

An aerial night view of London, showing the River Thames, St Paul's Cathedral, and the city lights. The text 'TRANSPORT FOR A WORLD CITY' is overlaid in white, sans-serif font.

TRANSPORT FOR A WORLD CITY

NATIONAL
INFRASTRUCTURE
COMMISSION

CHAIR'S FOREWORD



London's population and employment are at record levels. Its transport systems are under growing pressure, and there is a critical need to open up new areas for housing growth in and around the capital.

In this context the National Infrastructure Commission has been asked to review the strategic case for additional large scale transport infrastructure in the capital and its region, with particular reference to proposals for a new north-east to south-west "Crossrail 2" line.

The Commission concludes that the strategic case for Crossrail 2 is well founded and recommends that it is taken forward. It is not a substitute for smaller scale improvements, but these alone will not be enough.

Crossrail 2 should be viewed as an investment of national significance, because of its impact beyond Greater London and its importance in relieving nationally important rail terminal and interchange stations, especially Waterloo, Clapham Junction, Victoria, Euston, Kings Cross and St Pancras.

We have engaged with the Mayor of London, Transport for London, government departments and agencies, and hundreds of individual and corporate respondents. We are grateful to them all for their views and advice.

Andrew Adonis,
Interim Chair of the National Infrastructure Commission

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Transport for a world city: In brief

By 2030 London is likely to reach megacity status, with a population exceeding ten million. Even allowing for planned investment much of its transport network will be under severe pressure, and there is already an acute housing shortage.

In this context the National Infrastructure Commission has been asked to examine proposals for significant new public transport infrastructure in London.

The Commission's central finding, subject to the recommendations made in this report, is that Crossrail 2 should be taken forward as a priority. Funding should be made available now to develop the scheme fully with the aim of submitting a hybrid bill by autumn 2019. This would enable Crossrail 2 to open in 2033.

PART 1: PLANNING FOR THE 2030s

Current and proposed transport investment, including on the Underground network and Crossrail 1 (the 'Elizabeth Line'), is essential. But more will be needed. The commission has identified four specific challenges from the late 2020s: crowding on key Underground lines, lack of capacity on commuter service rail routes and at major Network Rail stations, insufficient orbital links particularly in east London, and the need for transport to promote significant housing growth within and around the capital.

Congestion is forecast to be especially acute on north-south Underground lines, commuter rail services in the south-west, and at major Network Rail stations on these routes.

PART 2: DEVELOPING THE PLAN

Faced with these challenges, a second Crossrail line, running south-west to north-east, is a priority for London and its region.

Crossrail 2 will provide a new central London artery linking the suburban railway network in the south-west to lines in the north-east via a brand new tunnel from Wimbledon to Tottenham Hale. This relieves or reinforces major suburban and Underground lines and a string of Network Rail's busiest stations, whilst opening up new areas for housing and regeneration.

PART 3: FROM DEVELOPMENT TO DELIVERY

Considerable work has been done to develop the case for Crossrail 2. This report recommends four steps to develop the scheme further:

- Identify proposals to phase costs and increase affordability
- Develop a strategy to unlock significant housing growth
- Deliver a funding plan in which London contributes its fair share to the project
- Maximise private sector involvement in the development and funding of stations and their surrounding areas

Following a resolution on the areas above, the aim should be for a hybrid bill to be submitted by autumn 2019 – the first step towards the railway opening in 2033.

CROSSRAIL 2 – IN NUMBERS

By 2030 London will be a megacity of

10m people

London

is currently growing by
2 tube trains per week



Even with planned interventions like

Crossrail 1 and Thameslink,

London's Transport Network will still suffer from severe overcrowding on key lines



Crossrail 2 will reduce crowding on the **Victoria, Northern, Piccadilly and Waterloo & City** lines

By the 2030s **Waterloo Clapham Junction Victoria** are predicted to have at least

40% more passengers in the morning peak



Crossrail 2 will provide capacity for **270,000** passengers to reach central London every morning

With the right framework in place, Crossrail 2 can provide for

200,000 new homes



Our recommendation **Crossrail 2** should be taken foreword as a priority

enabling the new line to open in

2033





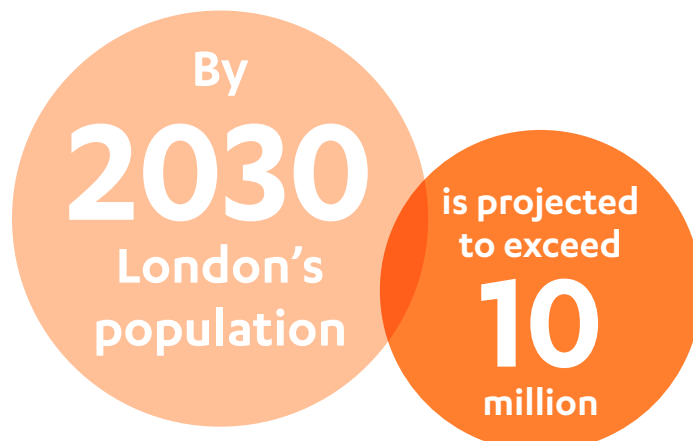
EXECUTIVE SUMMARY – TRANSPORT FOR A WORLD CITY

The National Infrastructure Commission has been asked to review the strategic case for future investment in large-scale transport infrastructure serving London and its region. Over the past four months the Commission has engaged with a range of stakeholders including the Mayor, the Greater London Authority (GLA), Transport for London (TfL), Network Rail, the Department for Transport (DfT), HM Treasury and local authorities in and around London. This has included assessing the current proposed plans for transport in London, including the business case for Crossrail 2, and evaluating over 130 responses to our call for evidence which covered Crossrail 2 and a range of other schemes.

The Commission's central finding, subject to the recommendations made in this report, is that Crossrail 2 should be taken forward as a priority. Funding should be made available now to develop the scheme fully with the aim of submitting a hybrid bill by autumn 2019. This would enable Crossrail 2 to open in 2033.

PART 1: PREPARING FOR THE 2030s

London is a hugely successful city, but it faces a range of challenges, chief among them is how to provide for current and future growth. This challenge is manifest today – be it in the critical gap in London's housing supply or in overcrowding on the transport system.



By 2030 London's population is projected to exceed ten million,¹ reaching the definition of a megacity. This is an increase of 1.4 million over today. Over the same period, London's wider commuter region is projected to reach a population of 9.9 million, an increase of 1 million over today.²

London's economy will also grow, with the number of jobs in the capital projected to increase by 800,000 over the next 20 years.³ A significant proportion of these jobs will be located in the centre of the city, where the dense concentration of business activity enables a level of productivity unmatched in the rest of the UK.

The Commission has identified in this report four specific challenges for London's transport infrastructure from the late 2020s:

1. Lack of capacity and major overcrowding on key central London Underground lines, particularly the north-south Victoria and Northern lines.
2. Lack of capacity and major overcrowding on key radial rail routes into central London and at key terminal and interchange stations, particularly at Clapham Junction and Waterloo.
3. Insufficient orbital links, in particular in east London, where limited river crossings by road are a major barrier to growth.
4. Insufficient transport access to key areas of future housing growth.

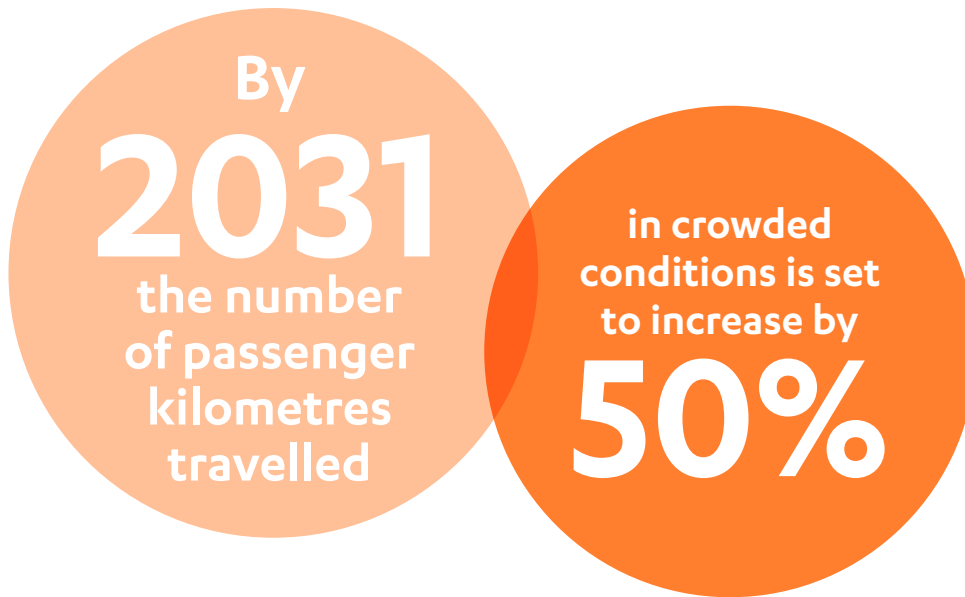
Responding to these challenges will require a range of interventions and innovations. This report focuses on the largest strategic transport projects proposed for London, which are of both a regional and a national significance, due to the scale of planning required and of likely impact.

PART 2: DEVELOPING THE PLAN

London is currently benefiting from a number of major enhancements of its transport infrastructure. This includes: Crossrail 1, Thameslink, Underground upgrades and investment in the London Overground. Currently planned schemes will add approximately 30% to total rail based public transport capacity in London compared with 2011.⁴

However, forecast growth in demand will use up this additional capacity in the 2020s and crowding on key lines will reach crisis point. By 2031, the number of passenger kilometres travelled in crowded conditions is set to increase by 50%.⁵

Further improvements are currently planned or in development. This includes the New Tube for London programme and the Silvertown Crossing, both of which are due to be completed in the 2020s. These plans are vital but they will not be sufficient. The Mayor, TfL and Network Rail, supported by London Councils, local authorities in the south-east, and the leaders of London's business community, have therefore proposed Crossrail 2 as a scheme of regional and national significance, essential to meeting London's long-term needs.



Crossrail 2 would be a north-east to south-west successor to the east-west Crossrail 1 scheme. The case for Crossrail 2 is that it will:

- Provide vital relief for the congested southern end of the Northern Line and for the Victoria Line through north-east and central London. These are forecast to see much of the highest levels of crowding anywhere on the Underground, after the opening of Crossrail 1.
- Provide an alternative route, via its connection to Crossrail 1, from south-west London to the City and Canary Wharf, reducing passenger numbers on the overcrowded Waterloo and City line and the eastern part of the Jubilee Line.
- Relieve capacity constraints on the critically over-crowded south-west London commuter lines coming into the capital through Wimbledon, Clapham Junction and Waterloo by providing an alternative route for inner suburban services via a new tunnel from Wimbledon into Central London.
- Reduce terminal congestion at the UK's busiest station, Waterloo, as well as cutting crowding levels at Clapham Junction, Vauxhall and Wimbledon, all of which are forecast to face insuperable operational difficulties due to the volume of passengers at peak hours.
- Release capacity on the existing south-west network for longer distance services from Basingstoke, Woking, Guildford, Southampton and beyond.
- Provide four tracks on the West Anglia Mainline to enable faster services on the London-Stansted-Cambridge Corridor.
- Link with Euston/St Pancras, to provide onwards dispersal for those arriving into London from the north on HS2, which is planned to be completed to Manchester and Leeds in 2033.

- Stimulate new housing, jobs and development along the whole route. In particular the line will transform access to the Upper Lee Valley Opportunity Area – one of the largest in London.
- Establish a turn-up-and-go level of service at a range of underserved destinations allowing for regeneration around transport hubs in Hackney, Haringey, Enfield and Tottenham.
- Unlock 200,000 homes, provided the right planning framework is applied.

In considering the available evidence for alternative major transport infrastructure investment, other ways of addressing the strategic challenges addressed by Crossrail 2 have also been examined. In the course of this review, no alternative proposal or proposals have been found that effectively deal with the challenge of Underground capacity once all proposed Underground line upgrades are exhausted, or which can effectively mitigate the crowding and dispersal challenges at Waterloo, Euston, Victoria and Clapham Junction.

Other major schemes, which are not focused on north-south capacity through the central London core, such as east London river crossings and the Bakerloo Line extension, do not help resolve this crucial strategic challenge. They may nonetheless have the potential, where affordable, to deliver valuable benefits – particularly where there is scope to explore alternative funding mechanisms or delivery models.

The Commission's conclusion, subject to the recommendations in part three below, is that Crossrail 2 is an essential response to the challenges London will face in the 2030s. Crossrail 2 provides a new cross-London artery on the city's most congested axis (following the completion of the current Crossrail 1 and Thameslink projects). It relieves the Underground lines forecast to experience the worst overcrowding and the stations facing the most severe dispersal challenges. It provides additional capacity in the congested south-west quadrant of the London rail network, and it opens up large parts of London for essential housing development.

Recommendation 1: Crossrail 2 should be taken forward as a priority with the aim of opening in 2033, subject to the recommendations below.

Recommendation 2: Crossrail 2 should be at the heart of the new London Plan, alongside existing commitments to upgrades and other pieces of new infrastructure. Crossrail 2 should not, subject to affordability, prevent the development of other high value schemes, particularly where alternative funding mechanisms are available.

- London must continue to plan strategically for the period 2030-2050 through the next iteration of the London Plan. Crossrail 2 should be at the heart of this strategy and TfL's wider programme of smaller scale interventions on the national rail, road, Underground and cycling networks in London should be integrated with it to complement and enhance its benefits.

- The London Plan should also include a detailed examination of the scope to deliver other strategic projects, such as further east London river crossings and the Bakerloo line extension, through alternative financing mechanisms. This should build on the precedents from the Silvertown Crossing and Northern line extension to Battersea/Nine Elms.

PART 3: FROM DEVELOPMENT TO DELIVERY

TfL and Network Rail have developed a plan for Crossrail 2 which seeks to optimise its benefits to ensure it meets the current challenges for London. This can be seen in the significant evolution of the scheme from the original 1991 Chelsea-Hackney proposal. TfL and the Department for Transport are currently reviewing and updating the business case and reviewing responses to the autumn 2015 consultation.

In this context, the Commission makes the following observations on key elements of the scheme:

- It is crucial that London makes a significant contribution to the costs of Crossrail 2 (currently estimated by TfL to be £32.6bn⁶). The funding package that has been proposed by TfL builds on the one that is currently delivering Crossrail 1. There may be scope for a larger London contribution to the scheme. There is also potential for the funding package to be linked to the delivery of Crossrail 2's benefits, in particular housing.
- It is important that Crossrail 2, learns from the experiences of Crossrail 1 and other major infrastructure projects. This includes keeping scope and costs under review, establishing clear governance structures and ensuring that phasing is considered in order to maximise affordability. In particular, there is strong potential for phasing the northern branches of Crossrail 2 to reduce the initial costs of the scheme and this should be given thorough consideration.

**Crossrail 2
is expected to
facilitate the
development of
200,000
homes**

- With the right planning framework, Crossrail 2 is expected to facilitate the development of 200,000 homes, over and above an estimated 60,000 homes that would be developed in areas linked to the line without the scheme. This will require an agreement between the GLA, boroughs and local government outside of London. This could also provide an effective model for unlocking increased numbers of new homes and improving the quality of new urban development in other parts of London.
- The Upper Lee Valley in the north-east of London is one of the most important Opportunity Areas in the capital, but suffers from some of the poorest connectivity anywhere in London. For example, Angel Road station, at the heart of the Opportunity Area, has only two trains between 7am and 9am each morning which connect to central London via a change at Tottenham Hale or Stratford stations.
- The current lack of home building in London drives up house prices and reduces quality of life. Improved transport links have a vital role to play in unlocking housing across London by making new areas of development accessible.

Recommendation 3: Sufficient development funds should be released in order for TfL and DfT to submit a revised business case for Crossrail 2 by March 2017 and aim to introduce a hybrid bill by autumn 2019. The revised business case should include developed plans on costs, funding, housing and stations. TfL estimates the overall development cost at c.£160m, to which TfL should be expected to make a reasonable contribution.

Recommendation 4: In developing the business case, it is crucial that TfL and DfT identify clear proposals to maximise its benefits and increase deliverability. The costs of Crossrail 2 are high and therefore every opportunity should be taken to improve its affordability.

- The updated case should include detailed options to reduce and phase the costs of the scheme. The most promising option identified to enhance affordability would be to delay the construction of the north-western branch to New Southgate. This could reduce the costs of the initial scheme in the 2020s by around £4 billion. More work should also be done on the costs and benefits of individual central London stations.
- If construction of the north-western branch is delayed, this would also provide the opportunity to consider the case for an eastern branch from Hackney as an alternative.

Recommendation 5: A 'London deal for Crossrail 2' funding agreement, through which London contributes more than half the costs of the scheme and which includes substantial measures to realise the full housing benefits, should be agreed ahead of hybrid bill submission.

- It is vital that a funding package for Crossrail 2 is developed which strikes a fair balance between the contributions made by London taxpayers and businesses and by central government. This should build on the work already undertaken by TfL, which indicated that around half the cost of the project could be funded from London sources.
- The government should work with TfL and GLA to explore new funding options, which could include consideration of further devolution. However, even without such devolution, HM Treasury should be in a position to recoup significant receipts from the added Gross Value Added (GVA) benefits and the rising value of property in London.
- A London deal for Crossrail 2 will need to cover both the funding of the project and the planning measures required to deliver Crossrail 2's benefits.

Recommendation 6: TfL and DfT in conjunction with other government departments and relevant bodies, should use the next stage of development to set out a clear, transformative plan to turn the proposed 200,000 homes into a reality.

- Strong measures to maximise the new housing enabled by the scheme should be included in the 'London deal for Crossrail 2'—this could include the establishment of one or more development corporations to lead the masterplanning and delivery of new housing and urban realm provision, and revised planning guidance for the whole route. These measures should be considered as a potential model for improving housing delivery more widely.
- For housing provision to be a success across the whole route, the London deal for Crossrail 2 will need to have buy-in from the GLA and London boroughs along the route as well as counties and boroughs outside of London which benefit from the new line. All parties will need to ensure the housing unlocked by Crossrail 2 is sustainable and meets the needs of Londoners and those in commuter regions around London.

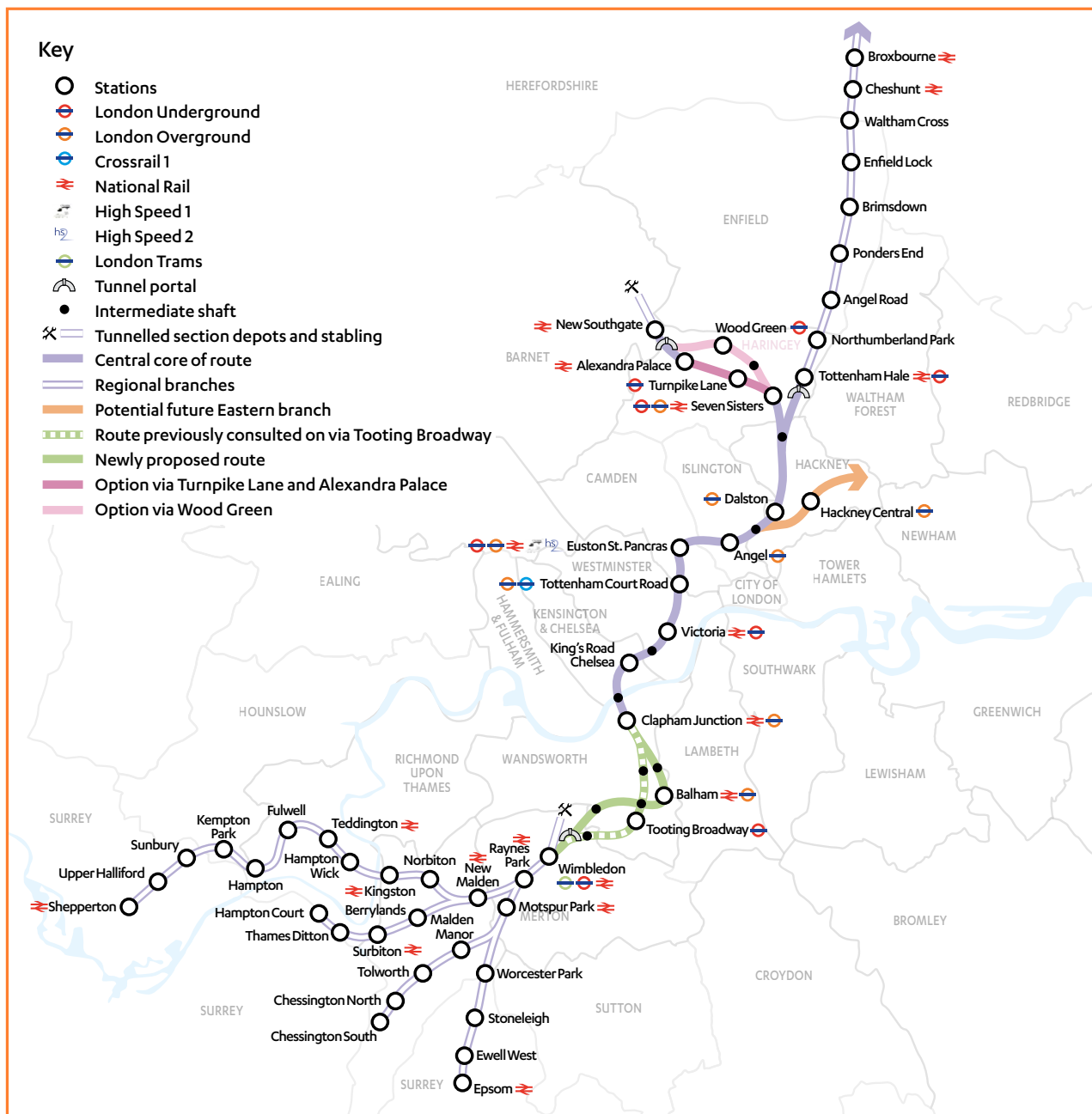
Recommendation 7: The opportunity should be taken to maximise private sector involvement in the development and funding of stations and their surrounding areas.

- TfL and DfT should leverage private sector capital and expertise to develop selected Crossrail 2 stations, including both the stations themselves and the surrounding land. Development could also be supported by land purchase powers and the ability to assemble sites.

Recommendation 8: Following the submission of a revised business case and agreement on the conditions above, the aim should be for a hybrid bill to be submitted by autumn 2019 – the first step towards the railway opening in 2033.

- Submission of a bill in 2019 would allow significant progress to be made on the passage of a bill before the end of this parliament.
- Completion of the project in 2033 would allow the project to open in time for the planned arrival of HS2 phase 2 at Euston.

Figure 1 – Proposed Crossrail 2 route as of October 2015



PART ONE: PREPARING FOR THE 2030s



FOR FOOLS!
Violence will NOT be tolerated and can result in a criminal

PART 1: PREPARING FOR THE 2030s

- 1.1 This chapter sets the context for this report, describes the current challenges faced by London and sets out how these are expected to develop into the 2030s.
- 1.2 To understand the challenges facing London the Commission has drawn on a range of sources including the strategic planning documentation that has been developed by the GLA, TfL and others; the business case and associated documents for Crossrail 2; and the responses to the Commission's call for evidence. All of these sources contain a common theme – the pressing need to plan for and accommodate London's future growth.
- 1.3 The evidence shows that by the early 2030s key parts of London's transport network will be under major stress. An inability to board trains, crush levels of crowding and closures of key terminal stations in peak hours will become the norm. This in turn will start to impact London's economy.
- 1.4 Transport congestion, however, is not the only challenge of growth. London faces substantial and growing pressure on its housing supply. Therefore, it is becoming increasingly important that, as well as facilitating journeys to and from work, education, shopping and leisure, London's transport system provides connections to new areas of housing growth.
- 1.5 Rail passenger usage has doubled in London over the last 20 years⁷ and TfL forecasts significant future increases in passenger numbers. This continued growth in passengers is in large part a result of London's success, driven primarily by an increasing population and strong employment growth across the city. Both these factors have a direct impact on demand for the Underground and rail network.
- 1.6 As a result of the current high levels of demand and forecast future growth, the Commission's assessment is that London will need to address four key strategic challenges at the end of the 2020s:
 - Lack of capacity and major overcrowding on key central London Underground lines, particularly the north-south Victoria and Northern lines.
 - Lack of capacity and severe overcrowding on key radial rail routes into central London and at key terminal and interchange stations.
 - Insufficient improved orbital links, in particular in east London, where limited river crossings by road are a prime barrier to connectivity.
 - Insufficient transport access to key areas of future housing growth.



**Rail usage
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Context

- 1.7 Many of the characteristics of the way London's infrastructure is used are unique to the city. 50% of Londoners take public transport to work compared to 16% in the rest of UK.⁸ Almost two-thirds of national rail journeys begin or end in London.⁹
- 1.8 As London has evolved so has its transport system. The last 20 years have seen significant investment in London's infrastructure and that will continue over the coming years. Currently planned schemes will add approximately 30% to total rail based public transport capacity in London compared to 2011.

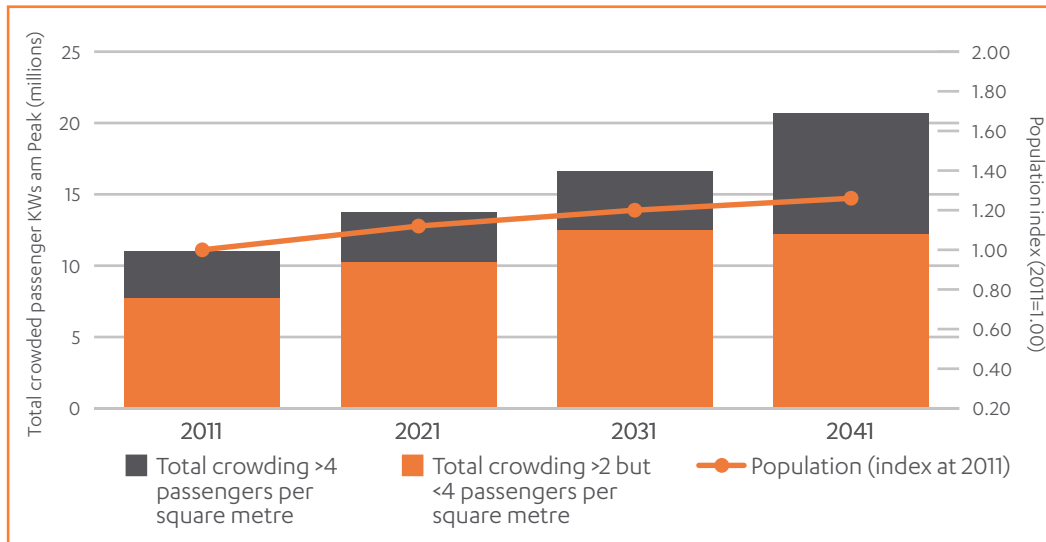
Table 1 – Summary of key schemes that increase capacity that are planned to be in place by 2030¹⁰

Schemes	Headlines	Assumed opening date
National Rail		
Multiple train and platform lengthening schemes	On several routes into London including Chiltern, Southern, South Western, Great Western and South Eastern	2019
Thameslink	Major upgrade and expansion of the existing Thameslink network	2018
West Anglia Mainline	Third track between Angel Road and Lea Bridge (STAR scheme)	2019
London Underground		
Rolling stock and signalling upgrades	New rolling stock and signalling upgrades on lines including the Sub-Surface, Piccadilly, Bakerloo and Central lines	Upgrades delivered throughout the 2020s and early 2030s
Wider network Improvements		
Crossrail	Major new east-west line providing 10% increase in rail-based public transport in London	2018/2019
DLR three-car on whole DLR network	Increased capacity as a result of all trains on the DLR network being at least three car	2016
London Overground	Additional capacity on West/North London Lines and Gospel Oak to Barking electrification	2019
High Speed 2	New high speed rail station at Euston, phase 1 planned for 2026, Phase 2 planned for 2033	2026

- 1.9 Nonetheless, forecast growth in demand is such that crowding is predicted to grow significantly by 2031 and eventually will cause significant operational difficulties. By 2041, the number of passenger kilometres travelled in severely crowded conditions (more than four passengers per square metre) is set to more than double.¹¹ There remain important transport corridors which will see comparatively little benefit from the major schemes shown above.

1.10 The graph below shows total crowding, measured by crowded passenger kilometres, indexed to population growth. It shows increases in overcrowding outstripping population growth in the 2030s, by the 2040s total crowded kilometres will have almost doubled and the amount of kilometres in severely crowded conditions will have increased by two and a half.

Figure 2 – AM peak crowding indexed to London population growth¹²



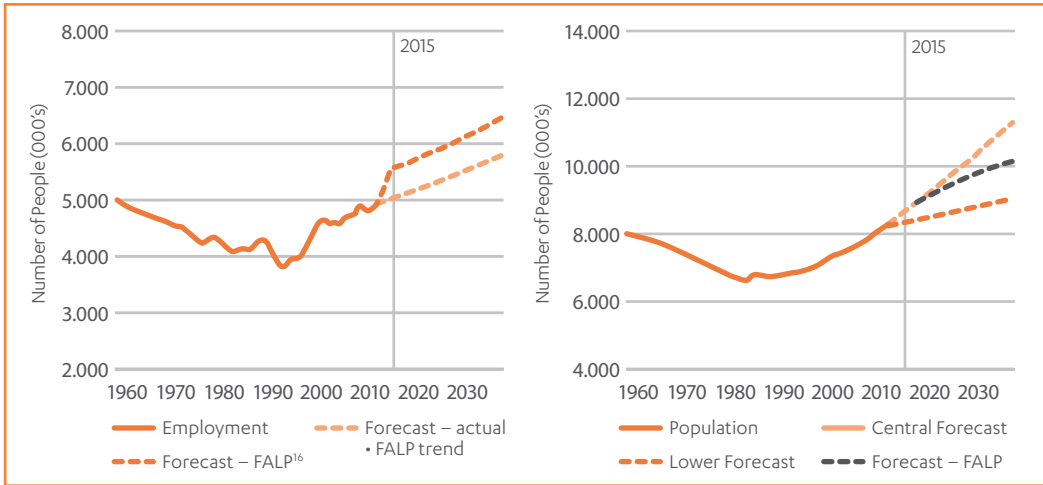
1.11 These forecasts are driven largely by continuing growth in London’s population and employment, following the consistent pattern that has been seen over the last two decades. By 2030 the population of London is projected to reach ten million, an additional 1.4 million people over today (more than the population of Birmingham).¹³

1.12 In this context, 2015 marked a milestone for London. London’s population at the end of 2015 stood at 8.6 million, equalling its previous high point of 1939. The population of London in 2015 was 10.3% higher than in 2008. This growth, despite the recession of 2008-09, has outstripped that predicted by planners in the 2010 Mayoral Transport Strategy. A 2015 report by WS Atkins with Oxford Economics and Centre for London, proposed higher population and employment projections than those underpinning the latest London Plan. It forecasts a 2036 population projection of 11.1 million, which is significantly higher than the current GLA range.¹⁴

50%
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work

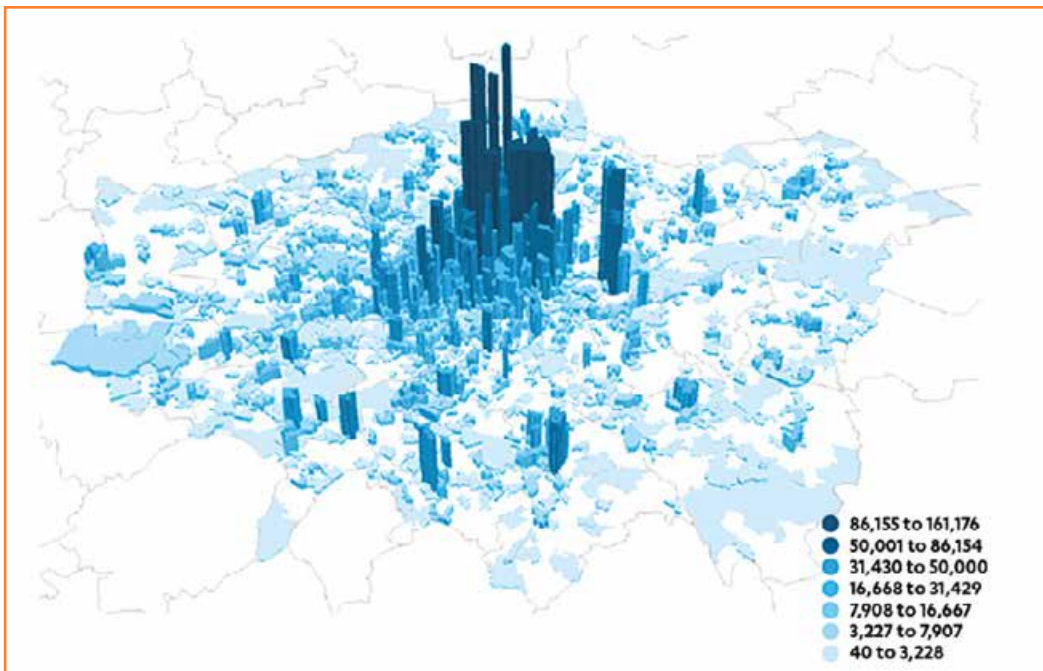
compared to
16%
in the rest of
the UK⁶

Figure 3 – Historic trends and projected growth in London’s employment and population to 2036¹⁵

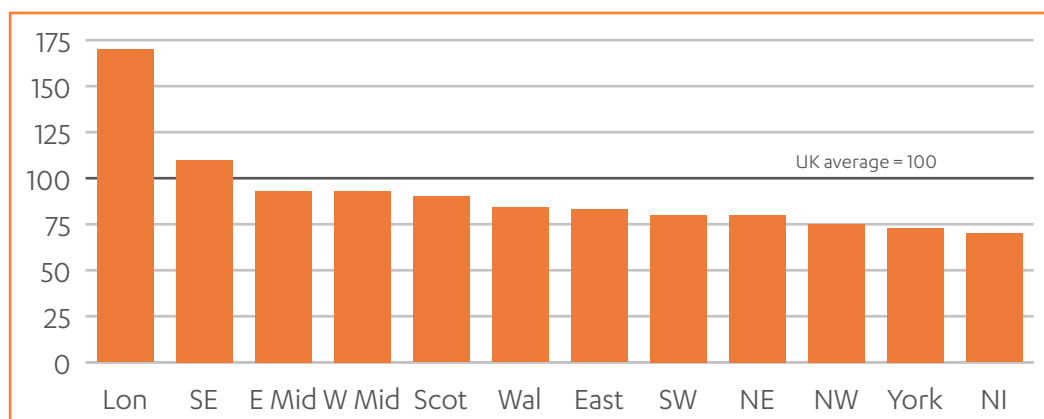


1.13 London’s economy is also growing. The number of jobs in London is projected to grow by 800,000¹⁷ over the next 20 years. A significant proportion of these jobs will be located in the centre of the city, where the concentration of business activity delivers an unmatched level of employment density and jobs which are typically among the most productive in the country.¹⁸

Figure 4 – London employment density: employees per square kilometre¹⁹



1.14 While London accounts for 13% of the UK’s population, its total nominal Gross Value Added (GVA), a measure of the value of goods and services produced in the area, was over £364 billion in 2015 and constituted around 20% of the UK’s total. The wider south-east contributed a further 15% to the national total²⁰. GVA per head in London is around 75% higher than the national average.²¹

Figure 5 – GVA per head by UK region (workplace based), 2014²²

Source: ONS

1.15 The high productivity and added GVA of the central London economy is supported by a large and highly-skilled workforce, three-quarters of which commute into the city's central zone by rail.²³ As growth in the central London economy is combined with broader population growth across the capital and its surrounding regions, this is placing increasing stress on London's transport networks. The next section of this report describes the most important challenges facing London's transport system which result from the changing nature of London.

London's Strategic Transport Challenges

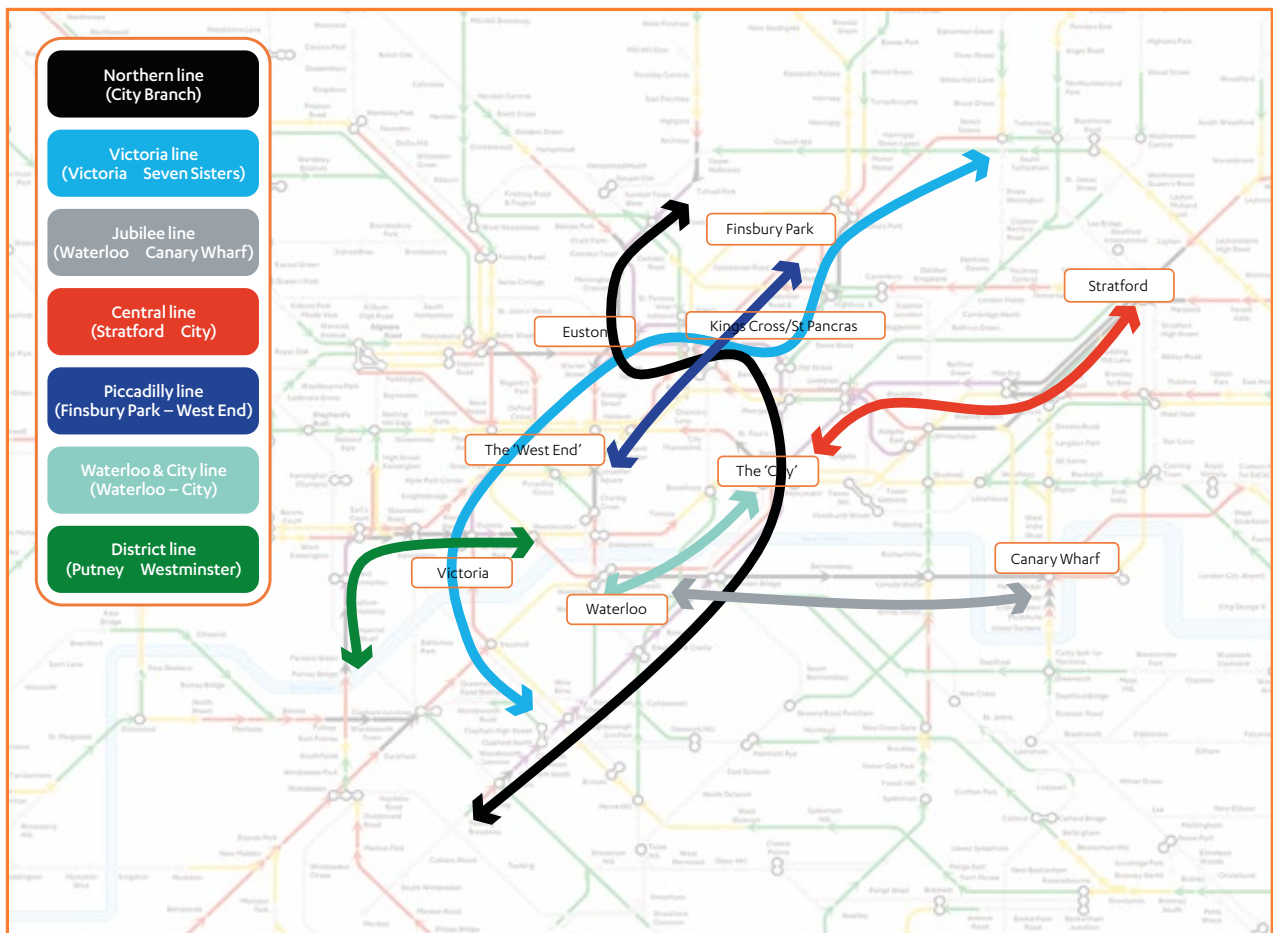
Lack of capacity and major overcrowding on key central London Underground lines, particularly the north-south Victoria and Northern Lines.

1.16 Continued growth is putting significant pressure on the London Underground network. 18 of the 20 busiest days ever recorded on the Underground were in 2015. The busiest day of all occurred on Friday 4 December 2015 when 4.82 million passengers travelled. The first week in December was also the busiest in the Underground's history with 28.76 million journeys, beating the previous record of 28.69 million journeys set less than two months earlier in October 2015.²⁴

1.17 New infrastructure is currently playing a role in relieving overcrowding on the Underground. Crossrail 1 will provide an entirely new east-west route through central London and the Thameslink upgrade will increase capacity and provide more frequent services on the north-south route through the City of London between St Pancras and London Bridge. Neither of these will provide any significant relief, however, for the Victoria and Piccadilly lines in central and north-east London or the District and Northern lines in south-west London.

- 1.18 The New Tube for London programme, described in the box on page 23, will also deliver a significant boost to capacity in the 2020s via new walk-through trains and signalling improvements. However, once this programme has been completed and the sub-surface lines (the Circle, District, Hammersmith & City and Metropolitan) have been upgraded, the vast majority of the network will have squeezed out all the remaining capacity that could be created and reached the physical limit beyond which it is not possible to run more trains.
- 1.19 As London reaches the 2030s, despite the planned investment, TfL is still forecasting severe capacity challenges across the London Underground network.²⁵ The graphic below shows the areas where crowding is expected to be at it most severe in 2031 during the morning peak. This modelling takes into account schemes currently under construction such as Crossrail 1 and planned enhancement programmes such as New Tube for London. A full map is available at Annex A.

Figure 6 – Forecast AM peak overcrowding 2031 – most severely affected Underground lines²⁶



1.20 The modelling shows the most serious Underground overcrowding problems are projected to be on key north to south routes, particularly on a south-west to north-east alignment. These are routes that will not benefit from the east-west capacity of Crossrail 1. The most crowded sections are forecast to be the Victoria line in from Finsbury Park to Victoria, the Central line into Liverpool Street and the City Branch of the Northern line into the City from Balham in the south and Archway in the north. Pressure is also forecast on parts of the District line, the Piccadilly line south of Finsbury Park and the Jubilee line east of Waterloo.



New Tube for London

TfL is currently planning for a complete upgrade of four Underground lines in the 2020s and issued an Invitation to Tender in January 2016. These upgrades follow on from work on the Victoria, Northern, Jubilee and sub-surface lines. In 2016 the Victoria Line will reach 36 trains per hour (tph). This will provide a train every 100 seconds during peak hours, making the Victoria line the UK's highest frequency railway and comparable with the very best in the world.

The planned upgrades are:

Piccadilly line – A peak service level of 33-36 tph, with air-cooled, walk-through Underground trains, by 2025, over the current line geography, and possibly the Ealing Broadway branch currently served by the District line. The line will have Platform Edge Doors and be capable of fully automatic operation.

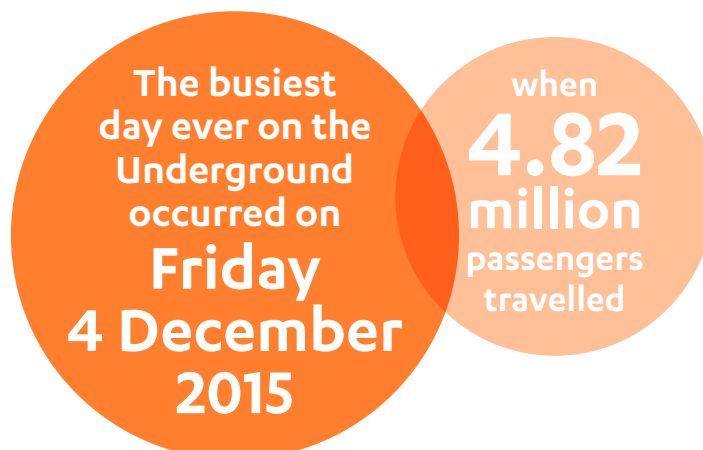
Bakerloo line – A peak service level of 27 tph with air-cooled, walk-through Underground trains by 2027.

Central line – A peak service level of 33-36 tph, with air-cooled, walk-through Underground trains by 2032. The line will have Platform Edge Doors and be capable of fully automatic operation.

Waterloo & City line – A peak service level of up to 30 tph, with air-cooled, walk-through Underground trains by 2032. The line will have Platform Edge Doors and be capable of fully-automatic operation.

Lack of capacity and major overcrowding on key radial rail routes into central London and at key terminal and interchange stations, particularly at Clapham Junction and Waterloo.

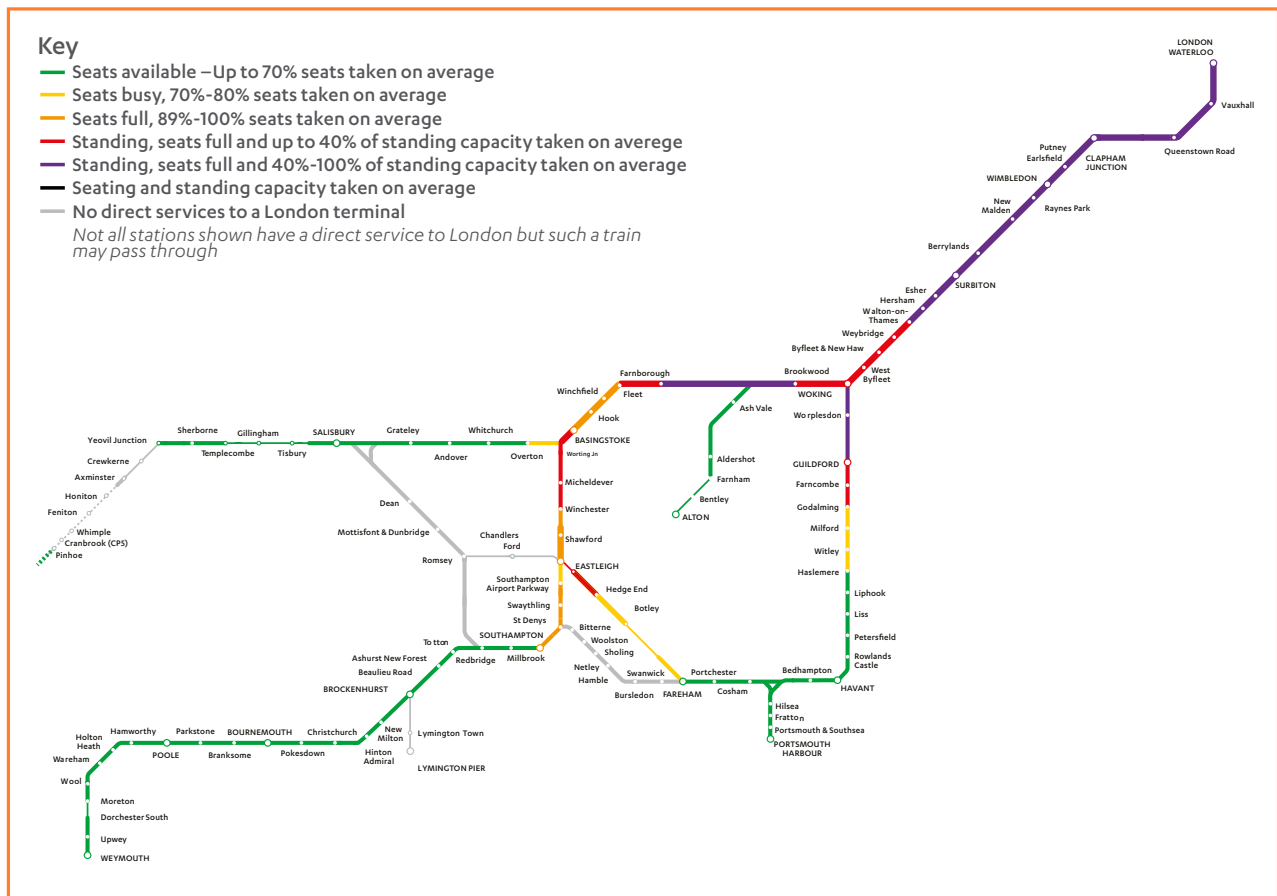
1.21 Alongside the pressures on the Underground network, there is also forecast to be serious overcrowding on key national rail routes. The national rail network has seen a huge increase in demand with passenger numbers in London more than doubling in the last 20 years.²⁷ As this growth continues, it will place very significant pressure on rail services into the capital.



1.22 The largest gap between demand and capacity, and hence the highest levels of crowding, for services into London in the 2030s are forecast by Network Rail to occur on the South West Main Line (SWML) and the Brighton Main Line (BML).²⁸

1.23 Proposals are being developed for the BML, particularly around Croydon, but there is currently no agreed plan to add capacity to the SWML. The chart below shows an example of the levels of mainline crowding forecast on the SWML into Waterloo in 2043.

Figure 7 – Main Line Crowding in London Waterloo 2043 – Peak Hour – no interventions after CP5²⁹



1.24 Many of the comparatively easy solutions, such as train lengthening have been completed on key routes into London. Moreover, providing more frequent or longer trains on a route only addresses half of the problem. Passengers will still need to be able to interchange between lines and use the underground for onward journeys. The key capacity constraint quickly switches to capacity at central London terminals and key interchanges. Solutions to increase platform or interchange capacity can be complex and expensive.

1.25 Increasing numbers of passengers transferring onto the Underground network at stations such as Waterloo will lead to increasingly frequent closures at peak times due to overcrowding if the capacity of the Underground through central London is not increased. Pressure is placed on station concourses leading to delayed trains, longer transfers from the entrance to the platform, and congested Underground lines. Examples of the extreme congestion caused by large numbers of passengers transferring between National Rail and the Underground can already be seen on the Victoria line in the morning peak at stations such as Vauxhall, Victoria, Finsbury Park, and Highbury & Islington.

Table 2 – Station demand forecasts for selected key stations (AM peak 07:00-10:00)

Station	Description of station demand	2031 % change over today	2041 % change over today	Station impact
Waterloo	Total LU/NR demand	+43%	+57%	Congestion levels will increase across the station.
Victoria	Victoria line (total boarders and alighters)	+43%	+54%	Despite Victoria Station Upgrade, ticket hall station control likely by 2041. Train service dwell times likely to be negatively impacted.
Finsbury Park	Total LU/NR demand	+42%	+54%	Increasing crowding at this busy station.
	Victoria line (southbound boarding)	+22%	+32%	
Clapham Junction	Total NR demand	+40%	+51%	Significant station congestion likely if no major infrastructure improvements are made.
	NR to NR interchange	+51%	+61%	
Liverpool Street/ Moorgate	Total LU/NR demand	+39%	+52%	Increasing crowding across the stations, potential gateline control to manage interchange demand.
Vauxhall	Victoria line (northbound boarding)	+30%	+32%	Despite recent station upgrade, station control likely by 2041 due to platform crowding.
Bank	Waterloo & City line (arrivals)	+24%	+37%	Acute platform congestion despite Bank station upgrade.

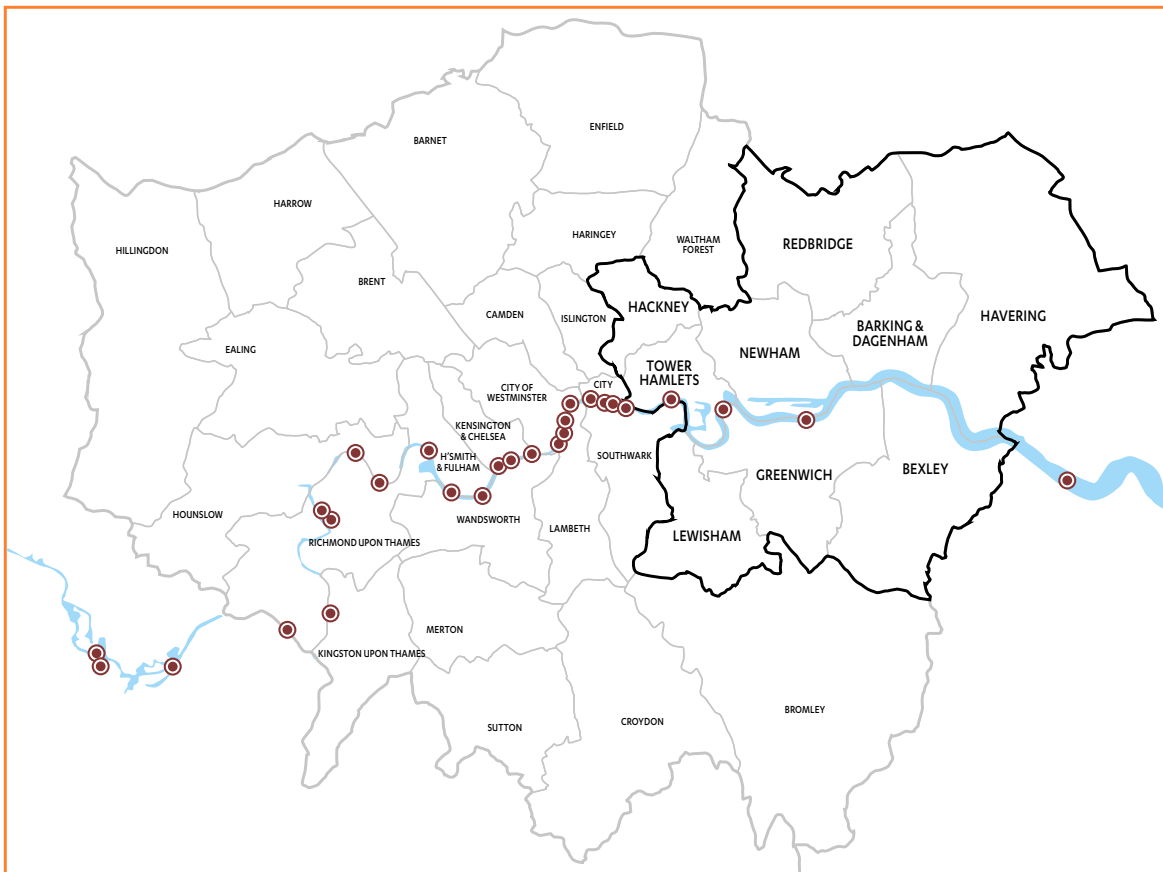
1.26 HS2 will also have an impact on both transport and development patterns in London. Although there will not be a significant increase in additional passengers (above existing organic growth) passing through Euston until the opening of the full “Y” network (phase 2) which is planned for 2033.

1.27 If the benefits of HS2 for London and the UK are to be fully realised, passengers will need to be able to travel with ease beyond Euston to locations across London and the surrounding region.

Insufficient improved orbital links, in particular in east London, where limited river crossings by road are a prime barrier to connectivity.

- 1.28 Based on GLA forecasts, all London's boroughs will experience increases in population, but this growth will be highest in east London. This is also where the majority of London's opportunity areas are. This predicted growth builds on current trends, for example In recent years the London boroughs of Newham and Tower Hamlets have been growing at three times the rate of the rest of the Capital, adding over 120,000 people between them since 2001.
- 1.29 The east London opportunity areas cover both sides of the Thames. However connectivity across the Thames is poor. In contrast to the high numbers of crossings to the west of Tower Bridge, there are just three road crossings in the 23 kilometres between Tower Bridge and the M25. As a result there is currently huge pressure on existing crossings, resulting in long delays and congestion.
- 1.30 The barrier is not just a transport one, the lack of orbital cross-river connections can be a physical and psychological barrier for the workforce. In Richmond, where there are many opportunities to cross the river, 50% of the labour force comes from the other side of the Thames. But the picture is very different in the Royal Docks, east London, where just 20% come from the other side of the river.
- 1.31 There are currently proposals under consultation for a new Lower Thames Crossing east of Dartford and a new crossing alongside the Blackwall Tunnel which could go some way to mitigating these problems, but more needs to be done.

Figure 8 – Distribution of Thames road crossings throughout London



Insufficient transport access to key areas of future housing growth

- 1.32 There is a broad consensus that London is facing a housing crisis. The slow rate at which new homes are built in London is driving up house prices and reducing the quality of life the city can offer its labour force. The London Plan identifies a need for 49,000 new homes per year; delivery has been around half this rate over the last 10 years.
- 1.33 Meeting the London Plan target means building more homes each year than at any time in the post-war period. Finding sites to accommodate large scale new development in London is challenging and is often dependent on improving transport links. Better transport connectivity can make a major contribution to housing delivery. Areas with good transport connections can support a higher level of housing density; they are also often more desirable, pushing up land values and making housing development more economically viable.
- 1.34 The London Plan identifies 38 Opportunity Areas across London, where there is significant brownfield development potential, with scope for at least 2,500 new homes in each case. Often these require improved public transport links to enable development. One of the largest of these, offering the potential to accommodate 40,000 new homes (with Crossrail 2), is the Upper Lee Valley Opportunity Area in north-east London.³⁰ The scope to deliver this housing is hampered by some of the poorest rail connectivity anywhere in London.
- 1.35 Ensuring good transport access is a necessary part of housing delivery in London, but it cannot alone support the scale of development required. Complementary policy changes - particularly around planning, land-use and delivery - are also necessary. Part three of this report addresses these issues in more detail.

Conclusion

- 1.36 The pressures on London's transport system are forecast to continue to increase over the coming decades, driven by a rapidly growing population and economy. While current investment plans will make a difference over the coming decade, by the late 2020s congestion levels on the capital's key public transport links are forecast to reach critical levels once again. Without further investment in new capacity crowding will cause significant operational difficulties.



PART TWO: DEVELOPING THE PLAN



PART 2: DEVELOPING THE PLAN

Context

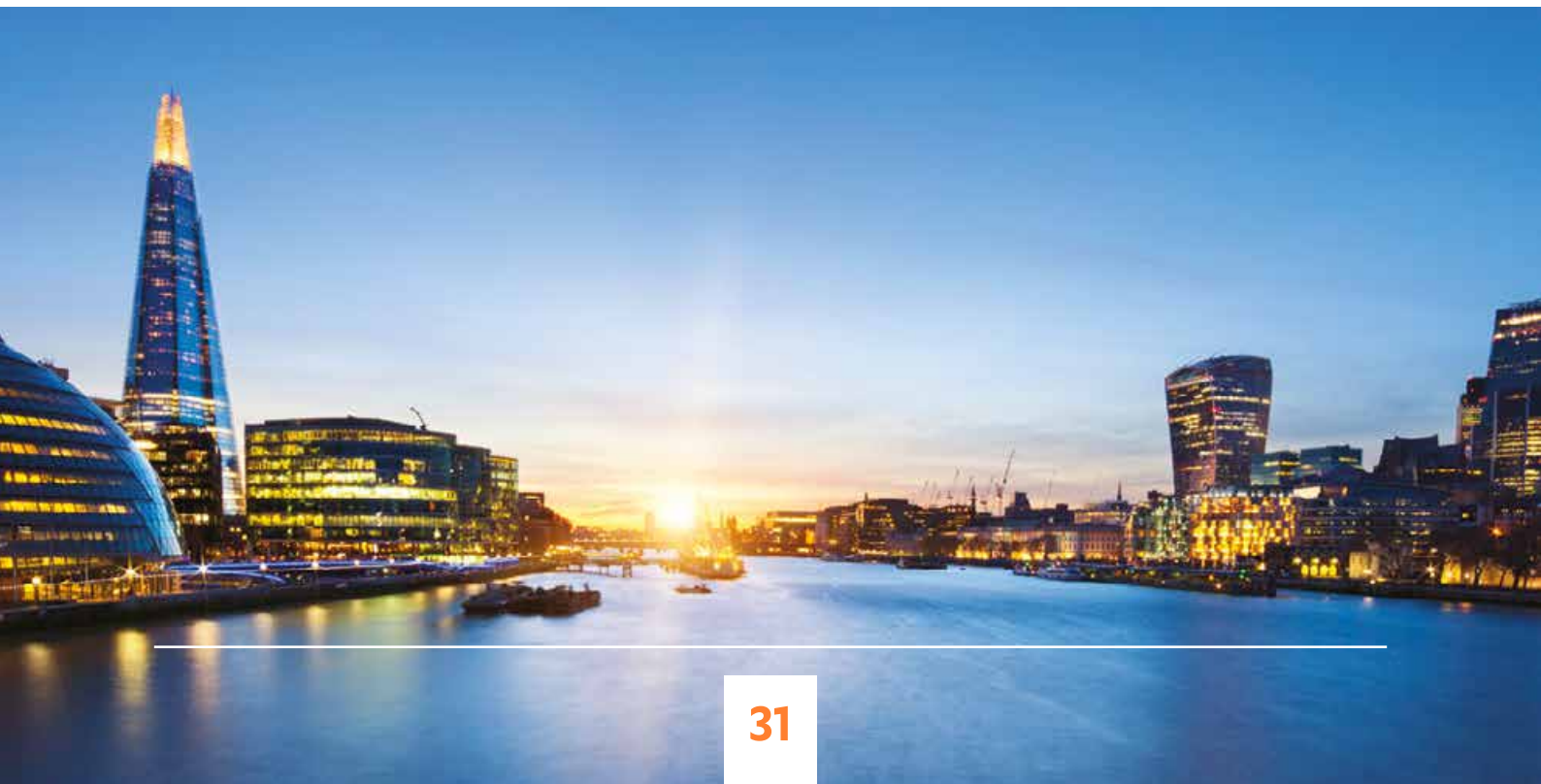
- 2.1 London has planned effectively for the enhancement of its transport networks over the past 15 years, due in part to having an elected mayor with significant transport planning powers and budgets. Underground modernisation and smart ticketing, the success of the Overground which has opened up whole areas of London with previously poor access to transport, and the current on time and on budget construction of Crossrail 1 demonstrate that with good planning and execution, London can successfully improve its transport infrastructure.
- 2.2 In other areas, plans have fallen short, for example the failure to build more road crossings across the Thames in east London has held back the growth of housing and jobs east of Tower Bridge, because of the lack of road crossings between the congested Blackwell Tunnel and the equally overburdened Dartford Crossing.
- 2.3 A well-developed statutory and non-statutory planning process has enabled the Mayor and GLA to identify and promote a coherent vision for the capital's development. The Greater London Authority's statutory spatial development strategy, the London Plan, is at the heart of this process. Alongside it sits the Mayor's Transport Strategy which sets a vision for the capital's transport up to 2031. More recently, the London Infrastructure Plan 2050 and its Transport Supporting Paper have presented a long-term plan for infrastructure investment to 2050.
- 2.4 The London Infrastructure Plan Transport Supporting Paper sets out around £200 billion of transport investment that the GLA believes could be needed to 2050 in order to support 1.3 million extra homes and 1.4 million extra jobs. These proposed schemes range from smaller interventions to large and complex projects such as Crossrail 2.
- 2.5 However, the current detailed plans for London end in the 2020s. Given the long timescales for the development and delivery of major transport projects, if significant new infrastructure is needed to deal with the strategic connectivity and congestion challenges identified for the 2030s and beyond, it will be important for development to start now.
- 2.6 The consensus from the submissions to the Commission's call for evidence is that further investment will be required. The submissions noted the need for continued investments in local schemes, bus provision, and local rail enhancement both to services and stations. Larger schemes such as the Bakerloo line extension, the extension of Crossrail 1 to Dartford, improved orbital links and potential east London river crossings also featured. However the overwhelming focus – which was also reflected in submissions from the GLA, TfL, London Councils and South East England Councils – was on planning for Crossrail 2.

Crossrail 2

- 2.7 Crossrail 2 is a proposed new rail line that would run south-west to north-east across London. Like Crossrail 1 and Thameslink, Crossrail 2 bypasses traditional terminal stations by sending trains across central London and out the other side. The line comprises 24 miles of tunnelled sections between Wimbledon in the south and Tottenham Hale/New Southgate in the north, connected directly to the national rail network at Wimbledon and Tottenham Hale. This provides a direct link in the south-west to the lines providing services to Kingston, Epsom, Chessington and other destinations in Surrey, and in the north-east to the West Anglia Main Line into Hertfordshire.
- 2.8 The tunnelled sections of the line would enable commuters from the south-west to bypass current routes into Waterloo and travel directly through Clapham Junction to Victoria, the West End, Euston and beyond. Passengers on north-eastern suburban trains would be able to continue their journey into central London without the need to change at Tottenham Hale, Seven Sisters or Liverpool Street. The scheme would enable a frequency of 30 trains per hour, comparable to Crossrail 1 and to the upgraded tube lines, to run through the central core and would add over 10% more central London rail capacity.
- 2.9 Crossrail 2 not only provides new journey opportunities but also responds to the key challenge of overcrowding at a number of London's main terminal stations. Just as Crossrail 1 contributes increased capacity at Paddington and Liverpool Street, and Thameslink increases capacity at Kings Cross St Pancras and at London Bridge, Crossrail 2 will provide a through-route to relieve congestion at Waterloo, Euston and Victoria. It also reduces congestion at Clapham Junction, the UK's busiest interchange station with over 25 million passengers changing trains each year.³¹
- 2.10 By allowing suburban trains from the south to bypass Waterloo and from the north-east to bypass Liverpool Street, Crossrail 2 also opens up paths for additional longer distance services into these stations – with the right complementary investment this would allow for additional and potentially faster services from destinations such as Southampton, Portsmouth and Guildford in the south-west. Four tracking the West Anglia Main Line which is part of the core Crossrail 2 scheme, would have the additional benefit of allowing for more frequent and potentially faster trains from Stansted and Cambridge.

Background to the scheme

- 2.11 As the railways developed in the mid-19th century, terminal stations sprung up around the edge of central London, lined up along the Euston Road in the north and originally bounded by the river in the south. Although some railway companies were able to bring their terminals closer to the centre of the city (Charing Cross and Blackfriars) the majority have remained in a ring around what today remains London's central activity zone. There have been many proposals to solve this problem, with the focus being on linking London's terminals together via new underground links. Proposal for cross-London rail tunnels feature in the 1944 Greater London Plan, the 1974 London Rail Study (the first mention of "Crossrail") and more recently in the Strategic Rail Authority's 2000 London East-West Study.
- 2.12 The idea of a new south-west to north-east tunnel was first developed in the 1970s when the 1974 London Rail Study recommended an Underground line be constructed from Chelsea to Hackney. A cross-London Underground on a south-west to north-east alignment was first safeguarded for development in 1991. This proposal was named the "Chelsea-Hackney Line". The original safeguarded scheme proposed running trains on the outer ends of the Central and District Lines instead of connecting to the national rail network.
- 2.13 Although this scheme provided the genesis for Crossrail 2, the plans have changed in the intervening years to address the current pressures on London's public transport system. TfL has undertaken a detailed optioneering process to inform the route alignment currently proposed, together with a series of public consultations between 2013 and 2015.
- 2.14 The current plans for Crossrail 2 have also been influenced by the outcomes of London's spatial, infrastructure and transport planning processes. Crossrail 2 has been tested and developed against this background and the scheme has been identified by the Mayor as a priority for the capital.



Case Study: Paris

The Réseau Express Régional (RER) was first developed in stages in the 1970s. Since then this network has expanded to five lines, all of which cross through the centre of Paris, bypassing traditional terminals. The network currently serves 257 stations, of which 33 are in Central Paris, and operates over 587km of track. In 2013 it carried over 780m passengers.

While constructing the RER, existing network infrastructure was heavily used. The majority of the RER track is located above ground, utilising legacy infrastructure, whilst the underground portion of the RER is almost exclusively located under the core of Paris. Therefore the majority of construction work related to connecting existing above ground rail lines to one another under the city, as well as extending lines specifically to airports and economic hubs.

Each line intersects with multiple key transport hubs throughout the centre of Paris. In addition, the average distance between RER stations is approximately four times that between metro stations, thus permitting faster transit through the city. Together, these factors help to support the existing metro system by spreading some of the volume of public transport congestion travelling through the city.

The RER network has supported the growth of the city. Suburban towns located on the RER lines have had sustained growth and the capacity constraints of the heart of Paris have been alleviated through the dense infrastructure network. Over time, employment both within the central business district and in other areas linked to the RER has grown and areas have become economic loci in their own right.

Responding to London's strategic transport challenges

2.15 In Part 1, the Commission identified four core strategic challenges for London:

- Lack of capacity and major overcrowding on key central London Underground lines, particularly the north-south Victoria and Northern Lines.
- Lack of capacity and major overcrowding on key radial rail routes into central London and at key terminal and interchange stations, particularly at Clapham Junction and Waterloo.
- Insufficient improved orbital links, in particular in east London, where limited river crossings by road are a prime barrier to connectivity.
- Insufficient transport access to key areas of future housing growth.

2.16 Crossrail 2 provides a convincing response to three of these challenges, and with the option of an eastern branch, it could in the future provide a further important contribution to the challenge of growth in east London.

Overcrowding on the Underground

- 2.17 By building an additional underground line across London, Crossrail 2 provides significant additional capacity on the Underground network – an increase of more than 10% to current rail-based capacity in central London.³² This will allow the network to meet growing demand for services once all London Underground upgrade options have been exhausted and the network reaches full capacity.
- 2.18 Using changes in AM peak crowded hours, one way of modelling the impact of Crossrail 2, TfL forecast that peak crowded hours on London Underground lines will be 19% lower in the early 2030s with Crossrail 2 than without. Crowded hours is a measure of time spent by standing passengers in crowded conditions, weighted for severity of crowding.

Table 3 – Changes in AM Peak Period Public Transport Crowded Hours in with the addition of Crossrail 2³³

Line	Change from the forecast as a result of Crossrail 2 ³⁴
Waterloo & City	-54%
Victoria	-48%
Piccadilly	-34%
Northern via Bank	-26%
Northern via Charing Cross	-23%
London Underground (total)	-19%
District	-10%
Circle – Hammersmith & City	-8%
Bakerloo	-7%
Jubilee	-5%
Metropolitan	-4%
Central	-3%

“ Crossrail 2 is desperately needed to address severe capacity constraints that will exist on the London Underground and mainline Network Rail services such as those into London Waterloo, London Liverpool Street and London Victoria. ”

London Councils

“ The successful delivery of Crossrail 2 represents the main priority for the FSB in terms of improving London Transport. ”

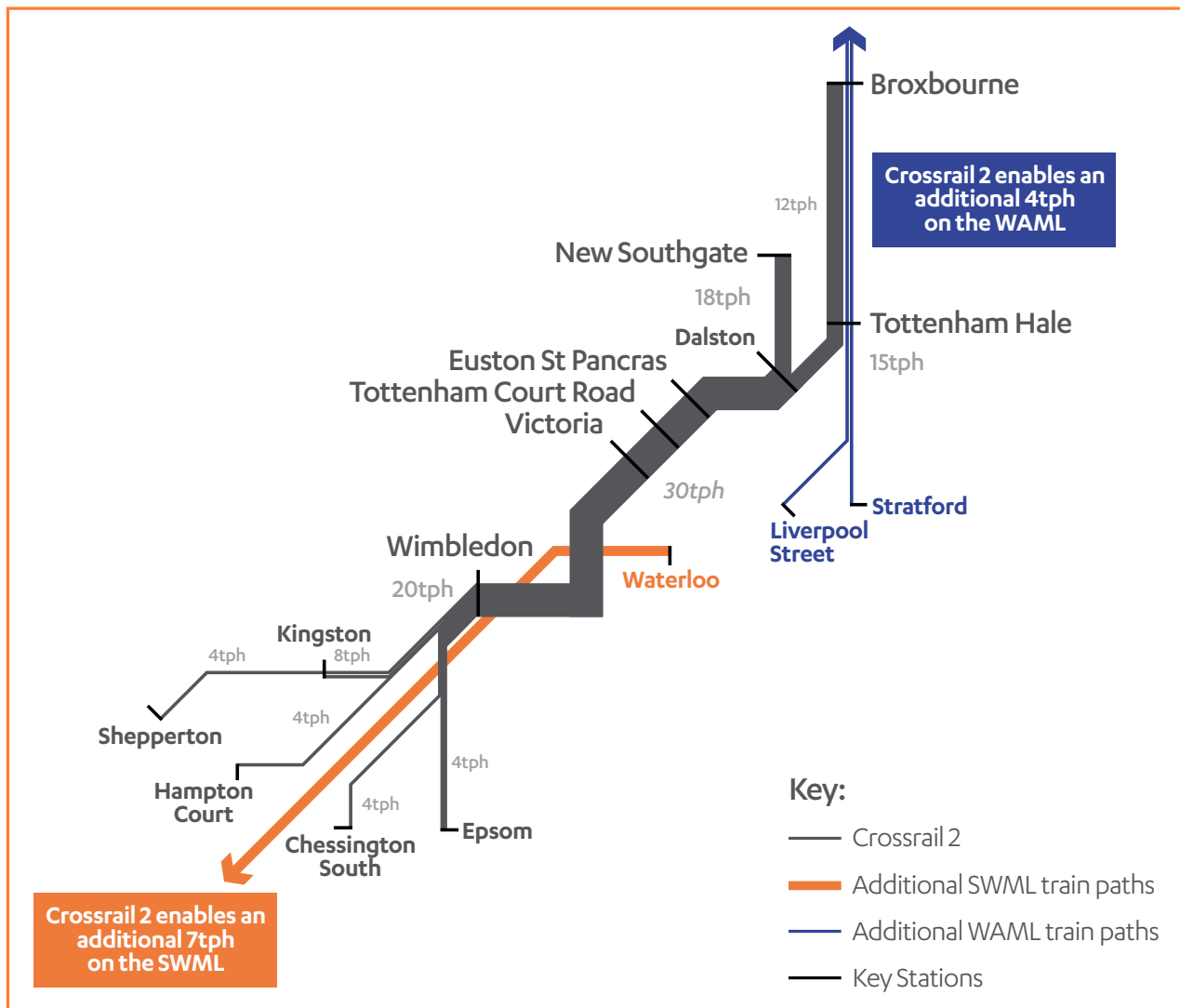
Federation of Small Businesses

- 2.19 In addition to overall capacity, the tunnelled route alignment provides vital relief to many of the lines forecast to suffer from the most acute overcrowding – notably the Victoria Line through north and central London and the southern end of the Northern line. Stops at Balham/Tooting, Victoria, Tottenham Court Road, Euston St Pancras and Angel provide northern and southern interchanges with the Victoria and Northern Lines. These lines are forecast to see a reduction in peak crowded hours of around 50% and 25% respectively in the early 2030s with Crossrail 2.
- 2.20 The route has an important interchange with Crossrail 1 at Tottenham Court Road, providing an alternative route to the City and Canary Wharf for passengers from south-west London. Although Crossrail 2 adds additional passengers to Crossrail 1 at Tottenham Court Road, modelling shows there is capacity for these extra passengers to be accommodated.
- 2.21 Crossrail 2 also facilitates the onward dispersal of HS2 passengers at Euston, which will become a critical challenge as passenger numbers rise in the 2030s following the opening of the second phase to Manchester and Leeds.

Overcrowding on the rail network and terminal stations

- 2.22 The previous chapter identified the South West Main Line (SWML) as one of the busiest and most congested routes on the London rail network, and the one to whose capacity challenges fewest practical responses have been identified. Crossrail 2 relieves congestion on this critically overcrowded artery by providing an alternative route for inner suburban services via a new tunnel to Wimbledon.
- 2.23 Thirty trains an hour would run from central London to Wimbledon, some trains would turnaround at Wimbledon and others travel onto the branches serving Shepperton, Hampton Court, Chessington South and Epsom. This allows passengers from the south-west to reach central London without travelling via Waterloo and relieves congestion at Clapham Junction by reducing the need for passengers to interchange, in particular by providing a direct route from Wimbledon and locations south-west of London into Victoria. It also provides crowding relief at Vauxhall and Wimbledon which are also forecast to be critically over-crowded by the 2030s.
- 2.24 By reducing the number of suburban commuter trains needed to serve Waterloo, Crossrail 2 also frees up capacity on the existing network for additional long-distance services from Basingstoke, Woking, Guildford, Southampton and beyond. With the combination other infrastructure upgrades in the outer area of the SWML (e.g. at Woking) the scheme is expected to generate up to seven additional train paths per hour into Waterloo for long distance services.
- 2.25 The benefits of Crossrail 2 are not only felt on the South West Main Line. In particular, Crossrail 2, includes four-tracking the West Anglia Mainline (WAML), also creates 50% extra capacity and enables faster services on the London-Stansted-Cambridge Corridor into Liverpool Street. Increasing capacity on the WAML is of substantial importance in unlocking the major opportunities for housing growth in this corridor.

Figure 9 – Crossrail 2 enabled AM Peak additional services (trains per hour in peak direction, working assumption – final Crossrail 2 service pattern to be developed)



Facilitating housing growth

2.26 In addition to its benefits in relieving congestion on the London Underground and National Rail networks, Crossrail 2 also has the potential to make a significant contribution to unlocking new housing growth in London. With the right planning framework and delivery mechanisms in place, the scheme has the potential to facilitate the development of 200,000 homes, over and above an estimated 60,000 houses that would be developed in the same areas without the scheme.

2.27 By providing improved transport connectivity to currently poorly served areas in north-east London, development which was previously unable to gain planning permission can be unlocked. And by improving capacity on currently congested parts of the central network and the South West Main Line, the scheme can make new developments and the densification of existing housing areas viable.

The economics of Crossrail 2

- 2.28 As set out above, Crossrail 2 provides an effective response to three of the most important strategic challenges facing London's transport system. As part of developing the scheme, TfL has carried out a detailed economic analysis, incorporating both conventional value-for-money assessment (following the Department for Transport's WebTAG methodology) and an assessment of a range of harder to quantify and unquantified impacts, including how Crossrail 2 may affect UK net GVA as a result of the additional capacity and employment impacts in the high productivity London Central Activity Zone.
- 2.29 The conventional assessment is based primarily on benefits to existing transport users and on this relatively narrow basis Crossrail 2 generates benefits that are only marginally greater than its costs, although these increase when wider economic impacts such as agglomeration are also taken into account. This reflects the high costs of the project (including optimism bias), which include very substantial investment in entirely new major infrastructure in the form of a new tunnel railway and stations across central London, and major upgrades and enhancements to existing lines and stations on the National Rail network. The scheme costs also allow for a new fleet of trains and the operating and maintenance costs of the railway, against which the additional ticketing and other revenues generated by the scheme are offset. It should be noted that the conventional assessment does not fully take into account land-use change and therefore does not include all the benefits of regeneration of the Upper Lee Valley, a key part of the rationale for the scheme.
- 2.30 A parallel strand of analysis has also been undertaken by TfL which attempts to quantify the potential Gross Value Added (GVA) benefits from the Crossrail 2 scheme as a consequence of providing capacity that removes the transport constraints to delivering the full productivity/economic density potential of London's Central Activity Zones (CAZ). This work was commissioned in response to concerns that traditional transport appraisal methodology did not capture all of the benefits of transport infrastructure investments of this scale.
- 2.31 The conclusion of the work was a range of UK net GVA impact of between £16bn and £102bn Present Value (PV – at 2011 prices) depending on model assumptions and nature and scale of elasticity adopted, with a mid-point PV range of between £33bn and £47bn. It should be noted that these estimates are based on new and developing methodologies and are highly uncertain in comparison to traditional value-for-money assessments.
- 2.32 Given the high costs associated with Crossrail 2 and the inherently uncertain nature of the benefits, there is a clear imperative to focus on delivering the strategic and economic benefits of the scheme in a cost-effective way. The Commission's proposals for doing so are set out in the next chapter of this report.

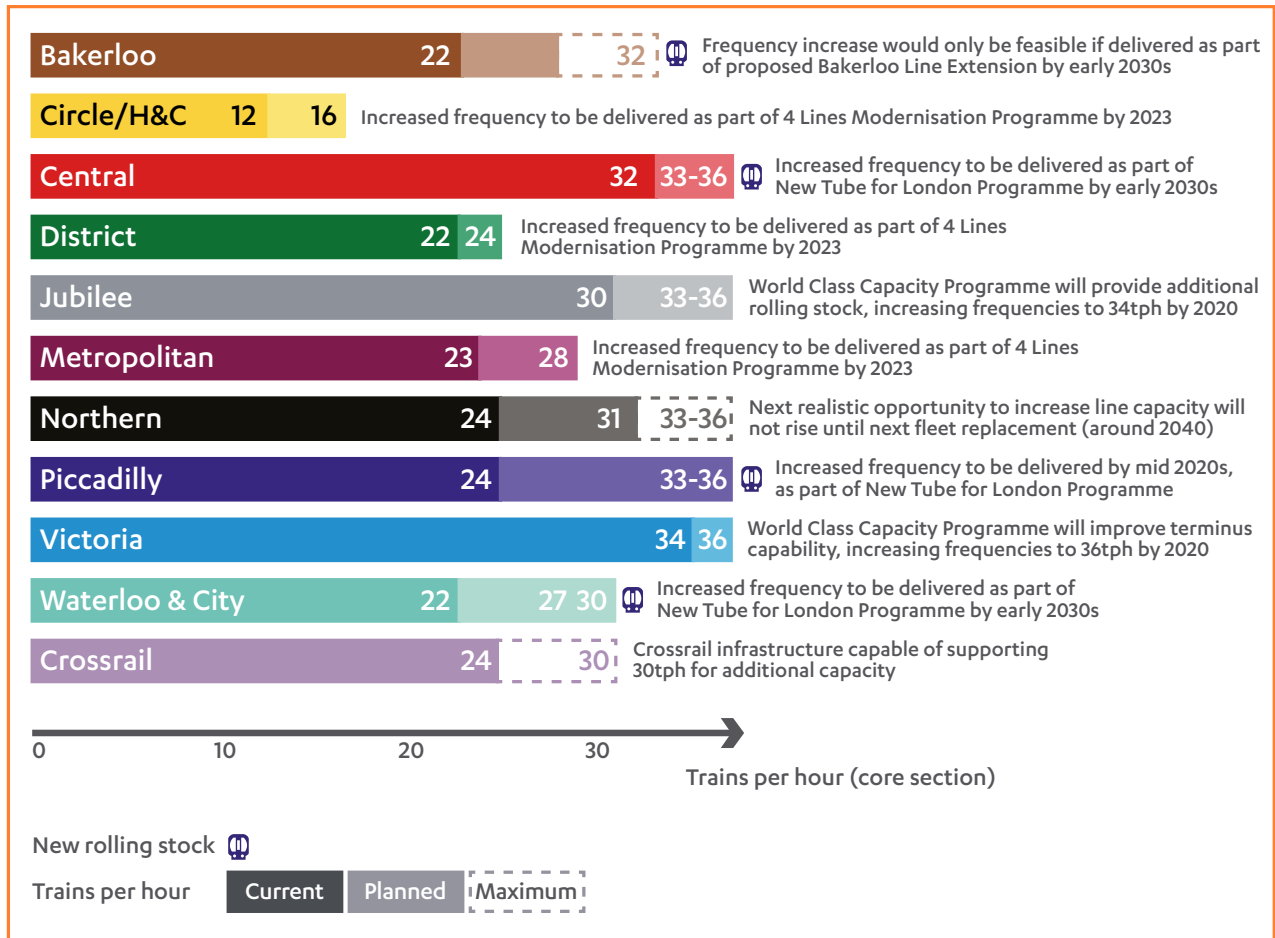
Strategic Alternatives

- 2.33 Alongside reviewing the strategic and economic case for Crossrail 2, the Commission has examined a number of other options for dealing with the challenges that Crossrail 2 addresses, as well as reviewing, at a high level, the evidence for alternative major transport infrastructure investments in the capital which do not add central London rail capacity. In the course of this process, no alternative proposal or proposals that effectively deal with the challenge of Underground capacity once all feasible Underground line upgrades are exhausted, or which can effectively mitigate the crowding and dispersal challenges at Waterloo, Euston, Victoria and Clapham Junction, have been found.
- 2.34 Other major schemes, which are not focused on capacity through the central London core, such as east London river crossings and the Bakerloo line extension, also have potential to deliver valuable benefits but address only part of the identified challenges for London. These projects may still constitute value for money and subject to overall affordability, should be considered on their own merits, particularly where there is scope to explore alternative funding mechanisms or delivery models. But they cannot, on their own, resolve the crucial strategic challenges posed by long-term demand growth into and through central London.

Alternative central London capacity options

- 2.35 The current Underground investment programme focuses on providing incremental enhancements to the existing central London infrastructure to add additional capacity, such as signalling and rolling stock upgrades. Upon completion of the current investment programme the scope for further such schemes is far more limited as the physical and practical limits of the Underground system will have been reached in most cases. This situation has been described by TfL as ‘peak tube’ and is the point at which it is no longer practical or economically beneficial to continue to invest in relieving constraints on current lines.
- 2.36 The figure below, shows how much further capacity could be generated on each line before ‘peak tube’ is reached and demonstrates that only a handful of limited opportunities remain. Of the limited future alternatives, some may not be economically viable – for example replacing relatively new fleets on the Northern and Victoria lines ahead of life expiry – and others, such as the provision of additional capacity on the Bakerloo line, would do little to address the most significant forecast congestion issues.

Figure 10 – Train service frequency on the Tube: current, planned and maximum theoretically achievable levels³⁵



2.37 The implication of reaching the maximum capacity of the current Underground infrastructure is that the only means of providing significant additional central London capacity will be through a major new alignment. This could be connected into the national rail network, as is the case for Crossrail 1 and Thameslink, or it could operate as a ‘metro-style’ Underground line. The key point is that an option is needed which provides a new tunnel. Once this is built there are then further benefits from linking it into the national rail network.

South West Main Line capacity options

2.38 Having determined that the South West Main Line is a key priority for further investment, TfL and Network Rail have developed two alternative options for improving capacity into London Waterloo. These options are in addition to the currently programmed work to bring the Waterloo International platforms back into use and lengthen suburban services to ten-car.

2.39 By the end of Network Rail Control Period 5 (2019) all 'fast' lines into Waterloo will be at their operational limits and opportunities for lengthening trains and platforms will be used up. However, demand is predicted to continue growing with the high peak hour demand forecast to increase by 40% to 2043. Network Rail have determined that in order to meet this gap, capacity in the peak hour for longer distance services would need to rise from 24 trains per hour (tph) currently to 37 tph.³⁶ Network Rail as part of its route studies work has identified three options to close this gap:

- a 'Digital Railway' signalling solution with automatic train control;
- adding a fifth track between Surbiton and Clapham Junction; and
- Crossrail 2, which would remove a significant proportion of the inner suburban services on the slow lines allowing an additional 7 tph for Outer Suburban services to use the released capacity

2.40 Of these, it is Crossrail 2 which by using a digital signalling (ETCS³⁷ and automatic train control) and re-routing trains away from Waterloo to free up valuable platform space, gives the greatest capacity increase to 42 tph. Digital signalling or a fifth track, on their own, could enable an increase to 34 tph but would still be subject to capacity constraints on the entrance to Waterloo and in respect of platform capacity. This falls short of the 37 tph which is needed. In the case of a fifth track very considerable cost and land take would also be required. Crossrail 2 has the additional advantage of removing passengers from Waterloo, whereas both a combined digital railways and a fifth line solution would result in around 40,000 additional passengers arriving at Waterloo in the AM peak period, as shown below.

Figure 11 – Passengers arriving into London Waterloo in the average three hour AM peak period³⁸



2.41 In a scenario in which the lines into Waterloo are upgraded but Crossrail 2 is not built, the impact on station crowding would be significant and could require a large scale rebuilding of Waterloo. The number of passengers interchanging between the national rail platforms and the Jubilee line increases by 50% from approximately 30,000 in 2011 to 45,000 by 2041. Network Rail has forecast that certain exits and interchanges with the London Underground would operate at over 200% capacity. This could result in frequent gate line closures, and queuing to manage crowding as well as difficulties operating the station.

Alternative non-central London capacity options

2.42 The two major alternative infrastructure investments that have been proposed by London stakeholders, which do not add central London capacity, are east London river crossings and the Bakerloo line extension.

East London River Crossings

2.43 TfL have recently consulted on a number of possible additional river crossings in east London. There are currently only three road vehicle crossings of the river Thames in London east of Tower Bridge (the Rotherhithe and Blackwall Tunnels and the Woolwich Ferry). The only crossing east of the Woolwich Ferry is the Dartford Crossing, leaving a gap of some 14km between crossings. A new river crossing at Silvertown is being planned in order to relieve the Blackwall Tunnel, a severe bottleneck on the east London road network and Highways England is consulting on a new Lower Thames Crossing. Even with this additional capacity, the river Thames will however remain a significant barrier to movement in east London.

2.44 This lack of connectivity reduces the network benefits of the road system in east London, with implications for land use and economic efficiency, reducing people's employment, leisure and education opportunities and reducing business efficiency and competitiveness. TfL argue that access to skilled labour and business-to-business transactions are both impeded as a result since long journey times prevent the integration of local labour markets. This lack of connectivity also risks impeding the development of the major Opportunity Areas in the London Thames Gateway area.

2.45 For these reasons, it is likely that investment in new river crossing capacity could play a valuable role in tackling two of London's key strategic challenges – the lack of orbital links to the east of the capital and the need to better connect areas of housing growth. It would not, however, deal with the critical congestion issues either on the Underground lines through central London or on national rail lines and at key terminal stations.

2.46 The Commission's view is that, subject to affordability, there is a strong case for providing additional cross-river capacity in east London, and that the scope to fund such links through tolling should therefore be explored. But it does not consider that these would offer an effective alternative to investment in Crossrail 2.

Bakerloo line extension

- 2.47 TfL has also consulted on an extension to the Bakerloo line, which would extend the line from its current southern terminal of Elephant & Castle to Lewisham via the Old Kent Road. This would improve connectivity from south-east London, taking advantage of the fact that the Bakerloo line, relative to other lines, is not forecast to experience high levels of crowding and would have sufficient capacity to incorporate the additional demand that an extension would generate.
- 2.48 To the south-east of Elephant & Castle, significant development capacity for new housing exists within a corridor linking two Opportunity Areas around the Old Kent Road and in the New Cross-Lewisham-Catford area. Both of these Opportunity Areas contain areas of high deprivation and suffer from poor transport connectivity; in particular, the Old Kent Road corridor is currently only served by buses and is often severely congested.
- 2.49 The proposed Bakerloo line extension could therefore improve transport access to a number of important areas of housing growth, although the growth associated with the two Opportunity Areas connected to the scheme totals 20,000 homes (with the Bakerloo line), this compares to 40,000 in the Upper Lee Valley Opportunity Area (with Crossrail 2).³⁹ In addition, the Bakerloo line extension would not address any of the most pressing congestion issues on the national rail network, and its impacts on Underground capacity through central London would be very limited in comparison to Crossrail 2.
- 2.50 For this reason, the Commission does not consider that the Bakerloo line extension, despite its potential benefits, offers a viable alternative investment to Crossrail 2. There may still be a case, subject to affordability, for a new link on this corridor, however, and options for alternative funding mechanisms, linked to the provision of new housing, as used for the Northern line extension to Battersea/ Nine Elms, should be fully considered.

Wider Planning for London

- 2.51 A new Mayor will be elected in May 2016. This will lead to a new London Plan and transport strategy. Alongside considering the major investments described above, these will need to incorporate a range of smaller programmes on the rail, road and cycling networks. It will be important to integrate these smaller interventions with the longer term strategic planning framework. In relation to Crossrail 2, this primarily requires ensuring that new stations and interchanges that are created by Crossrail 2 are properly integrated into and complement local transport networks. The owners of other key national infrastructure networks, including Highways England and Network Rail also are developing new projects and enhancements, such as the proposal for a new lower Thames Crossing, which have a direct impact on London. It is important that these are also taken into account in London's strategic planning.

Conclusion

2.52 The Commission’s assessment of the case for Crossrail 2 and of a number of alternative proposals for investment indicates that Crossrail 2 is uniquely able to address the most important strategic challenges that London faces – the need for additional Underground capacity across central London, the need to tackle congestion on the National Rail network and at key terminal and interchange stations, and the need to provide better transport access to unlock areas of housing growth.

2.53 Therefore, the Commission’s view is that Crossrail 2 should be taken forward for further development, with a view to opening in 2033 when HS2 Phase 2 is planned to open.

2.54 Nonetheless, the very high costs of Crossrail 2 make it imperative that every opportunity is identified to reduce its initial costs and maximise its benefits. The Commission’s proposals for how this should be achieved are set out in the next chapter.

Recommendation 1: Crossrail 2 should be taken forward as a priority with the aim of opening in 2033, subject to the recommendations below.

Recommendation 2: Crossrail 2 should be at the heart of the new London Plan, alongside existing commitments to upgrades and other pieces of new infrastructure. Crossrail 2 should not, subject to affordability, prevent the development of other high value schemes, particularly where alternative funding mechanisms are available.

- London must continue to plan strategically for the period 2030-2050 through the next iteration of the London Plan. Crossrail 2 should be at the heart of this strategy and TfL’s wider programme of smaller scale interventions on the national rail, road, Underground and cycling networks in London should be integrated with it to complement and enhance its benefits.
- The London Plan should also include a detailed examination of the scope to deliver other strategic projects, such as further east London river crossings and the Bakerloo line extension, through alternative financing mechanisms. This should build on the precedents from the Silvertown Crossing and Northern line extension to Battersea/Nine Elms.

“ We are certain that Crossrail 2 is vital to ensure our transport infrastructure can continue to cope with demand ”

East of England LGA, London Councils, South East England Councils

PART THREE: FROM DEVELOPMENT TO DELIVERY

PART 3: FROM DEVELOPMENT TO DELIVERY

- 3.1 TfL and Network Rail have developed a plan for Crossrail 2 which seeks to ensure that it tackles the most important long-term transport challenges for London. This plan has evolved significantly from the original 1991 Chelsea-Hackney proposal as London's challenges have changed. Nonetheless, given the very high costs of Crossrail 2, further work is still needed to strengthen the case for the scheme, focusing in particular on:
- Identifying proposals to phase costs and increase affordability
 - Developing a strategy to unlock significant housing growth
 - Delivering a funding plan in which London contributes its fair share to the project
 - Maximising private sector involvement in the development and funding of stations and their surrounding areas
- 3.2 This work should form the core of the next stage in the development of Crossrail 2. This chapter sets out the Commission's analysis and more detailed recommendations in each of these areas.

Recommendation 3: Sufficient development funds should be released in order for TfL and DfT to submit a revised business case for Crossrail 2 by March 2017 and aim to introduce a hybrid bill by autumn 2019. The revised business case should include developed plans on costs, funding, housing and stations. TfL estimates the overall development cost at c.£160m, to which TfL should be expected to make a reasonable contribution.

Cost and Phasing

- 3.3 TfL has been examining options for the current proposed Crossrail 2 route since 2008. In identifying the current route, over 100 options along a south-west to north east corridor were considered which covered a range of destinations. The cost of the current proposed scheme is estimated by TfL at £32.6bn,⁴⁰ of this 33% (£10.8bn) is for stations, 12% (£4bn) is for tunnelling and 4% (1.4bn) is for rolling stock.
- 3.4 While each of the currently proposed stations and branches has a clear rationale, given the very high costs of Crossrail 2, it is important to consider options for phasing the delivery of the scheme to reduce its initial cost. In particular, if any elements could be delivered to a slower timetable without significantly reducing the overall benefits of the scheme, this could strengthen its initial business case significantly.

3.5 The case for deferring the north-western branch of the Crossrail 2 tunnel, serving Seven Sisters, Turnpike Lane, Alexandra Palace and New Southgate, merits particular scrutiny. The core benefit provided by this branch is its relief of the Piccadilly line, through the connection at Turnpike Lane, but this is less crowded than the Victoria and Northern lines in the early 2030s, as it will have more recently benefited from new capacity through the New Tube for London programme. The branch does offer some additional relief for the Victoria line, but many of these benefits would be likely to be delivered in any case through the link to the Victoria line at Tottenham Hale. Its impact in terms of unlocking new housing is also much smaller than from any other major part of the Crossrail 2 scheme, as shown in the table below.

Table 4 – High level branch assessment⁴¹

	West Anglia Mainline (WAML)	New Southgate	South West Mainline (SWML) branches	Core (Wimbledon to portal)
Capex 2014 prices	£3.7bn (11%)	£4.7bn (15%)	£2.2bn (7%)	£22.0bn (67%)
Cost per km £m	204	588	55	846
Number of stations	13	4	25	9
AM Peak CR2 Boarders ⁴	26,000 (12%)	30,000 (13%)	35,800 (16%)	130,000 (59%)
% of Total at public transport User Benefits, by trip origin...	18%	11%	45% (includes benefit long distance paths into Waterloo)	26%
...by destination	4%	3%	7%	86%
Operational factors	Provides turn-back and stabling facilities sufficient to support its own services.	Provides service resilience from a Crossrail 2 exclusive terminus (similar to CR1 Abbey Wood) with turn-back and stabling facilities. Provides tunnel maintenance facility.	Provide turn-back and stabling/depot facilities, reduces risk of excessive interchange at Wimbledon and Clapham Junction. Mixing with residual SWML services into Waterloo represents operational risk to core.	Requires branches, stabling and turnback locations to enable a 30mph service.
Contribution to transport benefits	Significant enhancement in connectivity and capacity for the WAML corridor. Relieves severely crowded Victoria Line services via Tottenham Hale interchange.	Relieves Piccadilly Line at Turnpike Lane, and Victoria Line and London Overground at Seven Sisters. Helps create capacity for those boarding the Victoria and Piccadilly lines at Finsbury Park and Highbury and Islington.	Relieves severely crowded SWML rail services, facilitating growth in capacity for both inner and outer suburban services. Reduces interchange pressure at Vauxhall and Waterloo, particularly impacting Victoria line.	Relieves severely crowded Victoria and Northern lines, and also Piccadilly, Jubilee and Waterloo & City lines. Provides substantial National Rail termini dispersal benefits at Waterloo, Victoria, Euston, King's Cross, St Pancras.
Additional homes by 2051	80,000	15,000	55,000	50,000

- 3.6 Given its high costs, the Commission believes there may be a strong case for deferring the delivery of this branch until a later phase. This would reduce the costs of the initial scheme by over £4 billion, reflecting the fact that some facilities currently provided by the New Southgate branch would need to be moved elsewhere to enable the first phase to operate. It would also enable the relative case for the north-western branch and the proposed eastern extension to be considered when the second phase of the scheme is planned. The latter would be more expensive, but could bring greater overall benefits, particularly in relation to its impacts in unlocking housing and economic growth in the east of the capital.
- 3.7 In addition to phasing, we have also looked at options to reduce the absolute cost and scope of the scheme. The one area for scope reduction is the removal of a sub-surface central London station. Each of these stations and associated works can cost up to £1bn. The commission has noted the debate around removing the stop at Kings Road. Although this station would provide improved access to an area which has not previously had good Underground connections compared to other inner London areas, a stop on the Kings Road does not provide the strategic interchange or crowding relief provided by other stations.
- 3.8 There may also be costs to be saved by making smaller alterations to the scheme. Examples could include the proposal to move the Northern line connection from Tooting to Balham, following new evidence regarding the geological conditions at Tooting; work on the station design and approaches to Wimbledon; and the proposed option for a single station at Wood Green, as an alternative to two stations at Turnpike Lane and Alexandra Palace on the New Southgate branch.

Recommendation 4: In developing the business case, it is crucial that TfL and DfT identify clear proposals to maximise its benefits and increase deliverability. The costs of Crossrail 2 are high and therefore every opportunity should be taken to improve its affordability.

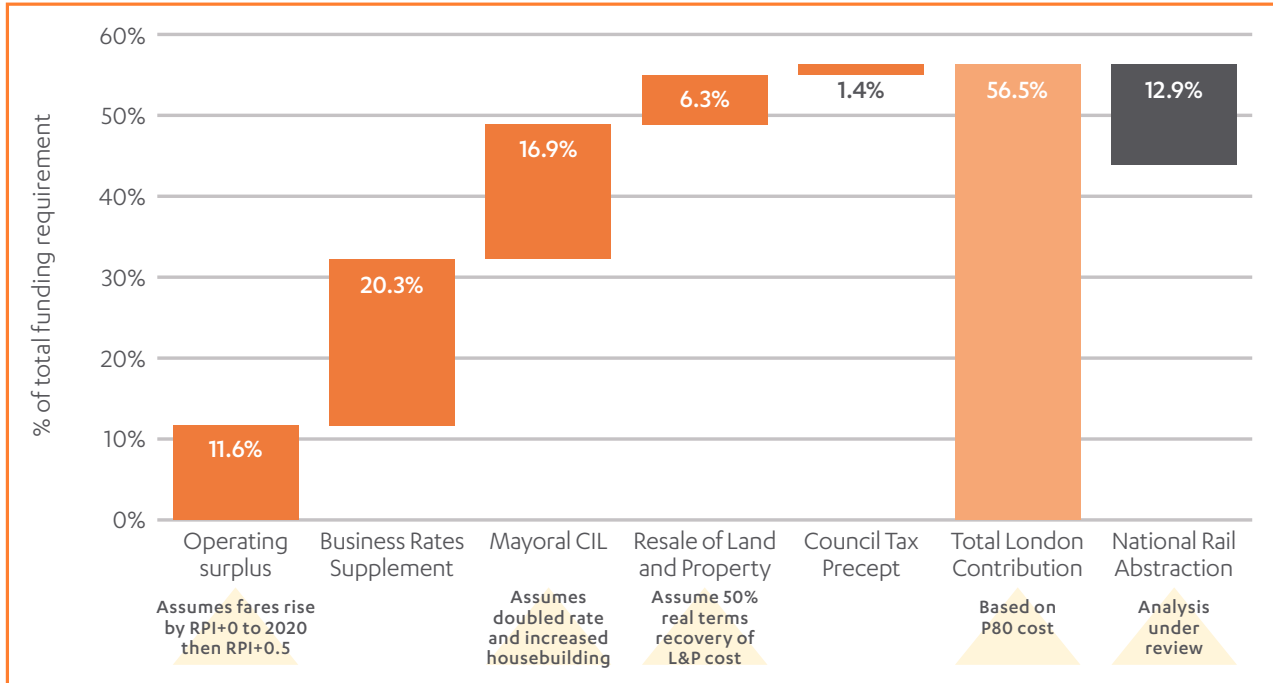
- **The updated case should include detailed options to reduce and phase the costs of the scheme. The most promising option identified to enhance affordability would be to delay the construction of the north-western branch to New Southgate. This could reduce the costs of the initial scheme in the 2020s by around £4 billion. More work should also be done on the costs and benefits of individual central London stations.**
- **If construction of the north-western branch is delayed, this would also provide the opportunity to consider the case for an eastern branch from Hackney as an alternative.**

Funding

- 3.9 The government has made it clear that London as a whole will need to make a substantial contribution to the cost of Crossrail 2. This builds on the principles established for Crossrail 1, principles that have also been extended on a more localised basis for the Northern line extension to Battersea-Nine Elms.

3.10 Using Crossrail 1 as a starting point, TfL has developed a potential funding package for Crossrail 2 which seeks to ensure that just over 50% of funding comes from London sources.

Figure 12 – Sources of Funding for Crossrail 2 (as % of total funding requirement)⁴²



3.11 The package is made up of:

- The surplus from operating Crossrail 2. This comes from growth in passenger revenues following the arrival of Crossrail 2. The contribution is calculated on the basis of current fares policy, although some of the newly generated Crossrail 2 fares will come at the expense of revenues on the national rail network as passengers move to the new Crossrail 2 service (shown as abstraction on the chart above). This would mean a loss of revenue for DfT franchised services. However, the analysis is currently under review and potential rail devolution to TfL could internalise a significant proportion of this effect within London.
- A continuation of the Business Rate Supplement (BRS) that has been successfully used on Crossrail 1. This has allowed London to collect an additional levy on commercial properties with a rateable value of £55,000. The BRS is currently hypothecated to Crossrail 1 but is expected to finish in the early 2030s at which point it would be available for Crossrail 2.
- An enhanced Mayoral Community Infrastructure Levy (Mayoral CIL), at double the existing rates and with a new central London zone. The original Mayoral CIL was designed for Crossrail 1 and the mechanism is well understood. The current rates of Mayoral CIL vary across different London boroughs and apply to both new residential and non-residential development. Like BRS it is anticipated this rolls over to Crossrail 2.

- Resale of land and property. It is envisaged that delivery of Crossrail 2 will require the project to take ownership of land along the development to allow access, create work sites and provide storage facilities. Some of this land may ultimately form part of the infrastructure but excess land can be sold and developed to provide additional funds for the project. There may be potential to raise the amount generated from land, this is discussed further in the stations sections.
- A new Council Tax Precept. This can be levied for a specific and time-bound purpose and in this case would replace the London Olympic Games precept.

3.12 A review for the Commission suggests the assumptions made by TfL are reasonable and it is feasible for London to make a 50% contribution. However this would still leave a substantial proportion of funding to come from central government grant. It should also be noted that most of the London contribution would involve borrowing against future revenue streams and therefore there would still be an impact to the Exchequer which will need to be taken into account. In addition there are significant benefits of Crossrail 2 outside the London boundary and the cost reductions from not making other interventions on the national rail network in the south-west and north-east of London. These benefits would fall to Network Rail and should be factored in.

3.13 As part of an agreed funding package there may be scope to include risk sharing mechanisms that go further than the package for Crossrail 1. These could take the form of risk share and gain share in order to incentivise London government to ensure the wider objectives of the scheme e.g. housing and growth are delivered. Further work would needed to be done in this area but it is an approach which has been used as part of city deals.

3.14 There may also be scope to go further in terms of the percentage contribution made by London, but this would require significant changes to local authority funding and/or increased devolution for London. Although the Commission has not studied further devolution for London in detail, several pieces of work, most notably the London Finance Commission, have argued in recent years for London to retain more of the tax collected within its boundaries. Any such change would be significant, but could allow London to fund a larger percentage of future transport infrastructure improvements.

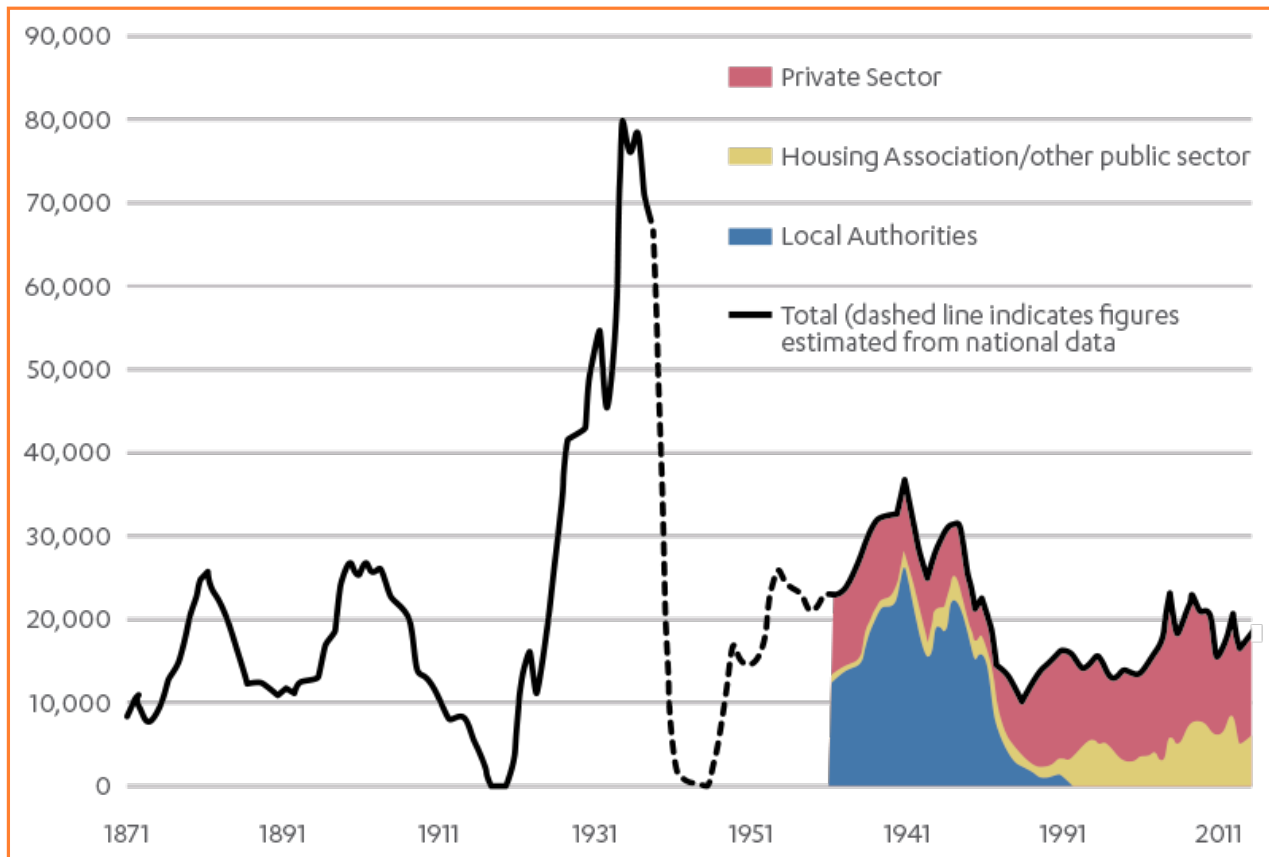
Recommendation 5: A ‘London deal for Crossrail 2’ funding agreement, through which London contributes more than half the costs of the scheme and which includes substantial measures to realise the full housing benefits, should be agreed ahead of hybrid bill submission.

- It is vital that a funding package for Crossrail 2 is developed which strikes a fair balance between the contributions made by London taxpayers and businesses and by central government. This should build on the work already undertaken by TfL, which indicated that around half the cost of the project could be funded from London sources.
- The government should work with TfL and GLA to explore new funding options, which could include consideration of further devolution. However, even without such devolution, HM Treasury should be in a position to recoup significant receipts from the added Gross Value Added (GVA) benefits and the rising value of property in London.
- A London deal for Crossrail 2 will need to cover both the funding of the project and the planning measures required to deliver Crossrail 2’s benefits.

Housing

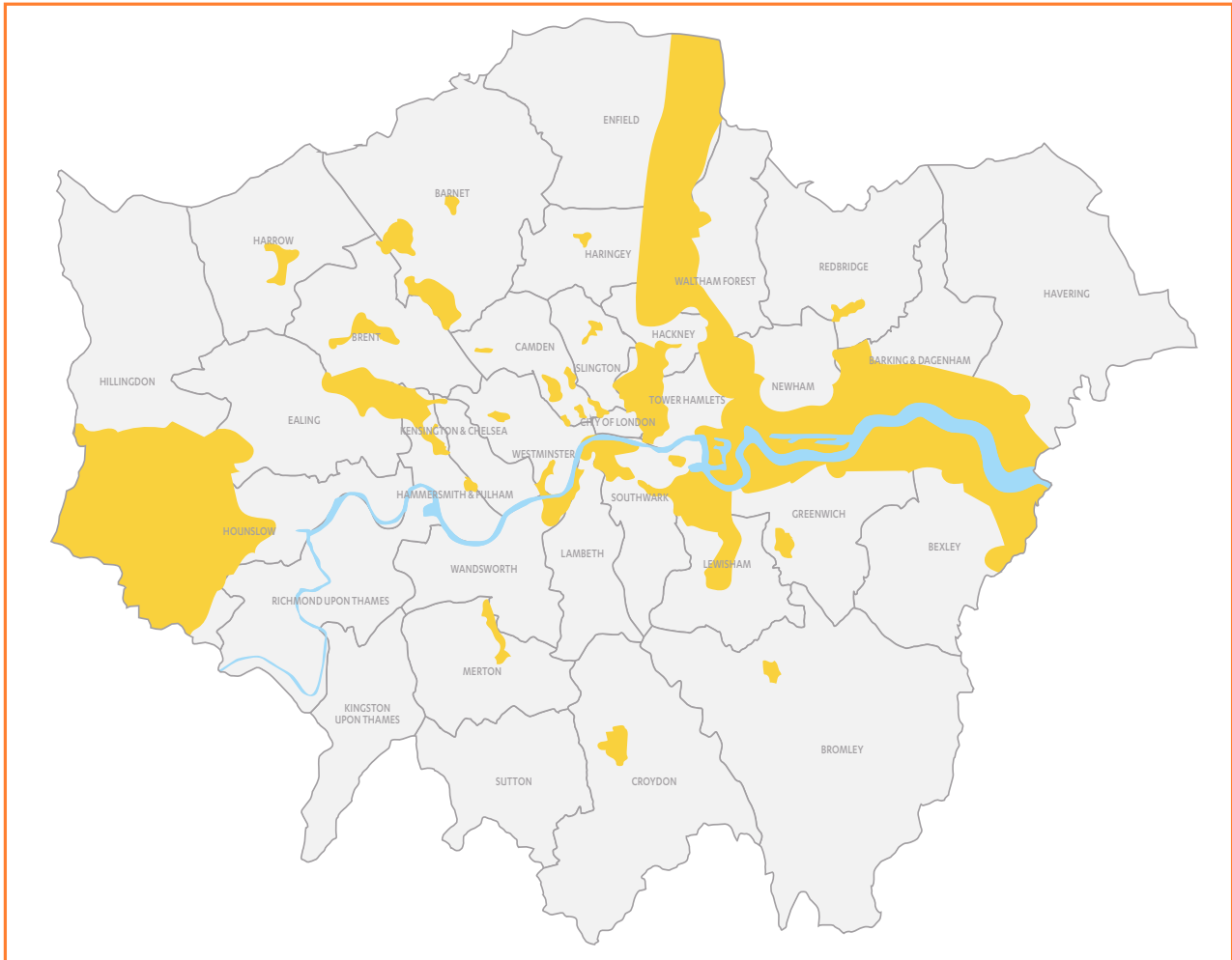
- 3.15 Crossrail 2 is not just about transport capacity and connectivity, housing is central to the scheme’s strategic case. TfL’s analysis has indicated that Crossrail 2 has the potential to enable the delivery of 200,000 new homes in and around London. Although the homes enabled by Crossrail 2 will not be fully realised until after the opening of the railway, it is important to understand the current housing pressures faced by London and the policy framework required to realise Crossrail 2’s housing benefits.
- 3.16 There is a clear consensus that London is experiencing a housing crisis and that meeting current and future demand for housing in the capital is a priority. London is suffering from a chronic lack of housing to accommodate its workers. Nine in ten Londoners think there is a housing crisis and more than half think housing is the most important issue facing London.⁴³
- 3.17 The GLA estimates that London will need 49,000⁴⁴ new homes each year between 2015 and 2036, but less than half of these are being built each year.⁴⁵
- 3.18 The table below illustrates just how ambitious London’s house building targets are. Even the post-war council housing boom produced a peak of only 37,400 new homes in 1970. Better transport links help make this ambition possible, but are only part of a solution.

Figure 13 – New homes built in Greater London, 1871 to 2014⁴⁶



Source: Housing in London 2015, p14

3.19 Finding opportunities to accommodate large scale development is also a major challenge. The Mayor’s London Plan 2015 identifies 38 Opportunity Areas for development and seven Intensification Areas. Opportunity Areas are brownfield sites with significant capacity to accommodate new housing, commercial or other developments. They are either served by existing public transport or require public transport improvements to enable development. Intensification Areas already have the required infrastructure, but are capable of supporting a denser level of housing or jobs.⁴⁷

Figure 14 – London Plan Opportunity Areas⁴⁸

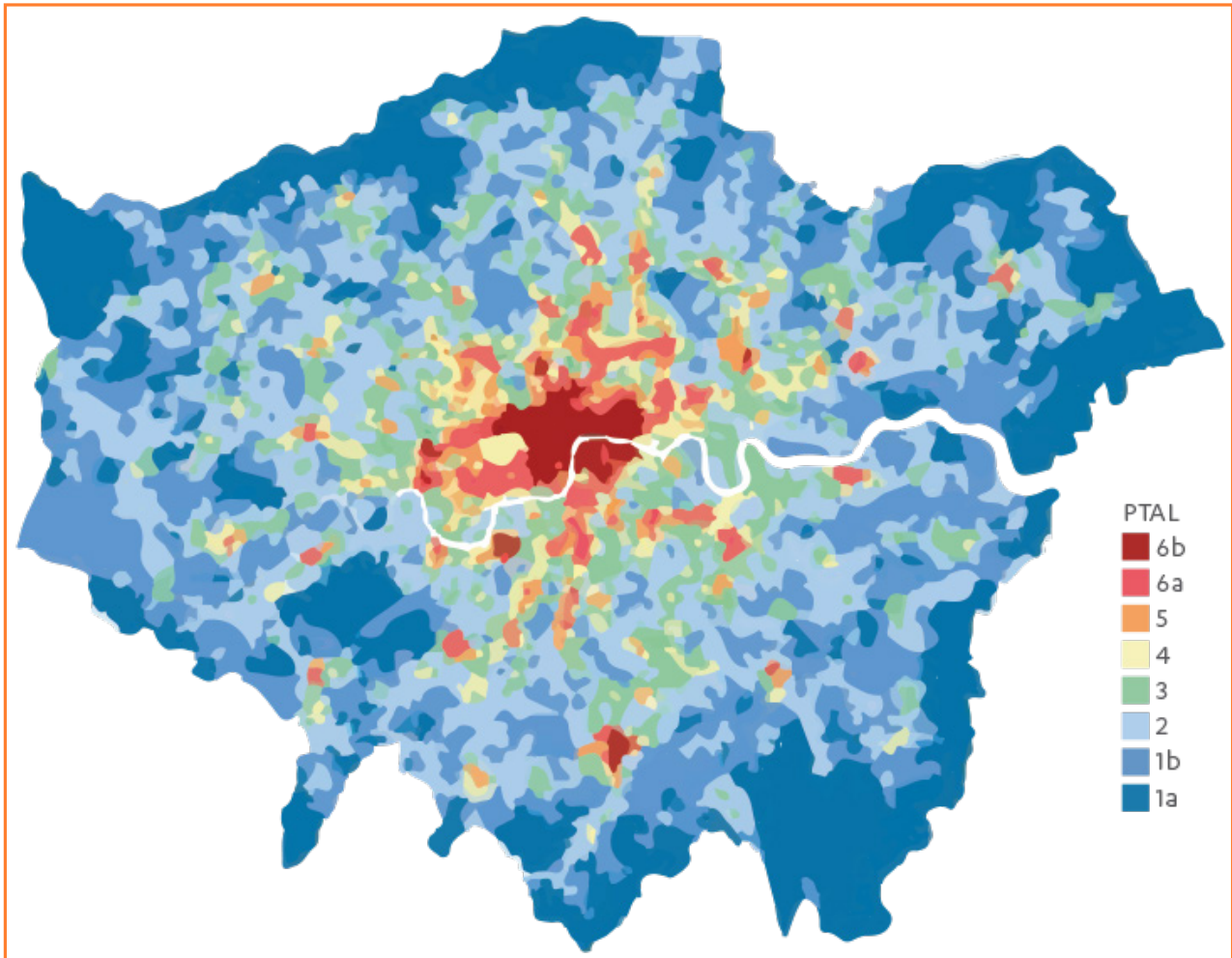
Housing and transport

3.20 Transport can play a major role in supporting housing delivery. Where transport connections are good, a higher level of housing density can be supported. Improved transport connectivity can make an area more desirable (e.g. by shortening journeys to work) pushing up land values and making new housing development viable. Improving transport connections can also have a direct impact on housing planning policies – one of the major reasons for rejecting new housing or increased density is lack of transport.

3.21 A strong example of the impact of new transport links on housing development is the Jubilee line extension (JLE). Residential development has increased more quickly in this corridor than other parts of east London since approval was granted. Development around JLE stations has also been higher than expected since the line opened.⁴⁹

3.22 The level of density at which new housing can be delivered in the capital, as set out in the London Plan, is linked to Public Transport Accessibility Levels (PTALs), a measure of proximity to and frequency of local public transport. Areas in London are categorised as suburban, urban or central; this designation along with their PTAL determines the recommended density of development.

Figure 15 – London Public Transport Accessibility Levels (PTAL)⁵⁰



Source: TfL

3.23 Access to public transport can also influence land-use designation. Local development plans designate areas of land as suitable for different uses, such as housing, industry or retail. A change in transport connectivity can trigger a decision to change land use designations. Strategic Industrial Locations (SILs) are a category of land protected by the London Plan. SILs accommodate functions including logistics, waste management and opportunities for relatively affordable workspace. They also offer, however, some of the most important opportunities for new housing growth in the capital where they can be reclassified. In many cases, improvements in the level of public transport connectivity affect decisions on reclassification.⁵¹

Crossrail 2 and housing

- 3.24 TfL analysis demonstrates that Crossrail 2 has the potential to unlock 200,000 new homes by improving accessibility to new areas for development – such as the Upper Lee Valley – and by increasing transport capacity along the line, supporting housing densification around existing and connecting stations.
- 3.25 By introducing a turn-up-and-go rail service to the Upper Lee Valley for the first time, Crossrail 2 will open up one of London’s largest housing opportunity areas. The area covers 3,900 hectares and sits within the nationally significant growth area of the London Stansted Cambridge Corridor (LSCC). The Upper Lee Valley is currently poorly served by public transport. Its two track railway has a very low frequency of trains. Some stations along the route, such as Ponders End, have only two trains per hour to central London at peak times.⁵² Angel Road station, at the heart of the Opportunity Area, has only two trains between 7am and 9am each morning which connect to central London via a change at Tottenham Hale or Stratford stations. Short term plans are in place to add greater frequency, but Crossrail 2 will deliver much more significant connectivity benefits by combining further frequency improvements with the provision of a direct link through central London, and reduced journey times.⁵³

“ The council strongly supports Crossrail 2 and believes it will provide the catalyst for transformational change in the Upper Lee Valley ”

Enfield Council

“ There are parts of London with significant space for house building that are currently not being built on. In many cases the reason is simple; these areas do not have effective transport connections. ”

Institute of Civil Engineers

3.26 Within London, the Upper Lee Valley Opportunity Area and north-east outer London have the potential to provide up to a quarter of the homes unlocked by Crossrail 2. The scope for development and densification along the line, in south-west London and outside London to the north-east and north-west, is also large and includes areas such as Chessington and Tolworth. Significant opportunities exist outside the Greater London boundary. 75,000 of the 200,000 homes potentially unlocked by Crossrail 2 are outside Greater London into Surrey and Hertfordshire. New housing will come from both new developments and the intensification of existing housing areas and town centres along the route.

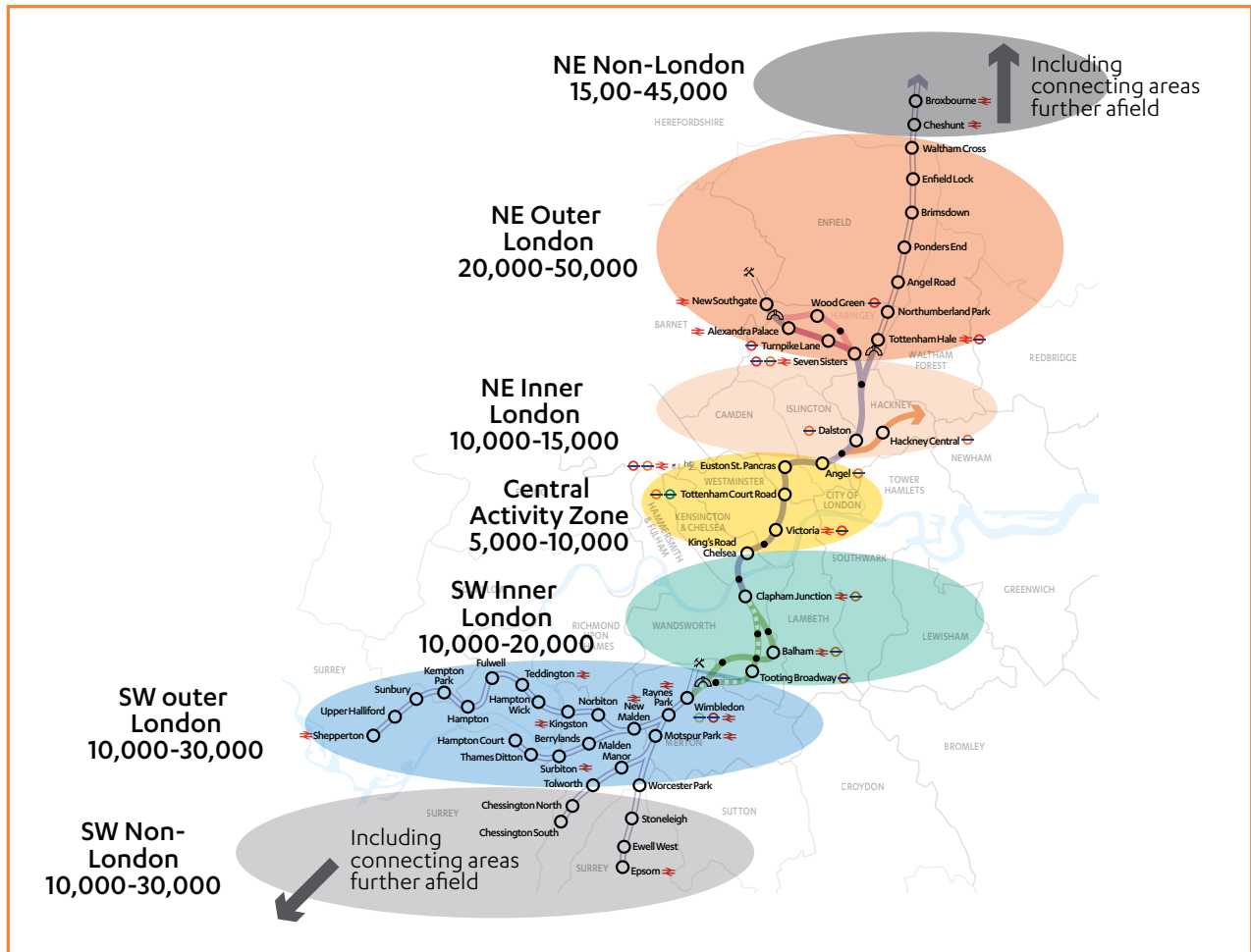
3.27 The enhanced connectivity provided by Crossrail will also improve the accessibility of employment from other areas of London and the south east. The table below illustrates the improvements in access to jobs from a number of the areas most affected by Crossrail 2 following its opening.

Table 5 – Change in the number of jobs accessible within a 45 minute travel time⁵⁴

Location	Number of jobs within 45 minutes without Crossrail 2	Number of jobs within 45 minutes with Crossrail 2	Difference
Brimsdown	320,000	1,270,000	+430%
Ponders End	670,000	1,380,000	+105%
Turnpike Lane	2,530,000	2,780,000	+10%
Tooting Broadway	2,700,000	3,100,000	+15%
Wimbledon	3,450,000	3,577,000	+4%
Tolworth	90,000	115,000	+28%
Kingston	300,000	500,000	+65%
Surbiton	1,600,000	1,900,000	+19%

3.28 Crossrail 2 also has the potential to support housing growth along other transport corridors set to benefit from congestion relief. Long-distance services into Waterloo from Woking, Basingstoke and beyond will benefit from congestion relief on existing routes and capacity growth as new paths into Waterloo are freed up when Crossrail 2 is opened. Equally, Underground lines will benefit from freed up capacity as passengers switch to Crossrail 2. This increased capacity can support housing growth and densification in areas away from the Crossrail 2 route itself.

Figure 16 – Housing that could be unlocked by Crossrail 2. Low and high scenarios based on planning assumptions⁵⁵



Source: TfL

3.29 Realising the potential of Crossrail 2 to unlock 200,000 new homes is achievable, but will require a number of strong measures to be put in place, in particular:

- Significant changes to planning policy;
- A co-ordinated approach from the GLA, London boroughs, adjoining counties and central government; and
- The establishment of one or more development corporations to lead the masterplanning and delivery of new housing and urban realm provision.

3.30 Without such measures, there is little likelihood of the promised 200,000 homes being delivered. In the Commission's view, however, if the necessary steps are taken and strong leadership is provided, 200,000 homes should not be seen as a limit on what could be achieved. If successful, the package of measures described below and proposed for Crossrail 2 could also provide a model for enabling wider housing growth in other areas of the capital.

Planning Policy Changes

3.31 TfL has undertaken extensive work to explore how Crossrail 2 can facilitate the delivery of housing. The following planning policy changes underpin Crossrail 2's housing case:

- **Industrial land release:** An increased rate of Strategic Industrial Location (SIL) release for housing development.
- **Density:** An increase in the housing density levels applied by the London Plan⁵⁶ (including the intensification of existing housing estates)
- **Metropolitan Open Land/Green Belt release:** Densification around Crossrail 2 stations; including, where appropriate in specific cases, the limited release of Metropolitan Open Land (MOL) and Green Belt land.

3.32 The need to release Strategic Industrial Location (SIL) land is already recognised in the London Plan,⁵⁷ which states that “the release of surplus industrial land should as far as possible be focussed around public transport nodes to enable higher density redevelopment, especially for housing”. Nevertheless, since the decision to release industrial land for housing is taken by local planning authorities, enabling Crossrail 2 to deliver on its housing promise will require a co-ordinated approach to SIL release.

3.33 In respect of densification, it is already possible to build at higher densities either by improving public transport accessibility (generating a higher PTAL) or by changing the development density level permitted by planning policy. This would potentially mean altering the London Plan classification of areas into suburban, urban or central and/or the density ranges of each category. Local planning authorities in London would then need to align their planning policies with the London Plan.

3.34 Development in London already regularly exceeds the Mayor's density targets. In 2013/14, 50% of all housing units approved in London were at density levels above the range set out in the Sustainable Residential Quality (SRQ) matrix of the London Plan.⁵⁸ This is consistent with the five year average (51%). This happens particularly in the case of newly developed Opportunity Areas, such as the high density housing schemes approved at Vauxhall Nine Elms Battersea - made possible by the Northern line extension.

3.35 Outside London, development at higher densities is at the discretion of Local Planning Authorities. Achieving the housing densification envisaged by Crossrail 2 would require appropriate planning policy to be adopted by local authorities outside London, notably Surrey and Hertfordshire, but potentially also further afield.

3.36 Again, in relation to Green Belt release, changes are already being considered. While the Green Belt is protected under national planning policy as well as the London Plan (MOL is protected by the London Plan), a number of local authorities - including some on the Crossrail 2 route - are already reviewing Green Belt designations. The Crossrail 2 Growth Commission notes that the future role of the Green Belt is not an issue confined to Crossrail 2 and will need to be considered further as part of the London Plan and other local and national planning

processes.⁵⁹ The release of limited parcels of such land around Crossrail 2 and connecting stations currently contributes at least 10% to Crossrail 2's housing goal of 200,000 new homes,⁶⁰ but a co-ordinated approach across local authorities on the release of land for development is again needed.

A co-ordinated planning framework

3.37 The Crossrail 2 Growth Commission is looking at how the regeneration, house building and job creation opportunities associated with Crossrail 2 can be developed to their full potential and is due to report in the summer of 2016. It has identified a range of ways in which the public sector can better support housing growth, by improving confidence in delivery and value capture. These include:

- greater use of the GLA's land acquisition powers;
- extending Crossrail 2's potential Compulsory Purchase Order powers; and
- the use of new towns policy and similar mechanisms to support joint ventures.⁶¹

3.38 Each of these can play an important role in ensuring that development happens and houses get built, but they are dependent on the right planning framework being in place within which decisions on development associated with Crossrail 2 are taken. Neither the London Plan nor any individual Local Authority's local plan covers the entirety of the Crossrail 2 route, and National Policy Statements are limited in their impact on housing decisions. Therefore it is likely that any such framework would require the Mayor and local authorities along the route to develop joint or complementary local plans. This can be done on a voluntary basis or can be required by the Secretary of State under new powers in the Housing and Planning Bill.

3.39 The government could also create its own policy framework via powers in a Crossrail 2 Act (a hybrid bill is currently TfL's preferred route to powers for the scheme). This would give the authority for Crossrail 2 to progress and confidence that local plans would be supportive, but the process of passing a hybrid bill is time-consuming and it may be possible to agree a joint local plan more quickly.

3.40 Whatever approach is taken, establishing the necessary policy planning framework inevitably involves a process of preparation, public consultation and environmental assessment, the full details of which may not be known ahead of a decision to proceed with the scheme. But building Crossrail 2 without securing the policy changes that will facilitate the housing which it is intended to support risks not delivering against a key strategic objective of the scheme.

Development Corporations

3.41 Planning policy changes alone are unlikely to deliver the level of housing promised. In some areas along the route where land values are already high, a change in allowed development densities may be enough for the market alone to bring forward housing development, but in less well developed areas - notably the Upper Lee Valley - a more co-ordinated approach to housing delivery will be required.

- 3.42 In the Commission's view, one or more development corporations, with combined powers to consent to and deliver housing, could be the appropriate vehicle to ensure Crossrail 2 delivers on its housing promise. This option has also been proposed by the Growth Commission.⁶²
- 3.43 Any development corporation could have powers to combine plan making, land assembly and consenting. It would not necessarily have to be given powers over one unbroken stretch of land, it could cover separate pieces of land around stations, or a separate development corporation could be established at each station with significant development potential along the line of route.

Conclusion

- 3.44 Strong measures are necessary to maximise the new housing enabled by Crossrail 2. This could include the establishment of one or more development corporations to lead the master-planning and delivery of new housing and urban-realm provision in north-east London and revised planning guidance for the whole route, with CPO powers. Plans to take this forward should form part of the 'London deal for Crossrail 2' to be in place before a hybrid bill is deposited.
- 3.45 This is important not only to maximise the benefits of the scheme, and ensure that it contributes to tackling one of London's most significant strategic challenges, but also because housing plays a role in the funding case for Crossrail 2. Generating the level of Community Infrastructure Levy receipts assumed by TfL requires a level of housing development in line with proposals in the London Plan, but the capital is a long way from achieving this. Realising – or beating – Crossrail 2's housing forecasts could play an important part in meeting the London Plan's overall housing goals and therefore in realising TfL's proposed funding streams for the scheme.
- 3.46 Crossrail 2 also provides an opportunity to rethink how housing is planned and delivered in London and the south-east. Newly released land should be developed sympathetically, promoting high-density mixed-used development and an attractive public realm and ensuring the necessary social and community infrastructure is established in parallel. In addition, the measures proposed to facilitate the delivery of new housing along the Crossrail 2 route could, if successful, provide an effective model for unlocking housing growth in other areas of the capital and across the wider region.

Recommendation 6: TfL and DfT in conjunction with other government departments and relevant bodies, should use the next stage of development to set out a clear, transformative plan to turn the proposed 200,000 homes into a reality.

- **Strong measures to maximise the new housing enabled by the scheme should be included in the 'London deal for Crossrail 2' – this could include the establishment of one or more development corporations to lead the masterplanning and delivery of new housing and urban realm provision, and revised planning guidance for the whole route. These measures should be considered as a potential model for improving housing delivery more widely.**

- For housing provision to be a success across the whole route, the London deal for Crossrail 2 will need to have buy-in from the GLA and London boroughs along the route as well as counties and boroughs outside of London which benefit from the new line. All parties will need to ensure the housing unlocked by Crossrail 2 is sustainable and meets the needs of Londoners and those in commuter regions around London.

STATIONS

1. Crossrail 2 has the potential to link over a dozen stations on its tunnelled route and more than 30 on its above ground lines. The arrival of the new line provides significant opportunities for development, both of the land around the stations and of the stations themselves.
2. Development on and around stations can not only contribute to Crossrail 2's housing goals, but also provide significant opportunities for commercial development. These opportunities should be maximised and wherever possible private sector contributions to the cost of stations construction should be negotiated.
3. The model of private sector contributions to station development has been used with some success in the case of Crossrail 1. Both Woolwich and Canary Wharf Stations received private sector contributions towards station development. In the case of Canary Wharf, the new Crossrail Station has been designed and built by the Canary Wharf Group, which contributed £150m of the £500m cost. The station is six storeys high and incorporates retail and park areas. A smaller deal was agreed at Woolwich, where a station was not within the original scope of Crossrail 1, but was added following an agreement reached with Berkeley Homes for a contribution to its construction costs.⁶³ The station provides the connectivity necessary for housing development in the area.
4. Crossrail 1 has sought to raise £500m from over station development. The scheme has integrated the design of 12 major property developments over and around its central London stations, and has worked to integrate station design, over station development and urban realm design.
5. Although both the deals at Canary Wharf and Woolwich benefited from individual circumstances, Crossrail 2 should work to build on these precedents where possible. DfT and TfL should play a coordinating role in order to maximise private sector involvement in station development and funding and to ensure development happens in parallel to urban realm improvements. This role could be supported by the granting of land purchase powers and the scope for land assembly.

Recommendation 7: The opportunity should be taken to maximise the private sector involvement in the development and funding of stations and their surrounding areas.

- TfL and DfT should leverage private sector capital and expertise to develop selected Crossrail 2 stations, including both the stations themselves and the surrounding land. Development could also be supplemented by land purchase powers and the ability to assemble sites.

PROGRESS AND NEXT STEPS



PROGRESS AND NEXT STEPS

- 4.1 Extensive work has been undertaken to develop Crossrail 2. As has been discussed, detailed work on optioneering and route development has taken place to get to the current proposed route. In 2013, the government provided funding to enable TfL to commission a detailed report on options for the funding and financing of the scheme, and the following year it provided £2m of funding to support the development of a comprehensive business case for Crossrail 2. This contained detailed work on housing, route options and an updated funding and financing report and was submitted to the DfT in summer 2015.
- 4.2 Between 2013 and 2016, TfL undertook three consultations on route options for the scheme. In addition, the Crossrail 2 Growth Commission, chaired by Sir Merrick Cockell, was established in July 2015 to identify the actions needed to ensure that the regeneration, house building and job creation opportunities associated with the scheme are maximised and realised. The Growth Commission is due to report in spring 2016.
- 4.3 As joint sponsors of Crossrail 2, DfT and TfL will need to undertake an extensive programme of work, if the aim of depositing a hybrid bill in 2019 is to be met. This will need to include the environmental assessments and public consultation required before any final decision to take forward the scheme is taken. The next stage in the development of Crossrail 2 will also coincide with the beginning of a new mayoral term in May 2016 and the GLA's preparation of a new London Plan and Mayoral Transport Strategy.
- 4.4 The first element of this work should be a review of the Crossrail 2 business case, focusing in particular on the costs, funding and housing elements of the case. The Commission recommends that this should be submitted to government in March 2017.
- 4.5 As part of this process, the sponsors will also need to review the economic case for the scheme, particularly in light of any changes to its scope and costs, and to consider how other elements of the case, including its treatment of strategic alternatives, can be strengthened. TfL and DfT must also ensure a robust appraisal of scheme costs is carried out. Clear governance and sponsorship arrangements for Crossrail 2 will also need to be agreed in the year to March 2017.
- 4.6 The second stage of work, between March 2017 and the hybrid bill deposit in 2019, will require the scheme sponsors to agree a 'London deal for Crossrail 2' funding agreement with all relevant parties, including the establishment of one or more development corporations able to ensure the delivery of the 200,000 homes linked the scheme. In parallel, the sponsors will need to prepare for a hybrid bill. This is an extensive piece of work which will involve undertaking all the relevant environmental statements, engineering work and public consultations, without which the scheme cannot proceed.

- 4.7 The scheme will also have to take account of the pipeline of other major infrastructure projects - both in London and nationally – which have the potential to compete for engineering, construction or other resources. If the supply chain is managed well, the sequence of major infrastructure projects can be complementary and can collectively develop and retain the necessary specialist skills and knowledge base.
- 4.8 The deposit of a hybrid bill will mark the first step towards the line opening in 2033. This will enable it to be in place broadly in parallel with the opening of the second phase of HS2, which is the point at which the challenges associated with dispersing arriving passengers at Euston are forecast to become critical. This is an ambitious timetable which will need to be kept under review, but the Commission believes that with strong leadership and effective programme management in place it will be achievable.

Recommendation 8: Following the submission of a revised business case and agreement on the conditions above, the aim should be for a hybrid bill to be submitted by autumn 2019 – the first step towards the railway opening in 2033.

- **Submission of a bill in 2019 would allow significant progress to be made on the passage of a bill before the end of this parliament.**
- **Completion of the project in 2033 would allow the project to open in time for the planned arrival of HS2 phase 2 at Euston.**

THE NATIONAL INFRASTRUCTURE COMMISSION



Chair

Lord Andrew Adonis

Lord Andrew Adonis was appointed as chairman of the National Infrastructure Commission on 5 October 2015. He was a member of the independent Armitt Commission, which recommended an independent National Infrastructure Commission in 2013.

Andrew Adonis was formerly the Transport Secretary from 2009 to 2010, Minister of State for Transport from 2008 to 2009 and Minister for Schools from 2005 to 2008. He was Head of the No10 Policy Unit from 2001 to 2005.

Commissioners



Sir John Armitt

Sir John Armitt is Chairman of the National Express Group and City & Guilds, Deputy Chairman of the Berkeley Group and a member of the Board of Transport for London, Senior Vice President of the Institution of Civil Engineers and a Fellow of the Royal Academy of Engineering, the Institution of Civil Engineers and City & Guilds of London Institute. He has received honorary doctorates from the universities of Portsmouth, Birmingham, Reading and Warwick and was awarded the CBE in 1996 for his contribution to the rail industry and a knighthood in 2012 for services to engineering and construction.

In September 2013 the Armitt Review, his independent review of long term infrastructure planning in the UK, was published. The review is now Labour Party policy.



Tim Besley

Tim Besley is School Professor of Economics and Political Science and W. Arthur Lewis Professor of Development Economics at the LSE. He was a co-chair of the LSE growth commission and a member of the IFS's Mirrlees Review panel, and is currently Chair of the Council of Management of the National Institute of Economic and Social Research.



Demis Hassabis

Demis Hassabis was the co-founder and CEO of DeepMind, a neuroscience-inspired AI company, bought by Google in Jan 2014. He is now Vice President of Engineering at Google DeepMind and leads Google's general AI efforts.



The Rt Hon Lord Michael Heseltine CH

The Rt Hon the Lord Heseltine CH was a Member of Parliament from 1966 to 2001. He was a Cabinet Minister in various departments from 1979 to 1986 and 1990 to 1997 and Deputy Prime Minister from 1995 to 1997. He is founder and Chairman of the Haymarket Group, and most recently was appointed by the government as an advisor to the Secretary of State for Communities and Local Growth.



Sadie Morgan

Sadie Morgan BA (HONS), MA (RCA), FRSA is a co-founding director at the award-winning practice, dRMM Architects. She became the youngest and only third ever-female President of the Architectural Association in 2013. In March 2015, Sadie was appointed as Design Chair for High Speed Two (HS2) reporting directly to the Secretary of State.



Bridgett Rosewell

Bridget Rosewell OBE, MA, MPhil, FICE is a UK economist, with a track record in advising public and private sector clients on key strategic issues. She is a founder and Senior Adviser of Volterra Partner and a non-executive director of Network Rail and of Ulster Bank. She was Chief Economic Adviser to the Greater London Authority from 2002 to 2012. She has been a member of several Commissions looking at the future of public services, cities, infrastructure and local finance.



Sir Paul Ruddock

Sir Paul Ruddock is Chair of Oxford University Endowment Management and Chair of the Oxford University Investment Committee. Sir Paul was a co-founder of Lansdowne Partners in 1998 and CEO of Lansdowne Partners Limited from 1998 to 2013 when he retired. From May 2007 to October 2015 he was Chair the Board of Trustees of the Victoria & Albert Museum as well as Chairman of the Gilbert Trust for the Arts. He is a Trustee of the Metropolitan Museum of Art, New York and a Fellow of the Society of Antiquaries.

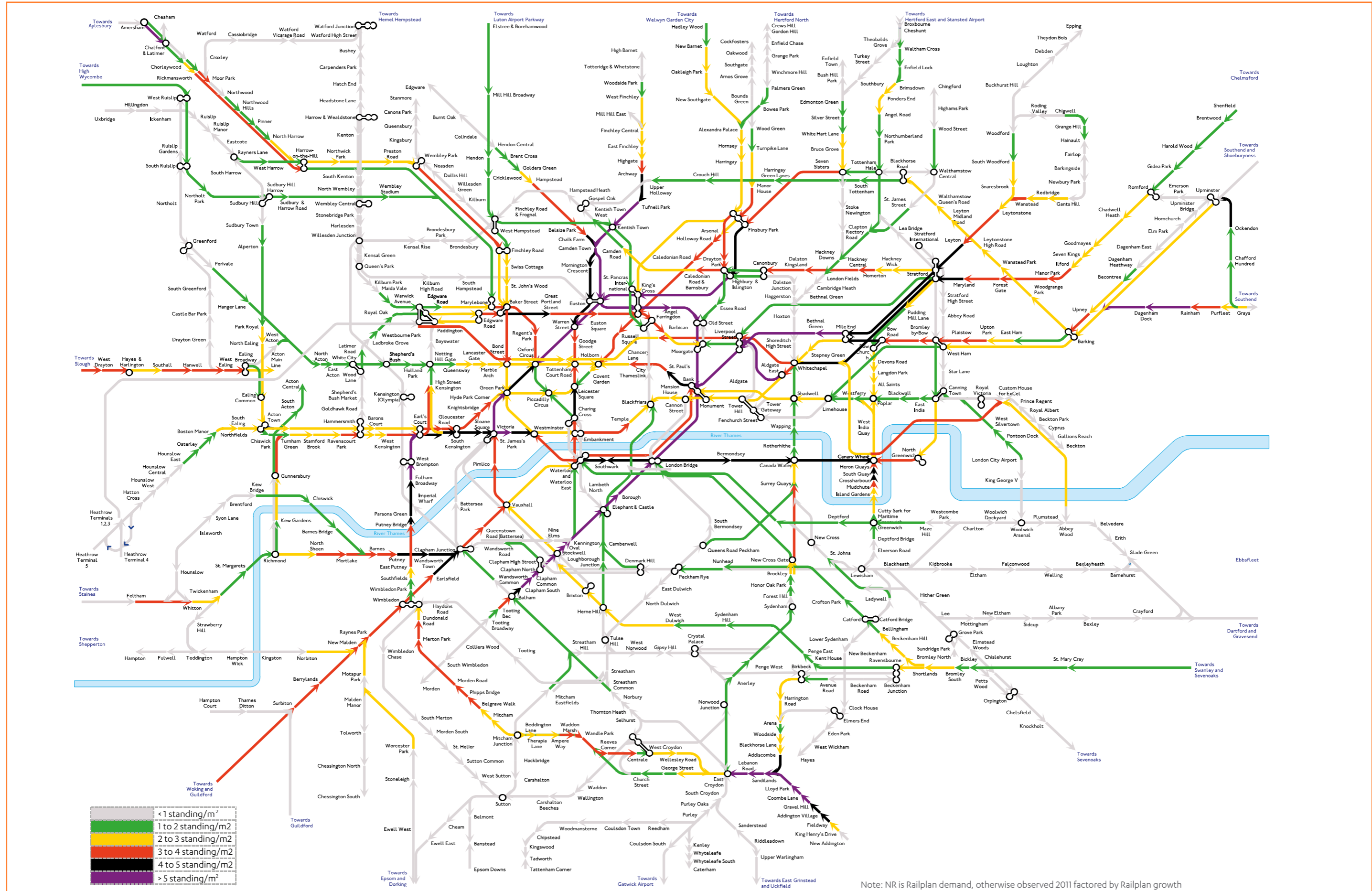
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ANNEX A: 2031 PEAK HOUR CROWDING

Annex A shows TfL's modelling of AM peak crowding on the London rail network in 2031, without the addition of Crossrail 2. The purple sections indicate the most severely crowded routes, with more than five passengers standing per square metre on average. In these areas passenger demand is sufficient to cause operational difficulties such as station closures and queuing to get onto trains. The black sections also indicate severe overcrowding, with more than four passengers standing per square metre on average. The map is derived from TfL's Railplan model and includes Underground, National Rail and tram services.⁶⁴



	< 1 standing/m ²
	1 to 2 standing/m ²
	2 to 3 standing/m ²
	3 to 4 standing/m ²
	4 to 5 standing/m ²
	> 5 standing/m ²

Note: NR is Railplan demand, otherwise observed 2011 factored by Railplan growth

