectations.

[8] ONS, Table 1: 2016-based subnational population projections for regions in England, 24 May 2018, www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationprojections/datasets/regionsinenglandtable1, (accessed 7 April 2019).

[9] TfL, *Cycling Safety Action Plan*, 2018, content.tfl.gov.uk/cycle-safety-action-plan.pdf, (accessed 7 April 2019).

What should happen?

As the mayor of London himself wrote, last year, "affordability remains the project's most pressing issue, so it is important to identify ways to deliver the scheme for less and get value for taxpayers' money."[10] This must be the overriding aim of the project management and it is encouraging that a review of the costs has been set up with a view to finding savings.

Much of the detail of the proposal is not public and would be beyond the scope of this exercise to review anyway. But a thorough review of these details by transport, construction and project management experts, particularly in view of the lessons already to be learned from Crossrail 1, is likely to form a basis for finding savings and enhancing value for money.

Nonetheless, some high-level alterations to the scope of the project can be assessed from publicly available information and this exercise presents five suggested changes. It also offers three suggestions for transferring funding of the project from taxpayers to passengers and finally offers six suggestions for alternative uses of money saved from the reductions suggested. Many of these six offer overlapping benefits so should not be considered as an alternative programme but instead a selection of possible projects which may, after much more considered appraisal than this exercise can offer, present better value for money with respect to some of the objectives of Crossrail 2.

TfL should consider the £11 billion of savings presented here, together with the transfers of funding from taxpayers to passengers worth approximately 13 per cent of the project's cost (or 19 per cent after adjusting for the suggested cost reductions). The transport and other benefits foregone as a result of the savings should be judged independently to see if Crossrail 2 or other projects, such as one or more of the six identified by this report, might offer better overall value for money (not just measured against the narrow criteria of Crossrail 2's objectives).

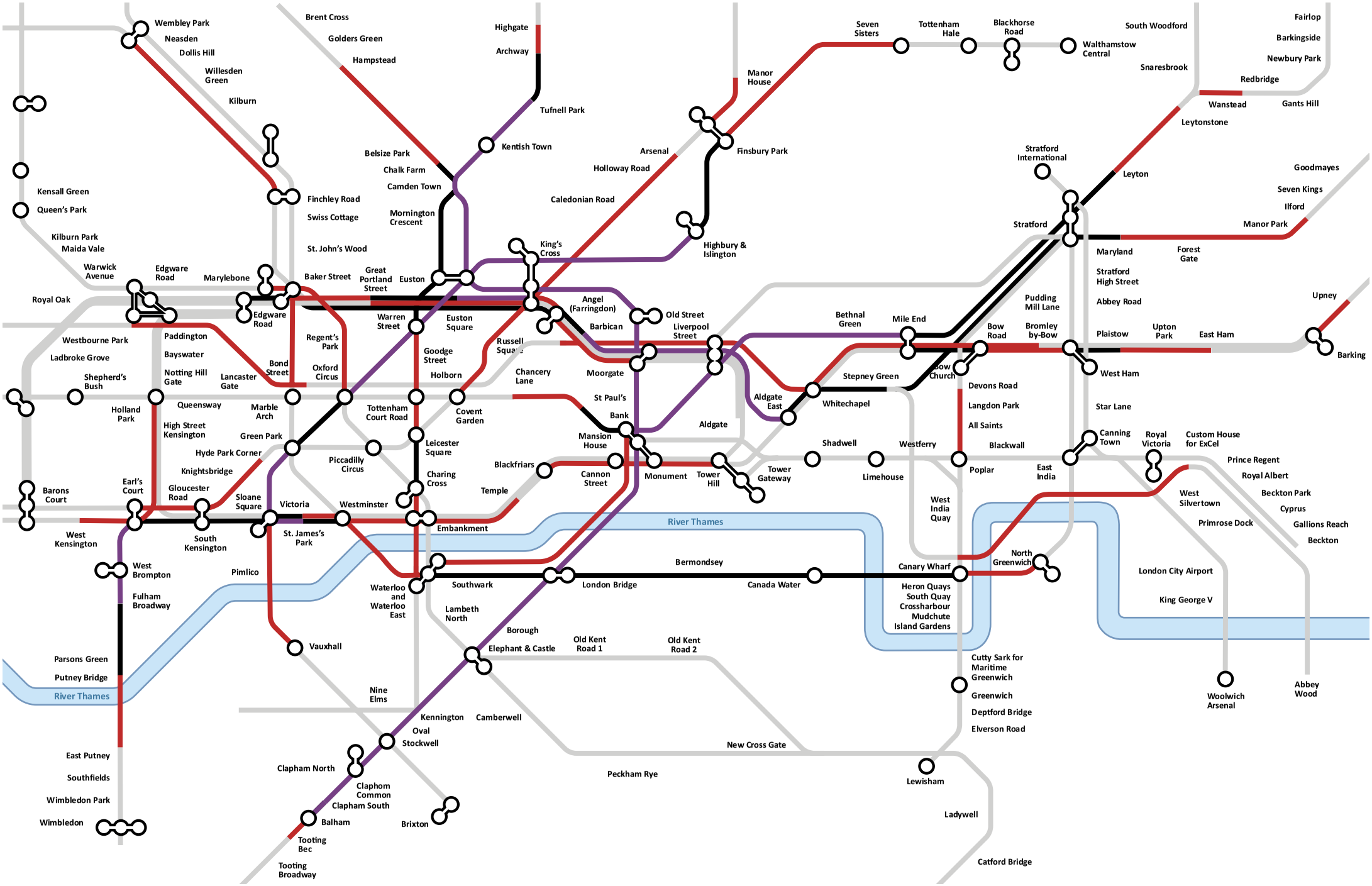
For example, figure 2 (opposite) shows expected crowding on tube lines in 2031, with purple denoting the worst crowding, five or more people standing per square metre. The most crowding is forecast at Mile End to Bank, Tufnell Park to Clapham South via Bank, Oxford Circus to Highbury & Islington and Fulham Broadway to Earl's Court. A simpler, cheaper Crossrail 2 might be able to address Victoria line and National Rail crowding almost as well while freeing up funds for other projects to better tackle other identified crowding problems as well as improving journey times and connectivity more substantially. In addition, smaller schemes such as extensions of existing lines or new self-contained lines are less complicated, more easily managed and could be delivered more quickly.

Figure 2 (opposite): forecast weekday AM peak crowding on London Underground in 2031[11]

Legend: 3 to 4 standing per m^2 4 to 5 standing per m^2 >5 standing per m^2

[10] Khan, S., *Response to Darft Consultation Budget- January 2019*, Greater London Authority, 8 January 2018, MGLA141217-7677, www.london.gov.uk/sites/default/files/pre_budget_report_-_response_from_mayor.pdf, (accessed 7 April 2019).

[11] TfL, *Crossrail 2 NIC Supplementary Submission*, 12 February 2016, crossrail2.co.uk/wp-content/uploads/2016/10/Cross-rail-2-NIC-evidence-submission.pdf, (accessed 8 April 2019), p. 85.


Wembley Park
Neasden
Dollis Hill
Willesden Green
Kilburn
Brent Cross
Golders Green
Hampstead
Highgate
Archway
Tufnell Park
Kentish Town
Belsize Park
Chalk Farm
Camden Town
Mornington Crescent
Finchley Road
Swiss Cottage
St. John's Wood
Kensall Green
Queen's Park
Kilburn Park
Maida Vale
Warwick Avenue
Edgware Road
Marylebone
Baker Street
Great Portland Street
Euston
King's Cross
Angel (Farringdon)
Old Street
Barbican
Liverpool Street
Manor House
Arsenal
Holloway Road
Caledonian Road
Finsbury Park
Highbury & Islington
Seven Sisters
Tottenham Hale
Blackhorse Road
Walthamstow Central
South Woodford
Snaresbrook
Wanstead
Redbridge
Fairlop
Barkingside
Newbury Park
Gants Hill
Leytonstone
Stratford International
Leyton
Stratford
Goodmayes
Seven Kings
Ilford
Manor Park
Maryland
Forest Gate
Stratford High Street
Abbey Road
Pudding Mill Lane
Bethnal Green
Mile End
Bow Road
Bromley by-Bow
Plaistow
Upton Park
East Ham
Upney
Barking
West Ham
Bow Church
Stepney Green
Devons Road
Langdon Park
All Saints
Star Lane
Whitechapel
Aldgate East
Aldgate
Shadwell
Westferry
Blackwall
Poplar
East India
Canning Town
Royal Victoria
Custom House for ExCel
Prince Regent
Royal Albert
Beckton Park
Cyprus
Gallions Reach
Beckton
Primrose Dock
West Silvertown
London City Airport
King George V
Woolwich Arsenal
Abbey Wood
North Greenwich
Canary Wharf
Heron Quays
South Quay
Crossharbour
Mudchute
Island Gardens
West India Quay
Limehouse
Tower Gateway
Tower Hill
Monument
Mansion House
Bank
St Paul's
Chancery Lane
Moorgate
Russell Square
Holborn
Covent Garden
Goodge Street
Warren Street
Euston Square
Tottenham Court Road
Leicester Square
Charing Cross
Piccadilly Circus
Blackfriars
Cannon Street
Temple
Embankment
Waterloo and Waterloo East
Southwark
London Bridge
Bermondsey
Canada Water
Lambeth North
Borough
Elephant & Castle
Old Kent Road 1
Old Kent Road 2
Cutty Sark for Maritime Greenwich
Greenwich
Deptford Bridge
Elverson Road
New Cross Gate
Lewisham
Ladywell
Catford Bridge
Peckham Rye
Nine Elms
Vauxhall
Pimlico
Victoria
St. James's Park
Westminster
Green Park
Hyde Park Corner
Knightsbridge
Sloane Square
South Kensington
Gloucester Road
Earl's Court
West Kensington
Barons Court
West Brompton
Fulham Broadway
Parsons Green
Putney Bridge
East Putney
Southfields
Wimbledon Park
Wimbledon
Kennington
Oval
Stockwell
Clapham North
Clapham Common
Clapham South
Balham
Tooting Bec
Tooting Broadway
Brixton
Paddington
Bayswater
Notting Hill Gate
Lancaster Gate
Bond Street
Oxford Circus
Regent's Park
Marble Arch
Queensway
High Street Kensington
Holland Park
Shepherd's Bush
Ladbroke Grove
Westbourne Park
Royal Oak
River Thames
River Thames

TfL should consider afresh how to reduce the cost of Crossrail 2

Given recent doubts about the certainty and strength of demand for additional transport capacity addressed above, and the financial weakness arising from Crossrail 1 delays, the fares freeze and the reduction in TfL's grant from the Department for Transport, TfL should fully examine how to bring down costs of Crossrail 2, particularly with respect to aspects of the project which have arisen for political rather than transport imperatives.

This exercise presents five suggestions to reduce the cost and, in some cases, also improve the benefits of Crossrail 2. These suggestions require more detailed analysis than this exercise is able to provide. For example, it only uses publicly available information, nor has it been able to consider many three dimensional aspects, such as the locations of tunnels for electricity cables or geological constraints. One such tunnel runs from Wimbledon to St John's Wood, for example. They should, however, present no more of a problem than crossing other underground tunnels.

The five suggestions are:

- remove the New Southgate branch
- reroute via Clerkenwell, Farringdon or City Thameslink between Victoria and Dalston
- remove the station at Chelsea
- reroute via Earlsfield between Wimbledon and Clapham Junction
- build Wimbledon station above ground

These suggestions could mean substantially faster journey times. The shorter, more direct routes between Wimbledon and Clapham Junction, and between Clapham Junction and Victoria, and removing the station at Chelsea could save passengers over four minutes each journey. Rerouting the central section nearer more passengers' final destinations could substantially improve journey times further still, reducing the number of passengers who need to change to another service.

This would also, of course, reduce crowding on those services. Added to the time saving between Wimbledon and Victoria, the shorter journeys between Dalston and Victoria could equate to a 5 minute shorter journey between Wimbledon and Dalston. Passengers travelling to many destinations in the City would not only enjoy a simpler journey but also save time spent changing platforms and waiting for a connecting service.

TfL should also thoroughly investigate options for reducing costs outside of the scope of this exercise, such as whether four platforms at Wimbledon station are really necessary, given that equivalent stations on the Crossrail 1 project have not required four.

It is not possible to estimate the potential savings with a great deal of accuracy because TfL have not published full details of cost estimates (for example, a full list of estimated costs for every station), and some of their statements do not appear to reconcile with others.

Nonetheless the five suggestions could together save as much as £11 billion, or 31 per cent of the £36 billion costs, which could in turn make the project substantially more viable.

Figure 3: five suggestions to reduce Crossrail 2 costs

1. Remove the New Southgate branch
2. Reroute via Clerkenwell, Farringdon or City Thameslink
3. Remove the station at Chelsea
4. Reroute via Earlsfield
5. Build Wimbledon station above ground

1. Remove the New Southgate branch

The primary function of Crossrail 2 is to connect inner suburban National Rail services in south west London from Waterloo with their equivalents in north east London, inner suburban commuter services to Broxbourne from Liverpool Street. A tunnelled spur to New Southgate via Seven Sisters is also proposed, diverging between Dalston and Tottenham Hale. Two options for the branch were consulted on in Autumn 2015, one via Turnpike Lane and Alexandra Palace and another via Wood Green.

As well as providing Crossrail 2 services to people and businesses in the areas near the stations on the spur, it also serves to provide relief to the Piccadilly and Victoria line and National Rail services, by offering those lines' passengers interchange to a faster service into central London. It also provides service resilience from a single terminus and access to stabling facilities (where rolling stock is stored when not in use, such as overnight).

The cost for the New Southgate spur is estimated to be £5.1 billion and there are serious questions as to whether this is optimal way to spend such a large sum. For example, if suitable stabling cannot be found elsewhere on the line from the portal at Tottenham Hale to Broxbourne, an extension to Harlow may offer better value for money.

Harlow Council, supported by Essex County Council, have suggested extending the line approximately 8 kilometres north to Harlow Town, where they point out that there is space for stabling and that they own land abutting the line which could be used for maintenance depots. They also calculate that it could 'release' 50,000 homes, in contrast to the 15,000 homes Crossrail 2 estimates that the New Southgate spur would support.

A potentially much cheaper alternative spur could provide some relief to Great Northern line passengers and, consequently, Victoria and Piccadilly lines (because passengers would no longer change at Finsbury Park and Highbury and Islington). This would utilise the land between Edmonton Green and Angel Road stations (which used to be railway), take over the London Overground spur to Enfield Town and then tunnel the approximately 0.9 kilometres to Gordon Hill. See item 5 on page 44 for more details.

Figure 4: map showing routes to New Southgate spur[12]

[12] TfL, *Crossrail 2 factsheet: Seven Sisters to New Southgate Route Options*, October 2015, consultations.tfl.gov.uk/crossrail2/october2015/user_uploads/s2.pdf, (accessed 8 April 2019).

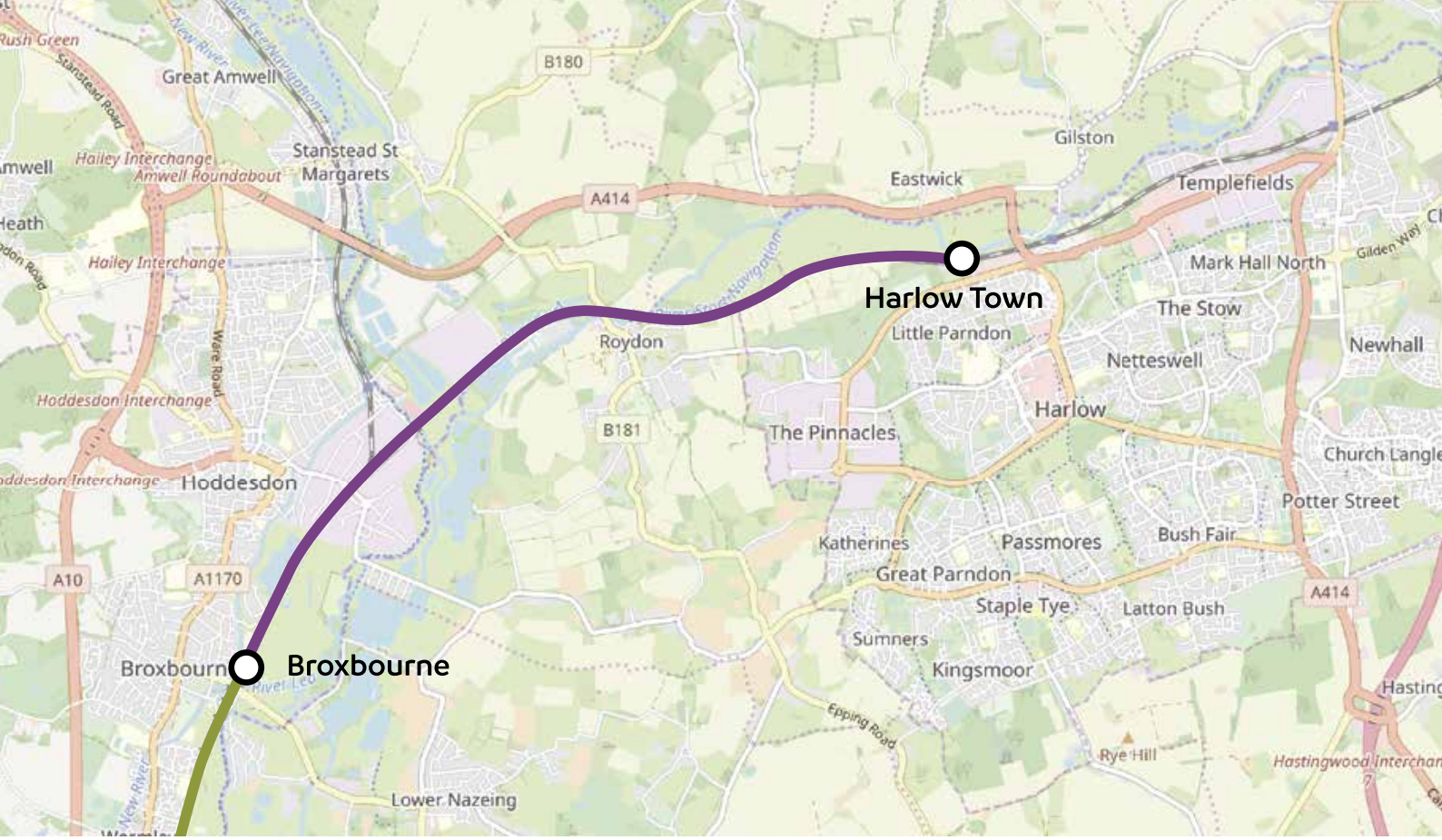


Figure 5: map showing potential extension from Broxbourne to Harlow Town[13]

Legend: proposed route suggested alternative

This makes the option of terminating trains at Dalston, in anticipation of a subsequent phase implementing the New Southgate branch, appear unwise. This is because of the 'turn back' tunnels required, which might eventually be extended to form the full spur to New Southgate. TfL has estimated that these could cost up to £546 million,[14] which would be wasted if alternative options were instead pursued. At most, 'passive provision' should be provided, sparing most of this cost, with trains turning back at Tottenham Hale, which would also improve the immediate benefit of relief to passengers on the Victoria line.

[13] Map adapted from OpenStreetMap, which is © OpenStreetMap contributors, available under the Open Database Licence. For details, see www.openstreetmap.org/copyright. Crossrail 2 stations and alignments from TfL Crossrail 2 route map, Ordnance Survey, TfL and AECOM data © Crown copyright. Available at crossrail2.co.uk/route/route-map/,(accessed 8 April 2019).

[14] TfL, *Crossrail 2 NIC Supplementary Submission*, 12 February 2016, crossrail2.co.uk/wp-content/uploads/2016/10/Cross-rail-2-NIC-evidence-submission.pdf, (accessed 8 April 2019), p. 72. The report provides an estimate of £250 million to £500 million, which has been adjusted for inflation.


ALDGATE

2. Reroute via Clerkenwell, Farringdon or the City

Between Victoria and Dalston, the proposed route runs via Tottenham Court Road, Euston and Angel. In its stations assessment exercise for its submission to the National Infrastructure Commission in support of Crossrail 2, TfL did not assess Tottenham Court Road or Euston. They exempted themselves from assessing Tottenham Court Road due to its "critical Crossrail 1 / LU interchange" role while its "HS2 / National Rail" interchange role provided a rationale for Euston's exemption.

The problem is that while there are transport advantages to London Underground, National Rail and HS2 interchanges in general, and those available at Tottenham Court Road and Euston in particular, there are also drawbacks to the proposed route and also questions about the scale of the transport benefits, in particular those offered by an HS2 interchange.

Alternative, more direct routes, which do not serve Euston, or even Tottenham Court Road and Angel, could offer a better balance of benefits to costs. Three potential alternatives are suggested below. One replaces only Euston with a new station in Clerkenwell, another replaces Tottenham Court Road, Euston and Angel with Leicester Square, Farringdon and Old Street while a third suggests Leicester Square, City Thameslink and Liverpool Street.

Instead of exempting particular stations from assessment, Crossrail 2 should fully assess the transport benefit objectives of particular station choices and routes against their costs, including the foregone transport benefits of alternative route and station combinations.

HS2 interchange

High Speed 2 is a proposal for a new dedicated rail line built to be capable of speeds of 360 kilometres per hour. Its first phase would run from Euston to Birmingham via Old Oak Common and open in 2026, with a subsequent phase proposed to extend to Manchester and Leeds opening in 2033.

The political significance of the Crossrail 2 station at Euston heightened when the previous mayor of London demanded HM Government support for Crossrail 2 as a condition for his own support, as mayor of London, for the HS2 project.

The problem is that there are serious questions about whether HS2 will go ahead following reports of its projected costs being far in excess of its already substantial and revised budget, and significant opposition from across the political spectrum, including within the cabinet. Even if it does go ahead some reports have suggested that it should terminate at Old Oak Common instead of Euston, to save money. Finally, analysis of HS2 proposed service patterns demonstrates that its impact on Euston is likely to be modest.

HS2 trains are expected to have 1,100 seats each, and it is proposed to run 18 trains per hour into Euston. This implies up to 19,800 passengers per hour alighting at Euston. But questions have arisen about whether such a service pattern is realistic.

At the house of commons transport committee, Steve Baker asked Pierre Messulam, the rail strategy and regulation director of SNCF, if anywhere operated 18 trains per hour. He replied: "On a high speed line, nowhere in the world. The Japanese are running 12 trains per hour. We are running a maximum of 12 trains per hour. We are considering next December 13 trains per hour, and nobody does more."

A service pattern of 13 trains per hour implies a maximum of 14,300 HS2 passengers per hour arriving at Euston, before accounting for the reduction in existing passenger capacity into Euston. Discounting the reduction in passengers capacity on the west coast main line and an allowance for

those who will exit Euston on foot, taxi, private car or bus, it is therefore unlikely that HS2 will add any more than around 10,000 passengers per hour at the peak.

This compares to an existing Underground and rail capacity of 183,000 passengers per hour and planned upgrades amounting to 73,000 passengers per hour, a total of 256,000 (including Euston Square). HS2's maximum of around 10,000 passengers per hour in the peak is unlikely to be a significant factor at Euston.

National Rail interchange

There is a clear benefit to National Rail interchange at Euston St Pancras. A large number of journey combinations are clearly improved, particularly those combining stations on Crossrail 2 south west of Clapham Junction with those on National Rail services from Euston, King's Cross and St Pancras. Given the size of the stations, Euston St Pancras is probably the best location for National Rail interchange benefits.

However, more direct, shorter routes could incorporate National Rail interchange at various combinations of City Thameslink, Farringdon, Liverpool Street and Old Street. None of these options appear to offer National Rail interchange benefits as great as those at Euston St Pancras, but they offer both cost savings and other transport and regeneration benefits which the proposed route lacks.

London Underground interchange and relief

The proposed central route via Tottenham Court Road, Euston St Pancras and Angel offers substantial interchange and line relief benefits. In particular, existing 'inward' journeys on the Victoria line from Victoria or Euston, especially those which interchange with the Central line, would be much quicker using Crossrail 2's proposed route.

Other routes, however, offer both cost savings and superior transport interchange and relief benefits, primarily because they offer station exits which will serve as the final destinations for more passengers, reducing the need for interchange and dispersal on other lines.

The difference between the proposed route and these three alternatives in terms of relief to existing services is that the TfL proposal is likely to offer greater relief to the Victoria line but weaker relief to the Northern line. Conversely, the alternatives are likely to offer greater relief to the Northern line and weaker relief to the Victoria line.

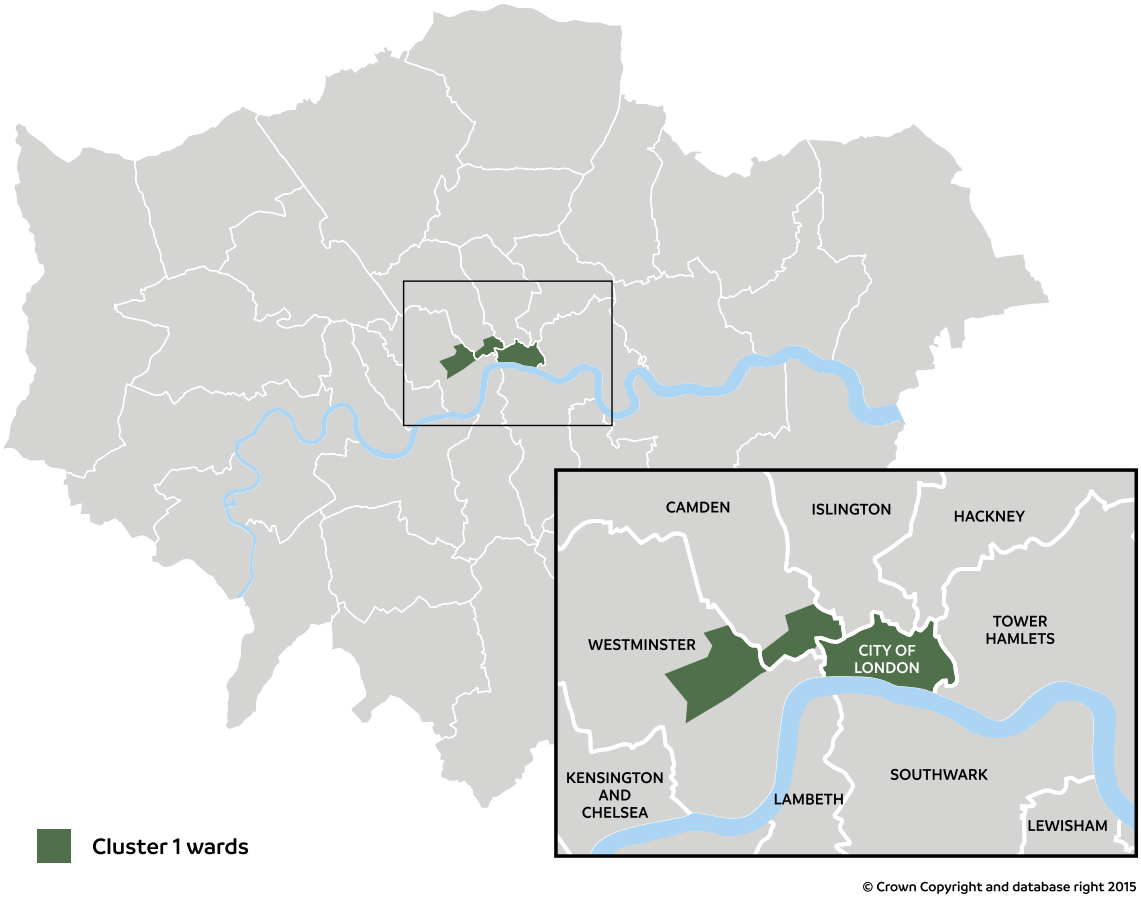
The alternative routes will offer some northbound AM peak Victoria line relief by reducing interchange at Vauxhall from National Rail and collecting passengers at Victoria travelling to destinations such as Old Street or Angel. Southbound AM peak Victoria line relief will be providing by picking up passengers at Tottenham Hale for destinations such as Victoria. This relief is unlikely to be as significant, however, as with an alignment which includes Euston and Victoria.

By contrast, routes via Clerkenwell, Farringdon or City Thameslink are likely to offer substantially improved relief to the AM peaks on the Northern and Waterloo and City lines as well as National Rail. Serving City destinations would be likely to lead more passengers to use Crossrail 2 instead of National Rail to Waterloo for the Waterloo and City line. Similarly, some passengers who would change at Angel to board southbound Northern line passengers might instead stay on Crossrail 2 services to alight at Moorgate or Old Street.

Serving final destinations

The most significant transport flaw with the route via Tottenham Court Road, Euston St Pancras and Angel is that it poorly serves the most employment dense areas, which means that it does not maximise its impact on reducing journey times and interchange requirements. Only one station, Tottenham Court Road, is located within the 'Cluster 1' of the wards with the densest employment (the City of London, Holborn and Covent Garden in Camden and West End in Westminster) identified by GLA Economics.[15] By contrast, two of the three suggested alternative routes have two stations serving the cluster, while the third has three.

Figure 6: map highlighting 'cluster 1' wards with high employment density



That suggests that the proposed alternative routes would provide a larger number of passengers with direct journeys to their workplaces without requiring a change. Data on travel patterns further corroborates this analysis. Crossrail 2 takes over National Rail lines which currently terminate at Liverpool Street and Waterloo. In both cases, the most significant final destinations for AM peak arrivals are in the City of London.[16]

Crossrail 2's proposed route would entail these passengers having to change onto the Circle line at Victoria or the Elizabeth (Crossrail 1) or Central lines at Tottenham Court Road. By contrast, all three suggested alternative routes offer substantially superior proximity to passengers' final destinations.

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[15] Togni, L., *More residents, more jobs? 2015 update The relationship between population, employment and accessibility in London*, Greater London Authority, October 2015, Working Paper 71, www.london.gov.uk/sites/default/files/working-paper-71.pdf, (accessed 8 April 2019), p. 7 & p. 18.

[16] TfL, Central London Rail Termini: Analysing passengers' onward travel patterns, content.tfl.gov.uk/central-london-rail-termini-report.pdf, (accessed 8 April 2019), p. 104 & p. 132.

Alternative route A: Clerkenwell

This suggested alternative route diverges immediately north of Tottenham Court Road station and immediately east of Angel station and might involve retaining the plans at Tottenham Court Road (because there is already 'passive provision' in the Crossrail 1 project for Crossrail 2) while slightly relocating the Angel platform locations (to suit the alternative, more direct alignment to Tottenham Court Road instead of Euston St Pancras).

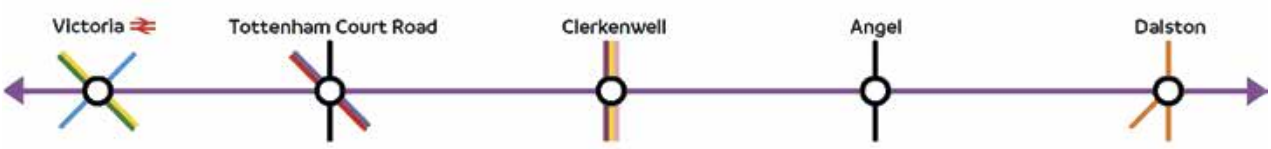
Instead of stopping at Euston St Pancras, an entirely new station in Clerkenwell would be built, with the eastern end near the junction of Goswell Road and Roseberry Avenue. This location is in the middle of a long stretch of the Circle line between King's Cross and Farringdon with relatively poor public transport access. A new stop on the Circle line to both enable interchange with Crossrail 2 and to enhance public transport provision in the Clerkenwell area could be provided.

The principal differences between this route and the existing proposal is that one of the two most expensive stations would be removed (replaced with a cheaper station nearer employment centres) and there would be approximately 1 kilometre less tunnelling, resulting in lower tunnelling costs, lower rolling stock costs, lower station construction costs and improved journeys for passengers.

The route between Angel and Tottenham Court Road via Euston St Pancras is approximately 1 kilometre longer than via Clerkenwell (7 kilometres compared to 6 kilometres). This extra distance equates to each journey between Victoria and Dalston taking half a minute longer, assuming the same underground speed of 100 kilometres per hour as the Elizabeth line (Crossrail 1).[17] This approach could save an estimated £147 million, based on Crossrail 2's 2016 estimate of tunnelling costs of £153 million per kilometre.[18] The shorter journeys further imply rolling stock cost reductions of £32 million.

The Euston St Pancras Crossrail 2 station is estimated to cost £1.7 billion.[19] The alternative Clerkenwell station, however, shares the single line interchange and characteristics with stations in Crossrail 2's bands 1 and 2, meaning that it is could cost around £490 million.

This Clerkenwell route could therefore save £1.4 billion.



[17] Crossrail, *Rolling Stock*, 2017, learninglegacy.crossrail.co.uk/wp-content/uploads/2017/08/3D-015-08_Info-Pack-rolling_stock.pdf, (accessed 8 April 2019).

[18] TfL, *Freedom of Information Act 2000 'Alternative routes between Clapham Junction and Victoria.'*, 18 January 2016, FOI-1721-1516. A figure of £140 million was provided, which has been adjusted for inflation.

[19] The total estimated costs for stations given TfL, *Crossrail 2 NIC Supplementary Submission,* 12 February 2016, crossrail2.co.uk/wp-content/uploads/2016/10/Crossrail-2-NIC-evidence-submission.pdf, (accessed 8 April 2019), was allocated to individual stations using as a guide: TfL, *Crossrail 2 - Per station costs*, 21 December 2015, ref: 1438-1516, www.whatdotheyknow.com/request/crossrail_2_per_station_costs, (accessed 8 April 2019).

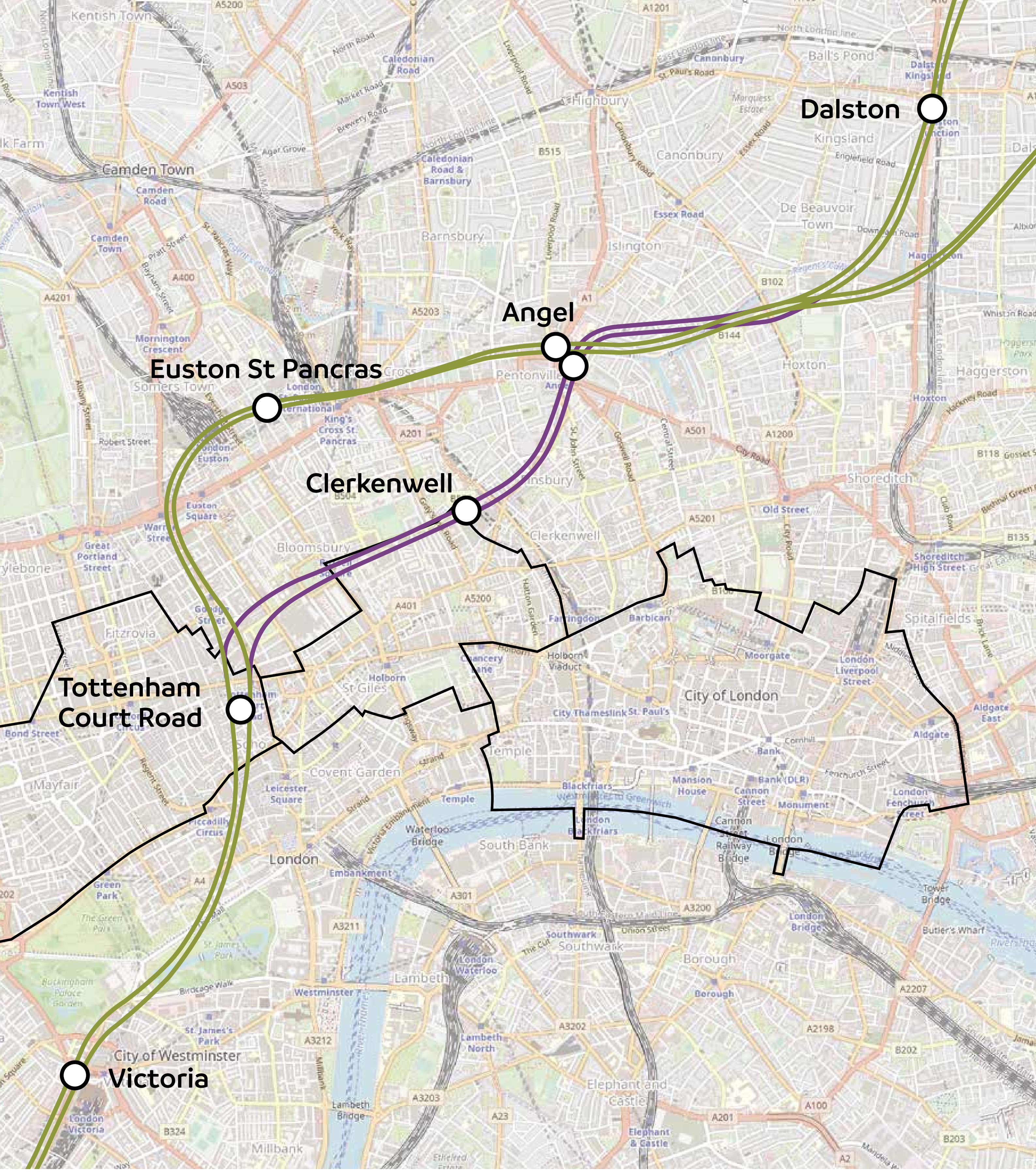


Figure 7: map showing proposed Euston route and route via Clerkenwell[20]

Legend: proposed route | suggested alternative | employment-dense wards

[20] Map adapted from OpenStreetMap, which is © OpenStreetMap contributors, available under the Open Database Licence. For details, see www.openstreetmap.org/copyright. Crossrail 2 stations and alignments from TfL Crossrail 2 route map, Ordnance Survey, TfL and AECOM data © Crown copyright. Available at crossrail2.co.uk/route/route-map/, (accessed 8 April 2019).

Alternative route B: Farringdon

This suggested alternative route diverges between Dalston and Angel in the north east, and immediately north of Victoria in the south west.

Instead of stopping at Tottenham Court Road, Euston St Pancras and Angel, it would stop first between Piccadilly Circus and Leicester Square, then between Chancery Lane and Farringdon and finally near Old Street. Piccadilly Circus is approximately 400 metres from Leicester Square, as is Chancery Lane from Farringdon. Exits from either end of the 250 metre platforms would be approximately 75 metres from each pair of stations.

The principal differences between this route and the existing proposal is that one of the two most expensive stations would be removed (replaced with a cheaper station nearer employment centres) and there would be approximately 1.3 kilometres less tunnelling, resulting in lower tunnelling costs, lower rolling stock costs, lower station build costs and improved journeys for passengers.

The route between Victoria and Dalston via Euston St Pancras is approximately 1 kilometre longer than via Farringdon (6.9 kilometres compared to 5.6 kilometres). This extra distance equates to each journey between Victoria and Dalston taking around 45 seconds longer, assuming the same underground speed of 100 kilometres per hour as the Elizabeth line (Crossrail 1).[21] This approach could save an estimated £197 million, based on Crossrail 2's 2016 estimate of tunnelling costs of £153 million per kilometre.[22] The shorter journeys imply rolling stock cost reductions of £42 million.

Assuming that a station at Old Street would be similar in cost to Angel (band 2), and one between Piccadilly Circus and Leicester Square would also be similar in cost to one at Tottenham Court Road (band 4), the difference in station costs between the routes would lie in switching Euston St Pancras for one between Farringdon and Chancery Lane.

The Euston St Pancras Crossrail 2 station is estimated to cost £1.7 billion.[23] The alternative Farringdon station, however, shares the single line interchange and characteristics with stations in Crossrail 2's bands 3 and 4, meaning that it is could cost around £963 million.

This route via Farringdon could therefore save £962 million.

[21] Crossrail, *Rolling Stock*, 2017, learninglegacy.crossrail.co.uk/wp-content/uploads/2017/08/3D-015-08_Info-Pack-rolling_stock.pdf, (accessed 8 April 2019).

[22] Crossrail 2, *Our response to issues raised Autumn 2015 Crossrail 2 Consultation*, 7 July 2016, crossrail2.co.uk/wp-content/uploads/2016/08/Response-to-Issues-Raised-July-2016.pdf, (accessed 8 April 2019), p28.

[23] The total estimated costs for stations given TfL, *Crossrail 2 NIC Supplementary Submission*, 12 February 2016, crossrail2.co.uk/wp-content/uploads/2016/10/Crossrail-2-NIC-evidence-submission.pdf, (accessed 8 April 2019), was allocated to individual stations using as a guide: TfL, *Crossrail 2 - Per station costs*, 21 December 2015, ref: 1438-1516, www.whatdotheyknow.com/request/crossrail_2_per_station_costs, (accessed 8 April 2019).

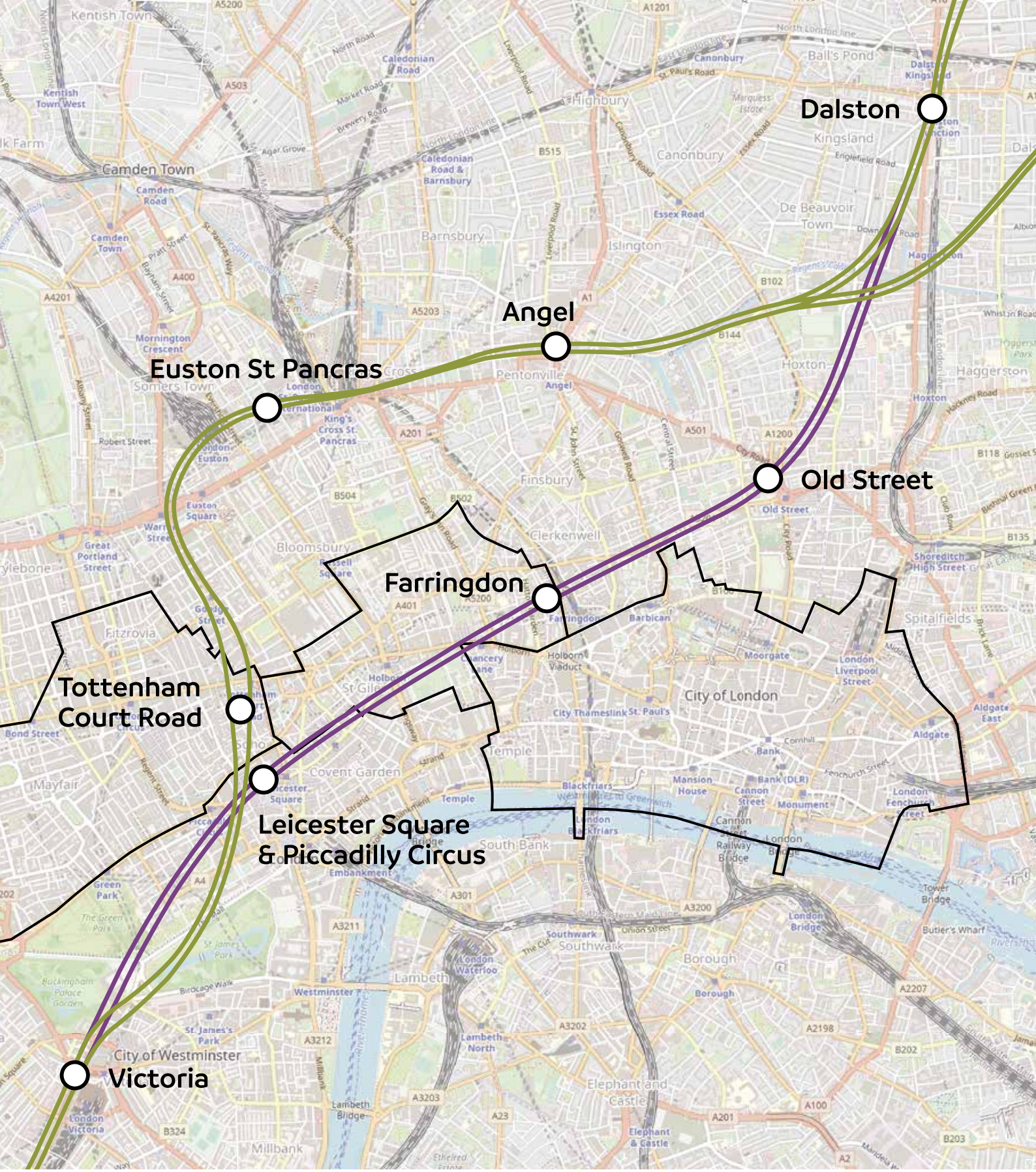


Figure 8: map showing proposed Euston route and route via Farringdon[24]

Legend: proposed route | suggested alternative | employment-dense wards

[24] Map adapted from OpenStreetMap, which is © OpenStreetMap contributors, available under the Open Database Licence. For details, see www.openstreetmap.org/copyright. Crossrail 2 stations and alignments from TfL Crossrail 2 route map, Ordnance Survey, TfL and AECOM data © Crown copyright. Available at crossrail2.co.uk/route/route-map/, (accessed 8 April 2019).

Alternative route C: City Thameslink

This suggested alternative route diverges between Dalston and Angel in the north east, and immediately north of Victoria in the south west.

Instead of stopping at Tottenham Court Road, Euston St Pancras and Angel, it would stop first between Piccadilly Circus and Leicester Square, then between City Thameslink and St Paul's and finally between Moorgate and Liverpool Street. Piccadilly Circus is approximately 400 metres from Leicester Square, as is City Thameslink from St Paul's and Moorgate from Liverpool Street. Exits from either end of the 250 metre platforms would be approximately 75 metres from each pair of stations.

The principal differences between this route and the existing proposal is that one of the two most expensive stations would be removed, all three stations would lie within the 'Cluster 1' of high employment density wards and there would be approximately half a kilometre less tunnelling, resulting in lower tunnelling costs, lower rolling stock costs, lower station construction costs and improved journeys for passengers.

The route between Dalston and Victoria via Euston St Pancras is approximately 0.6 kilometres longer than via City Thameslink (6.9 kilometres compared to 6.3 kilometres). This extra distance equates to each journey between Victoria and Dalston taking around 20 seconds longer, assuming the same underground speed of 100 kilometres per hour as the Elizabeth line (Crossrail 1).[25] This approach could save an estimated £86 million, based on Crossrail 2's 2016 estimate of tunnelling costs of £153 million per kilometre.[26] The shorter journeys further imply rolling stock cost reductions of £18 million.

Assuming the station between Piccadilly Circus and Leicester Square would entail a similar cost to one at Tottenham Court Road (band 4), the difference in station costs between the routes would lie in switching stations at both Euston St Pancras and Angel for stations between City Thameslink and St Paul's; and Moorgate and Liverpool Street.

The Euston St Pancras Crossrail 2 station is estimated to cost £1.7 billion.[27] The alternative City Thameslink and Liverpool Street station, however, while likely to be cheaper than Euston St Pancras are also likely to be more expensive than Angel. It does therefore not appear clear that this route could offer savings on station costs. It does, however, offer tunnelling and rolling stock savings of perhaps £104 million.

[25] Crossrail, *Rolling Stock*, 2017, learninglegacy.crossrail.co.uk/wp-content/uploads/2017/08/3D-015-08_Info-Pack-rolling_stock.pdf, (accessed 8 April 2019).

[26] TfL, *Freedom of Information Act 2000 'Alternative routes between Clapham Junction and Victoria.'*, 18 January 2016, FOI-1721-1516. A figure of £140 million was provided, which has been adjusted for inflation.

[27] The total estimated costs for stations given TfL, *Crossrail 2 NIC Supplementary Submission*, 12 February 2016, crossrail2.co.uk/wp-content/uploads/2016/10/Crossrail-2-NIC-evidence-submission.pdf, (accessed 8 April 2019), was allocated to individual stations using as a guide: TfL, *Crossrail 2 - Per station costs,* 21 December 2015, ref: 1438-1516, www.whatdotheyknow.com/request/crossrail_2_per_station_costs, (accessed 8 April 2019).

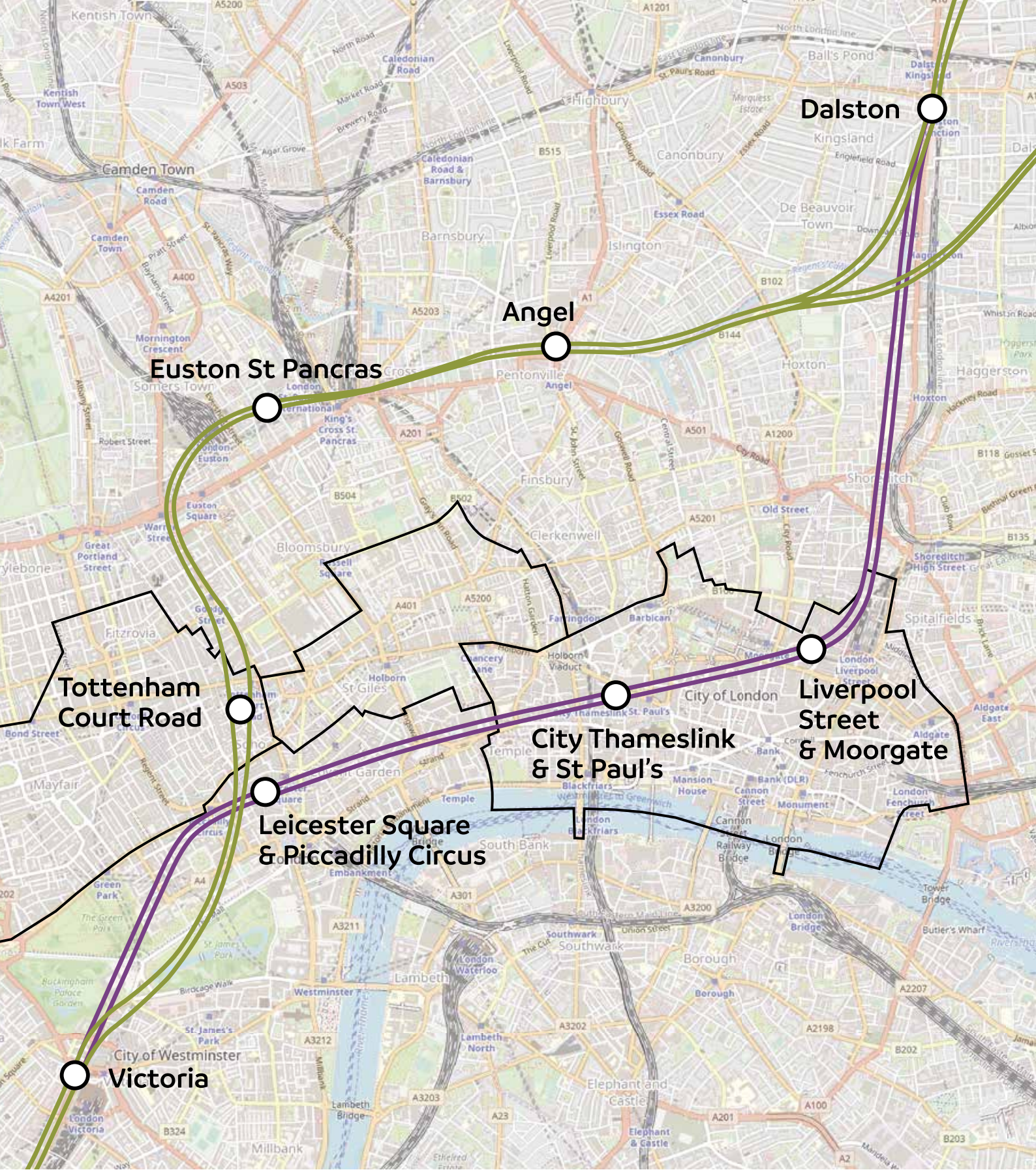


Figure 9: map showing proposed Euston route and route via City Thameslink[28]

Legend: proposed route | suggested alternative | employment-dense wards

[28] Map adapted from OpenStreetMap, which is © OpenStreetMap contributors, available under the Open Database Licence. For details, see www.openstreetmap.org/copyright. Crossrail 2 stations and alignments from TfL Crossrail 2 route map, Ordnance Survey, TfL and AECOM data © Crown copyright. Available at crossrail2.co.uk/route/route-map/, (accessed 8 April 2019).


The Royal Borough of Kensington
and Chelsea
CHELSEA MANOR
STREET,
S.W.3

3. Remove the station at Chelsea

Between Victoria and Clapham Junction, a station is proposed at Chelsea on the King's Road. Given the relatively central and high density urban environment of Chelsea, the lack of an Underground or National Rail station has long been seen as unusual and formed part of the rationale for the Chelsea-Hackney line proposals which eventually became Crossrail 2.

But there are significant downsides to using the Crossrail 2 scheme to address Chelsea's relatively poor public transport provision, and the benefits of the proposed station are weak, particularly in terms of regeneration of deprived communities.

Compared to most of London, Chelsea has relatively good access to public transport. Its public transport access level scores around the proposed station are currently rated between 3 and 6a, where 6b is the best and 0 is the worst. The proposed station would improve this range to between 4 and 6b. While a score of 3 is low for dense inner London, it is not for London as a whole. Only 12 per cent of London has a score of 4 or better and 72 per cent has a score of 2 or worse.[29]

Chelsea is also not the obvious place for a programme aimed at relieving deprivation though a transport project. Kensington and Chelsea is Britain's richest local authority. In 2016, average gross disposable household income was £62,600, compared to £27,151 for London as a whole and £19,432 for the United Kingdom, so the case for using taxpayers' money here for this purpose is arguably non-existent. While a Chelsea station would enhance access to jobs in Chelsea and improve the transport provision for those living near the station, it would also worsen other Crossrail 2 passengers' journeys, increase tunnelling, rolling stock and station costs.

Crossrail 2 is considering a route alignment that runs directly from Clapham Junction to Victoria without a stop between. Given that this option both increases the transport benefits of the project and reduces the cost by £1 billion, it is difficult to see how the advantages of a direct route would not overwhelm the advantages to those Chelsea residents and workers who might benefit.

Faster journeys

The route between Clapham Junction and Victoria via Chelsea King's Road is approximately 1 kilometre longer than a direct route (5 kilometres compared to 4 kilometres). TfL have estimated that the station would add 1 minute 47 seconds to every passing journey compared to a direct route between Clapham Junction and Victoria. In fact, removing the station would increase the London-wide transport benefits of the project by 1 per cent, according to their modelling (which calculates journey times, connectivity and crowding relief).

Less tunnelling

A direct route from Clapham Junction to Victoria would be approximately 1 kilometre shorter, This approach could save an estimated £153 million, based on Crossrail 2's 2016 estimate of tunnelling costs of £153 million per kilometre.[30]

[29] TfL, 2015 PTAL Grid Values, 2015, data.london.gov.uk/dataset/public-transport-accessibility-levels, (accessed 8 April 2019).

[30] TfL, *Freedom of Information Act 2000 'Alternative routes between Clapham Junction and Victoria.'*, 18 January 2016, FOI-1721-1516. A figure of £140 million was provided, which has been adjusted for inflation.

Lower rolling stock costs

Waiting, braking and accelerating time for the station slows a journey down by the equivalent of an extra 1 kilometre of route. Combining the 1 kilometre shorter route through the core tunnel with the reduced delay in braking, waiting and accelerating reduces the rolling stock requirement by around 4.3 per cent, equivalent to £65 million.

No station costs

A direct route from Clapham Junction to Victoria would eliminate expenditure on a station in Chelsea.

TfL have estimated that a Chelsea station would add £900 million (£974 million in 2019-20 prices) to the cost of the project.[32]

Figure 10 (opposite): map showing routes between Clapham Junction and Victoria[31]

Legend: proposed Chelsea route suggested direct alternative

[31] Map adapted from OpenStreetMap, which is © OpenStreetMap contributors, available under the Open Database Licence. For details, see www.openstreetmap.org/copyright. Crossrail 2 stations and alignments from TfL Crossrail 2 route map, Ordnance Survey, TfL and AECOM data © Crown copyright. Available at crossrail2.co.uk/route/route-map/, (accessed 8 April 2019).

[32] The Royal Borough of Kensington and Chelsea, Crossrail 2, www.rbkc.gov.uk/planning-and-building-control/planning-policy/consultations/crossrail/crossrail-2, (accessed 8 April 2019).


Victoria
King's Road Chelsea
Clapham Junction

4. Reroute via Earlsfield

To relieve crowding on the Northern line, a station is proposed at either Balham or Tooting Broadway, between Wimbledon and Clapham Junction. Crossrail 2 argues that passengers who would otherwise use the Northern line from Morden, South Wimbledon, Colliers Wood, Tooting Broadway and Tooting Bec and Balham (if Balham rather than Tooting Broadway is chosen) will change for Crossrail 2 at the interchange rather than stay on their train, because Crossrail 2 services are faster and in some passengers' cases will have stations closer to their destinations. In addition to this, the proposal offers connectivity benefits for various other trip combinations which involve using both the Northern line and Crossrail 2.

It is questionable, however, whether this route detour represents best value or even good value for money for the transport benefits it offers. A more straightforward route would align with the South Western line via Earlsfield, which as well as a potentially substantial cost reduction offers a number of transport benefits: faster journeys for all passengers except those changing; an improvement in the service at Earlsfield (instead of a degradation), less tunnelling and fewer trains.

Faster journeys

The route between Wimbledon and Clapham Junction via Balham or Tooting Broadway is almost 3 kilometres longer than via Earlsfield (8.2 kilometres compared to 5.5 kilometres). This extra distance equates to each journey taking over a minute and a half longer via Balham compared to via Earlsfield, assuming the same underground speed of 100 kilometres per hour as the Elizabeth line (Crossrail 1).[33]

If the Earlsfield route is achieved above ground, however, by using land adjacent to existing lines, the trains would be able to travel at their above ground top speed of 160 kilometres per hour. The distances and acceleration mean that this could save passengers another half a minute. The total time saving for each journey could amount to over two minutes.

Less tunnelling

There are three options for a Crossrail 2 route via Earlsfield. The first would be to tunnel the Crossrail 2 line from Wimbledon, similar to how a Balham or Tooting Broadway route would be constructed, with a new underground station at Earlsfield. This approach could save an estimated £414 million, based on Crossrail 2's 2016 estimate of tunnelling and associated costs of £153 million per kilometre.[34] A second option would tunnel the South Western 'fast' non-stopping line with Crossrail 2 taking over the tracks they now use. This could also save £414 million, but would involve constructing four additional tunnel portals.

A third option could use land adjacent to the existing South Western lines (see picture opposite). This option could save up to £1.3 billion in tunnelling and associated costs, less the cost of above-ground engineering works such as reconstructing verges and building or rebuilding up to 11 new bridges.

[33] Crossrail, *Rolling Stock*, 2017, learninglegacy.crossrail.co.uk/wp-content/uploads/2017/08/3D-015-08_Info-Pack-rolling_stock.pdf, (accessed 8 April 2019).

[34] TfL, *Freedom of Information Act 2000 'Alternative routes between Clapham Junction and Victoria.'*, 18 January 2016, FOI-1721-1516. A figure of £140 million was provided, which has been adjusted for inflation.

Lower station and rolling stock costs

As well as lower costs for tunnelling and improved journey times for passengers, a shorter, more direct route potentially offers savings on items such as track, overhead electrification infrastructure and rolling stock. In addition, a substantial saving could be made by adapting the existing Earlsfield station above ground to accommodate Crossrail 2 services instead of building a new station deep underground. This could also provide passengers with cross platform interchange which as well as allowing passengers a convenient option to change trains, would also remove the need for Earlsfield passengers to decide which service to select, allowing them the option to take the first train, thereby reducing the impact of delays on one or other of the lines.

Better crowding relief alternatives

There are questions about how effective the relief to the Northern line from a Crossrail 2 station at Balham or Tooting Broadway will be, particularly with the proposed alignment through central London which does not serve the City. Under TfL's proposed alignment, some Elizabeth line (Crossrail 1) passengers travelling to the southern part of the City of London may find it quicker to change onto the Northern line and alight at London Bridge, rather than stay on until Victoria or Tottenham Court Road to change onto the Circle, Central or Elizabeth lines. This could worsen Northern line crowding rather than alleviate it.

Instead, a new metro service through Northern line station catchment areas such as the Blackfriars – Herne Hill proposal on page 42, is much more likely to offer relief, as well as improving access to public transport in underserved areas and improving connectivity.

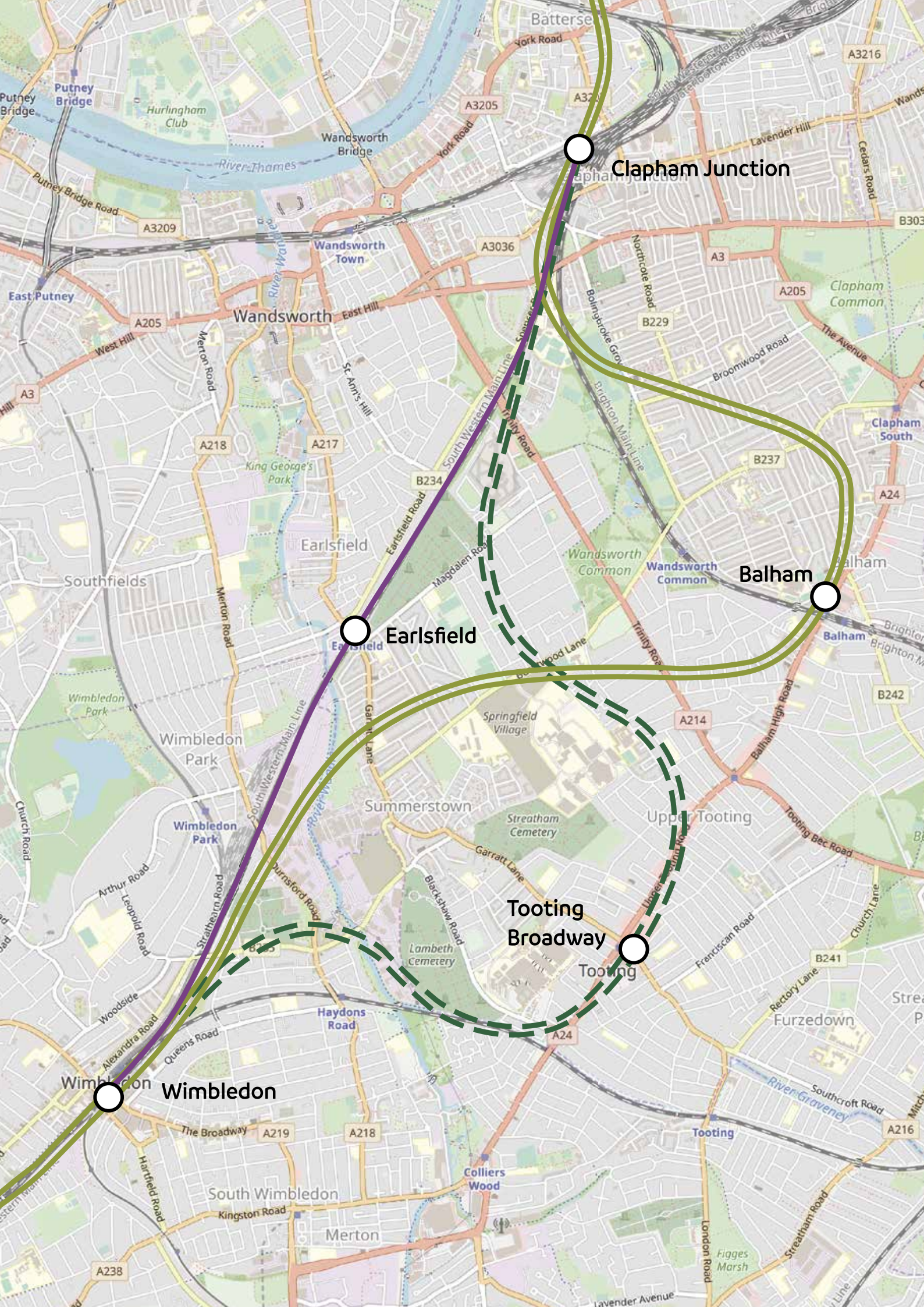
Assuming adapting Earlsfield station costs of £75 million (to add a platform and access to the platform), this option could save £455 million in station costs compared to Balham, or £986 million compared to Tooting Broadway. Meanwhile, a 3 kilometres shorter route through the core tunnel reduces the rolling stock requirement by around 5.8 per cent, equivalent to £89 million.

The total savings compared to a route via Tooting could therefore add up to as much as £2.3 billion, or £1.8 billion compared to a route via Balham.

Figure 11 (opposite): routes between Wimbledon and Clapham Junction[35]

Legend: Balham route Tooting route suggested Earlsfield route

[35] Map adapted from OpenStreetMap, which is © OpenStreetMap contributors, available under the Open Database Licence. For details, see www.openstreetmap.org/copyright. Crossrail 2 stations and alignments from TfL Crossrail 2 route map, Ordnance Survey, TfL and AECOM data © Crown copyright. Available at crossrail2.co.uk/route/route-map/, (accessed 8 April 2019).


Clapham Junction
Earlsfield
Balham
Tooting Broadway
Wimbledon


10a

5. Build Wimbledon station above ground

Current proposals for Wimbledon station involve building the Crossrail 2 platforms underground, at a depth of 10 metres below street level to the top of the tunnel, under the land currently used by the Centre Court Shopping Centre (see figure 12 opposite, for the existing layout and figure 13 for the proposed layout with Crossrail 2). Four platforms are proposed, to provide capacity for some trains to terminate at Wimbledon instead of continuing further into south west London to the terminal stations.

In October 2015, an estimate was given for the cost of Wimbledon station of £1,820 million (£1,970 million in 2019-20 prices).[36] Part of the reason for the high cost is that the station is underground. A previous disclosure by TfL to a request for information revealed that stations within the tunnelled core of the scheme ranged from £400 million to £1.4 billion. Constructing the station at ground level may therefore offer an opportunity to reduce the cost.

Alternative platform configuration

Building Wimbledon's Crossrail 2 station at ground level might be delivered by utilising the largely unused South Western line platforms (6 and 7) which currently stand next to the 'fast' lines for non-stopping services. Instead of tunnelling Crossrail 2 lines, these fast lines could be tunnelled, leaving the space formerly used by the fast lines above ground for Crossrail 2 (see figure 14 for this suggested layout).

There are currently two tracks beside the Tramlink platform (see picture opposite), to allow a second "platform" to operate independently further down, as trams are short enough for this. But with the Tramlink stop being relocated, these two tracks and the Tramlink platform might be reallocated to Crossrail 2 while a new platform would be built adjacent to it, over land now occupied by a shopping centre. Some of the shopping centre might still be required for another ticket hall, but the necessary demolition might be substantially reduced.

Portals and tunnelling

If it is decided to retain the current proposed diversion to either Tooting Broadway or Balham, portals would need to be located north of the station to allow the fast lines to enter the tunnel under Wimbledon station and to allow the Crossrail 2 lines to enter the core tunnel. If the direct route to Clapham Junction (via Earlsfield) is chosen instead, Crossrail 2 could also utilise the existing fast lines beyond Wimbledon through Earlsfield (see previous suggested item), going underground shortly before reaching Clapham Junction.

Building Wimbledon Crossrail 2 station above ground would not remove the cost of tunnelling. In fact, the tunnelling cost would be higher because another four portals would be required, one at each end of the two 'fast' lines on the South Western route. Constructing these portals might require a period of two-track operation which would be disruptive, although this might be lessened by temporary tracks around the portal sites. It would also entail a loss of some flexibility.

Flexibility

When track works are carried out on the 'slow' lines, typically at weekends, stopping services can still use the 'fast' lines and stop at Wimbledon using platforms 6 and 7. This proposal would remove this

[36] TfL, *Crossrail 2 NIC Supplementary Submission*, 12 February 2016, crossrail2.co.uk/wp-content/uploads/2016/10/Cross-rail-2-NIC-evidence-submission.pdf, (accessed 8 April 2019).

flexibility. But this value is minimal due to the option for passengers to change at Clapham Junction or Raynes Park onto a Crossrail 2 service to Wimbledon in the event of a slow line closure.

The costs of this loss of flexibility, however, are likely to be dwarfed by the savings available from constructing the platforms and halls above ground.

Savings

Subtracting the £185 million cost of additional portals and a £510 million allowance for constructing the station above ground from the estimated £2 billion cost for constructing the Wimbledon Crossrail 2 station underground leaves a potential saving of £1.3 billion (see table 2).

Table 2: benefits and costs of tunnelling under Wimbledon station

	(£ million)
Four additional portals at £46 million each[37]	(185)
Construction above ground, assuming half the £1bn cost of rebuilding London Bridge[38]	(510)
Construction underground cancelled	1,970
Total	1,275

Figure 12: platform use at Wimbledon station, existing

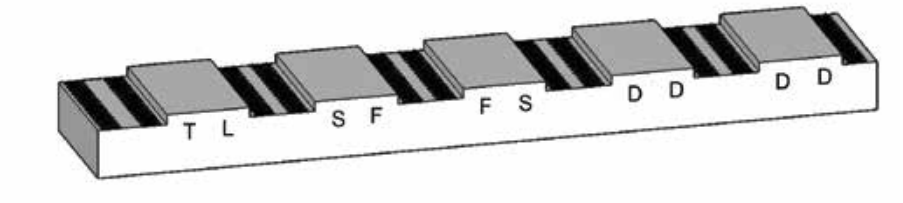


Figure 13: platform use at Wimbledon station, TfL proposed

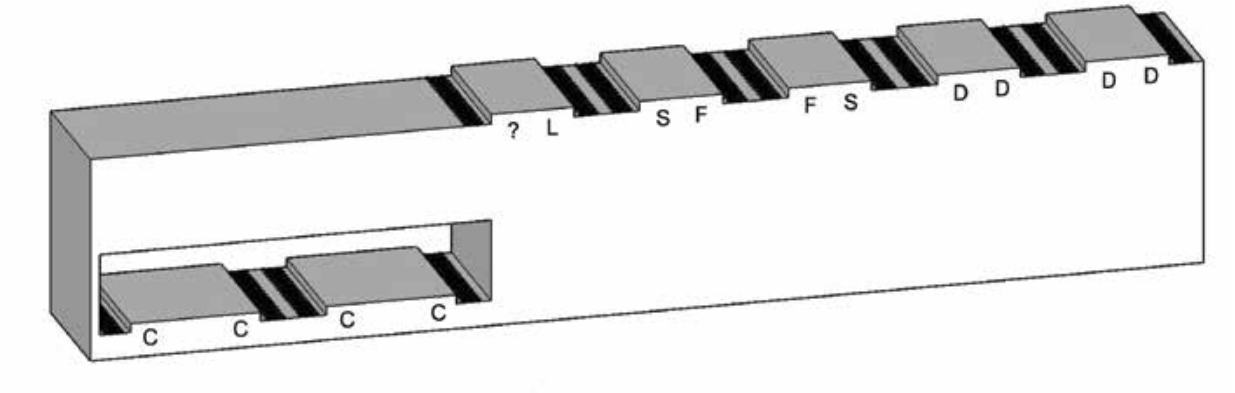
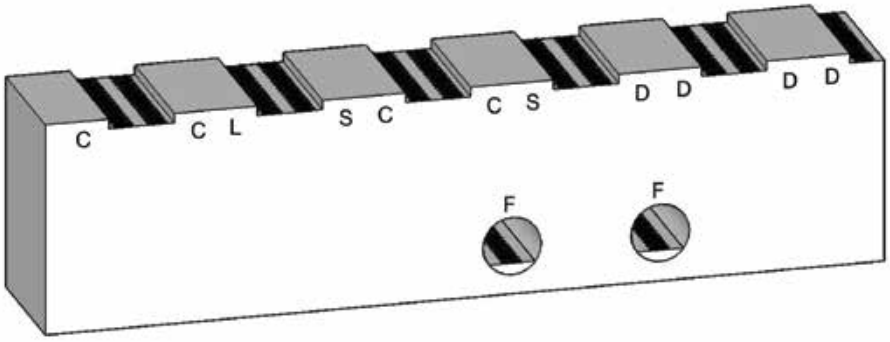


Figure 14: platform use at Wimbledon station, suggested ground-level alternative



Legend: T = Tramlink; L = Sutton Thameslink loop; S = mainline suburban lines; F = mainline fast lines; D = London Underground District line; ? = undecided.

[37] HS2, *High Speed Two A Guide to Tunnelling Costs*, 2015, assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/434516/HS2_Guide_to_Tunnelling_Costs.pdf, (accessed 8 April 2019).

[38] Network Rail, *London Bridge is open! Final section of massive new concourse and five new platforms open to the public as historic redevelopment begins countdown to completion*, www.networkrail.co.uk/feeds/london-bridge-is-open-final-section-of-massive-new-concourse-and-five-new-platforms-open-to-the-public-as-historic-redevelopment-begins-countdown-to-completion, (accessed 8 April 2019).

TfL should transfer more of the funding burden from taxpayers to passengers

As well as the enormous estimated costs involved in Crossrail 2 and whether particular elements represent best value for money or not, part of its viability problem lies in how it is proposed to be funded.

TfL commissioned PwC to study the funding and financing of Crossrail 2. They estimated that Crossrail 2 would run an operating surplus of £308 million in 2033-34, rising to £622 million in 2064-65.[39] As well as reducing the capital costs of Crossrail 2, improving the funding from passengers would improve the ability to finance the project.

At the time, PwC estimated that the fare revenue operating surplus could provide just 20 per cent of the finance, via the Public Works Loan Board. This compares to around 33 per cent for Crossrail 1. Since the study was undertaken, Crossrail 1 has been delayed, which has sent it over budget, with costly consequences for other projects such as the Bank station upgrade project. The mayor of London has also introduced a fares freeze policy and demand growth has been weaker than expected, both of which will have reduced the base case for PwC's assumptions.

Raising tax imposes economic costs which should be fully accounted for when assessing the funding and financing of Crossrail 2 (and other infrastructure projects). The funding and financing study by PwC suggested relying on the community infrastructure levy, a council tax precept and a business rates supplement in addition to funds from national government. Because of its negative effect on property owners providing property to commercial occupiers and on the viability of structures, business rates have serious economic consequences.[40] Similarly, the community infrastructure levy restricts development by making it more costly to finance, hampering one of the objectives of Crossrail 2 in the process.

Such a significant increase in tax should not be proposed without a full dynamic assessment of the behavioural consequences involved, and whether or not there would be an enhanced benefit to cost ratio if passengers paid a greater share of the costs of the infrastructure they use. The PwC review does acknowledge that the community infrastructure levy and business rates supplement "are in effect taxes on the very growth benefits that the project is seeking to deliver", but little further analysis is provided.

Three measures could be introduced to reduce the share of the project's costs paid for by taxes: reintroducing fares escalation, adding a Crossrail 2 fares premium, and exempting Crossrail 2 from concessionary fares policies.

[39] PwC, *Crossrail 2 Funding and financing study*, 27 November 2014, www.pwc.co.uk/capital-projects-infrastructure/assets/crossrail-2-funding-and-financing-study.pdf, (accessed 8 April 2019).

[40] TaxPayers' Alliance, *Business rates*, 2017, www.taxpayersalliance.com/business_rates_briefing, (accessed 8 April 2019).

1. Fares escalation

PwC estimated that raising fares by RPI plus 1 per cent would increase the share of financing from the operating surplus by 4.5 per cent of project costs from 20 per cent to 24.5 per cent, compared to the base case assumption of RPI plus 0.5 per cent. Crossrail 2 should go further than this and consider raising fares by RPI plus 2 per cent. This could increase the operating share of financing from fare revenues by another 9 per cent, to 33.5 per cent.[41]

2. Crossrail 2 fare premium

Crossrail 2 will offer passengers much faster, more convenient journeys, particularly if the recommendations in this report for faster, more direct routes which better serve employment centres are adopted. Some of the value created in this way could be captured by adding a surcharge for travel on Crossrail 2 services, to reflect the premium service on offer. A conservative assumption of 540,000 Crossrail 2 trips a day implies annual revenues of £197 million could be raised with a £1 surcharge per journey.[42]

Journeys on the outer branches which do not travel through the core tunnel will not be substantially improved (though service frequency will) so a surcharge need not apply there.

3. Crossrail 2 concessions exemption

Crossrail 2 should consider exempting its services from discounted or free fares, to help bring the project closer to being affordable. Free and discounted fares are offered to TfL staff, police staff, people aged over 60 or under 18, veterans, apprentices and students. This should only apply to journeys on the new, tunnelled core and not on branch lines taken over from existing rail services.

TfL estimated in its business plan that travel concessions, not including the 'Freedom Pass' which is funded by London boroughs after 09:30, resulted in foregone revenues of £268 million in 2017-18, against total passenger income of £4.6 billion.[43]

Applying this foregone revenue loss of 6 per cent to the modelled fare revenues improves the operating surplus by approximately 12 per cent annually, or £36 million in 2034-35. This could enable approximately 2.3 per cent of the financing to be supported by fare revenues.

[41] The relationship will not be linear and we have not attempted to estimate the impact more precisely, but a linear assumption provides a reasonable working assumption in the absence of a full model.

[42] The core tunnel has capacity for 90,000 end-to-end trips an hour.

[43] TfL, *Business Plan 2019/20 to 2023/24*, December 2018, content.tfl.gov.uk/tfl-business-plan-2019-24.pdf, (accessed 7 April 2019).

TfL should investigate alternative means of meeting its objectives

Instead of just assessing whether objectives of Crossrail 2 are met by the project, each objective should also be assessed on whether alternative projects might be able to meet the objective while offering better value for money.

Six potential projects are suggested which could meet some of the objectives for Crossrail 2 which may provide better value for money than trying to meet them through Crossrail 2 itself.

A Fulham to Canary Wharf metro line, for example, could satisfy a range of Crossrail 2 objectives. It could relieve crowding on the Wimbledon branch of the District line and improve access to public transport in Chelsea, as well as improving the viability of residential development and access to employment centres. It would also serve other public transport benefits not within the scope of Crossrail 2, such as improving access to public transport in Fulham, Tower Bridge Road and Bermondsey, as well as relieving the Jubilee and Circle lines, and further enhancing connectivity.

Other potential projects include an extension of the DLR from Bank to Euston; introducing a metro service on above ground National Rail lines between Newington and Herne Hill, with a tunnel onto central London; a Crossrail 2 spur to Gordon Hill via Edmonton and Enfield Town; an express line between Kentish Town and Canary Wharf; and a 'Crossrail 3' from Waterloo to Euston (or King's Cross).

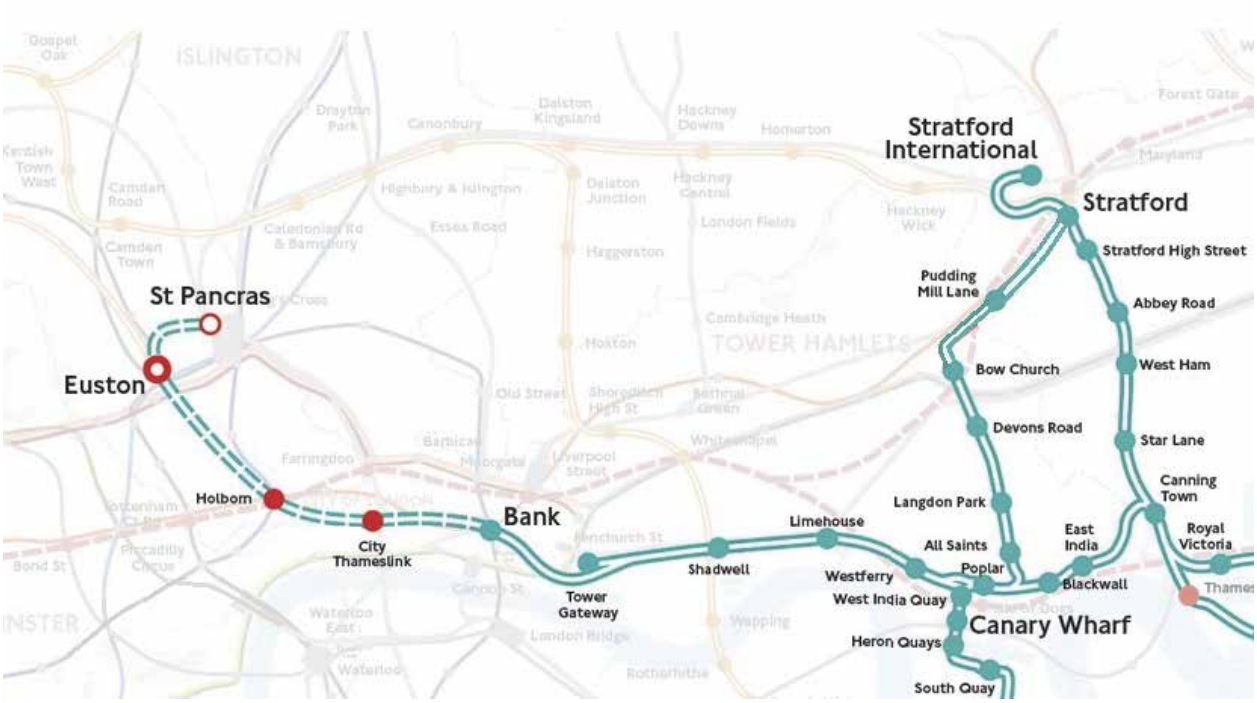
1. Bank – Euston DLR extension via City Thameslink and Holborn

Extending the DLR west of Bank to Euston, via City Thameslink and Holborn could satisfy the Crossrail 2 transport objective of passenger dispersal at Euston,[44] in the event of HS2 being delivered, while also providing relief to the Bank branch of the Northern line and the northern section of the Circle line east of Euston. It would also provide a direct service between Euston and Canary Wharf and improve connectivity between most stations across the DLR and Euston and the west of the City.

TfL published a map indicating this route as something it was considering in 2011, albeit without any accompanying official comment.[45] It should be noted, too, that this proposal is not featured in TfL's business plan and was published under the previous mayor.

Applying TfL's estimates for the cost of the Bakerloo line extension to this proposal implies a cost of £2 billion in 2019-20 prices.[46] But given that a DLR train's capacity is approximately 60 per cent smaller than that of a Bakerloo line train's, it might be reasonable to discount these cost estimates by half that difference, to reflect the lighter requirements. After this adjustment the cost would be £1.4 billion.

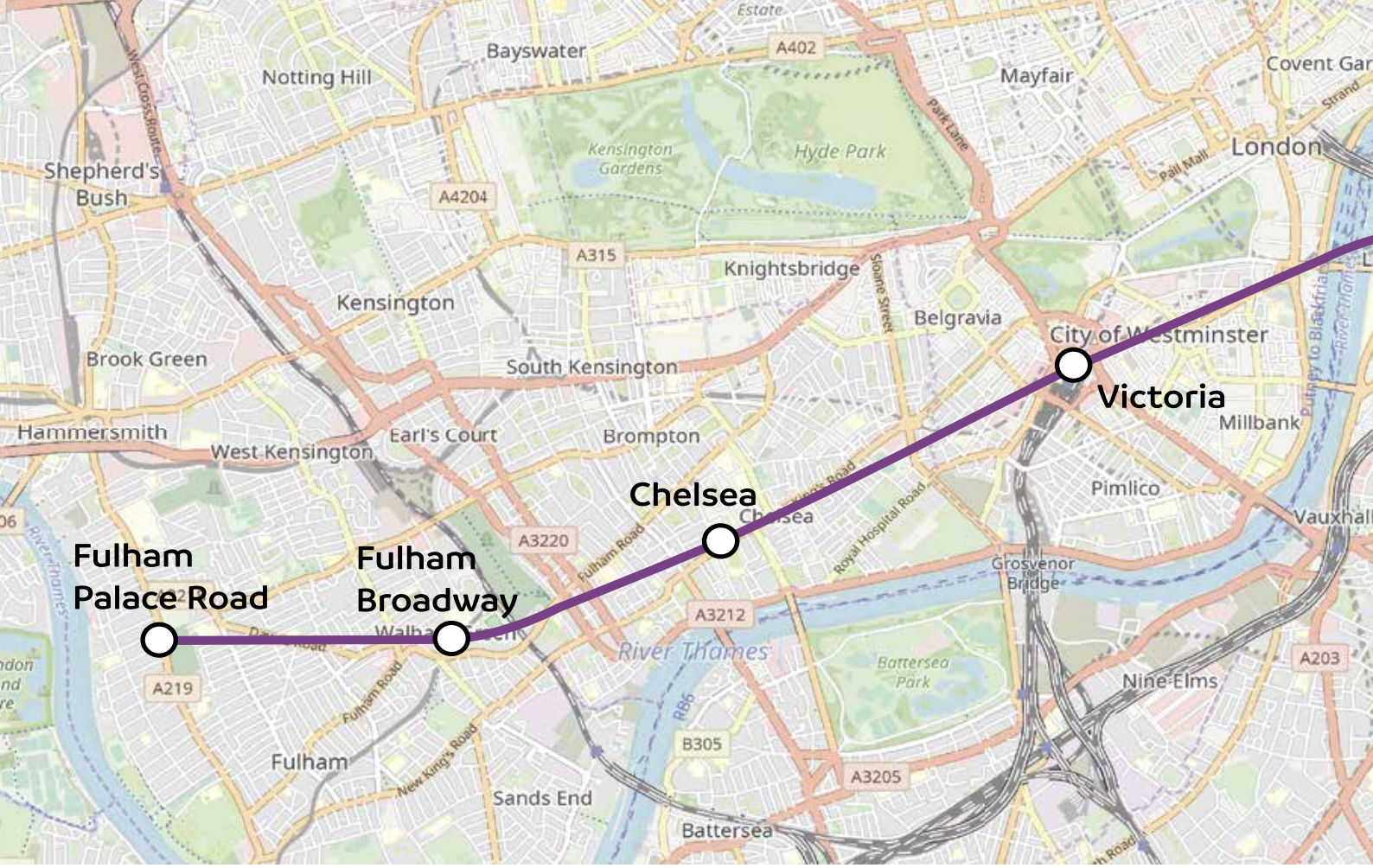
Figure 15: potential extension of the DLR from Bank to Euston



[44] City of London Corporation, *High Speed 2*, 19 July 2011, democracy.cityoflondon.gov.uk/Data/Policy%20and%20Resources%20Committee/20110721/Agenda/$16%20-%20High%20Speed%202.doc.pdf, (accessed 8 April 2019).

[45] Pedantic of Purley, *Extending the DLR*, London Reconnections, 2 May 2011, www.londonreconnections.com/2011/extending-the-dlr, (accessed 8 April 2019). Image adapted to remove a spur to Victoria.

[46] TfL, *Bakerloo line extension Options assessment report*, December 2015, consultations.tfl.gov.uk/tube/bakerloo-extension-2014/user_uploads/ble---options-assessment-report_final.pdf, (accessed 8 April 2019).



2. Fulham – Canary Wharf metro line via inner south London

A new underground metro line from Fulham to Canary Wharf might offer better value for money in providing relief to the District and Jubilee lines, as well as enhancing connectivity and access to public transport for Fulham, Chelsea and south London.

In Fulham, the western terminus might be at a new station somewhere between Hammersmith and Putney Bridge, a densely populated residential area approximately 3 kilometres between the stations. It could then stop at Fulham Broadway to provide interchange with the District line, and then somewhere on the King's Road, Chelsea, to satisfy the objectives stated by Crossrail 2 for their proposal for a station there. Then Victoria, Waterloo, Borough, a new station on or near Tower Bridge Road, South Bermondsey and Canary Wharf (perhaps at South Quay) as the eastern terminus.

The line's primary function in the AM weekday peak would be to pick up passengers who would have used the Jubilee line to Canary Wharf from the Wimbledon branch of the District line (at Fulham Broadway), the Circle line (at Victoria), National Rail services (at Waterloo and South Bermondsey) and the Bank branch of the Northern line (at Borough) and the Charing Cross branch of the Northern line (at Waterloo). In addition, it would enhance access to public transport in south London, Fulham and Chelsea, as well as access to jobs in Chelsea, Victoria, the South Bank and Canary Wharf.

Applying TfL's estimates for the cost of the Bakerloo line extension to this proposal implies a cost of £5.5 billion in 2019-20 prices.[47]

[47] TfL, *Bakerloo line extension Options assessment report*, December 2015, consultations.tfl.gov.uk/tube/bakerloo-extension-2014/user_uploads/ble---options-assessment-report_final.pdf, (accessed 8 April 2019)

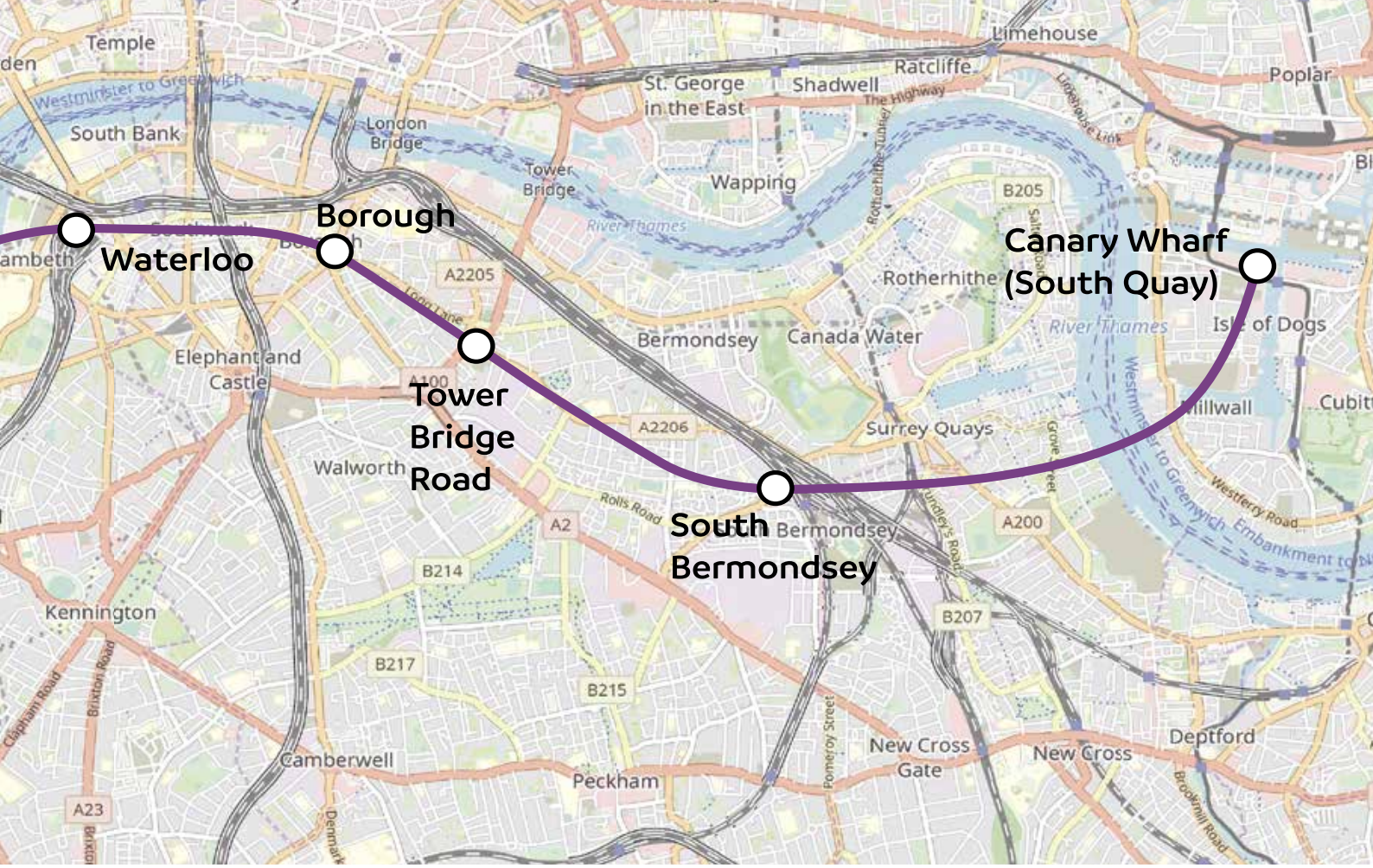
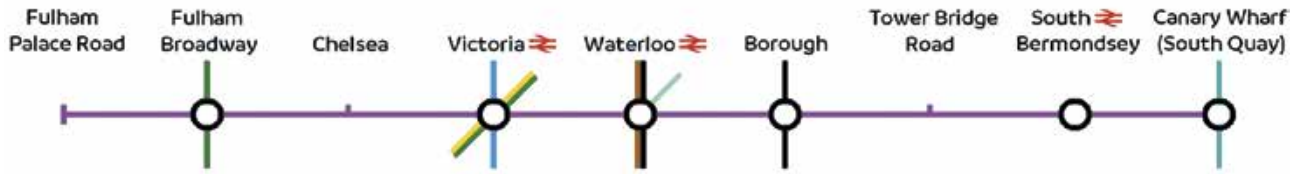


Figure 16: map showing potential Fulham – Canary Wharf metro route[48]

Legend: Potential Fulham – Canary Wharf metro route stations



[48] Map adapted from OpenStreetMap, which is © OpenStreetMap contributors, available under the Open Database Licence. For details, see www.openstreetmap.org/copyright

3. Herne Hill – Fenchurch Street (or King's Cross)

National Rail services run approximately 7 kilometres roughly due south through inner south London from Blackfriars to Herne Hill. The suburban services stop only at Elephant and Castle and Loughborough Junction. The Northern line runs a similar distance on a more south west-north east alignment between London Bridge and Clapham Common with six intermediate stations.

The Northern line suffers from serious projected crowding (see figure 2 on page 11), and one of the objectives of Crossrail 2 is to alleviate this crowding with a station at Balham or Tooting Broadway.

But using the existing above-ground railway infrastructure to create a new suburban service offers a potential opportunity to provide relief for the Northern line at relatively low cost, by picking up passengers who currently travel east to Northern line stations, as well as improving connectivity and access to public transport in relatively poorly served areas of south London.

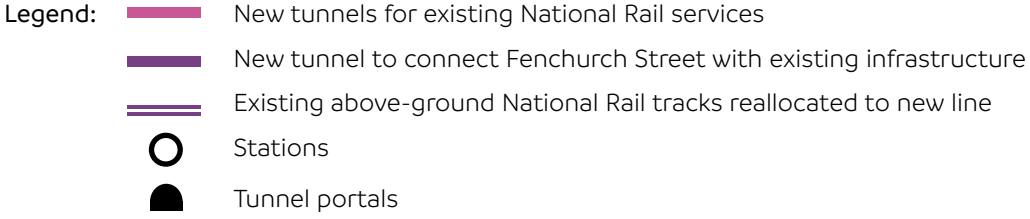
Building new stations above ground along this route would be much cheaper than constructing them underground in a new service, which could in turn make 'metro' intervals of between 1 and 1.5 kilometres viable, a similar type of service and coverage to Underground lines.

However, existing National Rail services already use the tracks, so their passengers would need tracks for them to run on if their tracks were reallocated. They could be tunnelled between north of Elephant and Castle and south of Herne Hill, with perhaps one or two underground stations (Elephant and Castle and/or Herne Hill), for connectivity, leaving the existing tracks for conversion to a new above-ground metro service.

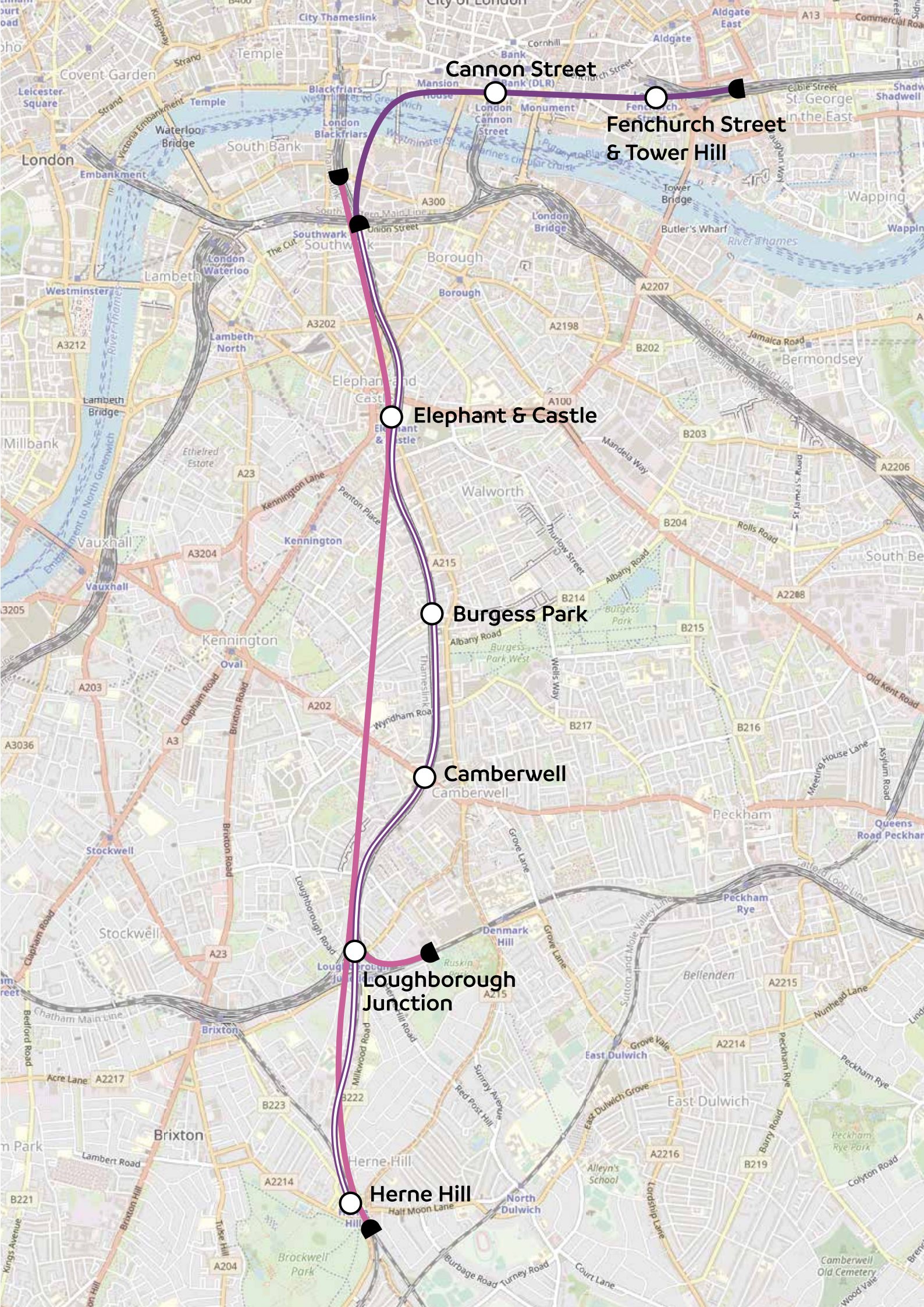
The new metro service above ground using the existing railway would then enter a portal and go underground north of Elephant and Castle; and could link to either the London, Tilbury and Southend line at Fenchurch Street, effectively extending the London, Tilbury and Southend line through the City to Herne Hill. The project would essentially build a new metro service along the route of the existing tracks, but save money by building the stations above ground on the existing tracks rather than underground along the new tunnels.

Alternatively, instead of connecting with the London, Tilbury and Southend line, it may be preferable to link to the Great Northern line at King's Cross, effectively extending that line to Herne Hill via central London.

Figure 17 (opposite): map showing potential extension from Fenchurch Street to Herne Hill[49]



[49] Map adapted from OpenStreetMap, which is © OpenStreetMap contributors, available under the Open Database Licence. For details, see www.openstreetmap.org/copyright.


Cannon Street
Fenchurch Street
& Tower Hill
Elephant & Castle
Burgess Park
Camberwell
Loughborough
Junction
Herne Hill

4. Angel Road – Gordon Hill Crossrail 2 spur via Edmonton Green and Enfield Town

An alternative Crossrail 2 spur could diverge north of Angel Road station and follow former Edmonton branch railway land adjacent to Tottenham Park Cemetery towards Edmonton Green. It would then take over the London Overground branch to Enfield Town, including Bush Hill Park. Enfield Town station would need to be rebuilt underground at a shallow depth to enable the route to continue in an approximately 900m tunnel to south of Gordon Hill, which would be rebuilt (above ground) as the terminus of the line.

The purpose of the line would be much the same as the proposed route to New Southgate, to provide an alternative branch on the north eastern end of the project, avoiding a single terminus. It would also pick up passengers on the Cheshunt and Enfield Town branches of the London Overground (at Edmonton Green) as well as Great Northern services (at Gordon Hill), relieving crowding on the Northern, Circle, Victoria and Central lines.

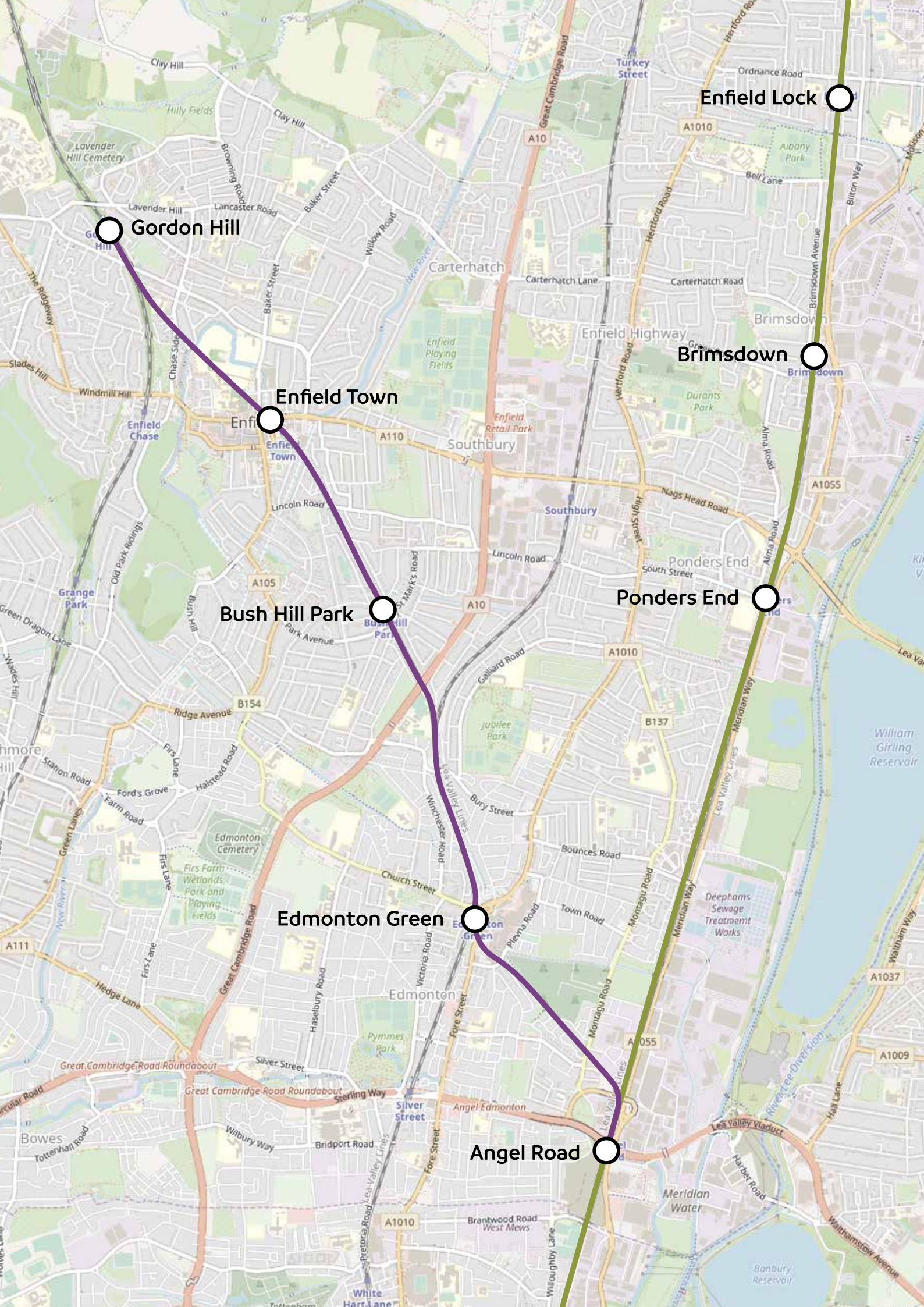
Due to its more northerly location, this proposed spur would pick up fewer passengers (and therefore offer less relief to the Underground lines listed) than the existing proposal. However, it is also likely to be significantly cheaper. This is because it only requires approximately 900 metres of tunnelling, no deep stations and only one shallow underground station. Between Edmonton Green and Bury Street Junction, where the Enfield branch diverges from the Cheshunt branch, the line might share tracks with the Cheshunt branch which only runs twice an hour in each direction.

Edmonton Green and Enfield Town are likely to be the most expensive parts of the proposal. In Edmonton, it is likely that some of the properties on the east side of Fraser Road and the buildings currently occupied by ASDA and Argos would need to be purchased and redeveloped as part of a new station. In Enfield, the station would need to be sunk to allow trains to enter a tunnel to Gordon Hill.

Figure 18 (opposite): map showing potential Crossrail 2 spur to Gordon Hill[50]

Legend: proposed line suggested spur to Gordon Hill stations

[50] Map adapted from OpenStreetMap, which is © OpenStreetMap contributors, available under the Open Database Licence. For details, see www.openstreetmap.org/copyright. Crossrail 2 stations and alignments from TfL Crossrail 2 route map, Ordnance Survey, TfL and AECOM data © Crown copyright. Available at crossrail2.co.uk/route/route-map/, (accessed 8 April 2019).


Gordon Hill
Enfield Town
Bush Hill Park
Edmonton Green
Angel Road
Ponders End
Brimsdown
Enfield Lock
Clay Hill
Lavender Hill Cemetery
Lavender Hill
Lancaster Road
Browning Road
Baker Street
Willow Road
Carterhatch
Carterhatch Lane
Carterhatch Road
Enfield Highway
Brimsdown
Brimsdown Avenue
Bell Lane
Ordnance Road
Turkey Street
Great Cambridge Road
Hertford Road
A10
A1010
A1055
Albany Park
Bilton Way
Slades Hill
Windmill Hill
Chase Side
Enfield Chase
Enfield Playing Fields
Enfield Retail Park
Durants Park
Alma Road
A110
Southbury
Nags Head Road
High Street
Lincoln Road
Old Park Ridings
A105
Grange Park
Green Dragon Lane
Wades Hill
Bush Hill
Park Avenue
St Mark's Road
Ponders End
South Street
Galliard Road
Jubilee Park
B154
B137
Ridge Avenue
Station Road
Firs Lane
Halstead Road
Ford's Grove
Farm Road
Green Lanes
Edmonton Cemetery
Firs Farm Wetlands Park and Playing Fields
Lea Valley Lines
Winchester Road
Bury Street
Bounces Road
Church Street
Meridian Way
Montagu Road
Deephams Sewage Treatmemt Works
William Girling Reservoir
Waltham Way
A111
Hedge Lane
Great Cambridge Road
Haselbury Road
Victoria Road
Plevna Road
Town Road
Edmonton
Fore Street
Pymmes Park
A1037
A1009
Great Cambridge Road Roundabout
Silver Street
Sterling Way
Angel Edmonton
River Lee Diversion
Lea Valley Viaduct
Hall Lane
Bowes
Tottenham Road
Wilbury Way
Bridport Road
Pretoria Road
Willoughby Lane
Harbet Road
Meridian Water
Brantwood Road
West Mews
A1010
Banbury Reservoir
Waltham Stow Avenue
White Hart Lane

5. Canary Wharf – Kentish Town express line via Liverpool Street

A new underground metro line from Kentish Town to Canary Wharf might offer better value for money in providing relief to the Northern, Victoria, Northern City, Circle and Hammersmith and City lines, as well as enhancing connectivity and access to public transport for north and east London.

The north western terminus might be located at Kentish Town (or Tufnell Park), where crowding on the High Barnet branch of the Northern line is forecast to be most severe. It might then stop at Caledonian Road on the Piccadilly line, Highbury and Islington on the Victoria and National Rail Northern City line, Old Street and Liverpool Street. East of Liverpool Street it might stop at Mile End with a terminus at Canary Wharf (possibly at Poplar or West India Quay).

The line's primary function in the weekday AM peak would be to pick up passengers from the High Barnet branch of the Northern line, the Piccadilly line and the Northern City line travelling to destinations near Old Street, Liverpool Street or Canary Wharf, and to pick up passengers from the Central line, Hammersmith and City line and the District line travelling to destinations near Liverpool Street or Old Street.

Deriving figures for non-station costs per kilometre and station costs from TfL's estimates for the cost of the Bakerloo line extension and applying them to this proposal implies a cost of £4.4 billion in 2019-20 prices.[51]

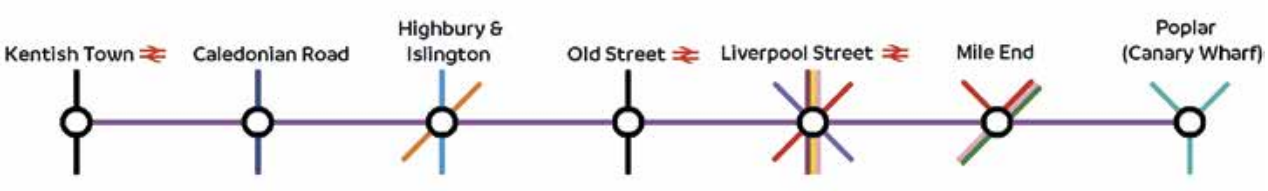


Figure 19 (opposite): map showing potential Kentish Town – Canary Wharf express route[52]

Legend: potential Kentish Town – Canary Wharf express route stations

[51] TfL, *Bakerloo line extension Options assessment report*, December 2015, consultations.tfl.gov.uk/tube/bakerloo-extension-2014/user_uploads/ble---options-assessment-report_final.pdf, (accessed 8 April 2019).

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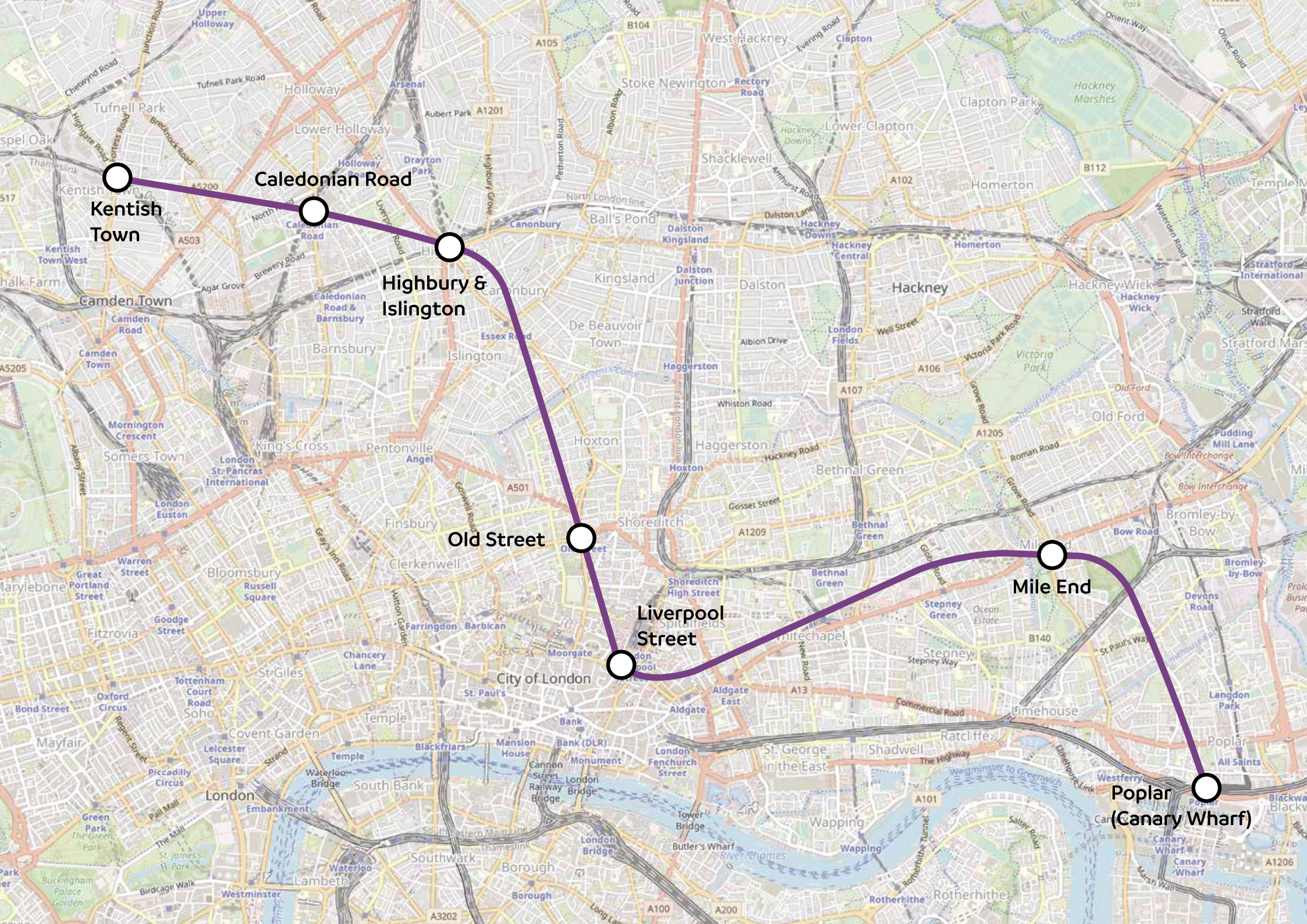
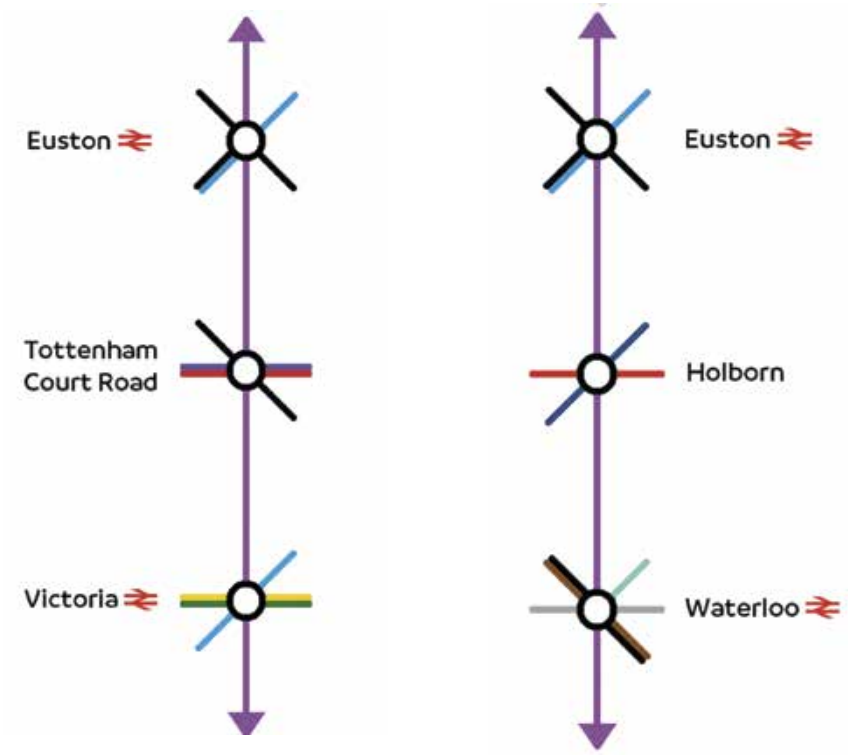

Kentish Town
Caledonian Road
Highbury & Islington
Old Street
Liverpool Street
Mile End
Poplar (Canary Wharf)

6. Victoria – Euston 'Crossrail 3'

A new pair of deep tunnels of approximately 5 kilometres in each direction could connect National Rail services terminating at Victoria or Waterloo to equivalent services terminating at Euston or King's Cross, with an intermediate station at Tottenham Court Road or Holborn.

The primary purpose of the line would be to improve journey times and connectivity for passengers on National Rail services into Waterloo and Euston (or King's Cross) while also providing relief to the Charing Cross branch of the Northern line and the Victoria line between Vauxhall and Euston (or King's Cross).

At approximately 5 kilometres, tunnelling would cost £764 million, with another £185 million for portals and perhaps £3.2 billion for stations at Waterloo, Holborn and Euston (or King's Cross), adding up to a total cost before rolling stock of £4.1 billion, using the same assumptions as for the savings on the Crossrail 2 project.

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