



CROSSRAIL INFORMATION PAPER

A1 – DEVELOPMENT OF THE CROSSRAIL ROUTE

This paper explains how the Crossrail route set out in the Crossrail Bill was developed.

It will be of particular relevance to those interested in the route development process.

This is not intended to replace or alter the text of the paper itself and it is important that you read the paper in order to have a full understanding of the subject. If you have any queries about this paper, please contact either your regular Petition Negotiator at CLRL or the Crossrail helpdesk, who will be able to direct your query to the relevant person at CLRL. The helpdesk can be reached at:

Crossrail
FREEPOST
NAT6945
London
SW1H 0BR

Email: helpdesk@crossrail.co.uk
Telephone: 0845 602 3813

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1. Introduction

1.1 This Information Paper outlines the alternative Crossrail route options that were considered during the development of the project and the reasons for selecting the preferred scheme.

1.2 The alternative options considered are divided into three categories:

- central London route alternatives;
- western corridor route alternatives; and
- eastern corridor route alternatives

2. Strategic Background

2.1 The concept of an east to west cross-London rail link was first advanced in the early part of the 20th Century and was revisited after the Second World War in the Abercrombie Plan for London (1945). The original 'CrossRail' concept was developed following the 1989 Central London Rail Study (Department of Transport et al) and a direction was issued to safeguard the alignment. A private Bill deposited in parliament in 1991 was rejected but the route was protected from incompatible development.

2.2 In December 1999, the Deputy Prime Minister asked the then Shadow Strategic Rail Authority (sSRA) to carry out a review of current and future issues relating to rail travel on an east-west axis across London and to propose outline solutions. The findings of this review, published as the London East-West Study (LEWS) (sSRA 2000) led to the planning and development work for the current Crossrail project.

2.3 Published in 2001, the LEWS recognised that there was a strong case for the construction of a new cross-London rail link between Paddington and Liverpool Street which would allow the through-running of rail services that currently terminate on the edges of the London's central area. The LEWS concluded that work should be carried out to define this project in greater detail, including the precise route of the central London tunnels and the services that would operate through it. This conclusion was accepted by Government and, in 2001, Cross London Rail Links Ltd (CLRL) was set up to carry out this task.

3. Approach to the Appraisal of Alternative Routes

3.1 The route and service options considered as part of the development of the Crossrail project were appraised in a manner consistent with the Government's New Approach to Appraisal (NATA). The NATA was developed following publication in 1998 of the White Paper on integrated transport entitled A New Deal for Transport: Better for Everyone (DETR, 1998). The purpose of the NATA is to provide a consistent framework for comparing different transportation options for solving the same problem and, in so doing, to inform decisions about the selection of an appropriate option.

3.2 Guidance on applying the NATA to projects is provided by the Government in Guidance on the Methodology for Multi-Modal Studies (GOMMMS). The GOMMMS framework was generally used as the basis for appraising the Crossrail options, with particular consideration also being given to ease of construction, reflecting the nature of the project.

3.3 GOMMMS lists five broad objectives against which options should be appraised, namely:

- economy;
- safety;
- accessibility;
- environment; and
- integration

In accordance with GOMMMS, the Crossrail options were appraised against a number of more detailed sub-objectives for each of the five broad objectives. These sub-objectives are listed in Appendix 1.

4. Central London Route Options

4.1 The LEWS recommended that the existing safeguarded alignment between Paddington and Liverpool Street and serving intermediate stations at Bond Street, Tottenham Court Road and Farringdon should be taken forward for further development. The study noted:

“To connect the central London termini requires a tunnel for which there are relatively few feasible alignments due to the presence of building foundations, existing Underground tunnels and obstructions” (LEWS, section 4.1.1).

The study also noted that this central London alignment was already highly designed and its adoption would minimize construction and consents risks.

4.2 An alternative option was proposed for central London by the Residents Association of Mayfair (RAM) also known as the ‘Northerly Alignment’. This is a long-standing proposal and was first considered at the time of the previous Crossrail submission to parliament in 1991 and has been re-examined. This alignment varies from that safeguarded between Paddington and Farringdon by following a more northerly route via Marylebone/Baker Street and Euston/King’s Cross stations. To the east of Liverpool Street, the RAM alignment would be similar to the safeguarded route. Work carried out by CLRL established that the option was feasible in engineering terms (CLRL, 2002).

4.3 In comparison with the safeguarded route, the CLRL assessment has shown that the RAM alignment would:

- attract fewer passengers;
- have lower passenger benefits;
- have higher costs;

- give less improvement to accessibility in the key area of the West End;
- necessitate more property demolition; and
- affect more areas of archaeological importance.

4.4 The principal difference between the safeguarded alignment and the RAM alignment is the extent to which passengers can reach their final destinations in the employment, business and entertainment areas of the West End. The safeguarded route corridor is centred on destinations in and around Oxford Street, allowing this area to be reached by foot from a Crossrail station. The RAM alignment, focused on the Marylebone and Euston Roads, is up to 1 km from these destinations and would consequently offer fewer journey time savings and would therefore carry fewer passengers. In addition, the RAM alignment was not supported by either of the two local authorities (the Westminster City Council and the London Borough of Camden) through which it would run.

4.5 There was no evidence that further development work could address the inherent disadvantages of the RAM alignment in terms of its inferior transport case, greater property demolition and opposition from the local authorities through which it would run. Accordingly, CLRL confirmed the choice of the safeguarded alignment as the preferred central London route for Crossrail.

5. Eastern and Western Corridors

Introduction

5.1 In 2001, CLRL defined the broad corridors to the east and west of central London as the starting point for the definition of the preferred Crossrail route. In 2003, a later option to serve Kingston and Richmond was added to the list of corridors agreed for consideration. These corridors were the subject of discussion with a wide range of key stakeholders and to a comprehensive assessment and sifting process using the GOMMMS criteria. Evaluation included a combination of desktop studies, computer modelling and site visits.

5.2 An important element of this option assessment work was the consultation that was carried out with stakeholders. The purpose of this consultation included informing people about the process and timescales for making decisions, explaining the criteria by which options would be chosen and seeking views on possible routes and service patterns for Crossrail.

Western Corridors

5.3 Six western corridors were considered for inclusion in the Crossrail preferred scheme:

- western corridor A — Watford Junction Line;
- western corridor B — Aylesbury Line via Amersham;
- western corridor C — High Wycombe Line;
- western corridor D — Uxbridge and Watford Metropolitan line;

- western corridor E — Great Western Line; and
- western corridor F — Kingston via Richmond Line.

The locations of these corridors are shown in *Appendix 2* and described in *Table 1*.

Table 1 Description of Western Route Options

Corridor	Description
A	Extend in tunnel from west of Paddington to Willesden Junction to join the Watford DC Lines and then run to Watford Junction. Crossrail would serve all stations between Willesden Junction and Watford Junction.
B	Extend in tunnel from west of Paddington to join the Chiltern and Metropolitan lines near Wembley Park and run to Aylesbury with a branch to Chesham. Crossrail would serve Wembley Park, Harrow-on-the-Hill, Northwood and all stations to Aylesbury and Chesham.
C	Run from Paddington, via the predominantly freight-only line, through Greenford to South Ruislip. North of South Ruislip, the route would serve all stations to High Wycombe. An alternative sub-option provided two routes to High Wycombe — the one described above plus a route via Sudbury and Harrow Road.
D	Extend in tunnel from Paddington and surface close to Wembley Park to join the Metropolitan line and run to both Watford (Metropolitan line) and Uxbridge. Crossrail would serve all existing Metropolitan line stations between Wembley Park and both Uxbridge and Watford.
E	Extend west over existing tracks from Paddington, with Crossrail terminating at Heathrow Airport and either Slough, Maidenhead or Reading. All existing stations between Paddington and either Reading, Maidenhead or Slough would be served by Crossrail.
F	Extend in tunnel from west from Paddington to Gunnersbury via Turnham Green and join the existing North London Line to serve Gunnersbury, Kew Gardens and Richmond. At Richmond, Crossrail would then join the existing line to Kingston serving all intermediate stations except St Margarets.

Appraisal of Western Corridors

5.4 This section summarizes the results of the option appraisal process carried out for the western corridors and explains the reasons for the selection of the preferred corridors and associated service pattern.

5.5 The High Wycombe corridor (corridor C) performed poorly against the GOMMMS sub-objective of transport economic efficiency. This reflected the low level of passenger demand and crowding relief provided by this option relative to other western corridors. In addition, the operation of a high frequency Crossrail service

from High Wycombe raised significant concerns about the levels of service reliability that could be achieved for both Crossrail and the Chiltern Trains services that currently operate in the corridor. As a result of these factors, this corridor was not selected for inclusion in the preferred scheme.

- 5.6 The Uxbridge and Watford Metropolitan line (corridor D) performed poorly against a number of criteria, particularly the sub-objectives of transport economic efficiency, increasing option values and beneficial wider economic impacts. The poor performance of this corridor reflects the fact that Crossrail would directly replace the existing Metropolitan line service that already provides a high-frequency cross-London service to the City. The benefits to passengers would therefore be low when compared to other corridors where there is no existing direct cross-London service. Based on these factors, this corridor was not selected for inclusion in the preferred scheme.
- 5.7 By serving the regeneration and opportunity areas of Wembley and Park Royal, the Watford Junction Line (corridor A) performed strongly against the sub-objective of beneficial wider economic impacts. However, the performance of this corridor against the sub-objective of transport economic efficiency was reduced by its low contribution towards relieving crowding on the national rail network. In addition, this option would require the permanent relocation of an operational train depot at Willesden to an alternative, unidentified site. Based on these factors, this corridor was not selected for inclusion in the preferred scheme.
- 5.8 The Aylesbury Line (corridor B) performed strongly against the sub-objectives of transport economic efficiency and reliability, however, this corridor was not selected for inclusion in the preferred scheme. This reflects the very significant adverse contractual impacts that Crossrail would impose on the current Chiltern Line franchise and the Metronet (Sub-Surface Lines) Public-Private Partnership concession for the Metropolitan line.
- 5.9 The Kingston via Richmond Line (corridor F) performed strongly against the sub-objective of transport economic efficiency, particularly by its contribution towards relieving congestion on National Rail services into Waterloo. A new rail underpass would have been required at Richmond station and would have had a major adverse construction impact on the surrounding residential area. Operational analysis also showed that Crossrail would require the withdrawal of District line services from Richmond and result in extended journey times for some existing passengers. In addition, the interaction of Crossrail and existing South West Trains services between Richmond and Kingston would have adverse reliability impacts on both groups of services. Based on these difficulties, the Department for Transport-commissioned review of the Crossrail business case, published in July 2004, concluded that for this option:

“There must also be some question as to its deliverability in practice.” (DfT 2004, paragraph 234).

Based on these constraints, this corridor was not selected for inclusion in the preferred scheme.

- 5.10 The Great Western corridor (corridor E) was selected for inclusion in the preferred scheme. This was primarily because use of this corridor would allow Crossrail to operate to Heathrow Airport and therefore meet a strategic objective of the project to improve international links. However, for operational reasons, the operation of Crossrail services only to Heathrow in the Great Western corridor would require the withdrawal of the Heathrow Express service to Paddington, a move strongly opposed by airport stakeholders. Additionally, operating Crossrail from Heathrow only would severely limit the number of Great Western stations that could be served by Crossrail, due to the need to accommodate non-Crossrail services in the corridor.
- 5.11 As well as serving Heathrow, CLRL considered the option of running Crossrail services from Slough. This option was rejected because it would require the construction of two additional tracks between Airport Junction (close to Hayes & Harlington) and Ladbroke Grove (close to Paddington) to ensure that stations to the west of Slough did not suffer a loss of frequency and/or significantly lengthened journey times as a result of Crossrail. This infrastructure would be costly to construct and require extensive land take between Airport Junction and Ladbroke Junction.
- 5.12 As an alternative to Slough, CLRL considered the feasibility of running Crossrail services from Reading. However, serving this destination would involve significant additional costs and risks, including the need to resignal the Reading station area. Analysis showed that these costs would not be justified by the benefits, as passenger demand on Crossrail services would be low due to the existence of alternative fast rail services to Paddington from Reading.
- 5.13 Analysis by CLRL showed that terminating Crossrail at Maidenhead would provide a robust and beneficial service pattern and meet the needs of other rail services, including intercity and freight, that operate in the corridor. The resulting Crossrail service pattern would permit all stations between Maidenhead and Paddington to be served by Crossrail, thereby spreading its benefits over a wide area, as well as allowing the retention of the Heathrow Express service to Paddington.

Eastern Corridors

- 5.14 Five eastern corridors were considered for inclusion in the Crossrail project:
- eastern corridor A — Great Eastern Line;
 - eastern corridor B — Tilbury Line via Forest Gate;
 - eastern corridor C — Tilbury Line via Royal Docks;
 - eastern corridor D — North Kent Line via Royal Docks; and
 - eastern corridor E — North Kent Line via Charlton.

The locations of these corridors are shown in *Appendix 3* and described in *Table 2*.

Table 2 Description of Eastern Route Options

Corridor	Description
A	Extend in tunnel from Liverpool Street to Stratford via Whitechapel, with Crossrail services terminating at Shenfield. All existing stations between Stratford and Shenfield (except Maryland) would be served by Crossrail.
B	Extend in tunnel from Liverpool Street to Stratford via Whitechapel, with Crossrail services running via Forest Gate and Barking to terminate at Grays. All existing stations between Stratford and Grays (except Maryland) would be served by Crossrail.
C	Extend in tunnel from Liverpool Street via Whitechapel to the Isle of Dogs and Custom House to join the Tilbury Line at a point close to Barking Reach. Crossrail would then serve all stations to Grays.
D	Extend in tunnel from Liverpool Street via Whitechapel to the Isle of Dogs, Custom House and new Thames tunnel to join the North Kent Line near Abbey Wood. Crossrail services would then serve all stations to Ebbsfleet via Dartford, although the majority of trains would start and terminate at Abbey Wood.
E	Extend in tunnel from Liverpool Street via Whitechapel to the Isle of Dogs and a new Thames tunnel to join the North Kent Line near Charlton. Crossrail would then serve all stations to Ebbsfleet via Woolwich Arsenal and Dartford.

Appraisal of Eastern Corridors

- 5.15 This section summarizes the results of the option appraisal process carried out for the eastern corridors and explains the reasons for the selection of the preferred corridors and their associated service patterns.
- 5.16 The weakest performing of the eastern corridors (in terms of the GOMMMS criteria) were the two corridors from the Tilbury Line (corridors B and C). Although these corridors performed strongly against the sub-objective of beneficial wider economic impacts by supporting the regeneration and economic objectives of the Northern Thames Gateway area, the corridors serving the Southern Thames Gateway area performed more strongly against this sub-objective.
- 5.17 In addition, corridor B (the Tilbury Line via Forest Gate) would have a major adverse construction impact on a residential area by requiring widespread residential and business property demolition in the Forest Gate area. These works would be necessary to allow Forest Gate Junction to accommodate the proposed Crossrail service frequency as well as the significant freight flows on the line. Corridor B could also only work in conjunction with corridor A and would therefore preclude serving the Isle of Dogs. Although corridor C would avoid these impacts at Forest Gate Junction, it performed poorly against the

sub-objective of transport economic efficiency, as construction would involve extensive and expensive tunnelling that would not generate comparable benefits. As a result of these deficiencies, neither of these corridors was selected for inclusion in the preferred scheme.

5.18 Both corridors serving the North Kent Line and Southern Thames Gateway area (corridors D and E) performed strongly against the sub-objective of beneficial wider economic impacts by supporting regeneration and economic development in the corridor. These corridors also performed strongly against the sub-objective of transport economic efficiency by providing a new high capacity rail link across the River Thames that would generate large journey time savings for passengers travelling to the Isle of Dogs, the City and parts of the West End from southeast London and north Kent. Although the route via Charlton would be cheaper to construct than the route via the Royal Docks, the decision was taken to include the Royal Docks corridor (corridor D) in the preferred scheme. This decision was based upon:

- the greater beneficial wider economic impacts that would be achieved by serving the Royal Docks as opposed to the Greenwich Peninsula;
- the avoidance of the need to completely restructure National Rail network services in south-east London and Kent;
- the avoidance of the very significant permanent environmental impacts that would have occurred in the area around Charlton station, including the demolition of a substantial number of residential and business properties; and
- the difficulty in identifying a feasible Crossrail station site on the Greenwich Peninsula.

5.19 For the selected Corridor D, CLRL considered the option of operating the Crossrail service from Abbey Wood only, rather than projecting a proportion of the service to start at Ebbsfleet. CLRL concluded that by sharing tracks with other rail services on the North Kent Line between Abbey Wood and Ebbsfleet, there was an unacceptable risk of disruption to Crossrail's high-frequency service pattern. As a result, Abbey Wood rather than Ebbsfleet was selected as the starting point for all Crossrail services in the corridor. (See Information Paper A5, Abbey Wood to Ebbsfleet).

5.20 The Great Eastern corridor (corridor A) was also selected for inclusion in the preferred scheme. Although this corridor performed less well than the other eastern corridors against the sub-objective of beneficial wider economic impacts, Crossrail would still have a positive impact on this sub-objective by improving accessibility to Stratford, where significant development is proposed. Inclusion of this corridor also offers significant transport economic efficiency benefits by providing crowding relief to both the National Rail and London Underground networks, as well as releasing additional rail capacity into Liverpool Street main line station. This additional rail capacity could be used to

improve services to destinations on the Lee Valley Line between London and Cambridge.

6. Summary of Route Option Selection Process

6.1 The route option selection process identified the following corridors for inclusion in the Crossrail preferred scheme:

- in the centre of London, the safeguarded alignment between Paddington and Liverpool Street was confirmed. This decision reflected this option's lower construction cost, lower adverse environmental impacts and higher passenger benefits than the alternative alignments;
- to the east of central London, two corridors were included in the preferred scheme. The first was the Great Eastern corridor from Shenfield. Selection of this corridor was based upon its contribution to crowding relief on the National Rail and London Underground networks and its ability to free up capacity at Liverpool Street to allow other train services to be expanded. The North Kent Line via Royal Docks corridor from Abbey Wood was selected on the basis of its role in assisting regeneration and economic development in the Thames Gateway, including the Isle of Dogs and Royal Docks; and
- to the west of central London, the Great Western Main Line was included in the preferred scheme, with services to both Heathrow and Maidenhead. Use of this corridor would improve links to Heathrow Airport, provide large journey time savings to the City and Isle of Dogs and achieve crowding relief on London Underground lines in west London.

References

Abercrombie (1945) Greater London Plan 1944, HMSO

CLRLL (2002) Study of Alternative Crossrail Alignment: Northern Route,

Department for the Environment, Transport and the Regions (DETR) (1998) A New Deal for Transport: Better for Everyone, DETR, 1998

Department for Transport (DfT) et al (1989), Central London Rail Study

DfT (2004) The Review of the Crossrail Business Case

Shadow Strategic Rail Authority (sSRA) (2000), London East West Study (LEWS)

Appendix 1: GOMMMS Sub-objectives

Objective	Sub-objective
Environment	<ul style="list-style-type: none"> • Reduce noise • Improve local air quality • Reduce greenhouse gases • Protect and enhance the landscape • Protect and enhance the townscape • Protect the heritage value of historic resources • Support diversity • Protect the water environment • Encourage physical fitness • Improve journey ambience
Economy	<ul style="list-style-type: none"> • Improve transport economic efficiency • Provide beneficial wider economic impacts • Improve reliability
Safety	<ul style="list-style-type: none"> • Reduce accidents • Improve security
Accessibility	<ul style="list-style-type: none"> • Improve option values • Reduce severance • Improve access to the transport system
Integration	<ul style="list-style-type: none"> • Improve transport interchange • Integrate transport policy with land-use policy • Integrate transport policy with other Government policies

DEVELOPMENT OF THE CROSSRAIL ROUTE – APPENDIX 1 – WESTERN ROUTE OPTIONS



