

# Notes

## **The Crossrail Business Case – Summary**

**Cross London Rail Links Ltd  
Strategic Rail Authority  
Transport for London**

**September 2003**

**[www.crossrail.co.uk](http://www.crossrail.co.uk)**

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# 1. Introduction

- 1.1** Cross London Rail Links Ltd (CLRLL) is a joint venture company, established in 2001 and owned by Transport for London and the Strategic Rail Authority, to promote and develop Crossrail lines 1 and 2.
- 1.2** In March 2002, a short list of route corridors for line 1 was identified and the views of key stakeholders and local authorities on each of these sought. This was followed in January 2003 by consultation on an additional line 1 route corridor to Kingston.
- 1.3** In July 2003, CLRLL submitted the business case for Crossrail line 1 to Government. This document included a strategic review of why this new east-west line is required, along with a discussion of both the benefits and costs of its construction. The purpose of this report is to summarise the main conclusions of the business case for Crossrail line 1, simply referred to as “Crossrail” in this report.

## 2. The Need for Crossrail

### Existing and Future Transport Problems

- 2.1** The current National Rail and London Underground networks are characterised by high levels of crowding on services into and through central London during the peak periods. On the National Rail network, crowding is experienced on the approaches to most London termini, while large sections of the London Underground network around and within central London carry passenger flows in excess of their crowding standards.
- 2.2** Problems for the rail network will be exacerbated in the future because employment growth is expected to continue to be concentrated in the central area, which already suffers the highest levels of rail crowding. Despite planned increases in capacity on the National Rail and London Underground networks, the overall rail network is forecast to be significantly more crowded in 2016 than at present.

### Future Growth

- 2.3** Regional Planning Guidance for the South East (RPG9, 2001) seeks to support and develop the London economy, promote employment and population growth in the Thames Gateway and the London Stansted Cambridge sub region, and support sustainable economic prosperity in the west. RPG9 recognises that derelict land, surplus labour, and proximity to central London combine to make the Thames Gateway a location for focusing and accommodating sustainable growth in the South East region. Transport infrastructure is seen as a significant component in the strategy for delivering growth in the Thames Gateway.

- 2.4** More recently, the Sustainable Communities Plan (2003) was published, setting out plans for growth in the Thames Gateway and the Lea Valley – Stansted area. This plans for an additional 120,000 new homes and up to 180,000 new jobs in the Thames Gateway. These projections have not been included in the scheme appraisal.
- 2.5** Substantial growth is planned in London over the medium term. The Mayor has prepared a draft London Plan that provides a strategy for accommodating that growth. The draft London Plan sets out a spatial development framework, identifying key areas where this growth can be accommodated, as well as a range of transport policies and proposals, including Crossrail, to help achieve the Plan.
- 2.6** Under the Plan, London's population is forecast to increase by 2016 by approximately 700,000 over the 2001 level and employment by approximately 600,000. A large proportion of the employment growth would take place in central London and the Isle of Dogs while much of the population growth would be accommodated in east London (including the Thames Gateway). Employment in the Isle of Dogs would grow at the fastest rate, but in absolute terms, expected employment growth in the West End/City is higher still.

## The Role of Crossrail

- 2.7** Crossrail would play a vital role in improving service levels for passengers, as a catalyst for forecast growth, facilitating regeneration of under-utilised land and encouraging sustainable development. It would achieve this in three principal ways:
- By reducing crowding levels on heavily loaded London Underground (LUL) and National Rail networks
  - By increasing capacity into and within the central area, thereby overcoming the constraint to central area growth posed by very high levels of crowding
  - By increasing accessibility to the central area from locations where large increases in residential population can be accommodated. This includes the Thames Gateway area, which would be directly served by Crossrail, and the Lea Valley, which would potentially benefit from a higher service frequency into Liverpool Street where terminal capacity would be released by Crossrail.

- 2.8** Crossrail's role within development and regeneration areas is important. Employment growth in the central area relies on the ability of London and the surrounding regions to accommodate the anticipated increase in population. Crossrail is integral to a co-ordinated approach to this challenge. In the east, Crossrail has a route along the Thames Gateway, opening up access to key development sites on both sides of the river, while in the west the key opportunity area of Hayes would be served. In addition, Crossrail would allow additional services to be operated over the Lea Valley line into Liverpool Street station. As a result, Crossrail would make these areas accessible to the additional jobs and increase the amount of development that would take place within them.

# 3. The Crossrail Proposal

## Development of the Strategic Specification

**3.1** The original Crossrail scheme was developed in the late 1980s and while some of the original objectives remain, in particular the relief of crowding on the National Rail and Underground networks in central London, some have evolved over time. Critically, since then, Docklands regeneration and growth ambitions have come to fruition and have now been extended into the wider Thames Gateway area. While the Jubilee Line extension and Docklands Light Railway (DLR) have been developed around the emerging pattern of demand in East London, there has been a sustained period of growth, both in population and employment.

**3.2** The original Crossrail concept was focused on central London's problems but now the consideration is much wider. Central London's economy is of very great significance nationally and extending its already substantial job catchment area and improving the efficiency and dependability of access journeys is a very important feature of the revised Crossrail proposal.

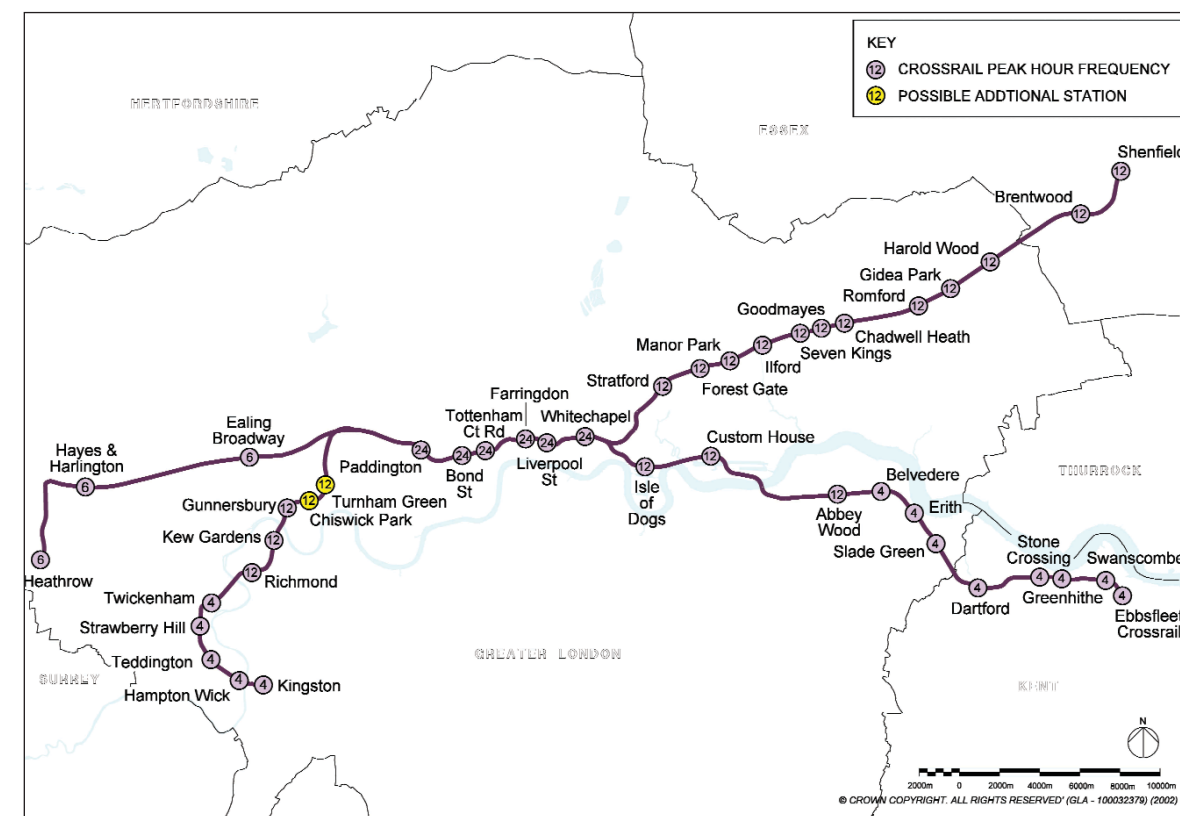
## The Crossrail Benchmark Scheme – Service Pattern

**3.3** Crossrail would operate a 24 trains per hour (tph) peak service in both directions through central London between Whitechapel and Paddington, with branches in the east from Ebbsfleet and Shenfield and in the west from Heathrow and Kingston.

**3.4** Although the precise service pattern on Crossrail is still under development, particularly on the west London routes, the Crossrail proposal presented here has been termed the “benchmark scheme”. The peak period Crossrail service frequencies underlying this scheme are shown in Figure 3.1 and assume:

- 12 tph service from Shenfield, replacing much of the existing Great Eastern Metro service
- 12 tph service from the North Kent line, with 4 tph originating from Ebbsfleet and 8 tph from Abbey Wood
- 6 tph service from Heathrow Airport, that replace the current 4 tph Heathrow Express service
- 12 tph service from the Kingston branch, with 4 tph originating from Kingston and 8 tph from Richmond.

Figure 3.1: Crossrail Benchmark Scheme – Route and Peak Service Frequency



**3.5** Crossrail services would generally operate as “all stations” services, although a number of lesser-used stations along the corridor would be omitted. In addition, services to and from Heathrow Airport would call only at Hayes & Harlington and Ealing Broadway to the west of Paddington.

**3.6** In the east, provision has been made for the current North London line service to use the route between Custom House and Abbey Wood. This service would be rerouted to start at Abbey Wood with Silvertown and North Woolwich stations being closed. This area would benefit from the DLR extension to London City Airport and King George V, currently under construction.

**3.7** In the west, the definition of the Crossrail service to both Kingston and Heathrow is still in progress, with the precise Heathrow definition subject to achieving agreement with BAA plc. Opportunities are also being explored to further enhance the benefits of the Kingston branch by providing an additional interchange at either Chiswick Park or Turnham Green.

## Other Service Improvements with the Benchmark Scheme

- 3.8** A major benefit of Crossrail would be the release of platform capacity in Liverpool Street station that would allow additional trains to operate on both the Great Eastern and West Anglia routes. On the Great Eastern line, it has been assumed that as well as the Crossrail service from Shenfield, a 6 tph peak service would operate between Gidea Park and Liverpool Street, while on the West Anglia line an additional 6 trains per hour are assumed to operate in the peak. A number of these additional West Anglia services are assumed to serve Stansted Airport.
- 3.9** The benchmark scheme would have the further major network benefit of reducing demand into Waterloo, thereby reducing congestion at that terminus and also bringing performance benefits. Crossrail would reduce levels of interchange between Network Rail and LUL services at Paddington and also free up platform capacity at Paddington, with consequent performance benefits.

## Rolling Stock

- 3.10** Trains would be up to 200 m long (10 x 20 m cars in two 5-car trains). Each car would have two sets of double doorways per side with wide stand-backs to facilitate rapid exit and entry of passengers. Passengers would travel in quiet, climate-controlled conditions and interiors would be carefully designed to accommodate their differing needs. Each train would have a maximum practical capacity approximately double that of a Central Line train.
- 3.11** A depot with all the appropriate facilities consistent with modern maintenance practices would be constructed. Appropriate stabling for rolling stock during the overnight and interpeak periods would be provided on each branch of the network.

## Constraints on Construction and Staging

### Construction Strategy

- 3.12** The construction of the central section of Crossrail would present significant construction challenges. Planning authorities would require that, wherever possible, the spoil produced by tunnel construction is removed by either rail or river. This would limit the number of sites available for tunnelling. For the central area, four rail-served sites have been identified, including one at each central area tunnel portal and two river-served sites in Docklands.

### Commissioning

- 3.13** It would be necessary to bring such a large project into use in stages. In practice, this probably means over a period of about 18 months. This is to allow for activities such as staff training and commissioning. When bringing a section of the system into use it is important that the commissioning should take place without unduly interfering with the existing operating railways or with parts of the system which are still under construction. Sections that are commissioned would require a facility to turn trains at either end of the section, as well as access to a depot.

### Possible Staging of Works

- 3.14** It would be possible to stage the works over a longer time period. This would lead to a spreading of the finance burden and would reduce any perceived market pressure caused by capacity constraints in the construction and project management sectors. Analysis of the impact on the business case indicates that it would reduce the benefit – cost ratio. This is because the relatively high costs of the central section would not bring in the full benefits until the relatively cheaper outer legs were completed.

# 4. Project Costs

## Introduction

- 4.1** The base capital cost for the project is £7 bn at 1st quarter 2002 prices, which increases to £10 bn when contingency is included, in accordance with HM Treasury “Green Book” guidance.
- 4.2** The largest single element relates to the central section. This has been under development since the late 1980s and the design and scope are comparatively well advanced. The existing designs however, continue to be scrutinised to ensure compliance with current standards and to optimise construction.
- 4.3** Some sections of the project, notably the extension to Richmond and Kingston and the service to Heathrow, require more work on optimising the scope and design of the final alignments. Where the project scope is under review and there are options, the higher cost options have been included.

## Capital Cost Benchmarks

- 4.4** The base costs for the project have taken account of out-turn costs of similar projects undertaken recently. For example, the cost of tunnelling was estimated using the out-turn costs of the tunnels bored for the Jubilee Line Extension.

## Contingency Analysis

- 4.5** Concerns about “optimism bias” have been addressed using a methodology consistent with guidance provided by HM Treasury.
- 4.6** Allowance has been made for contingency provisions based on a risk assessment. These provide for the possibility of higher out-turn costs than the relevant benchmarks and for potential changes in scope during the process of obtaining powers. For the scope and pricing of each category of work, key uncertainties have been calculated to provide a contingency figure. The categories of work including land & property, trackwork, stations and railway systems. In aggregate £3 bn for contingencies has been included in the capital cost. Improved identification of stakeholder requirements, project definition, value engineering and a competitive procurement process will help in reducing the scope of these contingencies.



## Operating and Maintenance/Renewal Costs

- 4.7** Operating and maintenance costs include the cost of leasing, maintaining and operating the rolling stock as well as operating Crossrail stations, maintenance of new infrastructure and track access charges where Crossrail runs on the existing network.
- 4.8** Operating costs for the project were calculated on the basis of detailed modelling of the operations with a choice of rolling stock procurement scenarios and due consideration of service patterns. All costs have been computed separately on a gross basis and, after subtracting operating costs avoided on the National Rail and LUL networks, on a net basis. Operating costs are assumed to rise in line with RPI.
- 4.9** Maintenance and renewal costs for new infrastructure were computed on the basis of cyclical repair and renewal cycles and by benchmarking against asset life assumptions used by London Underground and Network Rail. A real cost factor has been applied to new infrastructure maintenance costs to reflect construction inflation.

- 4.10** The total annual net operating and maintenance/renewal costs for Crossrail are estimated to be around £200 million at 1st quarter 2002 prices.
- 4.11** A 20% contingency has been assumed on all operating, maintenance and renewal costs. This level of contingency is consistent with pessimistic assumptions on costs of operating staff, train maintenance and access regimes, these being the key cost drivers.

# 5. Business Case

## Introduction

- 5.1** The business case is prepared in accordance with Government guidance on the appraisal of major transport projects – the Guidance on the Methodology for Multi-Modal Studies (GOMMMS) approach.
- 5.2** Crossrail will deliver a significant increase in rail capacity for central London that will deliver considerable economic benefits. The main benefits are:
- Time savings experienced by users of Crossrail
  - Crowding relief for passengers using Crossrail and other services
  - Increased fare revenue
  - Quality benefits including improved mobility impaired access
  - Reduction in highway congestion arising from a shift to public transport.
- 5.3** These economic benefits are assigned monetary values and compared with the net costs and subsidy requirements of Crossrail. The indicators used to measure the performance of a project are:
- net present value (NPV): net benefits – net costs
  - the benefit – cost ratio (BCR): net benefits/net costs.
- 5.4** For Crossrail, the indicators were derived through forecasting the effects of the benchmark scheme using consistent and established planning assumptions.
- 5.5** Benefit and demand forecasts were prepared using the London Transportation Survey (LTS) and Railplan models developed by TfL. The forecasts are based on the projections of population and employment embodied within the draft London Plan for the year 2016. This demand is assigned to a transport network that incorporates likely future changes advised by both the SRA and TfL. Empirically derived elasticities were used to estimate the net additional use made of the network as a result of Crossrail. The net difference between the 2016 ‘base case’ and ‘benchmark’ forecasts provides the basis for the estimation of benefits.

## The Base Case – London Without Crossrail

- 5.6** The forecasts for 2016 were based on the London Plan forecasts described in Chapter 2. Between 2016 and 2026, peak period net demand growth throughout London was assumed to increase by a further 0.7% per year, with the exception of the Isle of Dogs, where further growth in employment was assumed, consistent with the development strategy for that area. No peak growth was assumed beyond 2026. Off-peak growth in public transport demand was assumed to grow between 2016 and 2042 in line with the latest Treasury projections of GDP. On average, this approximates to 2.0% p.a. No off-peak growth was assumed after 2042.
- 5.7** The base case for the appraisal of Crossrail assumed a number of transport network improvements:
- Changes to the National Rail network (including committed projects in the SRA’s January 2003 Strategic Plan such as enhancements to Chiltern services, the East London Line, the Thameslink 2000 Project and the introduction of Channel Tunnel Rail Link Domestic Services) that on current programme might reasonably be expected to have been implemented by 2016
  - Enhancement to the LUL network as anticipated in the PPP up to 2016.
- 5.8** As a result of changes in capacity and demand between 2001 and 2016, the National Rail network is forecast overall to become slightly less crowded by 2016. Crowding will be reduced on services into Kings Cross, London Bridge and Victoria, primarily as a result of the introduction of Thameslink 2000 and Channel Tunnel Rail Link Domestic services, while crowding will increase on services into Liverpool Street, Fenchurch Street and Waterloo.

**5.9** On the LUL network, overall crowding is forecast to increase by 2016 within and around central London, despite the provision of additional capacity on most lines. The main exception to this will be the Northern Line which will benefit from both additional capacity and relief by Thameslink 2000.

**5.10** The net overall effect is an increase in levels of crowding compared to the already significant crowding observed in 2001.

## The Transport Benefits of Crossrail

### Crossrail Usage

**5.11** Crossrail is forecast to be used by a total of 158,000 passengers in the morning peak period in 2016 (0700-1000hrs).

The maximum loadings on each of the branches into the central area during this period would be:

- 36,000 from the Shenfield branch (approaching Stratford from the east)
- 19,000 from the Isle of Dogs/North Kent branch (approaching the Isle of Dogs from the east)
- 20,000 from the Kingston branch (approaching Paddington from Gunnersbury)
- 16,000 from the Heathrow branch (approaching Paddington from Ealing Broadway).

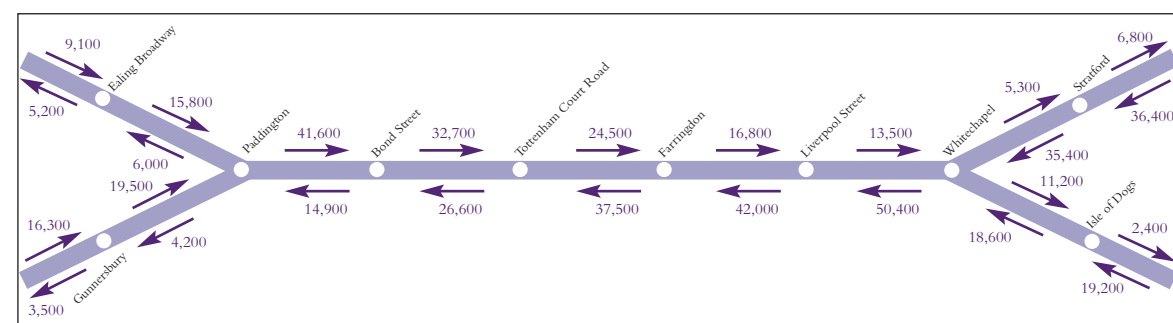
**5.12** In the central area (Paddington – Whitechapel) the scheme would also be heavily used by passengers interchanging from other National Rail Network or LUL services:

- 24,000 boardings in the eastbound direction of which 11,000 would be at Paddington
- 20,000 boardings in the westbound direction.

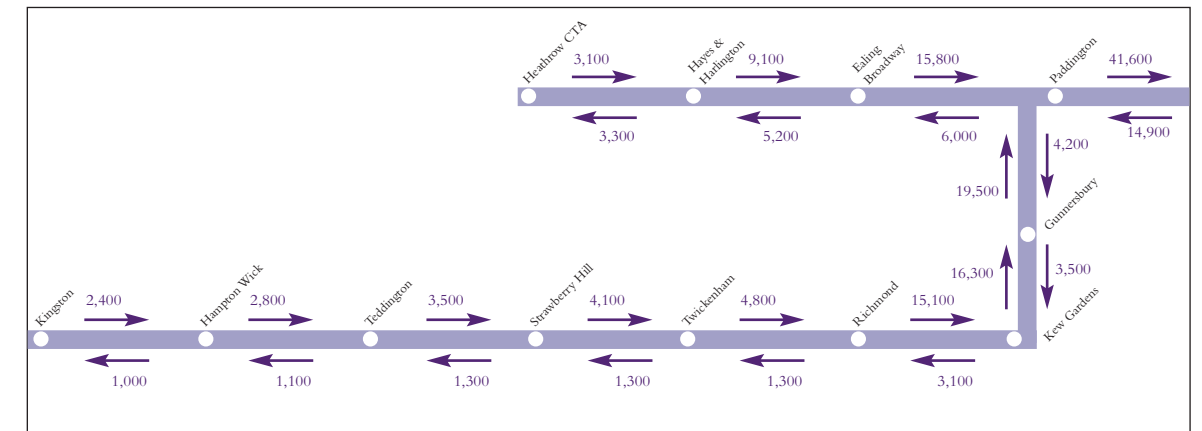
**5.13** Crossrail central area loadings are shown in Figure 5.1. In the Eastbound direction, passenger numbers would reduce steadily from around 42,000 leaving Paddington to 13,500 approaching Whitechapel and 11,000 approaching the Isle of Dogs, while in the Westbound direction, the peak period loading of 50,000 leaving Whitechapel would fall through the Central area to 15,000 approaching Paddington.

**Figure 5.1: Crossrail Passenger Loadings (AM Peak Period)**

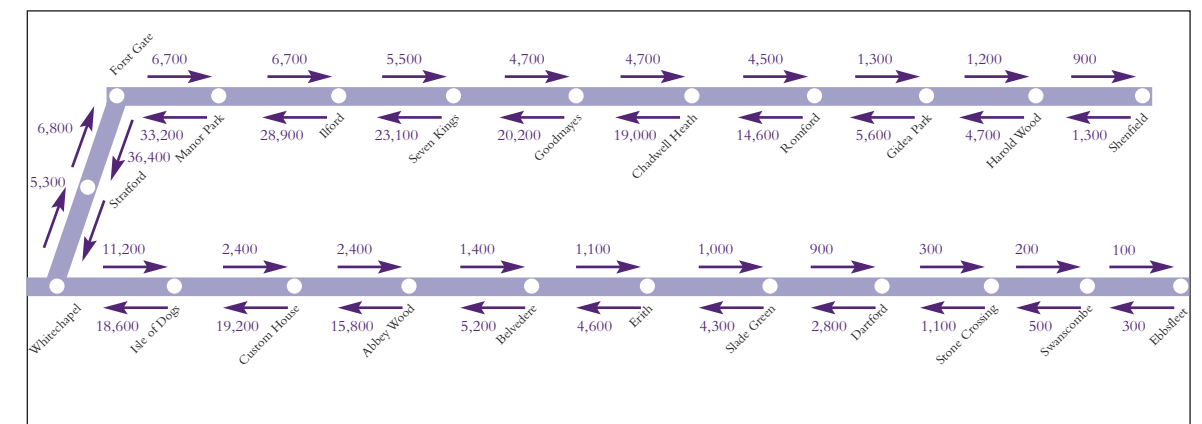
### Central Area



### West



### East



**5.14** Due to the attractive journey times to central London offered by Crossrail, services are forecast to be heavily loaded in the peak periods particularly on the western and eastern approaches to central London. Services through the central area would approach their planned maximum capacity at the points of maximum load.

**5.15** The forecasting process assumes that the demand would grow with Crossrail as a result of transfer between modes of transport and journey time improvements. This approach suggests an additional 23,500 public transport trips (an increase of approximately 1%) in the morning peak period in 2016. Most of this growth occurs on the eastern approaches to central London.

### Interchange

**5.16** Crossrail would deliver considerable benefits by enabling passengers to avoid interchange at Liverpool Street, Paddington, Waterloo and London Bridge in particular. The number of passengers entering central London at Liverpool Street and Paddington on Crossrail would be 42,000 at both locations. Many of these passengers would either avoid an interchange or otherwise have a more convenient journey with Crossrail and this represents an excellent utilisation of the assets with a good balance of east and westbound flows.

## Impact on London Underground

**5.17** Table 5.1 shows that all LUL lines with the exception of the Northern line see a decrease in boarders following the opening of Crossrail, with the greatest percentage decreases occurring on the Central, Bakerloo, Jubilee and Metropolitan/Hammersmith & City lines. Very substantial crowding relief benefits are achieved across the LUL network, particularly on the lines listed above. The very high level of crowding relief is achieved from just a 5% reduction in total LUL boarders, demonstrating that Crossrail provides effective relief for some of the most crowded parts of the LUL network.

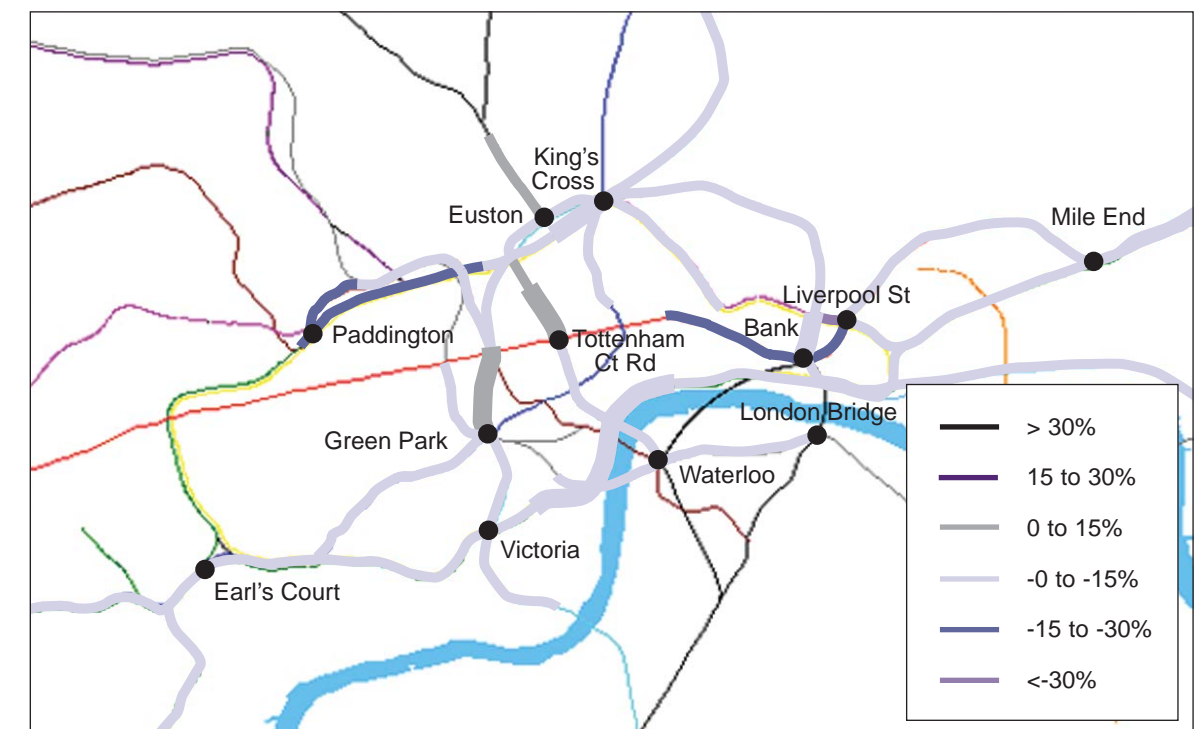
**Table 5.1: Changes in LUL Boarders and Crowding with Crossrail**

Line	% Change in Boarders	% Change in Crowding
Bakerloo	-8	-29
Central	-9	-27
District	-4	-21
Metropolitan/ H&C/Circle	-8	-25
Jubilee	-6	-18
Northern	+2	-2
Piccadilly	-3	-12
Victoria	-3	-8
Waterloo & City	-14	-31
<b>LUL Total</b>	<b>-5</b>	<b>-17</b>
<b>DLR Total</b>	<b>-8</b>	<b>-30</b>

**5.18** The changes in levels of crowding on the LUL network in 2016 with Crossrail are shown in Figure 5.2. This shows that significant reductions in crowding are achieved over large parts of the LUL network, in particular:

- Westbound on the Central line between Stratford and central London
- Westbound on the District line between east and central London
- Eastbound on the Piccadilly line between west and central London
- Southbound on the Bakerloo line between Paddington and Oxford Circus
- Eastbound on the Metropolitan/Hammersmith and City/Circle lines between Paddington and Moorgate
- On the Waterloo & City line.

**Figure 5.2: LUL & DLR – Changes in Levels of Crowding with Crossrail**





## Impact on Network Rail

**5.19** Table 5.2 shows the impact of Crossrail on the most affected sections of the National Rail network. The most significant impacts occur on services to Liverpool Street (Great Eastern). Boarders increase on West Anglia services due to the provision of additional capacity at Liverpool Street with Crossrail.

**Table 5.2: NRN – Changes in Boarders and Crowding with Crossrail**

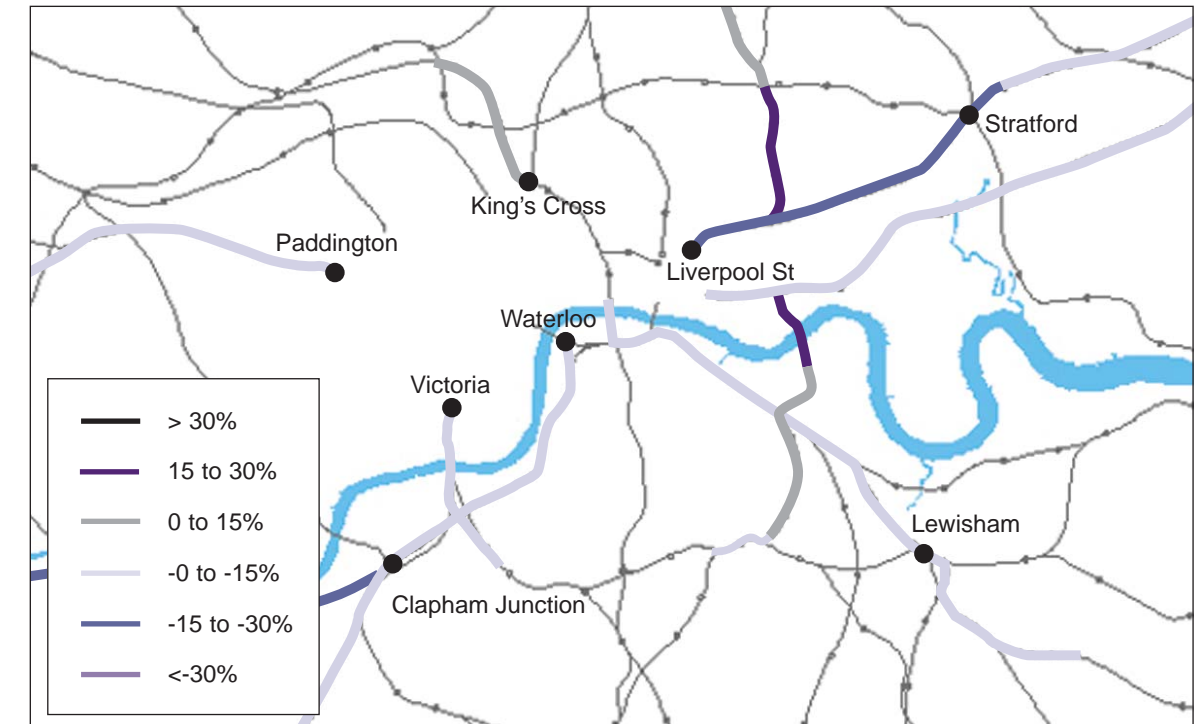
Service Group	% Change in Boarders	% Change in Crowding
Paddington	-10	-9
Liverpool St (Great Eastern)	-35	-36
Liverpool St (West Anglia)	+15	-12
<b>Total NRN (excluding Crossrail)</b>	<b>-5</b>	<b>-11</b>

**5.20** Services into Fenchurch Street, Charing Cross, Cannon Street and Waterloo would also benefit from less crowding due to the diversion of passengers on these lines onto Crossrail services.

**5.21** The changes in levels of crowding on the National Rail network in 2016 with Crossrail are shown in Figure 5.3. This shows that Crossrail achieves:

- Relief of Great Eastern and London, Tilbury & Southend lines into Liverpool Street and Fenchurch Street
- Relief of North Kent lines into London Bridge, Charing Cross and Cannon Street
- Relief of Richmond and Wimbledon lines into Waterloo

**Figure 5.3: NRN – Changes in Levels of Crowding with Crossrail**



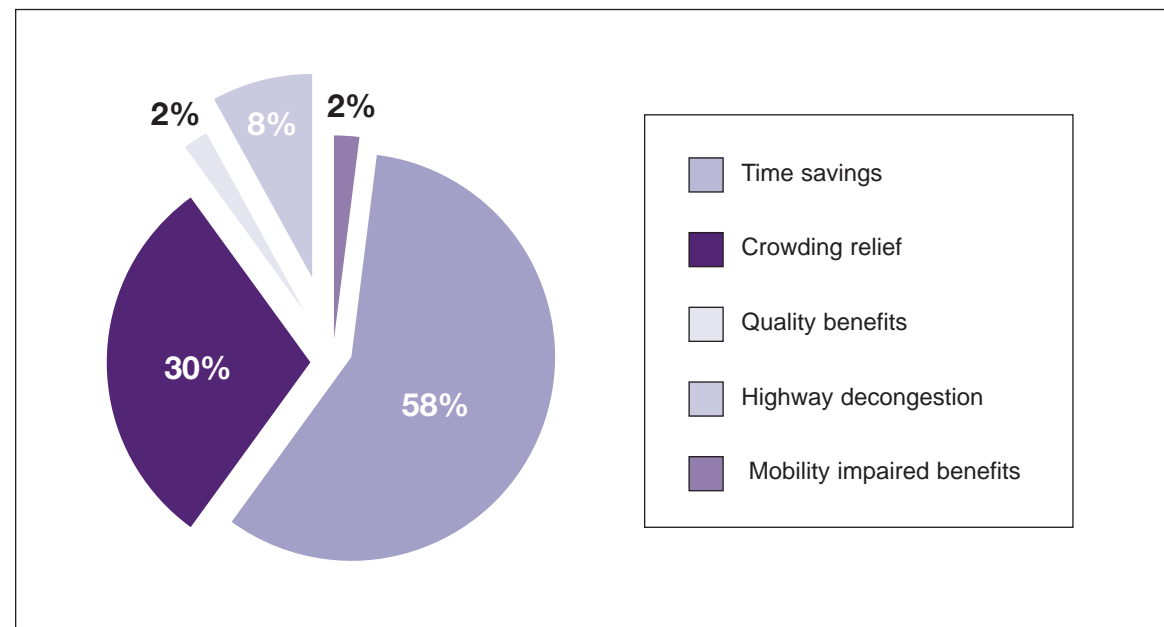
## Appraisal

**5.22** An Appraisal Summary Table (AST) was prepared for the benchmark scheme in accordance with the Department for Transport's GOMMMS requirements. When assessed against the Government's five objectives of Economy, Environment, Safety, Accessibility and Integration, the AST table for Crossrail shows that the scheme would deliver significant benefits. The table is reproduced as an appendix.

## Economy

**5.23** Crossrail would generate significant benefits to users of the public transport network, primarily by reducing journey times and levels of overcrowding on trains and in stations and increasing the quality of travelling by public transport. Crossrail would also generate benefits to users of the road network as a result of the transfer of some users to the public transport network. These benefits would largely arise from reduced journey times and accident cost savings. The breakdown of the benefits is given in Figure 5.4.

**Figure 5.4: User Benefits of Crossrail**



**5.24** The benchmark scheme has a benefit – cost ratio of 1.99:1 after applying optimism bias on both capital and operating costs, as per the assumptions given in chapter 4. The net present value is £11 bn.

**5.25** Sensitivity analysis has also been carried out to test the vulnerability of the scheme to unavoidable future uncertainties, including levels of demand growth, future network capacity and project costs. The results of the sensitivity analysis show that in all cases the benefit – cost ratio remains above one, indicating that the economic performance of the scheme is strong.

## Environment

**5.26** Temporary impacts during construction would be the most significant environmental effects. These would include temporary severance and traffic impacts arising from construction work sites. Permanent effects are assessed to be relatively slight.

## Safety

**5.27** Rail is a very safe mode of transport. Crossrail would encourage people to use rail and would be equipped with a wide range of safety measures on trains and at stations. The benefit – cost ratio includes an allowance for highway accident cost savings arising from the Crossrail project.

## Accessibility

**5.28** Crossrail would provide significantly enhanced journey opportunities for trips to many destinations. There would be significant time savings from all Crossrail branches to central London and to many other of London town centres.

## Integration

**5.29** Crossrail would form part of an integrated transport network with increased multi-modal interchange and mobility impaired access. It would significantly reduce the need for passengers to make undesirable rail interchanges at Liverpool Street, Paddington and Waterloo.

# 6. How Crossrail Supports Government Policy

## Introduction

6.1 Crossrail supports Government policy in the following ways:

- Support for the planning and transport policies of Government, the Mayor of London and the transport authorities
- Support for London's financial and business service (FBS) sector
- 'Regeneration effects', particularly in the Thames Gateway.

## Policy Benefits from Crossrail

### Government Policy

6.2 The Government 10-Year Transport Plan aims to tackle congestion and pollution by improving all types of transport. The Plan allocated £154m to investigate a new east-west rail link across London that is now being progressed by Cross London Rail Links Limited (CLRLL).

6.3 Crossrail addresses five of the National Rail objectives set out in the Transport Plan. It would:

- Increase the use of rail
- Improve service quality
- Provide better service integration
- Improve commuter services in London
- Provide modern trains and more attractive stations.

6.4 The project would also support the general policies and principles of national planning guidance and the Sustainable Communities Plan. Crossrail would provide more sustainable transport choices, promote the use of public transport to jobs, shopping, and leisure activities and reduce the reliance on travel by car.

### SRA Policy

6.5 Crossrail also supports the goals of the SRA Strategic Plan 2003 to:

- Promote a 50% growth in passenger traffic
- Reduce overcrowding on services in the London area
- Improve train service punctuality and reliability.

6.6 Crossrail would increase by 7% peak period rail demand and would also significantly increase off peak use. Crossrail would therefore make a significant contribution to the SRA policy on passenger growth.

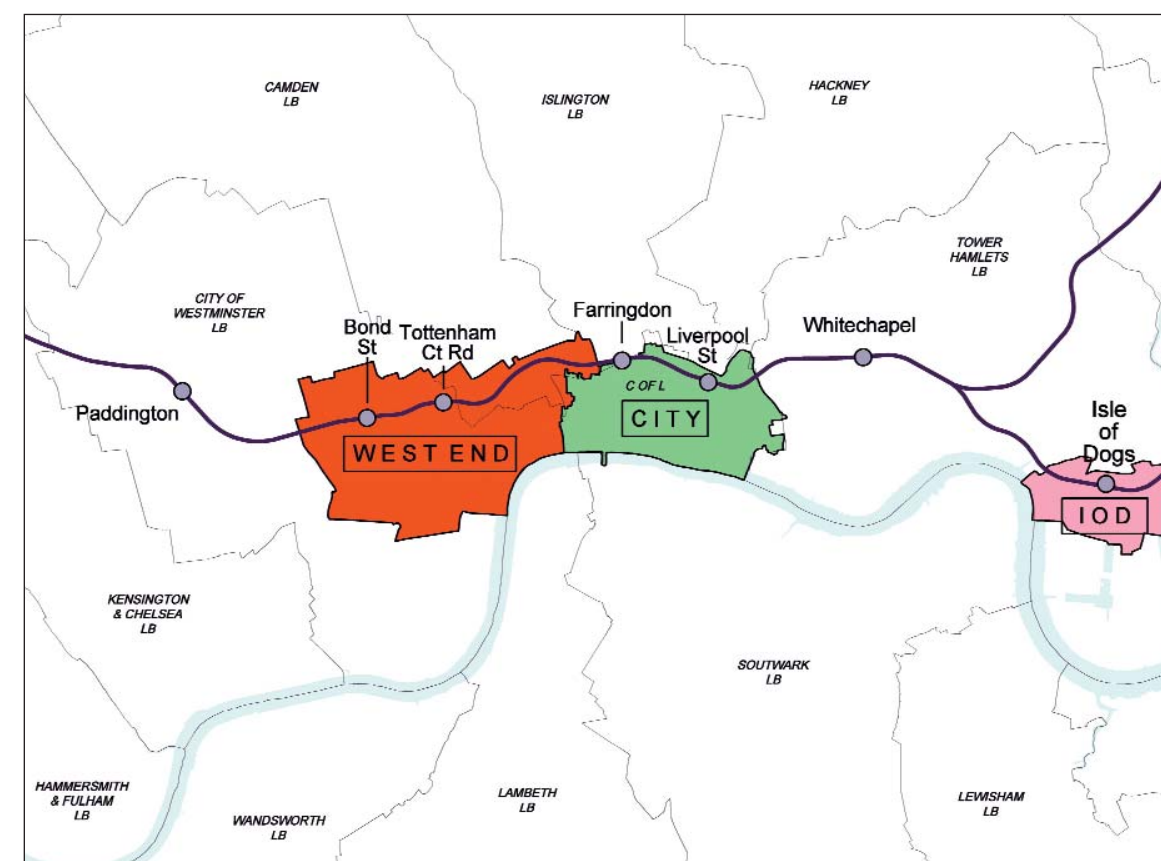
### London Planning and Transport Policy

6.7 The Mayor's Transport Strategy seeks to increase rail capacity in London by 50% between 2001 and 2016. Crossrail would be the largest single contributor to achieving this objective.

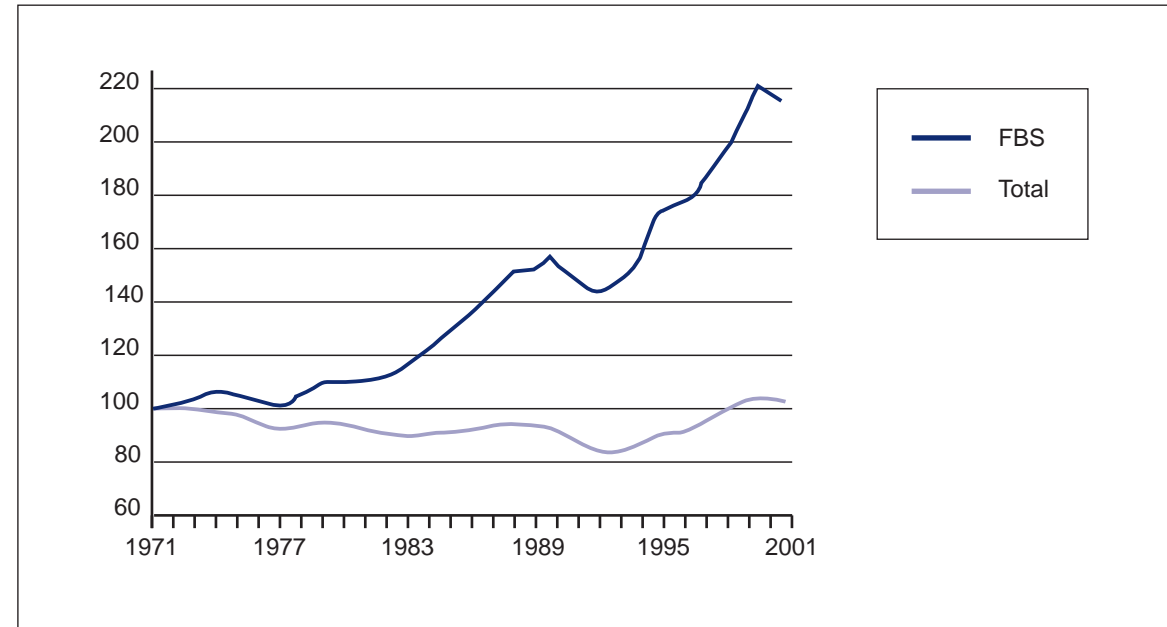
## Support for Financial and Business Services

6.8 London is the premier European financial district and one of three global financial centres (with New York and Tokyo). Crossrail would strongly support the continued success of the FBS sector in central London and the Isle of Dogs which is clustered as shown in Figure 6.1.

Figure 6.1: London's Financial and Business Service Clusters



**Figure 6.2: Greater London FBS and Total Employment Change, 1971-2000**



**6.9** London's employment in the FBS sectors has risen steadily over a 30 year period, from 750,000 in 1971 to 1.4 million in 2000 as shown in Figure 6.2. The FBS sectors currently account for over one third of employment in London. The projections for the draft London Plan indicate a growth by 2016 of 420,000 jobs in the central area boroughs. Here, employment has already been expanding faster than the rest of London for a considerable period.

**6.10** Analysis suggests that Crossrail could support over 20,000 additional jobs in central London by 2027. The methodologies required to conclusively establish the value from additional jobs is currently the subject of investigation by the Department for Transport.

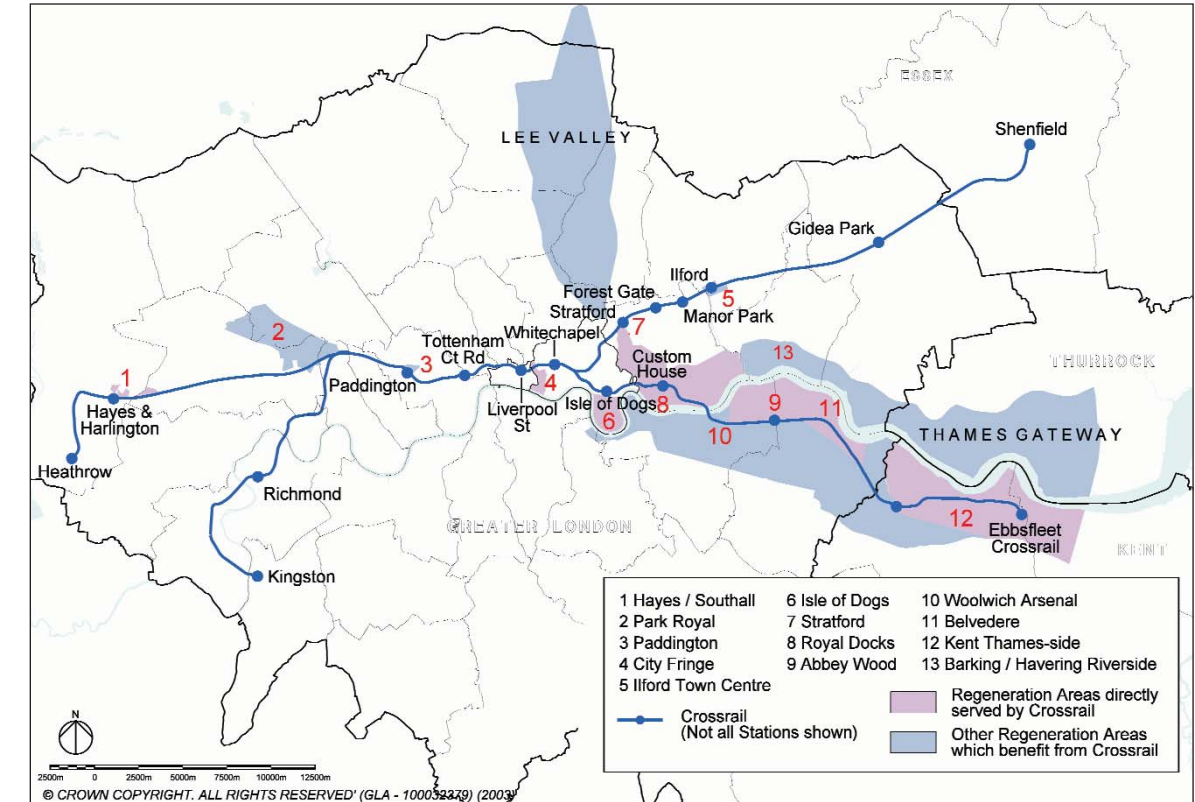
### The Regeneration Benefits of Crossrail

**6.11** In conjunction with other Government initiatives, such as housing, training, infrastructure investment, education and health, Crossrail would have significant benefits for regeneration areas by:

- Increasing public transport accessibility
- Improving accessibility to additional jobs, education opportunities and cultural facilities outside regeneration areas
- Improving the image and perception of regeneration areas.

**6.12** Crossrail would provide a new strategic link across London, which is vitally important to the integration of London's key strategic growth and regeneration areas shown in Figure 6.3.

**Figure 6.3: Areas of Regeneration that Benefit from Crossrail**



**6.13** The regeneration benefits have been measured, although not included in the economic appraisal. It is estimated that Crossrail would enable or attract between 56,000 to 110,000 jobs as a result of development activity within key regeneration areas directly served by the route. Between 45,000 to 78,000 of these estimated jobs would be enabled in the Thames Gateway (excluding employment growth in the Isle of Dogs).

**6.14** The number of those jobs that could be taken up by the unemployed and economically inactive residents were estimated by calculating and totalling:

- Job creation due to new economic activity attracted to regeneration areas
- Jobs accessible within a 30 minute travel catchment area
- Jobs from new residential activity in regeneration areas.

**6.15** Only a share of these jobs would be taken up by the most deprived people. It is estimated that residents of regeneration areas, who are currently unemployed or economically inactive, would take up between 14,000 - 26,000 net additional jobs.

## 7. Conclusions

- 7.1** Crossrail has a significant role to play in addressing existing and future crowding problems on the LUL and National Rail networks. It would also play a significant role in supporting the London Plan by facilitating economic development and regeneration.
- 7.2** The Crossrail benchmark scheme consists of a tunnelled section through the centre of London using the currently safeguarded alignment from Paddington to Liverpool St plus extensions to Shenfield, Ebbsfleet via Isle of Dogs, Kingston and Heathrow.
- 7.3** The benchmark proposal would release capacity to operate additional trains services into Liverpool Street and Paddington Stations. It would increase peak hour rail capacity into central London by 7%.
- 7.4** The base capital cost for the scheme would be £7bn which increases to £10bn, including allowance for contingency in accordance with the HM Treasury 'Green Book'.
- 7.5** The benefit cost ratio of the benchmark scheme is 1.99:1. The scheme performance remains robust under a range of assumptions.

## Appendix

### Appraisal Summary Table



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OBJECTIVE	SUB-OBJECTIVE	QUALITATIVE IMPACTS	QUANTITATIVE MEASURE	ASSESSMENT
<b>ECONOMY</b>	Transport Economic Efficiency	Journey time, frequency and capacity enhancements would benefit existing public transport users and encourage shift from car with associated reductions in road congestion. New stations and rolling stock improve passenger environment and contribute to mode shift and reliability.	Benefit – Cost ratio: 1.99:1	Large beneficial
	Wider Economic Impacts	By increasing capacity and accessibility, Crossrail removes transport constraints, thereby securing the draft London plan growth forecast for central London. The Central London FBS clusters have high added value, and are internationally mobile; growth provides a net increase to UK GDP. Crossrail provides significant regeneration benefits.	7-10,000 additional jobs in Central London by 2016 rising to 20-23,000 by 2027  20,000 jobs taken up by unemployed and economically inactive residents in Regeneration Areas.	Large beneficial
<b>ENVIRONMENT</b>	Noise	Railway Noise: Increases in noise levels due to increases in train movements on surface sections between Gidea Park and Shenfield, Plumstead to Ebbsfleet, and Gunnersbury to Kingston.  Decreases in noise levels between Royal Oak and Heathrow where there will be some replacement of diesel with electric traction.	It is not anticipated that properties adjacent to the overland sections of the route will be subject to significant increases in airborne noise (an increase of 3dB or more).  Neither is it anticipated that properties that are likely to be effected by groundborne noise will experience what is considered to be a significant impact (40dB or more).	Neutral
	Local Air Quality	Road Traffic Noise: Reductions in road traffic noise through modal transfer would be imperceptible.  Slight improvements to local air quality may occur due to modal shift from road to rail. However, such changes are likely to be small.	Reduction in average vehicle kilometres travelled on the road network will be negligible (i.e. less than 1%) compared to the base case scenario.	Neutral
	Greenhouse Gases	Modal shift from cars to trains is predicted to result in a decrease in emissions of CO <sub>2</sub> . Decrease is equivalent to approximately 0.7% of Greater London's CO <sub>2</sub> emissions from road transport per year.		Slight beneficial
	Landscape	Depot could result in slight adverse impact on surrounding landscape and views.		Slight adverse
	Townscape	Demolition of property and the presence of portals, ventilation shafts and new station development have an impact on townscape. At the same time, there will be opportunities for improved urban design through the proposals, especially around stations.		Slight adverse

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OBJECTIVE	SUB-OBJECTIVE	QUALITATIVE IMPACTS	QUANTITATIVE MEASURE	ASSESSMENT
<b>SAFETY</b>	Heritage of Historic Resources	Effect on one listed building in central London and modifications to listed stations and structures. Impacts on Archaeological Priority Zones within, and adjacent to, route corridor. Potential impacts on listed buildings and structures due to settlement and vibration.	40 SINC's potentially affected.	Moderate adverse
	Biodiversity	Potential for impacts due to works within, or adjacent to, Sites of Importance for Nature Conservation (SINCs) including Hyde Park, which is a Site of Metropolitan Importance.		Slight adverse
	Water Environment	Diversions of culverts, sewers and a river. Minor changes in flow in a shallow aquifer may occur in London.		Neutral
	Physical Fitness	By encouraging people to use public transport, Crossrail encourages physical fitness via additional cycling and walking.		Slight beneficial
	Journey Ambience	Crossrail improves journey ambience by: a) providing a clean, reliable service with clear information for passengers, a pleasant journey environment and high levels of in-vehicle security; and b) providing services that are accessible to the mobility impaired.		Large beneficial
	Accidents	Rail is a very safe mode of transport. Crossrail encourages use of rail and would be equipped with a wide range of safety measures on trains and at stations		
	Security	Works at stations means major increase in security for passengers (CCTV, open design, lighting, landscaping, boundaries).		Large beneficial
	Option values	Crossrail provides significantly enhanced journey opportunities for trips to many destinations. There are significant time savings from all Crossrail branches to central London locations, and to many of London's town centres.	60-minute population catchment of City increases by 360,000, Isle of Dogs by 610,000, and the West End by 430,000.	Large beneficial
	Severance	As Crossrail mostly uses existing railway corridors or new tunnels, there is no significant effect on severance.		Neutral
	Access to the transport system	Through serving key London town centres, Crossrail improves accessibility to local services, social and cultural amenities. Crossrail would be accessible to mobility impaired passengers.		Large beneficial
<b>INTEGRATION</b>	Transport Interchange	Crossrail forms part of an integrated transport network, with increased multi-modal interchange and mobility impaired access. It significantly reduces the need for passengers to make undesirable rail interchanges at Liverpool Street, Paddington and Waterloo.	24 Major Interchanges stations with other National Rail, Underground and/or DLR services. Average number of interchanges per Crossrail trip falls from 1.33 to 1.07.	Large beneficial
	Land-Use Policy	Crossrail supports London's world city role by sustaining and developing the FBS sector in Central London and providing connections to Heathrow, City Airport, and CTRL interchange at Stratford and Ebbsfleet. It serves Thames Gateway and supports development opportunities in East London and the Lower Lea Valley at Isle of Dogs, Stratford and the Royal Docks.		Large beneficial
	Other Government Policies	Crossrail demonstrates significant benefits against the policy objectives set out in the government's ten year transport plan.		Large beneficial