Crossrail business case

Summary report

July 2010

MAYOR OF LONDON

Department for Transport

Crossrail

Transport for London

About Crossrail

This report presents the latest update of the business case for Crossrail, a new world-class and affordable railway across 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.

Crossrail will connect Maidenhead and Heathrow to the west of London with Shenfield and Abbey Wood to the east, running through a new 13 mile (21 km) twin-bore tunnel under central and east London. As well as linking commuter and suburban services, it will provide a high-frequency, high-capacity and accessible link between Heathrow Airport, the West End, the City of London and Canary Wharf. Figure A provides a route diagram for Crossrail, showing connections with the existing public transport network including the location of accessible stations.

Crossrail is being built under powers granted by Parliament in the Crossrail Act 2008. Initial construction started in May 2009, with main construction works starting in 2010. Crossrail services will be running through the central tunnel from 2017.

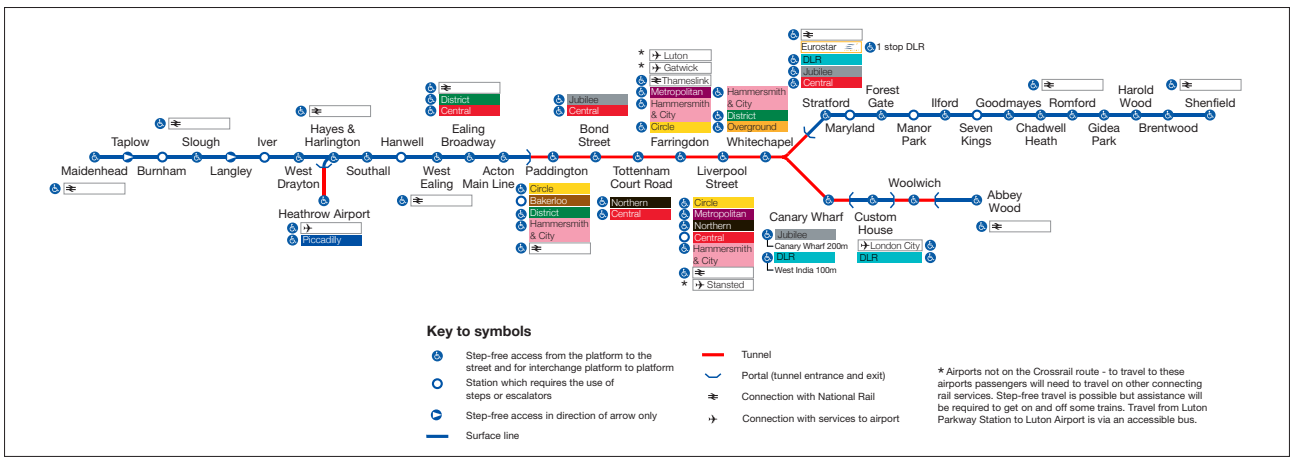
The project is being jointly sponsored by the Department for Transport (DfT) and Transport for London (TfL). Project delivery is being managed by Crossrail Ltd (CRL), a special-purpose subsidiary of TfL.

The capital cost will be financed, broadly, in three ways:

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

Figure A

Crossrail Route Network & Connections



The transport case for Crossrail

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 £15.9bn allocated) is being raised against surplus farebox revenues and contributions from businesses and developers including, BAA, Canary Wharf Group and the City of London.

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
- Bring wider benefits including: enhancing accessibility (including those with restricted mobility) thereby improving people's access to jobs, schools and other facilities; improving transport safety with reduced road accidents; and environmental improvements, including a reduction in CO_2 emissions

Supporting London's growth and relieving congestion

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 Underground, National Rail network and other transport systems, London is struggling to meet existing transport demands.

The existing extent of crowding on existing networks is illustrated overleaf in Figures B and C, which show the density of standing passengers at peak hours in 2006 for the Tube and DLR, and National Rail networks respectively.

Figure B

Tube and DLR Crowding 2006

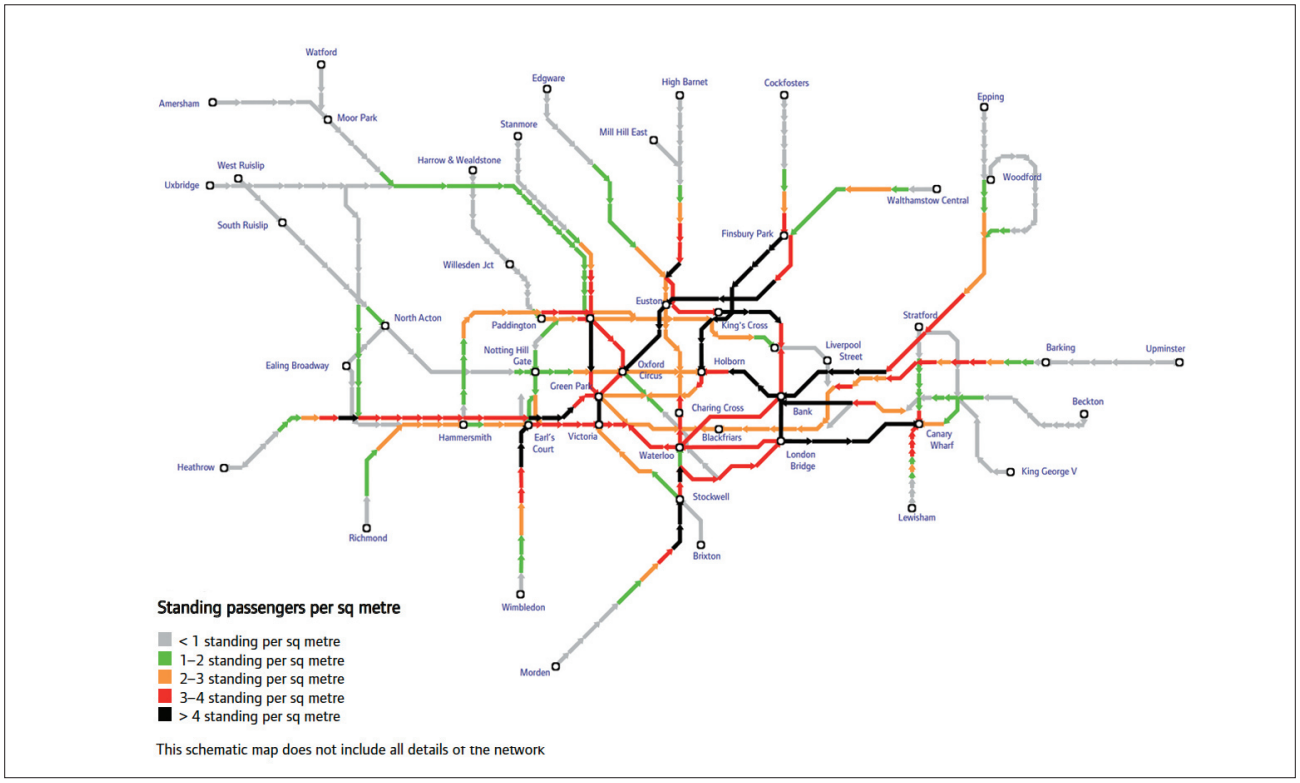
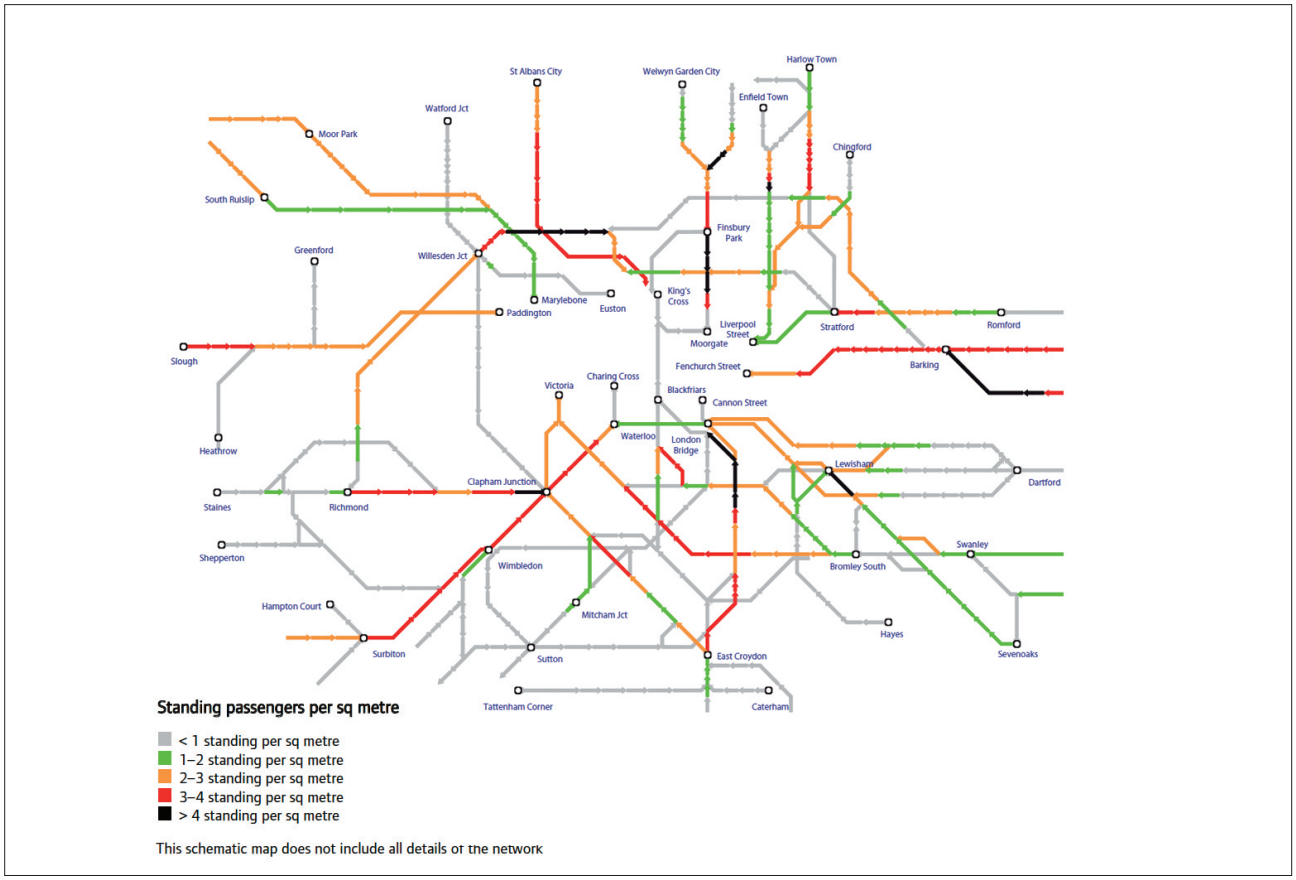


Figure C

Rail Transport Crowding 2006



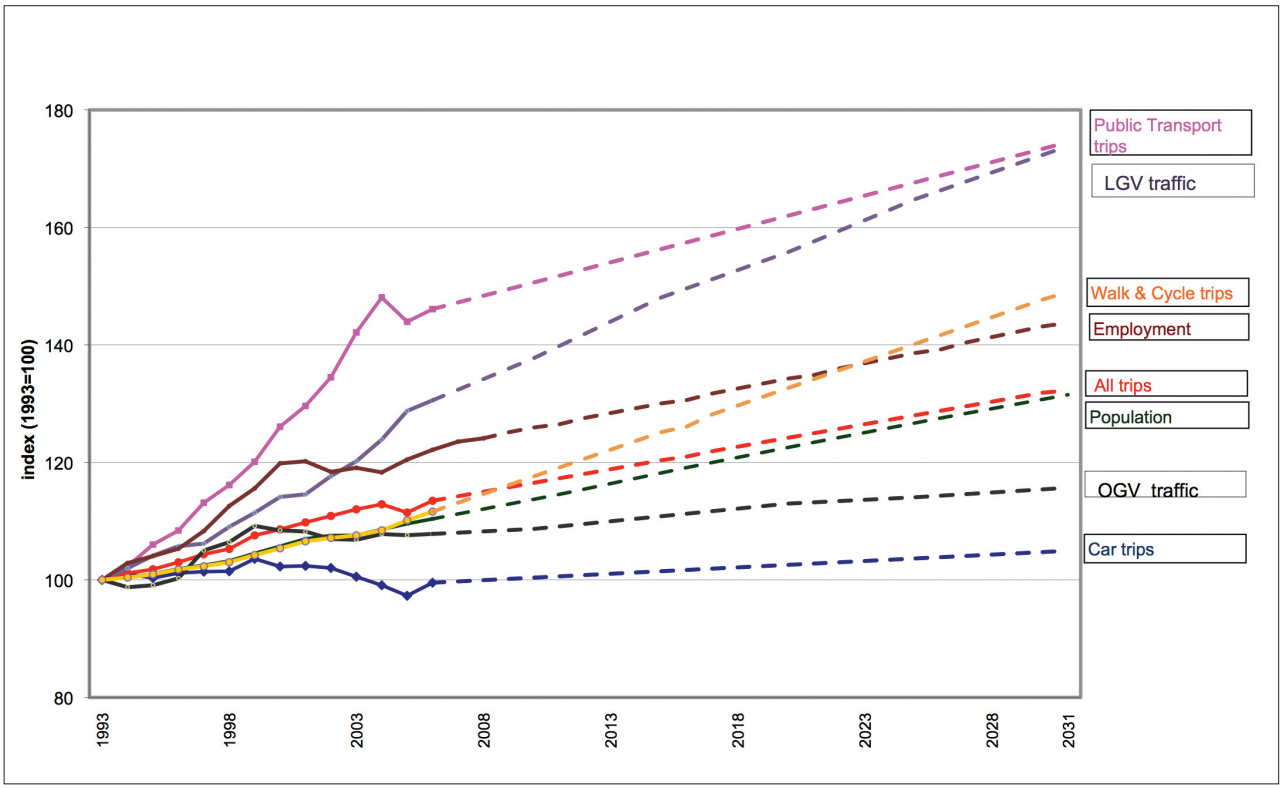
Furthermore, London is forecast to continue to grow, in terms of both population and employment. The latest draft London Plan, published in March 2010, expects that by 2031 nearly 1.3 million additional people and 750,000 new jobs will be in the capital.

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



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). This extra capacity will reduce congestion by between 20 per cent to more than 60 per cent on many rail lines – particularly the Bakerloo, Central, District and Jubilee Tube lines as well as Southeastern trains.

The combined effect of Crossrail – together with other planned investments – significantly reduces crowding on London's transport network. This is illustrated in Figures E and F, which show the expected changes in 2026 on the London Underground and National Rail networks.

Improving connections and reducing journey times

As well as the provision of extra capacity to support London's growth (as described above), Crossrail will improve connections betweendifferent parts of the transport network across London and the South East.

The most obvious element is the new direct connection between the National Rail networks running into 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.

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 impact on journey times

Example journey	2010 existing journey time	Crossrail journey time
Slough to Tottenham Court Road	55 minutes	36 minutes
Ilford to Bond Street	35 minutes	22 minutes
Heathrow to Liverpool Street	55 minutes	36 minutes
City/Liverpool Street to Abbey Wood	40 minutes	22 minutes
Paddington to Canary Wharf	30 minutes	17 minutes

Figure E

Tube Crowding Changes with Crossrail 2026

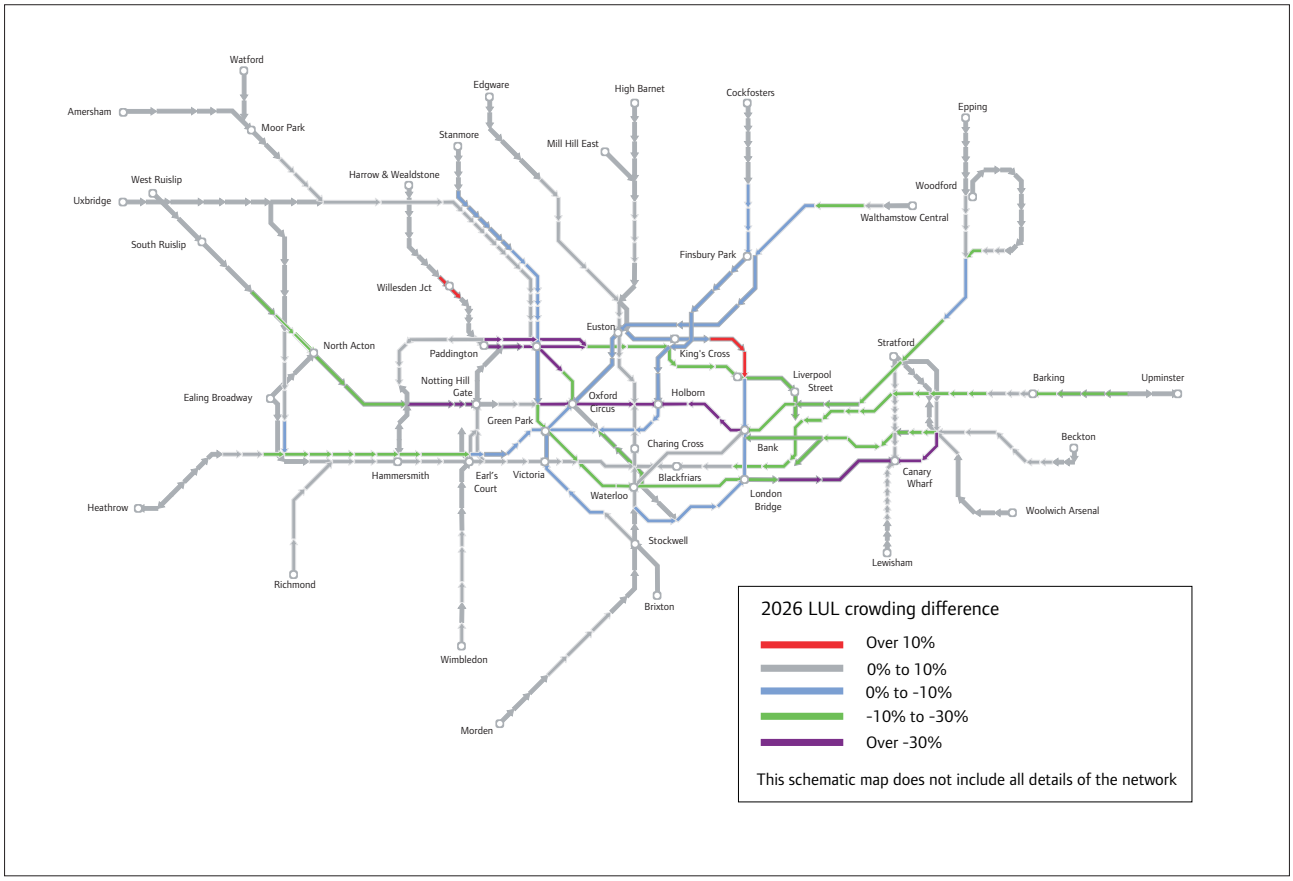
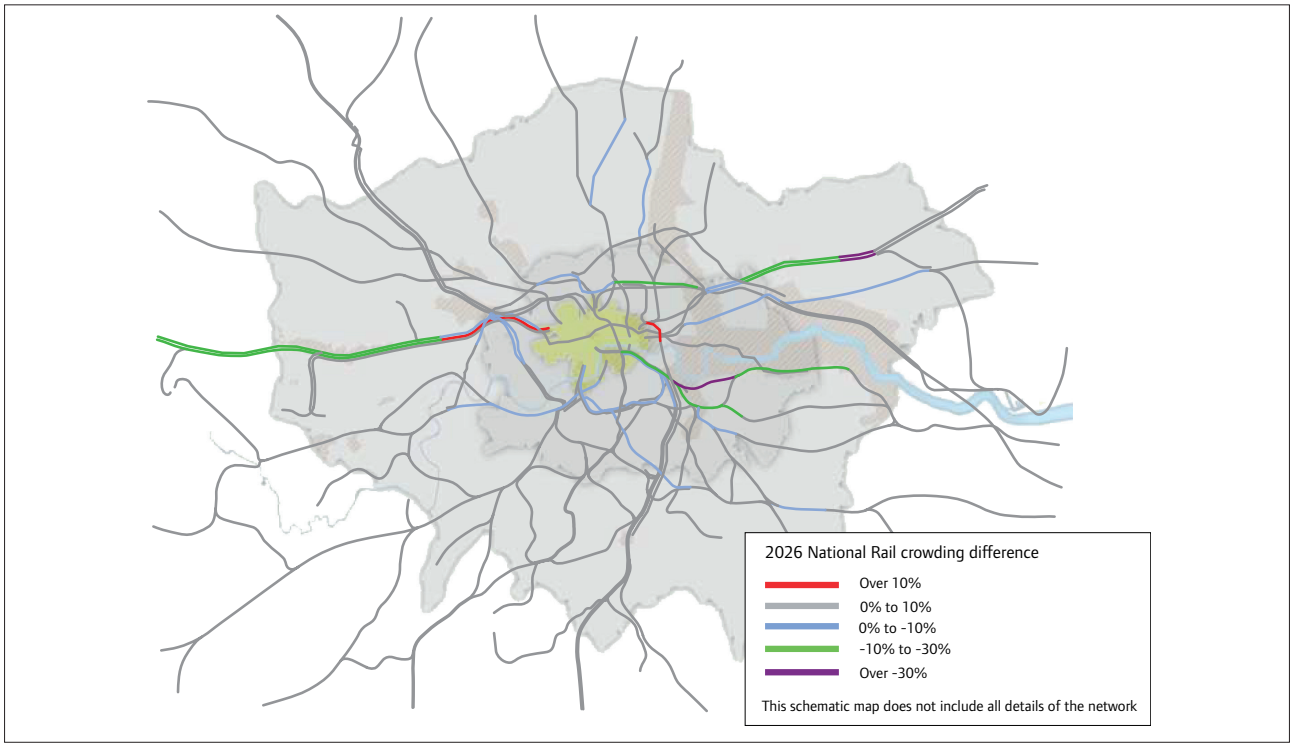


Figure F

Rail Crowding Changes with Crossrail 2026



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 in 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.

Wider transport benefits including enhancing accessibility

Crossrail will provide significant improvements to a range of other transport benefits including accessibility, service quality, safety, security, health and the environment.

People with restricted mobility will see significant improvements as a result of Crossrail. All of Crossrail's fleet of new trains will meet – or exceed – accessibility requirements, with wide doors and aisles, plenty of handles and dedicated spaces for wheelchairs.

All Crossrail stations will also provide enhanced accessibility features including improved signage and security with staffing throughout the day. Each of the eight new central stations – and the existing station at Heathrow – will provide independent, step-free access from street level to the Crossrail platforms and then level access onto the Crossrail trains. As well as ensuring step-free access from the street to Crossrail's platforms, the project will also bring step-free access at the interchanges between Crossrail and many of the existing Underground routes and Thameslink.

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 of all passenger trips on Crossrail will both start and end at a station with step-free access (please see Figure A for accessible station locations).

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.

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 emissions – 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).

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.

The economic case for Crossrail

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.

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 20 years provides an example 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. The existing systems would not be able to cope with the number of passengers commuting to Canary Wharf on the Jubilee line.

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 more than 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.

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 compares with just over 5 million who are currently within 45 minutes of the City as illustrated in Figure G. The increased productivity caused by clustering economic activity – with both improved commuting and working-time business travel across London – is crucial to supporting the UK's global comparative economic advantage and enabling London's future growth as a key international commercial centre.

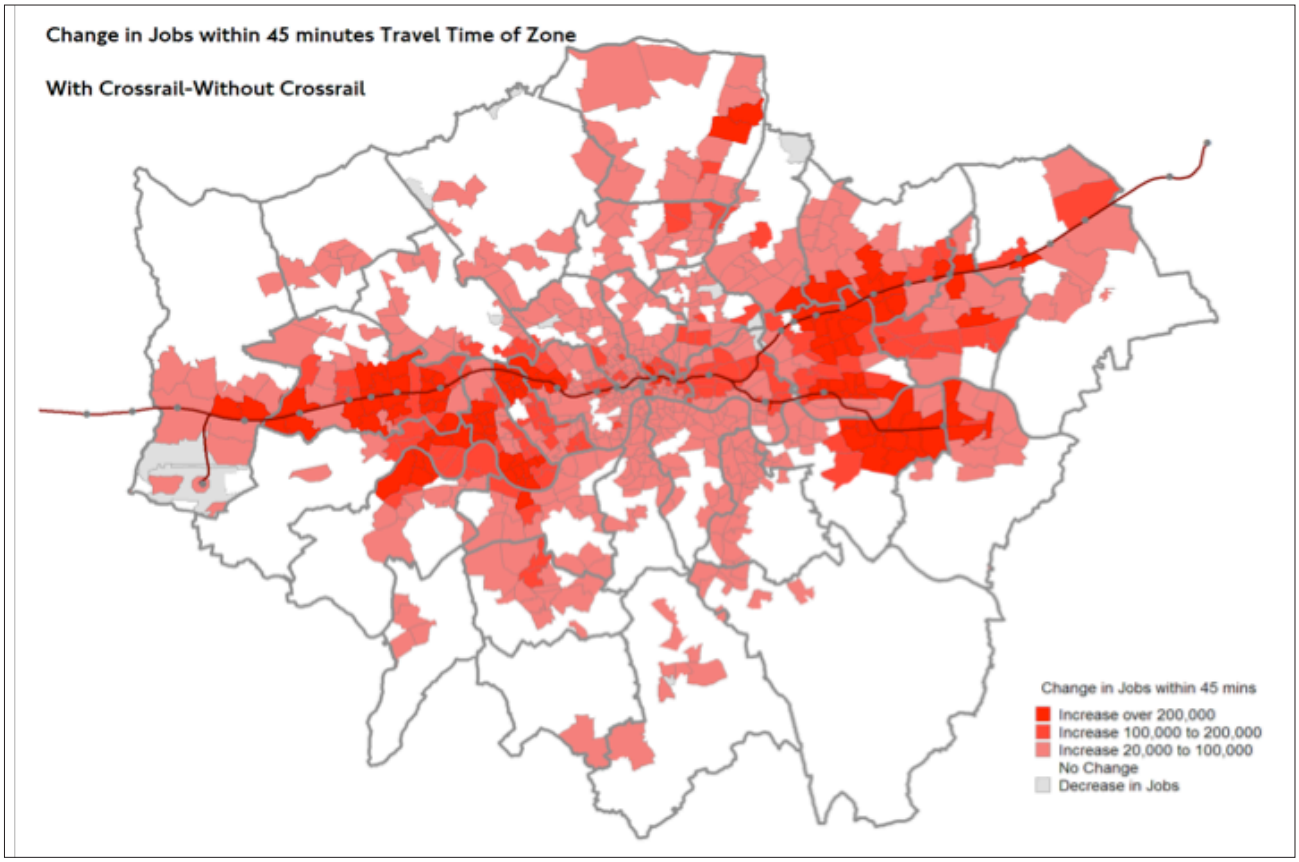
The actual construction of Crossrail, which has been identified as Europe's largest current civil engineering project, will also be economically significant in its own right, particularly in current economic circumstances.

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.

Figure G

Crossrail impact on access to jobs



The business case for Crossrail

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. A previous business case was published in 2005, when the enabling legislation for the project was presented to Parliament.

Since the 2005 update, a number of changes have been incorporated into the appraisal including:

- 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
- Updated demand modelling assuming March 2010 London Plan forecasts and committed network improvements (eg DfT 2007 High Level Output Specification (HLOS) and TfL November 2008 Business Plan deliverables)
- Changes to the economic forecasts of Gross Domestic Product (GDP) growth consistent with those set out in the Pre-Budget Report of December 2009

Conventional transport economic appraisal

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.

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.

To enable direct comparison with other projects, values in the economic appraisal have been expressed in 'Present Value' terms discounted to a 2002 price base. The appraisal has been assessed over a 60 year period from the opening of Crossrail services in 2017, through to 2076, with a discount rate of 3.5 per cent for the first 30 years and 3 per cent thereafter (these rates follow the HM Treasury Green Book).

The appraisal compares London with and without Crossrail, assuming a number of committed improvements to London's transport system are completed including the Tube line and Thameslink upgrades. Revenues generated are net of any abstraction from other public transport services.

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 1.87, with a figure of 2.55 using TfL's London-specific VoT figures.

Table 2

Crossrail Benefits and Costs Summary:

Component (£bn; PV 1Q 2002 prices)	**TfL** (London weighting VOT)	**DfT** (UKwide VOT)
User benefits:		
Time savings	10.2	7.4
Congestion relief	8.1	5.9
Others	0.5	0.5
Total user benefits	**18.8**	**13.8**
Costs:		
CAPEX	-10.2	-10.2
Operations/maintenance	-3.5	-3.5
Revenues	7.5	7.5
Other	-1.2	-1.2
Total user benefits	**-7.4**	**-7.4**
Net present value	**11.5**	**6.5**
'Conventional' BCR	**2.55**	**1.87**

Compared to the costs associated with building the project as well as the costs of operating and maintaining services (including longer term infrastructure renewal costs), Crossrail generates substantial net transport economic benefits, at nearly £6.5bn using DfT VoT or £11.5bn using TfL VoT.

More than 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.

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 15 per cent.

Crossrail's wider economic benefits

As noted previously, 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 GDP including increased tax receipts to the government.

DfT guidance identifies four specific components of these 'wider impacts' or 'wider economic benefits' (WEBs):

- Move to More Productive Jobs
- Pure Agglomeration
- Increase in Labour Force participation
- Impacts on Imperfect Competition

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.

The impact of Crossrail on the wider economy is substantial. The increase in UK GDP derived from the implementation of Crossrail is focused 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.

In total, Crossrail's wider impacts are estimated to be between £6bn and £18bn in welfare terms (at 2002 prices), including increased tax receipts, exceeding the initial public sector funding required to build Crossrail. Including the WEBs in the appraisal increases the BCR from 1.87 to between 2.73 and 3.05 (using UK wide values of time as applied by the DfT) and from 2.55 to between 3.47 and 4.91 (using London values as applied by TfL). Expressed in terms of impacts on GDP, the wider impacts are worth up to £42bn in 2002 prices or £50bn in 2010 prices.

These figures are summarised below in Table 3.

Comparisons with the 2005 business case

As noted, a business case for Crossrail was published in 2005. As can be expected, this was based on earlier – and now superseded – estimates of project costs etc and transport demand forecasts. In addition, some aspects of the underlying appraisal methodology have also changed to reflect updates to transport appraisal guidance by both DfT and TfL.

A direct comparison between the current business case and the case published in 2005 is also made complex because the 2005 publication took a different approach to the key issue of the VoT used in the appraisal. Rather than, as now, presenting appraisal values based on DfT, national and TfL London-specific VoT figures, the 2005 publication was based on a 'hybrid' value set between the two.

For comparative purposes, however, it has been calculated that the current appraisal using the 'hybrid' VoT used in 2005 would give an overall BCR of 2.08 – compared with the figure of 1.80 reported in the 2005 appraisal.

Similarly, changes in methodologies used makes a direct comparison between the currently-reported values for WEBs and those reported in 2005 more difficult. It can be noted, however, that the figures reported in 2005 are broadly lower than those reported in the current appraisal.

A significant change since the 2005 business case appraisal is the adoption of the revised GDP growth rates which reflect the recent economic downturn. The impact of these lower growth rates is to reduce the BCR by approximately 12 per cent compared to the 2005 appraisal.

Table 3

Crossrail's Wider Economic Benefits

Component (2002 prices)	TfL (London values)	DfT (UK values)
Wider economic benefits		
Welfare (including increased tax)	7 - 18	6 - 9
GDP (including welfare above)	42	6 - 15
BCR (including welfare WEBs)		
Central estimate	3.47	2.73
Sensitivity estimate	4.91	3.05

Conclusions

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

The revised business case demonstrates that the benefits of Crossrail are clear, measurable and substantial. 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.

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.

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 Tube networks and support improved access to the key centres of the City, West End and Canary Wharf.

As such – and with the WEBs it will bring – Crossrail will contribute strongly to the improvement of the economy of London and the South East, and thereby to the overall national economy.