

# Crossrail Business Case Update: Summary Report

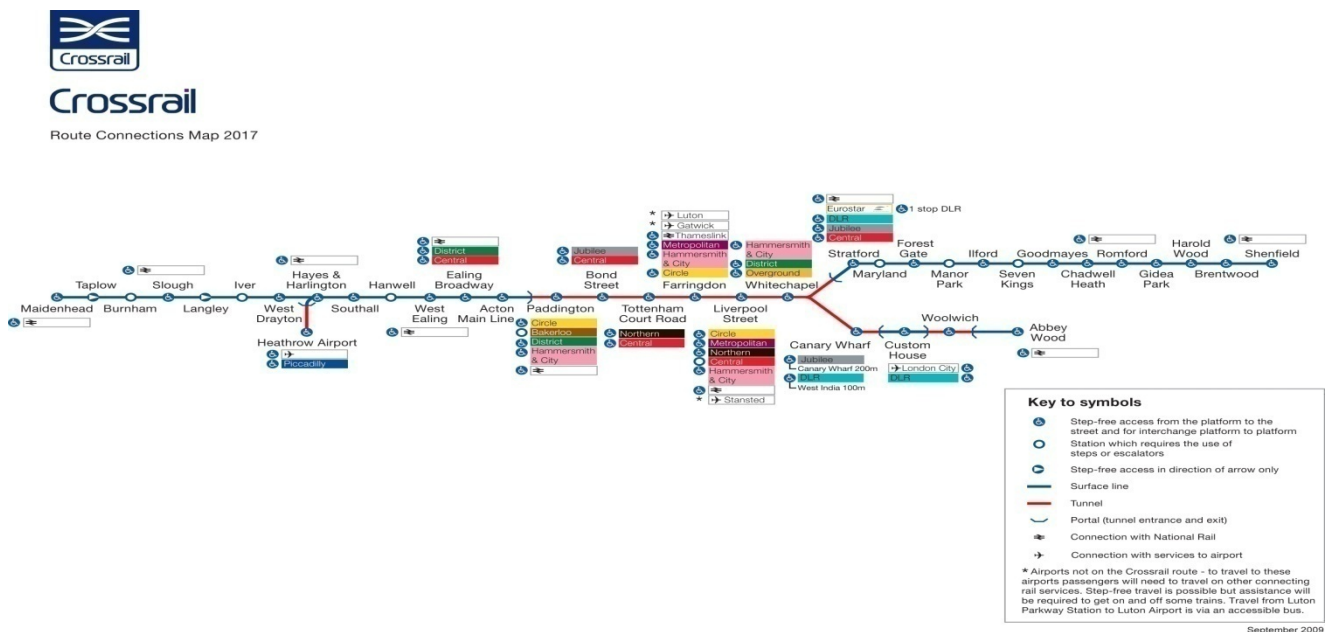
## July 2011

This report provides an update to the July 2010 Crossrail business case, including taking into account a number of changes to the costs and revenues forecast consistent with the outcomes of the UK Government's October 2010 Spending Review. Recent changes (April 2011) to Department for Transport (DfT) appraisal methodology have also been incorporated but no other changes have been made in particular to the underlying demand forecast for Crossrail services.

### 1 - About Crossrail

- 1.1 Crossrail, a new world-class and affordable railway across London provides a high-frequency, high-capacity and accessible link between Heathrow Airport, the West End, the City of London and Canary Wharf. Crossrail services will operate through a new 13 mile (21km) twin-bore tunnel under central and southeast London. The project is supported by the Coalition Government and forms a key part of the *Mayor's Transport Strategy*, published by the Mayor of London in May 2010. Figure A provides a route diagram for Crossrail, showing connections with the existing public transport network including the location of accessible stations.

**Figure A: Crossrail Route Network & Connections**



- 1.2 Crossrail is being built under powers granted by Parliament in the Crossrail Act 2008. Construction commenced in May 2009 with the start of work on the Crossrail Canary Wharf station box, followed by enabling works at sites across the central section. Crossrail is now in the full delivery phase, with all four tunnelling contracts awarded and work expected to start in spring 2012. Crossrail services are expected to commence from 2018.
- 1.3 The project is being jointly sponsored by the Department for Transport (DfT) and Transport for London (TfL). Project delivery is being managed by Crossrail Ltd (CRL), a special-purpose subsidiary of TfL.
- 1.4 The capital cost will be financed in, broadly, three ways:

- (a) through future farebox revenues generated by Crossrail services;
- (b) by businesses in London, through direct contributions to capital costs, developer contributions, and a Business Rate Supplement (BRS); and
- (c) by national taxpayers, through a grant provided by the DfT.

## **2 - The transport case for Crossrail**

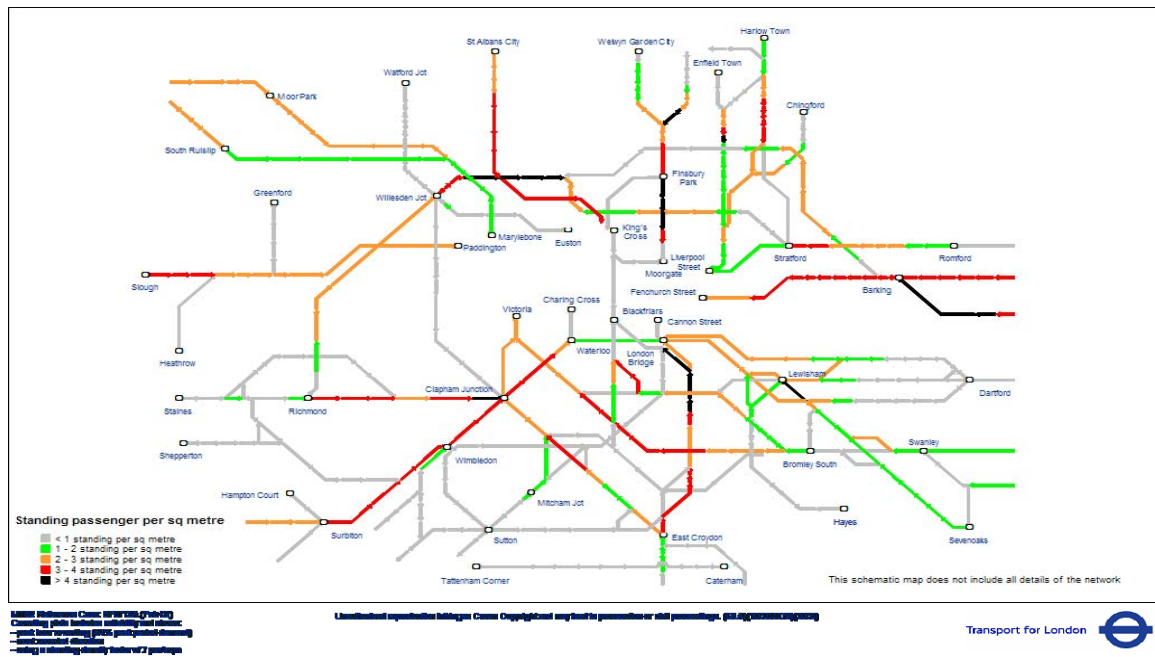
- 2.1 Crossrail plays a vital role in meeting London's current and future transport needs thereby securing the future economic growth of the UK and encouraging sustainable development. Reflecting the importance of the project in securing London's future success, over £10bn in funding (out of the £14.5bn now allocated) is being raised against surplus farebox revenues and contributions from businesses and developers including BAA, Canary Wharf Group and the City of London.
- 2.2 The key transport aims for Crossrail will support delivery of the objectives set out in the May 2010 Mayor's Transport Strategy, namely to:
- Support sustainable economic development and population growth by increasing transport capacity, reducing congestion on the transport network;
  - Improve transport connectivity through journey time savings; and
  - Bring wider benefits including: enhancing accessibility (including those with restricted mobility) thereby improving people's access to jobs, schools and other locations; improved transport safety with reduced road accidents; and environmental improvements; including a reduction in Co<sub>2</sub> emissions;
- 2.3 Crossrail will also support the delivery of objectives set out in the DfT's Business Plan, namely to:
- Support a transport system that is an engine for economic growth but one that is also greener and safer and improves quality of life in our communities;
  - Improve the links that help to move goods and people around;
  - Secure the sustainability of the railway and create capacity for improvement of services, by addressing the high cost of the UK railway compared with other railways and comparable industries; continue to invest in Crossrail and London Underground upgrades in the capital.

### **Supporting London's growth and relieving congestion**

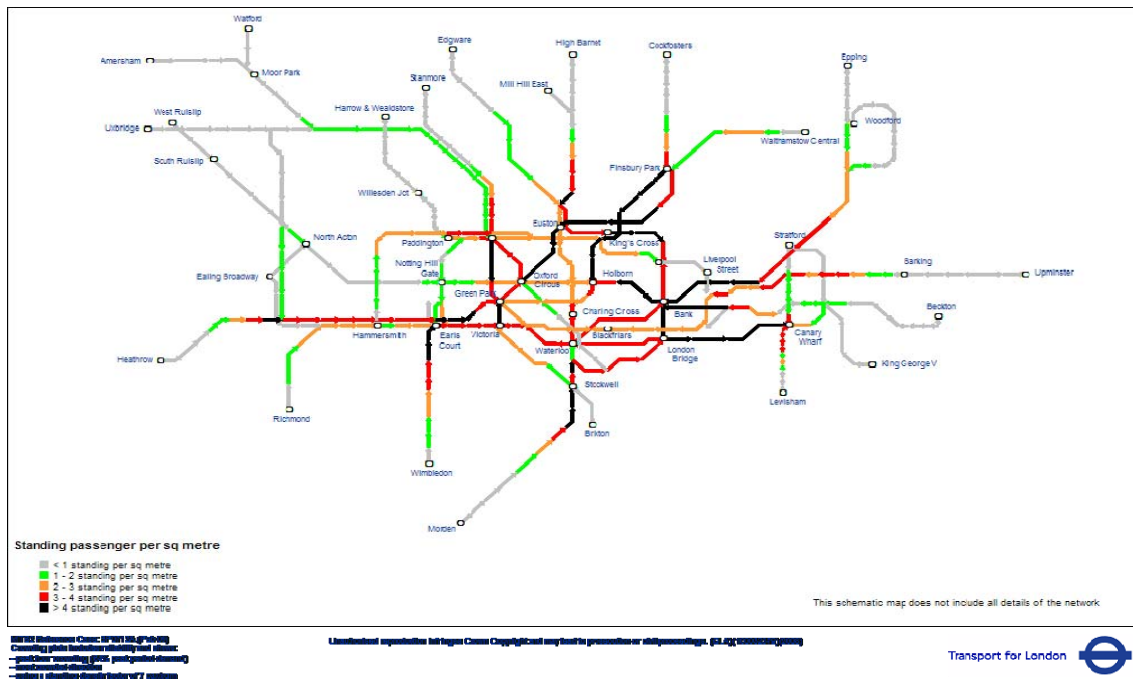
- 2.4 The current transport network in and around London is already highly congested, with high levels of crowding on key National Rail, London Underground and Dockland Light Railway (DLR) services, particularly during the peak period. Even with the on-going investment on the London Underground, National Rail network and other transport systems, London's transport system is struggling to meet existing demands.
- 2.5 The existing extent of crowding on existing networks is illustrated in Figures B & C, which show the density of standing passengers at peak hours in 2006 for the London Underground and DLR, and National Rail networks respectively.

## Figures B & C: Tube and Rail Transport Crowding 2006

### Rail crowding, 2006

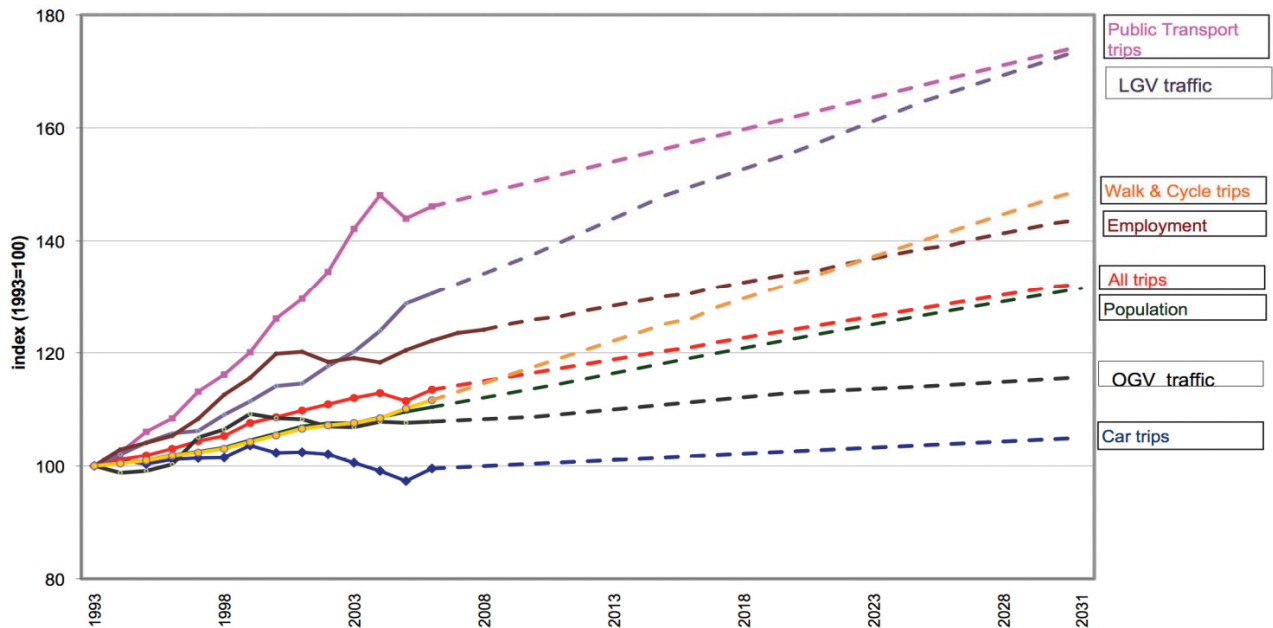


### Tube and DLR crowding, 2006



2.6 Furthermore, London is forecast to continue to grow, in terms of both population and employment. The latest draft *London Plan*, published in March 2010, expects that by 2031 nearly 1.3 million additional people and 750,000 new jobs will be in the capital. The projected 35 per cent growth in public transport trips will bring inevitable additional pressures on the transport network. These are illustrated in Figure D, which shows the trends for population, employment and transport demand against a baseline "index" level of 1993.

**Figure D: London trends and forecast for population, employment and travel demand**

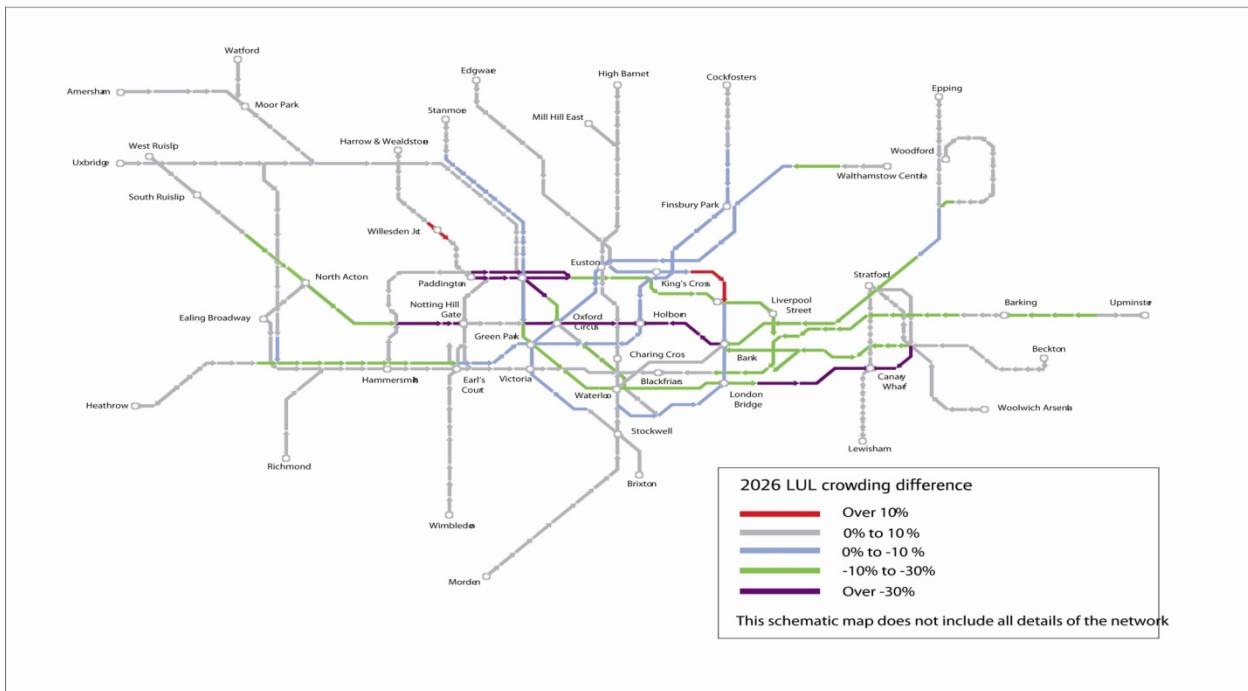


- 2.7 Crossrail will make a significant impact towards relieving this growing pattern of congestion and crowding. It will increase the capacity of London’s rail transport system by over 10 per cent which represents the largest single increase in London’s transport capacity since before World War II. Demand forecasts indicate that by 2026 Crossrail will be carrying over 200,000 passengers each day during the morning peak period (07:00 to 10:00 hours). This extra capacity will reduce congestion by between 20 per cent to over 60 per cent on many rail lines – particularly the Bakerloo, Central, District and Jubilee lines as well as Southeastern trains.
- 2.8 The combined effect on reducing crowding of Crossrail – together with other planned investments in London’s transport network – is illustrated in Figures E & F, which show the expected changes in 2026 on the London Underground and National Rail networks.

## Figures E & F: Tube and Rail Crowding Changes with Crossrail 2026

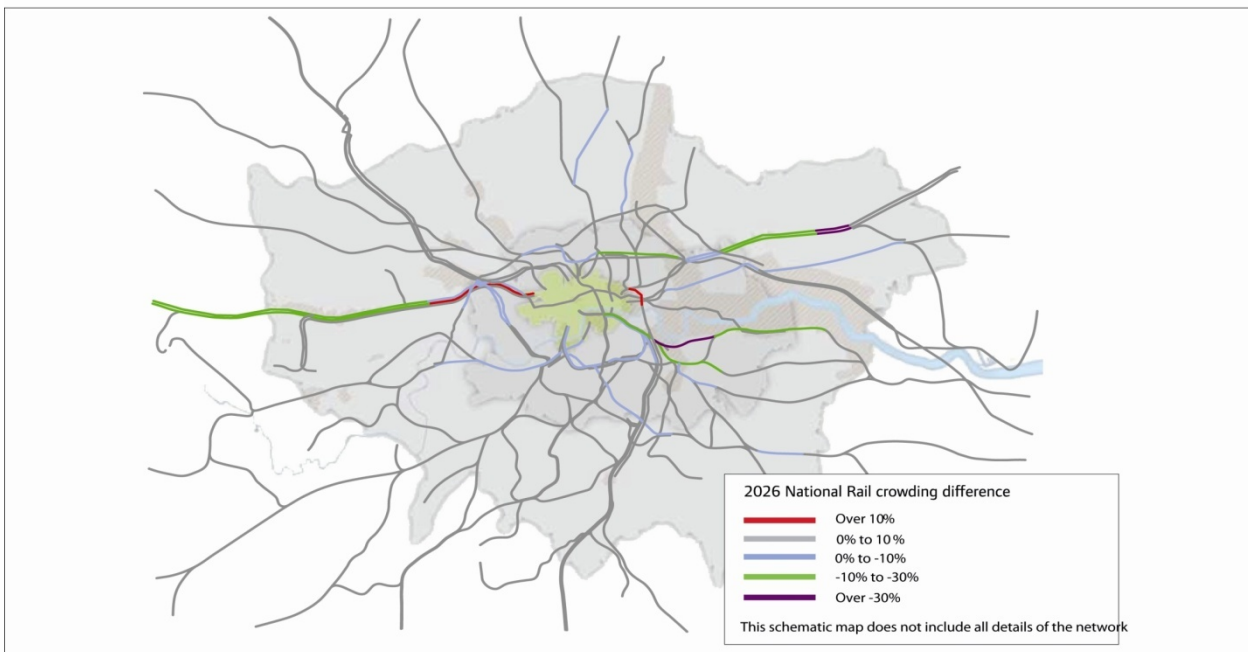
**Figure E**

Tube Crowding Changes with Crossrail 2026



**Figure F**

Rail Crowding Changes with Crossrail 2026



### Improving connections and reducing journey times

- 2.9 As well as providing additional capacity to support London's growth (as described above), Crossrail will also significantly improve connections across London and the South East with benefits to other parts of the existing transport network.
- 2.10 The most obvious element is the new direct connection between the National Rail networks running in to Paddington and Liverpool Street. The benefit from this is not just in terms of "through" passengers looking to travel right across London. More significantly

Crossrail will allow direct access to and from the new stations across the centre of London, with passengers no longer having to change at the termini of the existing National Rail routes.

- 2.11 The improved connections will bring appreciable reductions in journey times; some examples of changes in journey times between locations served by Crossrail are provided in Table 1.

**Table 1: Crossrail - impacts on example journey times**

Example Journey	2010 existing journey time	Crossrail journey time
Slough to Tottenham Court Road	55mins	32mins
Ilford to Bond Street	35mins	25mins
Heathrow to Liverpool Street	55mins	32mins
City/Liverpool Street to Abbey Wood	40mins	18mins
Paddington to Canary Wharf	30mins	16mins

- 2.12 As well as providing additional capacity to support London’s growth, Crossrail will also significantly improve connections across London and the South East. As can be seen from the route diagram at Figure A, each of Crossrail’s central stations is connected to other parts of the existing transport network – including Thameslink, the Underground and the DLR. So these benefits will also flow through into a wider range of journeys – those starting or finishing at locations that are not directly served by Crossrail but which can use Crossrail for part of the overall trip.

**Wider transport benefits including enhancing accessibility**

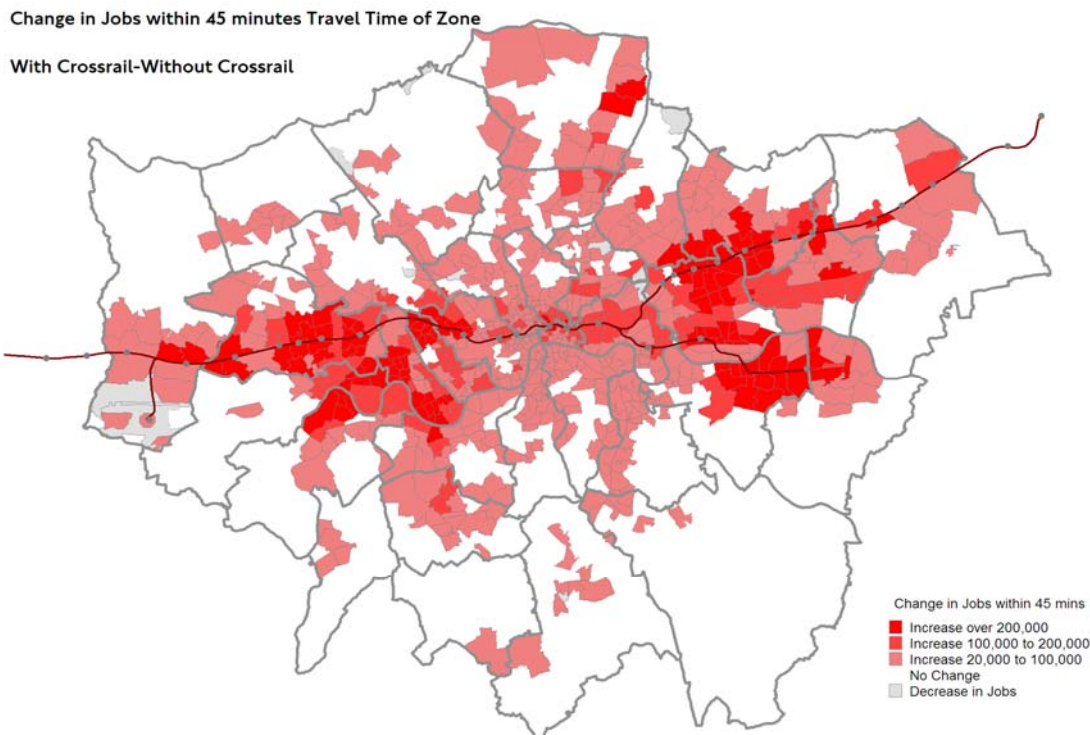
- 2.13 Crossrail will provide significant improvements on a range of other transport benefits including accessibility, service quality, safety, security, health and the environment.
- 2.14 The new trains are being designed to meet the needs of passengers in central London while also accommodating the needs of those travelling further afield. The new trains will significantly improve passengers’ comfort with wide doors and aisles, plenty of handles, dedicated spaces for wheelchairs, real time information with announcements made by PA and in-carriage screens, clear sightlines through the carriages and onboard CCTV.
- 2.15 People with restricted mobility will see significant improvements as a result of Crossrail. All of Crossrail’s fleet of new trains will be fully compliant with the latest European standards for facilities for passengers with restricted mobility and will comply with the latest European Interoperability and UK safety and performance standards.
- 2.16 All Crossrail stations will provide enhanced accessibility features including improved signage and security. Independent, step-free access from street level to the Crossrail platforms and then level boarding without ramps onto the Crossrail trains at the new central London stations. Crossrail will also bring step-free access at the interchanges between Crossrail and many of the existing Underground routes and Thameslink.

- 2.17 Stations on the existing National Rail network where significant works are undertaken will also offer step-free access from street to platform including the busiest stations such as Slough, Ealing Broadway, Ilford, Romford and Abbey Wood. In all, it has been estimated that 93 per cent all passenger trips on Crossrail will both start and end at a station with step-free access (please see Figure A for station accessibility).
- 2.18 On London's roads, Crossrail is expected to reduce pressures on road traffic, with an overall two per cent reduction across London. A more significant impact is expected on roads running parallel to the Crossrail route, with Crossrail also helping to alleviate future growth in road traffic by reducing the need for car trips to central London, Canary Wharf and, particularly, Heathrow.
- 2.19 Crossrail will also have beneficial impacts on the environment in terms of a reduction in pollution, noise and improvements for local communities. For example, Crossrail will contribute to wider goals to reduce carbon emission – as a result of modal shift, London's total carbon emissions will be reduced by over 1,300 tonnes per annum (net of emissions generated by Crossrail itself).
- 2.20 Crossrail also has a small, but beneficial, impact on safety with a two per cent reduction in road accidents as well as benefits derived from providing a safe, secure railway. All told, nearly five per cent of the quantified benefits from Crossrail result from improvements to the environment, safety and reduced road congestion.

### **3 - The economic case for Crossrail**

- 3.1 The future economic success of London and the South East is dependent on a robust transport infrastructure. As described above in the section on the 'transport case', Crossrail is a key part of the package of investments needed to ensure that London has a transport network sufficiently robust to meet its current and future needs.
- 3.2 Improved public transport is one of the major prerequisites for attracting more jobs and residents, delivering and facilitating the growth that is forecast in *The Draft London Plan of March 2010*. Over 35 per cent of the future employment growth in London is expected to be located in areas well served by Crossrail services – the West End, the City and Canary Wharf. The history of Canary Wharf over the past twenty years provides an example of the role of investment in public transport supporting and sustaining growth. After the initial opening up of Docklands with the development of road connections and the DLR, it is the opening of the Jubilee line extension in 1999 that has enabled current employment levels to be reached, as the previously-existing systems would not have been able to cope with the number of passengers who now commute to Canary Wharf on the Jubilee line.
- 3.3 Crossrail can also enable the regeneration of areas around other stations along its route through improving accessibility with shorter journey times, and giving employers located along the route better access to a larger, more highly skilled labour market with more choice of skilled employees. This is likely to attract new private sector development, and increased employment densities, near Crossrail stations. For example, it is forecast that over 100,000 additional jobs could be created across the Thames Gateway – with Crossrail directly serving Custom House, Woolwich and Abbey Wood as well as improving connections to other networks in the area.
- 3.4 Overall, Crossrail will bring 1.5 million more people within a 45 minutes commute of the existing major employment centres of the West End, the City and Canary Wharf. This

**Figure G – Crossrail impact on access to jobs**



- 3.5 The actual construction of Crossrail, which has been identified as Europe’s largest current civil engineering project, will also be economically significant in its own right, particularly in current economic circumstances. Up to 14,000 people are likely to be working on the construction of Crossrail at its peak, with approximately 1,000 net additional jobs being created to operate and maintain the railway once it is completed. Further jobs will be secured in supplying the project during construction and providing services to those directly employed by Crossrail.
- 3.6 Crossrail will also leave a longer term skills legacy behind. CRL is committed to the skills agenda and has devised a strategy which focuses on inspiring future talent, supporting local labour, revitalising our skills base and maintaining safety across the programme.
- 3.7 Crossrail construction passes through some of London’s most deprived areas. In March 2010 CRL signed a Memorandum of Understanding with Jobcentre Plus (JCP) which outlines how CRL and JCP will work together to source job-ready candidates for contractor vacancies.
- 3.8 CRL is also developing a Tunnelling and Underground Construction Academy (TUCA) in partnership with industry to offer training and recognised qualifications in underground construction skills, which will offer trained students the opportunity to work not only on Crossrail but on tunnelling projects in the UK and abroad in the future.



- 3.9 CRL is committed to providing a minimum 400 apprenticeships through its supply chain over the lifetime of the project.

#### 4 - The 'business case' for Crossrail

- 4.1 In common with other major planned transport investments, a formal 'business case' has been prepared for Crossrail, quantifying where possible – and comparing – the benefits and costs of building the railway. The June 2011 business case is an update to the July 2010 report which was the first update since 2005.
- 4.2 The June 2011 update takes into account the latest revenue and cost data consistent with the outcomes of the UK Government Spending Review, and changes to the business case methodology beyond those incorporated in the July 2010 update. The update also retains the latest demand modelling incorporated in the July 2010 update. The changes incorporated into the June 2011 update include:
- A comprehensive update of the requirements/scope, design, schedule, cost estimate, risks and inflation for the construction of Crossrail;
  - Updates to operating, maintenance and longer term renewal costs to provide planned Crossrail services;
  - Changes to the date of opening of services reflecting the later opening of Crossrail central tunnel section in December 2018;
  - Incorporating changes to the DfT appraisal methodology (WebTAG) from April 2011 in respect of GDP growth rates and the treatment of the loss of indirect tax revenues from highway abstraction;
  - Revised Real Fares growth assumption of two per cent between 2010 and 2017, one per cent thereafter for the duration of the appraisal period.

#### 'Conventional' transport economic appraisal

- 4.3 The conventional transport economic appraisal of a project assesses the transport benefits (and costs) associated with its implementation. It focuses on factors such as the travel time savings and journey quality benefits, assessing these against the total cost of the project over a period of time. Such appraisals have long been used to value the relative attractiveness of different transport projects by assigning monetary values to both the benefits and costs.
- 4.4 Preparation of the transport economic appraisal for Crossrail has followed the methodology in the latest national guidance published by the DfT (known as WebTAG), which is designed to be consistent with the broader guidance in the HM Treasury *Green Book*. One of the key parameters in any appraisal is the figures used for assessing the "Value of Time" (VoT) – this is essential for calculating, for example, the benefits of journey time savings. WebTAG specifies a national set of VoT figures, which are intended to be used for comparative purposes for all national transport projects. While TfL appraisal guidance is largely aligned with DfT guidance, it does apply London-specific VoT figures, based more closely on London employment values which are approximately one third higher. To reflect the needs of both of Crossrail's sponsors – DfT and TfL – the economic appraisal has been carried out with both sets of VoT figures being used in parallel.

- 4.5 To enable direct comparison with other projects, values in the economic appraisal have been expressed in 'Present Value' terms in billions of pounds discounted to a 2002 price base, and assessed over a 60 year appraisal period from the opening of Crossrail services in 2018 through to 2076 with a discount rate of 3.5 per cent for the first 30 years and three per cent thereafter (these rates follow HM Treasury *Green Book*).
- 4.6 The appraisal compares London with and without Crossrail, assuming a number of committed improvements to London's transport system are completed including the London Underground and Thameslink upgrades. Revenues generated are net of any abstraction from other public transport services.
- 4.7 The headline measure of a transport project's impact on the UK is its economic Benefit to Cost Ratio (BCR). Table 2 sets out the key values – benefits and costs – that have been used to calculate Crossrail's BCR. Calculated using nationally-comparable VoT figures, the BCR is 1.97, with a figure of 2.76 using TfL's London-specific VoT figures.

**Table 2: Crossrail Benefits and Costs Summary:**

<b>Component (£bn; PV 1Q 2002 prices)</b>	<b>TfL (London Weighting VoT)</b>	<b>DfT (UK wide VoT)</b>
<b>User Benefits:</b>		
– Time Savings	9.1	6.6
– Congestion Relief	7.3	5.3
– Other	0.5	0.5
– Indirect Tax Revenue	-1.4	-1.4
<b>Total User Benefits</b>	<b>15.5</b>	<b>11.0</b>
<b>Costs:</b>		
– CAPEX	-9.4	-9.4
– Operations/Maintenance	-3.9	-3.9
– Revenues	7.4	7.4
– Other	0.2	0.2
<b>Total User Costs</b>	<b>-5.6</b>	<b>-5.6</b>
<b>Net Present Value</b>	<b>9.9</b>	<b>5.4</b>
<b>"Conventional" BCR</b>	<b>2.76</b>	<b>1.97</b>

- 4.8 Compared to the costs associated with building the project as well as the costs for operating and maintaining services (including longer term infrastructure renewal), Crossrail generates substantial net transport economic benefits, at nearly £5.4bn using DfT VoT or £9.9bn using TfL VoT. Over 40 per cent of these transport benefits are associated with Crossrail's ability to increase the capacity of London's congested transport network to meet the existing and future transport needs of London.
- 4.9 A number of sensitivity tests have also been conducted to test the robustness of the project if a number of key assumptions were to be changed. These tests indicate that the benefits of Crossrail are resilient to possible future economic shocks to London and the UK and would still represent a good value for money investment.
- 4.10 Given the state of progress with the Crossrail project with most of the land purchased, much design work and some elements of main construction works already under way, significant amounts of the total cost of building Crossrail have already been incurred. The appraisal shown in Table 2 takes into account costs already incurred (or 'sunk' costs). If

excluded from the analysis, the BCR would improve by some 30 per cent. Table 3 sets out the BCR if these 'sunk' costs are excluded from the appraisal.

**Table 3: Crossrail Benefits and Costs Summary excluding 'sunk' costs:**

<b>Component (£bn; PV 1Q 2002 prices)</b>	<b>TfL (London Weighting VoT)</b>	<b>DfT (UK wide VoT)</b>
<b>User Benefits:</b>		
– Time Savings	9.1	6.6
– Congestion Relief	7.3	5.3
– Other	0.5	0.5
– Indirect Tax Revenue	-1.4	-1.4
<b>Total User Benefits</b>	<b>15.5</b>	<b>11.0</b>
<b>Costs:</b>		
– CAPEX	-8.0	-8.0
– Operations/Maintenance	-3.6	-3.6
– Revenues	7.4	7.4
– Other	0.2	0.2
<b>Total User Costs</b>	<b>-4.2</b>	<b>-4.2</b>
<b>Net Present Value</b>	<b>11.2</b>	<b>6.7</b>
<b>"Conventional" BCR</b>	<b>3.64</b>	<b>2.59</b>

### Crossrail's 'Wider Economic Benefits'

- 4.11 As noted above, the conventional appraisal methodology considers the direct transport benefits and costs. In addition to these, it is expected that a major project such as Crossrail will generate wider economic benefits that are not currently included as standard in a BCR calculation. Investing in public transport can have a significant impact on UK Gross Domestic Product (GDP) including increased tax receipts to the government.
- 4.12 DfT guidance identifies four specific components of these 'wider impacts' or 'wider economic benefits' (WEBs):
- Move to More Productive Jobs (M2MPJ);
  - Pure Agglomeration (Pag);
  - Increase in Labour Force participation (LFP); and
  - Impacts on Imperfect Competition (IC).
- 4.13 The DfT guidance on the calculation of these benefits has recently been revised and it is this guidance that has been used to provide an updated estimate of the WEBs Crossrail is likely to generate. A number of changes to the methodology and values applied to the WEBs analysis have been made since the 2005 published business case. A central estimate is presented which captures the Pag, LFP and IC elements. The M2MPJ element is only included as a sensitivity as this is concerned with additional passenger journey's taking place into central London, which will affect the central estimate of Pag through additional crowding.
- 4.14 The impact of Crossrail on the wider economy is substantial. The increase in UK GDP derived from the implementation of Crossrail is focussed on enabling the growth of central

London employment. This generates higher earnings and profits for UK businesses which translate into higher taxes to the UK government. As with transport economic benefits, the total value of these wider benefits are impacted by whether UK wide or higher, London-specific income rates are applied.

- 4.15 In total, Crossrail Wider Impacts are estimated to be £6 - £18bn in welfare terms, including increased tax receipts, exceeding the initial public sector funding required to build Crossrail. Including the wider economic benefits in the appraisal this increases the BCR from 1.97 to between 3.09 and 3.53 using UK wide values of time (as applied by the DfT) and from 2.76 to between 3.97 and 5.87 using London values (as applied by TfL). These figures are summarised in Table 4.

**Table 4 – Crossrail’s Wider Economic Benefits**

<b>Component (£bn; PV 1Q 2002 prices)</b>	<b>TfL (London values)</b>	<b>DfT (UK wide values)</b>
<b>Wider Economic Benefits</b>		
– GDP (includes Welfare below)	<b>42</b>	<b>6 to 15</b>
– Welfare (including Increased Tax)	<b>7 to 18</b>	<b>6 to 9</b>
<b>BCR (including Welfare WEBs)</b>		
<b>Central Estimate</b>	<b>3.97</b>	<b>3.09</b>
<b>Sensitivity Estimate</b> (including M2MPJ)	<b>5.87</b>	<b>3.53</b>
<b>BCR (including Welfare WEBs), without “sunk” costs</b>		
<b>Central Estimate</b>	<b>5.23</b>	<b>4.07</b>
<b>Sensitivity Estimate</b> (including M2MPJ)	<b>7.74</b>	<b>4.66</b>

### **Comparisons with the 2010 business case**

- 4.16 Since publication of the updated Crossrail business case in July 2010, a comprehensive update of the project’s costs (capital, operating and maintenance) has been undertaken. This has resulted in a net decrease in total costs. There have also been changes to the DfT appraisal methodology since the July 2010 publication.
- 4.17 The reduction in total costs has been the main contributor to an increase in the project BCR from 1.87 to 1.97. The changes to the DfT appraisal methodology are neutral in their impact on the BCR.
- 4.18 No changes have been made to the WEBs valuation reported in the July 2010 business case.

## **5 - Conclusions**

- 5.1 The latest assessment of Crossrail’s benefits and costs indicates a continuing strong business case, in particular in the project’s ability to reduce congestion on London’s existing transport network and allow London to generate more productive jobs. This is reflected in the increase in the BCR both with and without the impact of WEBs.

- 5.2 The revised business case demonstrates the continuing need for Crossrail – taking into account the revised (downwards) GDP forecasts from the Office of Budget Responsibility. Further sensitivity tests carried out as part of the appraisal – testing the impact of alternative scenarios for population and employment growth for example – indicate that the case for Crossrail remains resilient even with possible future economic shocks.
- 5.3 It is possible that the demand for Crossrail services will outstrip current forecasts – research undertaken for the Crossrail Sponsors into demand on other new services such as Thameslink, Paris RER and the Jubilee Line Extension indicates that transport projects designed primarily to relieve congestion of existing infrastructure and support future population and employment growth, generally meet or exceed their original demand forecasts.
- 5.4 Crossrail has a significant role to play in addressing the existing and future transport needs for London. The railway will significantly reduce congestion on National Rail and London Underground networks and support improved access to the key centres of the City, West End and Canary Wharf. As such – and with the Wider Economic Benefits it will bring – Crossrail will support growth in London and the Southeast, and thereby have a positive impact on the UK economy as a whole.