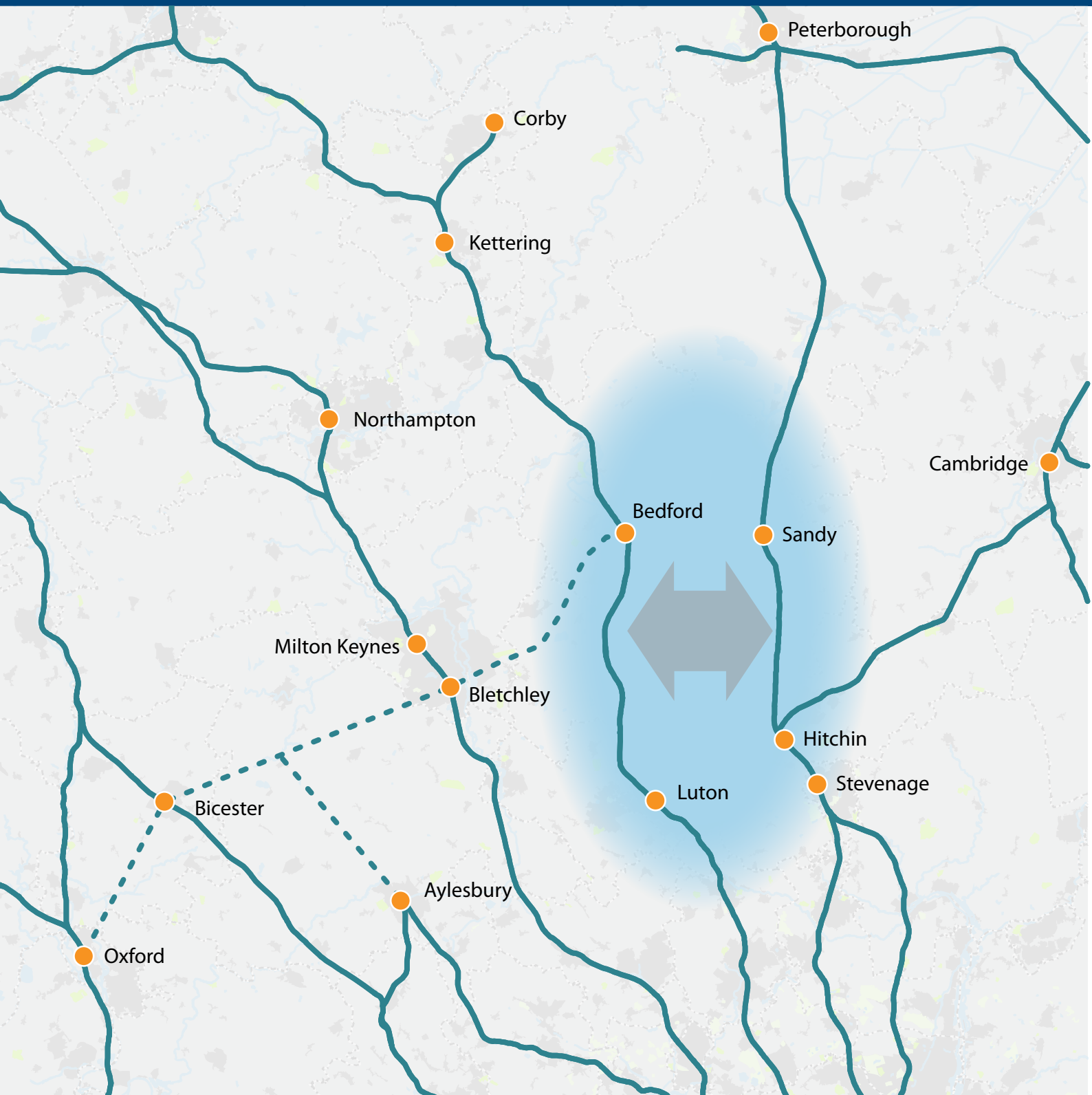
steer davies gleave

EAST WEST RAIL CENTRAL SECTION - OPERATING CASE

Discussion Paper

February 2009



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GLOSSARY

Abbreviation	Full name	Explanation where required
DfT	Department for Transport	
ECML	East Coast Main Line	The main rail route from London Kings Cross to Peterborough, Yorkshire, Newcastle and Edinburgh
EWRC	East West Rail Consortium	
FTAC	Fixed Track Access Charge	A fixed charge paid to Network Rail by franchised TOCs
GJT	Generalised Journey Time	In UK rail planning, a measure combining service frequency and in-vehicle journey time
GRIP	Guide to Rail Investment Projects	The rail industry framework for developing projects
IVT	In-Vehicle Time (Rail)	
LENNON	Latest Earnings Networked Nationally Over Night	The rail industry' central ticket sales data system
MML	Midland Main Line	The main rail route from London St Pancras to Bedford, Leicester, the East Midlands and Sheffield
ORCATS	Operational Research Computerised Allocation of Tickets to Services	A model used to allocate ticket revenue to services and hence to TOCs. An 'ORCATS raid' is the colloquial term for a new or revised service that is designed to 'poach' revenue (though not necessarily passengers) from an existing operator by exploiting the ORCATS system, rather than expanding the market as a whole
ORR	Office of Rail Regulation	
PDFH	Passenger Demand Forecasting Handbook	The 'industry standard' source of demand forecasting methodology and parameters
RJT	Road Journey Time	
TEMPRO	Trip End Model Presentation Program	The national database of trip end model projections, maintained by the DfT
TOC	Train Operating Company	Any operator of passenger or freight trains on the National Rail network
VTAC	Variable Track Access Charge	A charge paid by all TOCs to Network Rail per vehicle mile (varying by vehicle type), intended to account for the marginal cost of maintenance imposed
WCML	West Coast Main Line	The main rail route from London Euston to Milton Keynes, the West Midlands, NW England, North Wales and Glasgow
-	Chord	A relatively short link between two rail routes, either where they cross or in the angle where they join

Abbreviation	Full name	Explanation where required
-	Diagram	The individual journeys timetabled to be operated by a single item of rolling stock on any day
-	Down	(Generally) the direction away from London
-	Elasticity model	A model that predicts the change in an existing level of demand (or revenue etc) in response to a change in some variable (e.g. fare, journey time)
-	Headway	The time between consecutive trains in the same direction
-	MOIRA	A UK rail demand forecasting model based on detailed timetable data and existing rail demand
-	Pathing	Arranging the timing of trains to maintain headways and intervals that the infrastructure can accommodate, and hence avoiding conflicts
-	Standard Hour	A timetable pattern that is repeated through all or part of the day at the same 'minutes past each hour'
-	UK Rail	A term used when considering cost and revenue impacts on the UK rail industry as a whole, ignoring the effects on individual TOCs
-	Up	(Generally) the direction towards London

FOREWORD – NEIL GIBSON

EAST WEST RAIL – CENTRAL SECTION

DISCUSSION PAPER

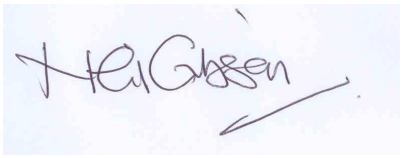
FOREWORD

The overarching objective of the EWR Consortium is to reopen the railway between Oxford and Cambridge to provide a strategic orbital rail link between the East of England and Central Southern England, avoiding the need to travel via London and connecting with all "core" radial routes out of London. It should support the O2C (Oxford to Cambridge) technology arc and should connect major areas of housing, jobs and growth across the South East and Eastern regions making for more sustainable communities.

The momentum behind the Western section (Bedford, Milton Keynes, Aylesbury and Oxford) of the East West Rail route has been building rapidly and work has now commenced on single option development outline design.

In 2008, the Consortium decided that it was timely to revisit the route option work for east of Bedford which had been undertaken in the late 1990s. Steer, Davies Gleave were therefore commissioned to take a fresh look at the opportunities and constraints currently presented and report their findings. The developments that have prompted this include: the growth area strategies, with substantial additional growth in housing and jobs across the region, major expansion of both Luton and Stansted airports and the granting of planning permission for the rowing lake just to the east of Bedford.

The findings of this report have been reviewed by the Consortium Steering Group over the past few months and the stage now reached for wider stakeholder engagement. The cover letter explains the process with the intention of trying to reach a consensus on a preferred routing strategy which can be fed into the East of England Plan review later this year.



Neil Gibson

Chair, East West Rail Consortium

February 2009

1. EXECUTIVE SUMMARY

1.1 The Western Section (Bedford, Milton Keynes, Aylesbury and Oxford) of the East West Rail route has been progressing over the last few years and has now reached GRIP 3 stage. A contract has recently been let to progress the scheme to GRIP 4 by December 2009.

1.2 The overarching objective of the EWR projects is to reopen the railway between Oxford and Cambridge to provide a strategic orbital rail link between the East of England and Central Southern England, avoiding the need to travel via London and connecting with all "core" radial routes out of London. It should support the O2C (Oxford to Cambridge) technology arc and should connect major areas of housing, jobs and growth across the Region, making for more sustainable communities.

1.3 Over the last few years there have been a number of developments, as a result of which the EWR Consortium considered it worthwhile to re-examine the options for the Central Section (the link between the Midland Main Line and the East Coast Main Line), which would complete the connections and enable through services from east to west across the sub-region. The developments that have prompted this include: the growth area strategies, with substantial additional growth in housing and jobs across the region, major expansion of both Luton and Stansted airports and the granting of planning permission for the rowing lake just to the east of Bedford. This lake would sever the previously adopted route between Bedford and Sandy.

1.4 The conclusion of the previous high level routeing assessment was that three basic route options should be investigated further, to determine whether there is an operating case that does not require a large long term subsidy (on the basis that options with a heavy subsidy requirement would be almost impossible to deliver in today's rail industry, irrespective of the capital cost). The three route options were:

- a southern route via a new link to the Midland Main Line in the Stewartby area, Luton, Luton Airport Parkway and a new alignment from there to Stevenage;
- a central route via Bedford, Sandy and the ECML, or via the former Bedford-Hitchin railway alignment;
- a northern route via Bedford, Kettering, Corby, Manton and Stamford to Peterborough.

1.5 Consideration was also given to a direct route from Bedford generally routeing via Sandy and across country to Cambridge. This route would require an additional 20 miles of new alignment east of Sandy. The additional cost of this would very high, more than doubling the cost and deliverability challenges of any other route. Although the direct journey time to Cambridge would be the shortest, the passenger interchange opportunities with the East Coast Main Line corridor would be significantly reduced, effecting the overall demand and viability of the business case. In addition, this route would just duplicate the existing Hitchin – Cambridge line some 8-10 miles to the south. This route was not pursued further as it was considered undeliverable predominantly on cost grounds.

1.6 The scope of this work was to revisit the Central Section, giving consideration to the following:

- a planning assessment to establish definitive land use assumptions for demand modelling;
- a review of the routeing options;
- demand forecasting;
- an outline service plan; and
- the establishment of an operating case.

1.7 The service patterns were developed by building on one of the Western Section timetables for the GRIP 3 study, with minor modifications. This is simply to give a sound basis for analysis and does not show any preference for a particular Western Section option. Also, a limited number of additional stops could be incorporated in any of the options, although this would increase the journey times.

1.8 Initially the eastern termini for services were considered as Stansted and Cambridge; subsequently, however, the Cambridge terminus was replaced by through services to Norwich and Ipswich (replacing part or all of the existing services east of Cambridge).

1.9 In the initial optioneering process, a number of different service patterns and routeing sub-options were considered for each of the basic routes, with combinations of through services from Birmingham & Reading to Stansted, Reading to Cambridge, Aylesbury to Peterborough, Aylesbury to Milton Keynes, Aylesbury to Bedford and Reading to Milton Keynes. Revenues and operating costs were determined to identify the broad operating case for each route and indicative capital costs were estimated. Generally all services were hourly, giving at least 2tph on the core route between the ECML and the Great Western.

1.10 Two key conclusions were reached at this stage and endorsed by the consortium:

- Through services to Birmingham incurred more additional operating cost than additional revenue, and were competing against existing fast WCML services between Birmingham and Milton Keynes. Further service pattern assessment should not take services north of Milton Keynes.
- The Northern route would require the largest long term financial support and delivered the lowest revenues, although at the lowest capital cost. On this basis it is the least likely option to receive DfT support or inclusion in any franchise specification. A service on this route would not deliver the core EWR objective of connecting Oxford with Cambridge to create a strategic orbital route between the East of England and Central Southern England. In addition, the journey times between places such as Oxford and Cambridge would still be quicker via London, including interchange and use of the Underground. Therefore no further work was to be undertaken on the northern route.

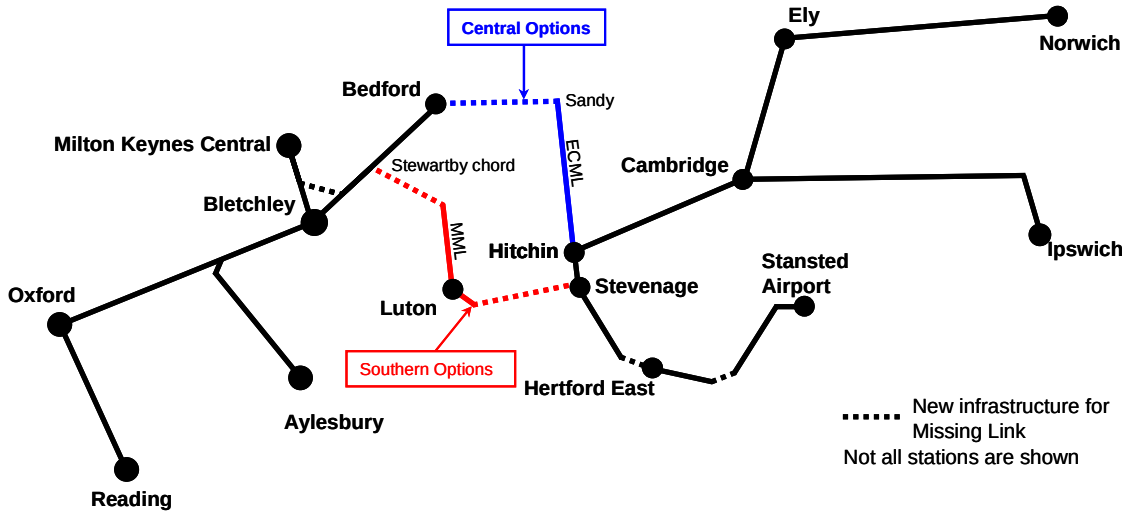
1.11 Five options were identified and agreed to be taken forward, three on the southern route via Luton and Stevenage and two on the central route via Sandy and Hitchin. These comprised the service patterns shown in Table 1.1.

TABLE 1.1 OPTIONS SELECTED FOR OPERATING CASE ASSESSMENT

	Southern (Luton) Options			Central (Sandy) Options	
	1A	1B	1C	2A	2B
Hourly	Reading-Oxford-Milton Keynes	Reading-Oxford-Milton Keynes	Reading-Oxford-Milton Keynes	Reading-Oxford-Milton Keynes	Reading-Oxford-Milton Keynes
Hourly	Reading-Oxford-Luton-Stevenage-Stansted Airport	Reading-Oxford-Luton-Stevenage-Cambridge, then Norwich or Ipswich (each every 2 hrs)	Reading-Oxford-Luton-Stevenage-Cambridge-Ipswich	Reading-Oxford-Bedford-Sandy-Stevenage-Stansted Airport	Reading-Oxford-Bedford-Sandy-Stevenage-Cambridge, then Norwich or Ipswich (each every 2 hrs)
Hourly	Aylesbury-Bedford	Aylesbury-Bedford	Aylesbury-Bedford	Aylesbury-Milton Keynes	Aylesbury-Milton Keynes
Hourly	Milton Keynes-Luton-Stevenage-Stansted Airport	Milton Keynes-Luton-Stevenage-Stansted Airport	Milton Keynes-Luton-Stevenage-Cambridge-Norwich	Milton Keynes-Bedford-Sandy-Stevenage-Stansted Airport	Milton Keynes-Bedford-Sandy-Stevenage-Stansted Airport
Two-hourly	Bletchley-Bedford stopping service	Bletchley-Bedford stopping service	Bletchley-Bedford stopping service	Bletchley-Bedford stopping service	Bletchley-Bedford stopping service

1.12 A composite map of the routeings is shown in Figure 1.1.

FIGURE 1.1 OUTLINE PLAN OF OPTIONS SELECTED FOR OPERATING CASE ASSESSMENT



1.13 The timetabling work identified competitive journey times between the key nodes, which reinforced the potential for direct EWR services. The journey time

comparisons below are given for the southern route, which is typically about 10mins faster than the central route. It should be borne in mind that this comparison does not take into account any specific journey time penalty for interchanging, which would not be insignificant given that journeys via London require at least two interchanges.

TABLE 1.2 SAMPLE NODE JOURNEY TIMES (HOURS/MINUTES)

Journey	EWR	Existing Rail
Oxford - Cambridge	1:45	2:30
Oxford - Stevenage	1:15	2:15
Ipswich - Oxford	2:25	3:07
Stansted - Oxford	2:10	2:41
Norwich – Milton Keynes	1:55	3:10

1.14 An overview has been undertaken of each of the routes, to identify the core infrastructure requirements and whether there are any insurmountable obstacles to delivery. The cost range is broadly from £50m for the Northern route where only a chord is required, to £300m - £400m for the southern and central routes. In delivery terms, there will be significant challenges establishing the connections through to Stansted and the southern route would require a significant amount of tunnelling, although this is more a cost than a delivery issue. The central route would have the challenge of bypassing the rowing lake. However, at this juncture we do not believe that any of the routes are technically undeliverable.

1.15 The demand and revenue forecasts for the options were developed from a gravity model calibrated against around 1000 non-London rail flows within the wider South East. This is a similar approach to that used for the Western Section of EWR and the recognised approach for new rail links. The model has taken into account the significant growth across the region up to 2031 using a combination of existing data sources and discussions with the local authorities

1.16 The UK Rail operating revenues, the net additional revenues received by the rail industry as a result of the new service, in 2016 and 2031 are shown in the table below.

TABLE 1.3 UK RAIL REVENUE (£MPA)

Option	2016	2031
Option 1A	14.1	24.7
Option 1B	16.4	28.5
Option 1C	16.7	28.8
Option 2A	11.3	19.5
Option 2B	13.9	23.8

1.17 The operating costs for the service patterns have been developed taking into account all the costs of operating the trains, including maintenance and the costs associated with operating on the existing rail network/infrastructure including capacity and access charges. As with the revenues, which are the incremental element resulting from the new services, the operating costs are also incremental and allow for the savings resulting from existing services which would be replaced or subsumed. The resultant operating costs are given in the table below.

TABLE 1.4 UK RAIL OPERATING COSTS (£MPA)

Option	2016	2031
Option 1A	18.71	35.98
Option 1B	19.21	34.28
Option 1C	18.34	33.21
Option 2A	18.13	34.99
Option 2B	18.50	33.16

Note: this table assumes that Fixed Track Access Charges are phased in over time between opening and 2031

1.18 As with the Western Section operating case we have defined a scenario whereby the cost of the rolling stock has been taken out, on the assumption that the cost of this could be capitalised. This reduces the operating cost in the table above by some £4m-£5m per year.

1.19 The operating case has been assessed both for the whole of EWR (including the Western Section services) and as an incremental scheme (impact of the Central Section, over and above the Western Section). The operating case for the whole scheme is stronger than for the incremental scheme, which is to be expected given the strength of the case for the Western Section.

Synopsis

Northern Route

- Little or no journey times advantage over existing routes, which include two interchanges in London
- Very poor operating case and services will require very large yearly support ad infinitum
- Relatively easy to deliver
- Infrastructure significantly cheaper than any other option

Central Route

- Significantly shorter journey times than current routes
- Services to Cambridge and beyond perform more strongly than those to Stansted
- Service operating costs similar to the southern route
- Incremental revenues about 80% of those on the southern route
- Operating case will require significant support for a long time even if the cost of rolling stock is excluded
- Deliverability challenges: routeing out of Bedford, by-pass of rowing lake, connection to ECML, pathing on ECML, connection to the new Hitchin chord
- Infrastructure costs with all services going to Cambridge (option 2C) approximately £250m

Southern Route

- Significantly shorter journey times than current routes
- Services to Cambridge and beyond perform more strongly than those to Stansted
- Service operating costs similar to the central route
- Highest incremental revenues
- Strongest operating case with the revenues exceeding operating costs if the cost of rolling stock is excluded
- Deliverability challenges: connection to Midland Main Line, tunnelling eastwards from the Midland Main Line in the vicinity of Luton Airport, connection at Langley junction just south of Stevenage
- Infrastructure costs with all services going to Cambridge (option 1C) approximately £300m

2. INTRODUCTION AND SCOPE

Background

2.1 The complete EWR project is to reopen the railway between Oxford – Cambridge to provide a strategic orbital rail link between the East of England and Central Southern England avoiding the need to travel via London and connecting with all "core" radial routes out of London. It should support the O2C (Oxford to Cambridge) technology arc and should connect major areas of housing, jobs and growth across the Region, making more sustainable communities.

2.2 Whilst the Western Section of EWR was being progressed, the consortium commissioned Steer Davies Gleave to re-visit the Central Section, the connection between the Midland Main Line (MML) and the East Coast Main Line (ECML). Since the previous work done early in this decade in partnership between EWRC, Skanska and GB Railways, significant changes have occurred in terms of the magnitude of growth across the region in terms of housing and jobs. In addition, substantial growth is projected for both Luton and Stansted airports; indeed the latter is developing its proposals for a second runway.

2.3 Another factor in re-visiting this section has been the granting of planning permission for the rowing lake, to the east of Bedford, which crosses the previous Bedford – Sandy alignment, thus rendering the previous EWRC preferred route undeliverable.

2.4 This work was to initially re-visit the routeing options across a wide area ranging from Peterborough in the north to outer London in the south, and then focus in on the options with the best potential to develop operating case scenarios

Commission and Scope

2.5 The early assessment of feasible alignments for the Central Section gave rise to three basic routes east of Bletchley:

- a southern route via a new link to the Midland Main Line, Luton, Luton Airport Parkway and a new alignment from there to Stevenage;
- a central route via Bedford, Sandy and the ECML, or via the former Bedford-Hitchin railway alignment;
- a northern route via Bedford, Kettering, Corby, Manton and Stamford to Peterborough.

2.6 The conclusions of earlier work on these options were presented to the East West Rail Consortium meeting on 13 March 2007. This covered forecast growth in population and employment at key locations in the EWR corridor, outline route options, approximate journey times and a qualitative assessment of the options under the headings of journey times, demand potential, costs and deliverability.

2.7 At the same Consortium meeting it was agreed to commission Steer Davies Gleave to prepare an updated assessment of the Central Section. This would include:

- a planning assessment to establish definitive land use assumptions for demand modelling;

- a review of the routeing options;
- demand forecasting;
- an outline service plan; and
- the establishment of an operating case.

2.8 Interim findings were presented to Consortium meetings in June 2007 and January 2008. This report brings together these findings and includes updated forecasts of demand, revenue and operating costs following changes to the options suggested by the Consortium at the meetings.

3. OPTION DEVELOPMENT

General

3.1 This chapter documents the options developed and tested during the course of the study and the process by which the final options for operating case assessment were arrived at. In it we present demand, revenue and operating cost estimates that were prepared at stages of the process - the methodology by which these were developed is discussed in later chapters. The final operating case is presented in more detail in Chapter 6.

3.2 This study took place in parallel with a study of the EWR Western Section scheme between Oxford, Milton Keynes, Aylesbury and Bedford, which is the most developed section of the overall route. The previous Central Section options were developed before the outputs of the work on the Western Section were available and therefore took no account of proposals for service patterns at the west end of the route.

3.3 However, during the course of the work, the timetables developed for the Western Section became established. To avoid compromising the objectives met by these timetables, it was therefore decided that all subsequent Central Section service patterns should build on the Western Section timetables. Furthermore, because of constraints on paths on the WCML, it was decided to retain the actual timings between Bletchley and Milton Keynes established in the Western Section work and 'drive' all the Central Section timetables from these.

3.4 The Western Section service pattern chosen to form the basis of the timetable development was Option 8A, the preferred Local Rail option (with one modification as described below). This approach does not anticipate a decision to pursue the Local Rail option in preference to the Regional Rail option assessed in the Western Section study, but was adopted because it offered the most suitable pattern on which to build services to the east. Option 8A consisted of:

- One train per hour between Oxford and Milton Keynes, calling at Bicester Town, Winslow and Bletchley, and occasionally at Islip;
- One train per hour between Oxford and Bedford, calling at Bicester Town, Newton Longville, Bletchley, Woburn Sands, and occasionally at Islip;
- One train per hour between Aylesbury and Milton Keynes, calling at Aylesbury Vale Parkway, Winslow and Bletchley; and
- One train every two hours between Bletchley and Bedford, calling at all intermediate stations.
- (These services would absorb the existing Oxford-Bicester and Bletchley-Bedford services).

3.5 One modification was made to the Option 8A timetable before developing the Central Section timetables, and this was to remove the intermediate calls at Winslow and Newton Longville, making the resulting services closer in terms of journey times to the Regional Rail option. The reason for this was that the extension to the east would open up a range of longer distance rail trips, and it was considered important to maximise the potential for these by offering the best possible journey times. Again, this choice does not imply that these two stations are not favoured, but omitting them

enabled a more realistic calling pattern for the long distance inter-regional services to be defined for testing. Further work on Central Section options could well include them, most likely in the shorter distance services terminating at Milton Keynes or Bedford.

3.6 The Central Section timetables were developed with the aim of maximising the potential of the new infrastructure and hence were developed with services extended beyond Oxford and Milton Keynes as well as eastwards from Bletchley/Bedford. Thus:

- All options include services projected west of Oxford to start at Reading; and
- Some options were also tested with a service starting from Birmingham via Northampton.

3.7 The eastern termini were initially chosen as:

- Stansted Airport, reached via Stevenage, a new north-to-east chord at Hertford, a new chord at Broxbourne Junction, Harlow and Bishops Stortford (or, in the case of the Northern route, via Peterborough, Ely and Cambridge); and
- Cambridge, reached via Stevenage and Hitchin (in the case of the Southern route only).

3.8 In the final options, however, services terminating at Cambridge were extended east to Norwich and Ipswich, absorbing some or all of the existing services on these routes.

Preliminary Options

3.9 Preliminary demand and revenue forecasts were prepared for an initial series of options in advance of the full model being developed. These options covered all three of the basic routes described in paragraph 2.5, and consisted of the services shown below (all at one train per hour on each service, and all accompanied by a two-hourly Bletchley-Bedford stopping service[1]):

Southern (Luton) Option S1:

- Reading-Oxford-Milton Keynes
- Reading-Oxford-Luton-Stevenage-Stansted Airport
- Aylesbury-Bedford
- Birmingham-Northampton-Milton Keynes-Luton-Stevenage-Stansted Airport

Southern (Luton) Option S2:

- As S1, except that the Reading-Stansted Airport service is diverted to run to Cambridge

[1] The assumption of a two-hourly stopping service, reduced from the hourly with the advent of parallel fast services, is consistent with the options tested in the Western Section work. However, there is no operational reason why the stopping service could not run hourly as at present, though this would require an additional set and does not appear to be justified by levels of demand at intermediate stations.

Central (Sandy) Option C1:

- Reading-Oxford-Milton Keynes
- Reading-Oxford-Bedford-Sandy-Stevenage-Stansted Airport
- Aylesbury-Milton Keynes
- Birmingham-Northampton-Milton Keynes-Bedford-Sandy-Stevenage-Stansted Airport

Northern (Manton) Option N1:

- Reading-Oxford-Milton Keynes
- Reading-Oxford-Bedford-Corby-Manton-Peterborough-Cambridge-Stansted Airport
- Aylesbury-Milton Keynes (reverse)-Bedford-Corby-Manton-Peterborough

3.10 For testing purposes, the Central option was defined as running via Sandy and the ECML. However, the alternative of using the Bedford-Hitchin line (as mentioned in paragraph 2.5) would be similar in terms of journey times and the results can be regarded as applicable to either alignment.

3.11 Consideration was also given to a direct route from Bedford via Sandy and then across open country to Cambridge, following the same corridor as the original Oxford to Cambridge line. This route would require an additional 20 miles of new railway alignment east of Sandy, much of which would probably need to be on new alignment because of development that has taken place since the original line was closed in 1967 (notably the radio telescopes at the Cambridge end). The additional cost of this would very high, more than doubling the cost and deliverability challenges of any other route. Although the direct journey time to Cambridge would be the shortest, the passenger interchange opportunities with the East Coast Main Line corridor would be significantly reduced, effecting the overall demand and viability of the business case. In addition, this route would just duplicate the existing Hitchin – Cambridge line some 8-10 miles to the south. This route was not pursued further as it was considered undeliverable, predominantly on cost grounds.

3.12 These tests, which were reported to the Consortium in June 2007, were sufficient to show that the Northern option via Manton performed far less well than the other two. The full results are not repeated here but showed that the additional revenue generated for the UK railway as a whole (at 2006/7 fare levels) would be as shown in Table 3.1

TABLE 3.1 PRELIMINARY OPTIONS - REVENUE AND OPERATING COSTS

Option	UK Rail Revenue (2011)	EWR TOC Revenue (2011)	Net Operating Cost
Southern S1	£13.3m	£9.0m	£19.6m
Southern S2	£15.1m	£10.7m	£19.5m
Central C1	£11.1m	£7.6m	£18.8m
Northern N2	£9.5m	£6.0m	£17.4m

3.13 The analysis also showed that journey times to East Anglian destinations would be longer via the Northern option, and Table 3.2 shows some comparative journey times and distances from Oxford. To show relative 'indirectness' of the Northern option, comparative road and straight line distances are also included.

TABLE 3.2 PRELIMINARY OPTIONS – SAMPLE TIMES AND DISTANCES

Oxford to:	Stevenage		Cambridge		Stansted Airport	
	Time	Miles	Time	Miles	Time	Miles
Southern S1 and S2	1:15	71	1:45	101	2:10	105
Central C1	1:25	74	-	-	2:20	108
Northern N2	-	-	2:45	155	-	179*
Road (fastest route)	-	73	-	101	-	96
Straight line	-	46	-	67	-	65

* changing trains at Cambridge

3.14 Given that the Northern route was also less favoured by southern East Anglian members of the Consortium, it was agreed not to pursue this option further but to include it in a further tests as a service to Peterborough only, to gauge its potential as a link to the East Coast Main Line.

Intermediate Options

3.15 The intermediate options were the first to use the Western Section work as the basis of timetables and consisted of three options:

Southern (Luton) Option 1:

- as Preliminary Option S2

Central (Sandy) Option 2:

- as Preliminary Option C1

Northern (Manton) Option 3:

- a cut-down version of Preliminary Option N1, designed to test the case for a link to the ECML at Peterborough without the costs of extending services via the indirect route from there to Cambridge, and consisting of hourly services as follows:
  - Reading-Oxford-Milton Keynes
  - Reading-Oxford-Bedford-Corby-Manton-Peterborough
  - Aylesbury-Milton Keynes

3.16 In each case the two-hourly Bletchley-Bedford stopping service was also included as before.

3.17 Table 3.3 shows the revenue estimates prepared for these options, while the operating costs are shown in Table 3.4.

TABLE 3.3 INTERMEDIATE OPTIONS - REVENUE

Option		2011 £m/yr	2031 £m/yr
1	Incremental UK Revenue	12.6	27.0
	Incremental Revenue to Western Section	7.1	15.5
2	Incremental UK Revenue	9.1	19.1
	Incremental Revenue to Western Section	3.6	7.6
3	Incremental UK Revenue	7.6	14.7
	Incremental Revenue to Western Section	2.0	3.2

TABLE 3.4 INTERMEDIATE OPTIONS - OPERATING COSTS

Option	Total including FTAC (60%) £m/yr	Total excluding FTAC £m/yr	Incremental including FTAC (60%) £m/yr	Incremental excluding rolling stock £m/yr
1	30.9	22	22.5	17.5
2	30.5	21.7	22	17
3	19.1	13.6	10.7	7.7

3.18 A sensitivity test based on Option 1 also showed that the extension beyond Milton Keynes to Northampton and Birmingham was of little value, generating only a small amount of incremental revenue to the rail network as a whole, and mainly abstracting demand from parallel services. Because such a service is not able to compete with WCML fast trains between Milton Keynes and the West Midlands, most journeys would be faster with an interchange at Milton Keynes.

3.19 In summary, it can be seen from the evidence presented above that a service on the Northern route would require the largest long term financial support and delivers the lowest revenues, although at the lowest capital cost. On this basis it is the least likely option to receive DfT support or inclusion in any franchise specification. A service on this route would not deliver the core EWR objective of connecting Oxford – Cambridge creating a strategic orbital route between the East of England and Central Southern England. In addition, the journey times between places like Oxford and Cambridge would still be quicker routeing via London, including interchange and use of the underground.

Final Options for Operating Case Assessment

3.20 Following the presentation of these results to the Consortium in January 2008, a final set of options was defined for operating case assessment. The Northern route via Manton was dropped, and five options developed in more detail based on the Southern and Central alignments.

3.21 The final options were a development of the previously tested options and consisted of the same basic services, but with two major changes:

- The Northampton and Birmingham service was cut back to Milton Keynes; and
- Services terminating at Cambridge (where applicable) were extended to Norwich or Ipswich.

3.22 In the latter case, the treatment varied by option according to the service frequency to Cambridge – more details are presented in Chapter 4.

The four final options were as described below. They are also summarised in Table 3.5 and illustrated in

Figure 3.1 to

3.23 Figure 3.5. As before, each of the services is hourly and all options also include the two-hourly Bletchley-Bedford stopping service.

Southern (Luton) Option 1A:

- Reading-Oxford-Milton Keynes
- Reading-Oxford-Luton-Stevenage-Stansted Airport
- Aylesbury-Bedford
- Milton Keynes-Luton-Stevenage-Stansted Airport

Southern (Luton) Option 1B:

- As 1A, except that the Reading-Stansted Airport service is diverted to run to Cambridge, then alternately every two hours to Norwich or Ipswich

Southern (Luton) Option 1C:

- As 1A, except that both the Reading-Stansted Airport and Milton Keynes-Stansted Airport services are diverted to run to Cambridge, with the former continuing to Ipswich and the latter to Norwich.

Central (Sandy) Option 2A:

- Reading-Oxford-Milton Keynes
- Reading-Oxford-Bedford-Sandy-Stevenage-Stansted Airport
- Aylesbury-Milton Keynes
- Milton Keynes-Bedford-Sandy-Stevenage-Stansted Airport

Central (Sandy) Option 2B:

- As 2A, except that the Reading-Stansted Airport service is diverted to run to Cambridge, then alternately every two hours to Norwich or Ipswich

TABLE 3.5 OPTIONS SELECTED FOR OPERATING CASE ASSESSMENT

	Southern (Luton) Options			Central (Sandy) Options	
	1A	**1B**	**1C**	**2A**	**2B**
Hourly	Reading-Oxford-Milton Keynes	Reading-Oxford-Milton Keynes	Reading-Oxford-Milton Keynes	Reading-Oxford-Milton Keynes	Reading-Oxford-Milton Keynes
Hourly	Reading-Oxford-Luton-Stevenage-Stansted Airport	Reading-Oxford-Luton-Stevenage-Cambridge, then Norwich or Ipswich (each every 2 hrs)	Reading-Oxford-Luton-Stevenage-Cambridge-Ipswich	Reading-Oxford-Bedford-Sandy-Stevenage-Stansted Airport	Reading-Oxford-Bedford-Sandy-Cambridge, then Norwich or Ipswich (each every 2 hrs)
Hourly	Aylesbury-Bedford	Aylesbury-Bedford	Aylesbury-Bedford	Aylesbury-Milton Keynes	Aylesbury-Milton Keynes
Hourly	Milton Keynes-Luton-Stevenage-Stansted Airport	Milton Keynes-Luton-Stevenage-Stansted Airport	Milton Keynes-Luton-Stevenage-Cambridge-Norwich	Milton Keynes-Bedford-Sandy-Stevenage-Stansted Airport	Milton Keynes-Bedford-Sandy-Stevenage-Stansted Airport
Two-hourly	Bletchley-Bedford stopping service	Bletchley-Bedford stopping service	Bletchley-Bedford stopping service	Bletchley-Bedford stopping service	Bletchley-Bedford stopping service

Note: The bars shown in the left hand column correspond to the colours used in the figures below.

FIGURE 3.1 FINAL OPTION 1A

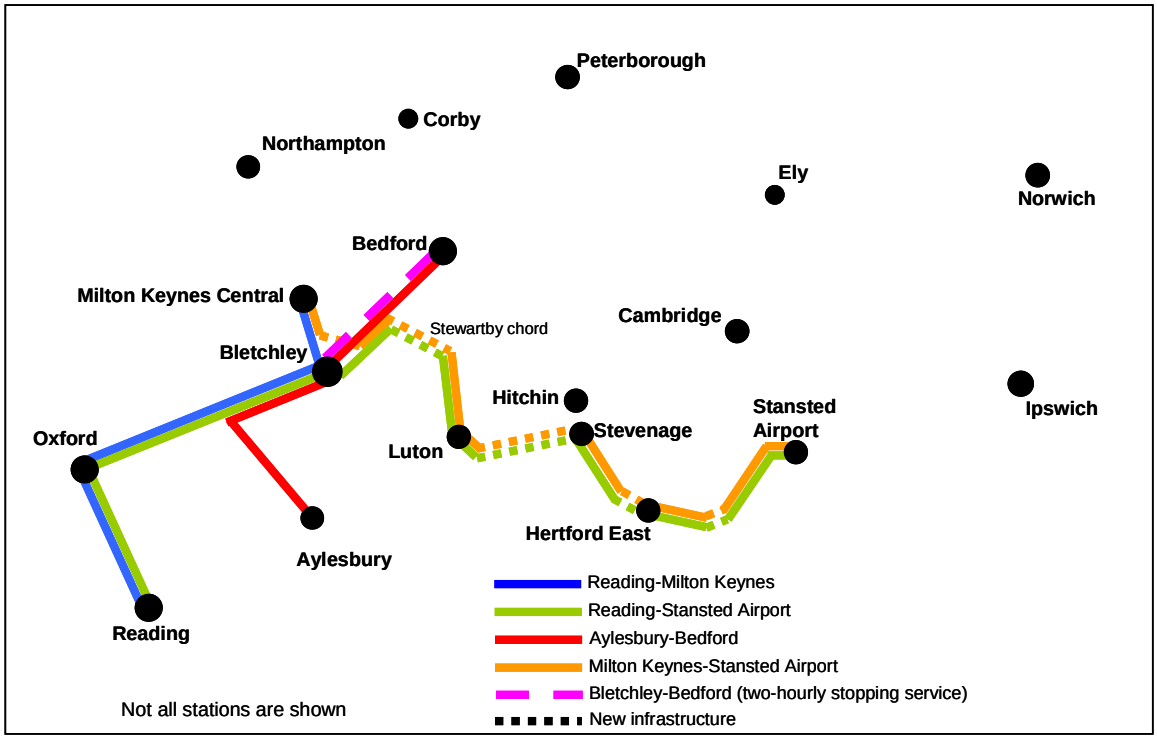


FIGURE 3.2 FINAL OPTION 1B

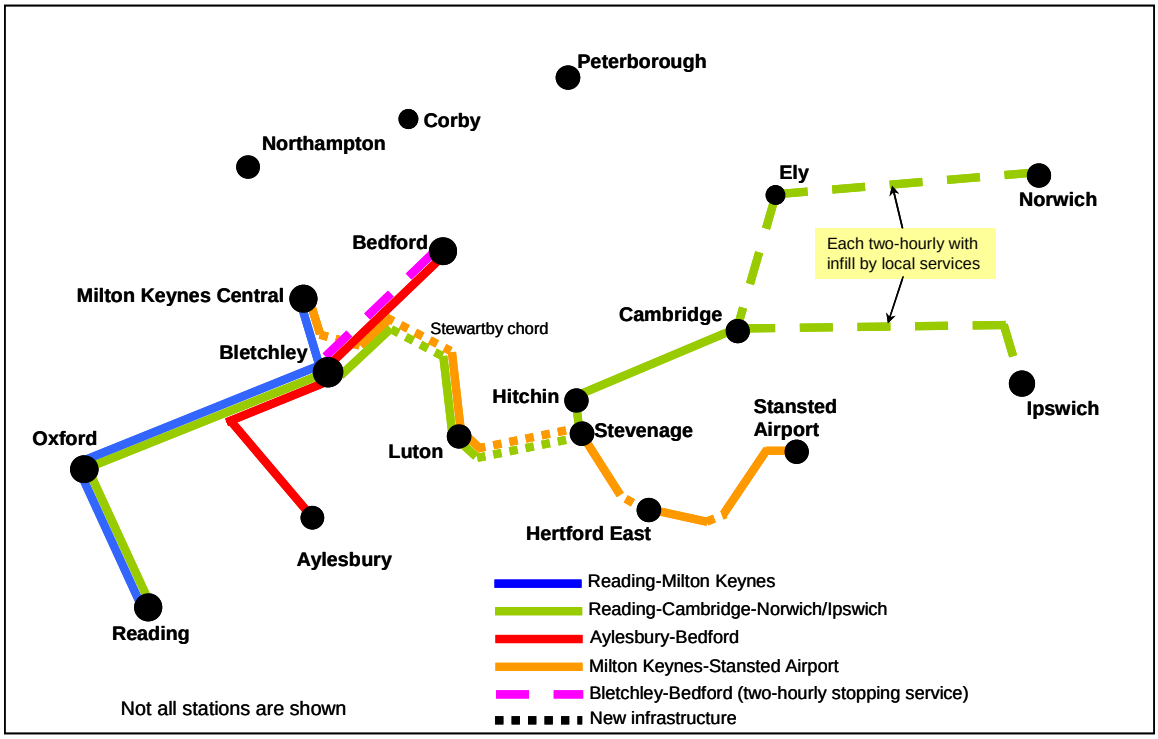


FIGURE 3.3 FINAL OPTION 1C

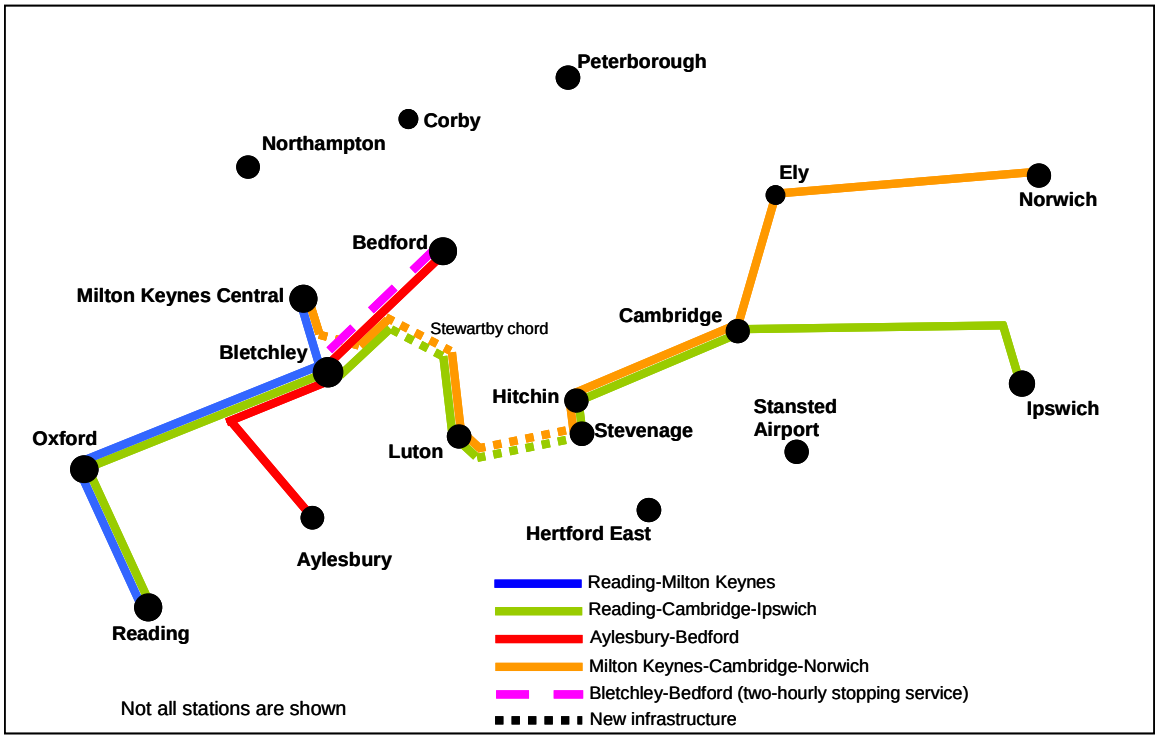


FIGURE 3.4 FINAL OPTION 2A

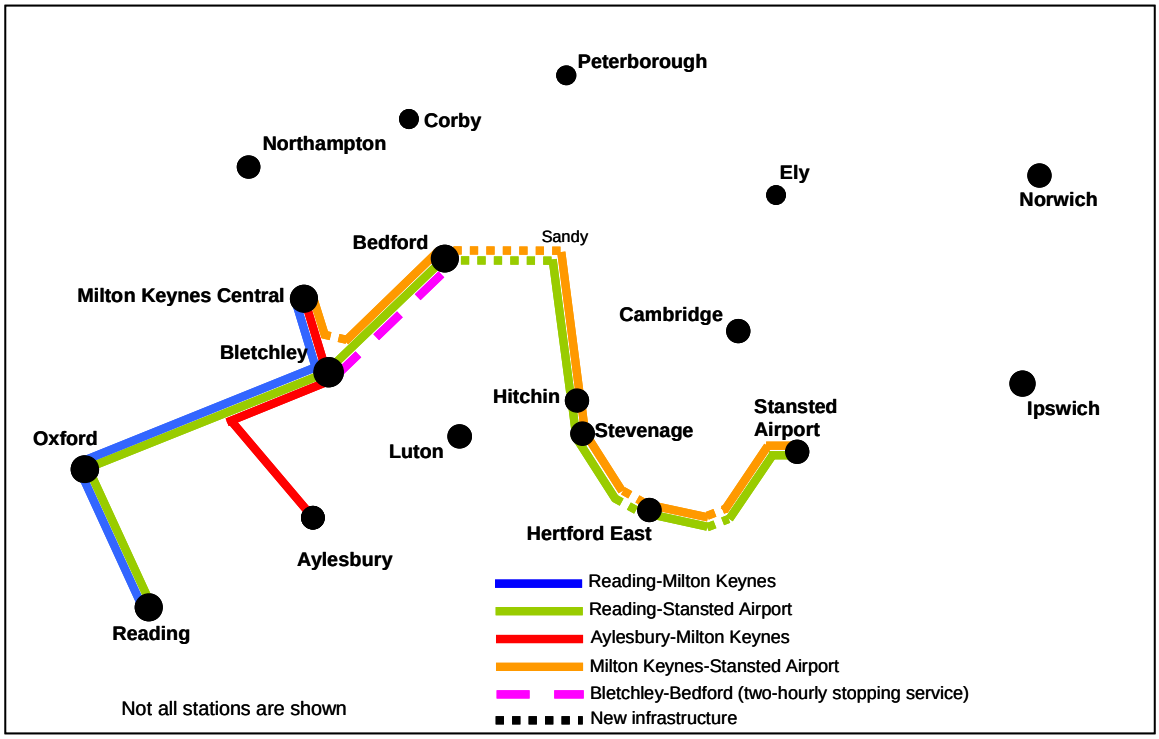
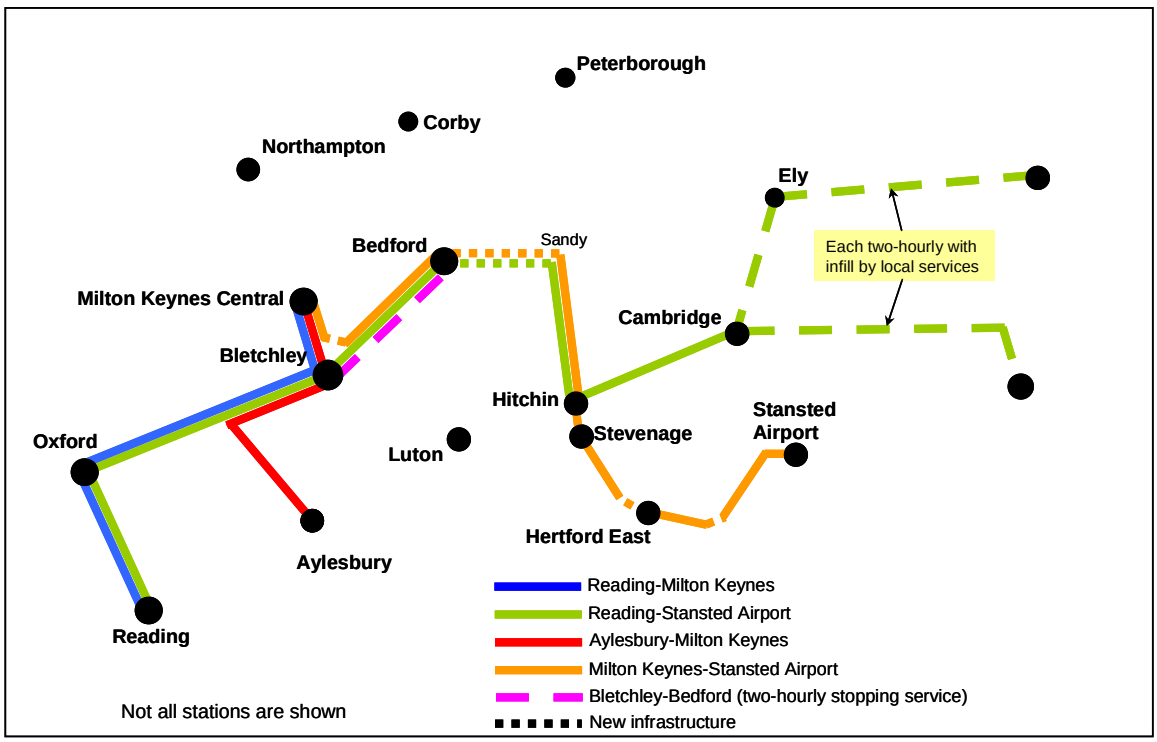


FIGURE 3.5 FINAL OPTION 2B



4. TIMETABLING AND OPERATIONS

Timetable Planning

4.1 As mentioned previously, the Central Section service patterns were based on the work on the Western Section and the timings between Oxford, Milton Keynes, Aylesbury and Bedford were retained as far as possible, particularly in respect of the available paths on the WCML between Bletchley and Milton Keynes. Together with the need to retain even headways (approximately, at least) on common sections, effectively determined the timings of most of the Central Section services. However, a considerable amount of planning work was required to ensure a workable set of timetables with a sufficient level of detail for demand forecasting.

4.2 The Western Section work included a considerable amount of detailed modelling to establish sectional running times for timetabling, at a level of certainty appropriate to the stage of project development. For route sections beyond the extent of the Western Section schemes, it was necessary to define inter-station times for the Central Section services. This was done in a number of ways:

- by reference to existing public timetables (public times being what is required for demand modelling), where existing;
- by reference to run time models developed in earlier phases of the EWR project, for example between Bletchley and Luton and between Luton Airport Parkway and Stevenage;
- occasionally by judgement, where alignments have not yet been defined in sufficient detail to enable times to be forecast, for example the routes via the possible new chords at Hertford and Broxbourne Junction.

4.3 Other than fitting in with WCML services as mentioned, the timetables take no account of the feasibility of finding paths on existing routes. In any case, a variation of only a few minutes can make the difference between a feasible path and a conflict, and the timetables are not sufficiently accurate for this.

4.4 In one respect, existing services have been taken into account. Where EWR services have been extended east of Cambridge, they are assumed to take over the existing service, not to provide an increased frequency.

4.5 The current Cambridge-Norwich and Cambridge-Ipswich services are both hourly, with some variations in calling patterns between individual trains. In Options 1B and 2B, where the hourly EWR service splits to serve Ipswich and Norwich every two hours each, alternate trains on each route have been replaced by the through services, with infill local services to maintain the hourly frequency on each route. In option 1C, where two trains per hour serve Cambridge, the entire service has been absorbed into the EWR service pattern.

4.6 In each case, trains have been advanced or retarded to suit the arrival and departure times of EWR at Cambridge (which, as mentioned, are determined by pathing at Milton Keynes), and the local infill services in Options 1B and 2B have also been retimed to maintain even headways and allow connections at Cambridge in alternate hours when no through train is provided.

4.7 The standard hour timetables for each option are shown in Appendix A. Although a full daily timetable has not been developed, the standard hour is assumed to operate with minor variations over the full day, with early and late journeys covering parts of the route to give a similarly-timed start and end of service to each section.

Operating Cost Assumptions

4.8 The same operating cost assumptions and methodology have been adopted as for the Western Section work, and the following general description is identical to that in the Western Section main report. If required, more detail can be found in the Western Section Operating and Business Case Report (Technical Report 5).

4.9 The operating costs for the two options have estimated using a model with a similar basis to that used in earlier phases of EWR business case development, with a number of updates reflecting advice received from TOCs.

4.10 The estimates include the following cost elements:

- Rolling stock lease costs
- Fuel costs
- Rolling stock maintenance costs (including an allowance for depot access and lease costs)
- Train crew costs
- Variable Track Access Charges (VTAC)
- Capacity Charge
- Station operating and maintenance costs (for new stations)
- Station Long Term Charges (for new stations)
- Fixed Track Access Charge (FTAC) – as an option
- Station Access Charges (for stations operated by other TOCs).

4.11 Most of these are self-explanatory but some require some clarification as set out below.

Capacity Charge

4.12 The Capacity Charge is an access charge levied on TOCs per train mile on busy sections of route. As with VTAC and FTAC, the rate is determined by the Office of Rail Regulation (ORR) but unlike these costs it relates to specific route sections and varies between them. Its purpose is to compensate Network Rail for the performance impact of the services in question, in theory by balancing the extra Schedule 8 compensation payments that NR becomes liable to pay to the operators of existing services.

FTAC

4.13 There is no standard method of estimating the Fixed Track Access Charge for a piece of new infrastructure where the capital costs are externally funded. FTAC is designed to provide Network Rail with a return on the asset value of the infrastructure and provide for long term replacement. However, the charges on the existing network are

set at levels appropriate to historic infrastructure where assets are at different stages in their life cycle, whereas the new infrastructure required for EWR will potentially be provided to NR at no cost (assuming funding sourced via a Section 106 levy) and in brand new condition. Moreover, FTAC does not necessarily represent the actual costs to NR of maintaining and renewing any particular part of the network but is an artificial concept designed to channel funding.

4.14 It is arguable, therefore, that any FTAC payable by TOCs using the new infrastructure should not be based on existing levels of FTAC but on the costs that NR actually incurs on the new infrastructure. In discussions, ORR have indicated that they would not expect EWR services to incur FTAC at the full rate in proportion to the rest of the network, but were unable to offer definitive guidance on what level might be reasonable. Therefore at this stage we have treated FTAC as a sensitivity test, with assessments of the operating cost based on:

- Central Case Assumption: A ramped profile increasing linearly from zero at opening year to full charges at Year 20;
- Sensitivity Test (lower bound): No FTAC; and
- Sensitivity Test (upper bound): Full charges incurred from opening year.

4.15 In each case, the FTAC has been estimated on the basis of vehicle kilometres, using a unit rate per kilometre obtained from data published by the ORR and based on the FTAC values for Chiltern Railways and C2C, these two being selected because they operate on largely self-contained networks. The magnitude of FTAC thus equates to £1.88 per vehicle mile.

Station Related Costs

4.16 Operating and maintenance costs would be incurred for the new stations added to the network specifically for EWR. In the Western Section work, these were Bletchley High Level and, for the Local Rail Option only, Winslow and Newton Longville. The Central Section would add very few additional stations to the network, especially when, as discussed in Chapter 3, Winslow and Newton Longville are omitted. The only additional station would be a new one at Bedford St Johns on the Sandy line, and that might well replace the existing one on the curve to Bedford Midland. In view of this, and the fact that train operating costs are much higher for the Central Section services, station costs have been assumed to be insignificant in the context of overall costs and have been omitted.

4.17 For existing stations, it is assumed that the total costs of operation and maintenance (including the long term charge) do not change.

4.18 The operating cost model uses a conventional approach based on cost drivers (metrics) calculated from the timetable plans for each option, together with unit cost rates for each metric.

4.19 The model uses the cost elements and drivers shown in Table 4.1. All costs are at 2005/2006 prices, and the staff costs include an allowance for pensions, NI contributions and overheads.

TABLE 4.1 UNIT OPERATING COST DRIVERS

Cost	Unit
Rolling stock leasing charges	number of vehicles
Fuel cost	vehicle mile
Light maintenance	vehicle mile
Heavy maintenance	vehicle mile
Variable track access	vehicle mile
Capacity Charge	train mile on WCML
Driver costs	number of drivers
Revenue staff costs	number of revenue staff
Route manager costs	number of route managers

4.20 Where existing services would be replaced or altered under the EWR options, the cost savings have been estimated using the same approach for consistency, although the results may not represent the true avoidable costs under the current situation (which are in any case very difficult to attribute). The services in question are:

- The Bletchley-Bedford stopping service, which would be reduced from hourly to two-hourly;
- The Oxford-Bicester service, which would be entirely replaced by new EWR services;
- The Cambridge-Norwich and Cambridge-Ipswich services, which would be partly replaced in Options 1B and 2B, and entirely replaced in Option 1C.

4.21 Where appropriate, the cost estimates take account of the different stock types used on the existing services. In particular, the Cambridge-Ipswich route is currently operated by a mixture of Class 153 and Class 156 sets, and the cost estimates take this into account.

Baseline Operating Costs

4.22 Table 4.2 sets out the operating cost estimates for each option, split into the main elements. The savings from avoided costs, as referred to above, are also accounted for in determining the Net Total. These costs do not include FTAC or any phased costs associated with increased train lengths to accommodate demand growth, and are referred to as 'baseline' costs.

4.23 The Gross or EWR TOC cost refers to the actual estimated operating cost of the Central Section service pattern in its entirety. The Net cost refers to the cost after allowing for the existing services that are replaced. The deduction for these is clearly more for those options that serve Cambridge, Norwich and Ipswich.

TABLE 4.2 BASELINE OPERATING COST ESTIMATES

	Operating Costs (£m p.a.) for all two-car sets, 2006 prices				
	Option 1A	**Option 1B**	**Option 1C**	**Option 2A**	**Option 2B**
Gross (EWR TOC)	20.14	26.75	26.70	19.58	26.05
Less replaced	2.25	8.36	8.36	2.25	8.36
Net (UK Rail)	17.90	18.39	18.34	17.34	17.69

Allowance for Demand Growth

4.24 The basic rolling stock assumption for the Western Section is that, initially, all EWR trains will be operated by 2-car Class 172 sets, except for the residual Bletchley-Bedford stopping service, which is assumed to be operated by a single car Class 153. Analysis of the forecast demand indicated that in the initial years of operation, this would provide sufficient capacity. However, as demand grows, there will be a need for some of the allocated sets to be formed of 3 cars, the number of sets involved and the timing of the increase being dependent on the demand scenario.

4.25 Because the Central Section is a longer term scheme than the Western Section (with an assumed 2016 opening year for appraisal purposes), different assumptions on train lengthening have been adopted, with some sets formed of 3-cars from the outset, and a staged increase in the number of 3-car sets. Unlike the Western Section, the ultimate scenario retains some 2-car sets because the demand on the eastern part of the route does not require the entire fleet to be lengthened.

4.26 To avoid penalising the EWR options, allowance has also been made for train lengthening on the base Cambridge-Norwich/Ipswich services in estimating the cost savings from replacing these with EWR.

4.27 The assumptions on capacity increases are shown in Table 4.3. The lower part of this table shows the lengthening assumptions for the replaced Cambridge-Norwich/Ipswich services as referred to above.

4.28 It is assumed that there is sufficient flexibility in the pool of available rolling stock to enable 3-car sets to be introduced only when required and the displaced 2-car sets to be redeployed elsewhere. It is also assumed that maintenance spares can be provided to match the proportions of 2- and 3-car sets.

TABLE 4.3 TRAIN LENGTHENING REQUIREMENTS

Growth case	Western Section Assumption	Central Section Assumption				
		Option 1A	Option 1B	Option 1C	Option 2A	Option 2B
G0	All 2-car sets	Not applicable, since opening year assumed after this date; hence some 3-car sets are required from the start				
G1	From 2015, one peak hour train into Oxford and one peak hour train into MK strengthened to 3 cars, in both peaks	From 2016 opening, 2 out of 3 diagrams on Reading-MK service to be 3 cars	as 1A	as 1A	From 2016 opening, 2 out of 11 diagrams on Reading/ Aylesbury-MK/Stansted* service to be 3 cars	as 1A
G2	From 2021, both peak hour trains into Oxford and MK strengthened to 3 cars in both peaks, with selective strengthening in shoulder and off peaks	From 2021, all 3 diagrams on Reading-MK service, and 2 out of 6 diagrams on Reading-Stansted service to be 3 cars	From 2021, all 3 diagrams on Reading-MK service, and 2 out of 9 diagrams on Reading-Norwich/ Ipswich service to be 3 cars	From 2021, all 3 diagrams on Reading-MK service, and 2 out of 9 diagrams on Reading-Ipswich service to be 3 cars	From 2021, 5 out of 11 diagrams on Reading/ Aylesbury-MK/Stansted* service to be 3 cars	From 2021, all 3 diagrams on Reading-MK service, and 2 out of 9 diagrams on Reading-Norwich/ Ipswich service to be 3 cars
G3	From 2031, three car railway all day except for Bletchley-Bedford service where self-contained	From 2031, all 3 diagrams on Reading-MK service, and 4 out of 6 diagrams on Reading-Stansted service to be 3 cars	From 2031, all 3 diagrams on Reading-MK service, and 4 out of 9 diagrams on Reading-Norwich/ Ipswich service to be 3 cars	From 2031, all 3 diagrams on Reading-MK service, and 4 out of 9 diagrams on Reading-Ipswich service to be 3 cars	From 2031, 7 out of 11 diagrams on Reading/ Aylesbury-MK/Stansted* service to be 3 cars	From 2031, all 3 diagrams on Reading-MK service, and 4 out of 9 diagrams on Reading-Norwich/ Ipswich service to be 3 cars
G0	Replaced services east of Cambridge (all options)	Not applicable				
G1		From 2016, all single car 153 diagrams replaced with 2-car 172				
G2		From 2021, all single car 153 diagrams replaced with 2-car 172; and one Cambridge-Norwich 170 diagram to be 3 cars.				
G3		From 2031, all single car 153 diagrams replaced with 2-car 172; and two Cambridge-Norwich 170 diagrams to be 3 cars.				

* Diagrams interwork between routes on a cycle Reading-MK-Aylesbury-MK-Reading-Stansted-Reading

Full Operating Cost Estimates

4.29 Taking the above into account there are a number of combinations of options and assumptions. The total operating costs for the two key years 2016 and 2031 are summarised below in Table 4.4, both with and without FTAC.

TABLE 4.4 TOTAL OPERATING COSTS

	Operating Costs (£m pa) , 2006 prices									
	Gross (EWR TOC) (gross cost ignoring savings from replaced services)					Net (UK Rail) (net cost after deduction for replaced services)				
	1A	1B	1C	2A	2B	1A	1B	1C	2A	2B
Excluding FTAC										
From 2016	20.95	28.37	27.51	20.38	27.67	18.71	19.21	18.34	18.13	18.50
From 2031	23.06	30.44	29.55	22.36	29.75	20.82	20.37	19.49	20.12	19.69
Including FTAC										
From 2016	34.91	47.73	46.71	34.25	46.54	31.56	31.90	30.88	30.90	30.71
From 2031	39.33	52.03	50.96	38.35	50.91	35.98	34.28	33.21	34.99	33.16

Infrastructure

4.30 Mention has been made of new infrastructure additional to the Western Section that is required for Central Section services, including:

- a new chord in the Stewartby area to enable trains from Bletchley to gain the Midland Main Line towards Luton (applies to southern options 1A/1B/1C);
- a new route branching off the Midland Main Line near Luton Airport Parkway and running east to cross the East Coast Main Line and join the Hertford Loop south of Langley Junction, thus enabling access to the ECML Slow lines without Fast line conflicts (applies to southern options 1A/1B/1C);
- restoration of the former Bedford-Sandy route, with some deviation where the alignment has been, or will be, lost to development (applies to central options 2A/2B);
- a north-to-east chord at Hitchin to enable trains to run direct from Sandy to Cambridge and vice versa (applies to central option 2B).

4.31 All the above infrastructure has been examined in previous studies and although each route has its own challenges none are deemed to be undeliverable. These challenges include grade separated junctions with main lines and tunnelling on the Luton – Stevenage route and all will require land acquisition. No detailed engineering has been undertaken as part of this study; however we believe that all options are technically deliverable.

4.32 On the route via Sandy, considerable progress has been made in promoting the Bedford Rowing Lake since the earlier Central Section studies, and Planning Permission for the lake was granted in 2006. Since this severs the original Bedford-Sandy rail route, consideration needs to be given to alternatives routes. Such consideration is not part of the present work, but it has been assumed that an alternative alignment can be found.

4.33 As mentioned earlier, the alignment of the former Bedford-Hitchin railway line also provides a possible alternative link between Bedford and the ECML if the Sandy route were to be impracticable. This line was closed in stages between 1962 and 1969 but the route remains largely intact except at Shefford, where the alignment has been lost to residential and industrial development and an alternative route would be required. There is a substantial tunnel at Old Warden, which appears to be in good condition[2].

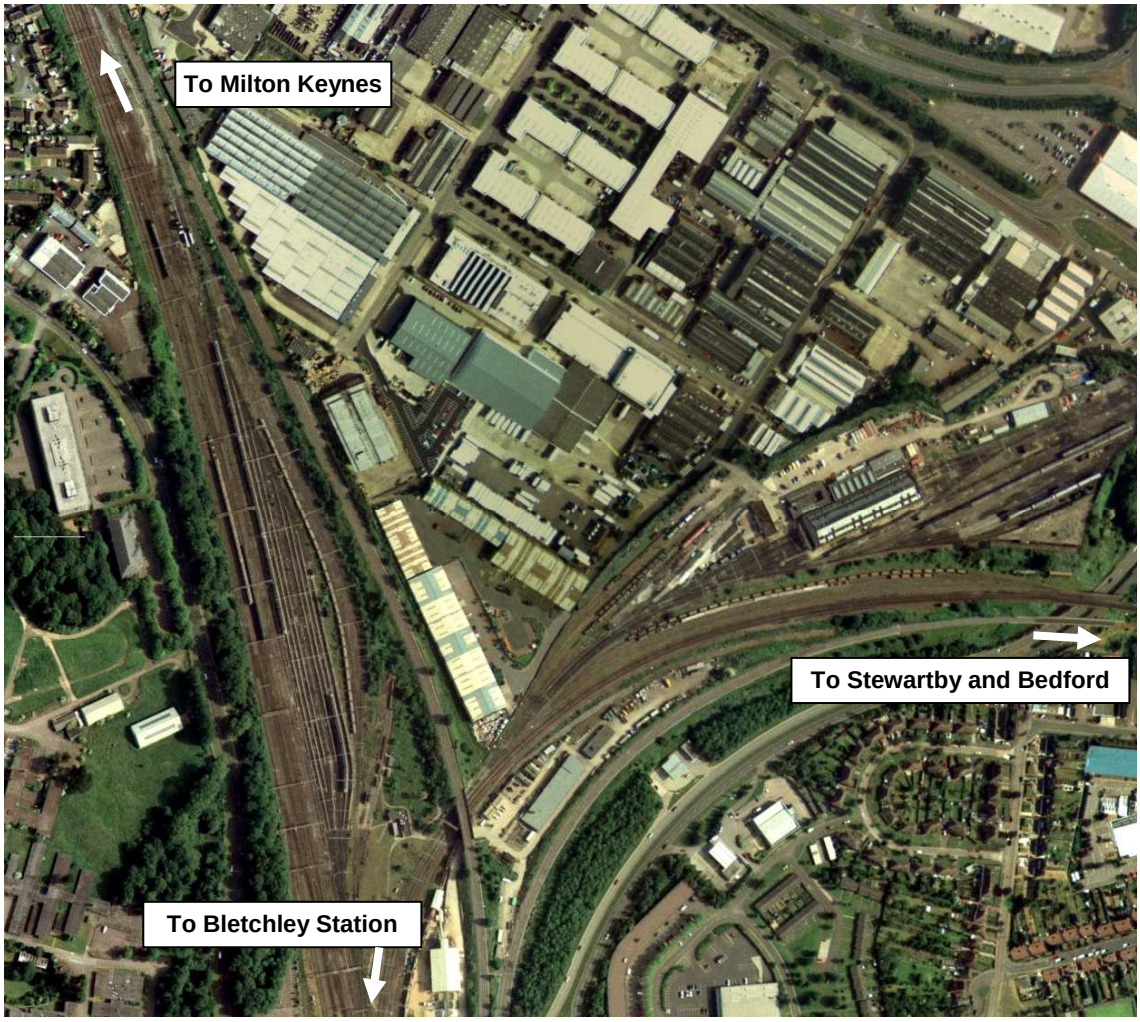
4.34 Some additional pieces of infrastructure are also required for the Central Section services now under consideration and these are discussed in outline the following section. No detailed assessment of the feasibility of these has been carried out as part of this exercise, but a very brief examination of maps and aerial photographs has been undertaken. The following is a description of the assumed infrastructure and operations at each location - it should be re-emphasised that this is preliminary and further work will be required to confirm the assumptions made.

Bletchley Chord

4.35 The options now being considered include direct services from Milton Keynes to the east. These have been assumed to use a new chord at Bletchley, passing through an area currently occupied by warehousing and Bletchley rail depot. The area is shown in Figure 4.1.

[2] http://www.darkplaces.co.uk/phpBB2/viewtopic.php?t=7416

FIGURE 4.1 BLETCHLEY CHORD LOCALITY

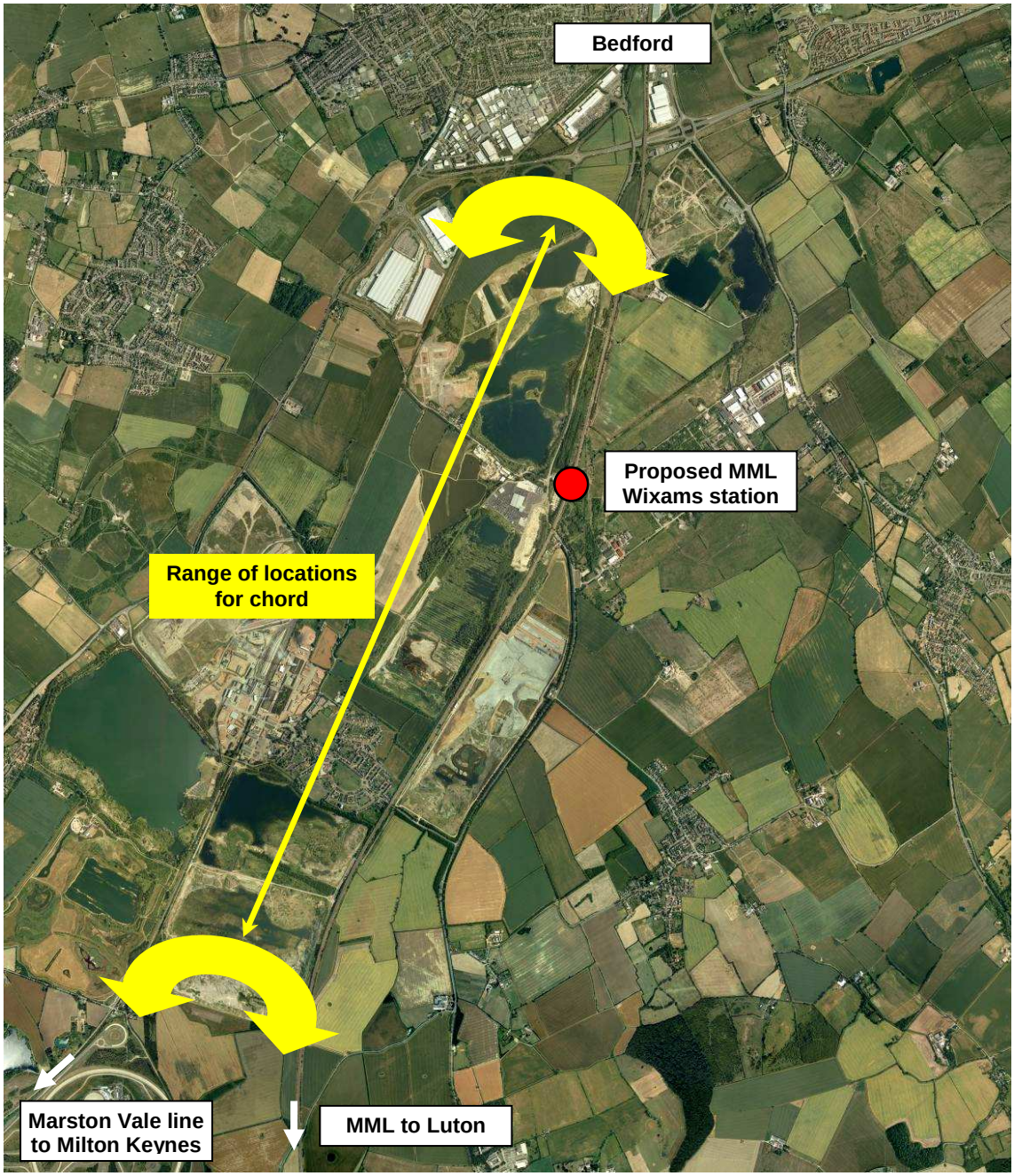


Original Aerial downloaded from Microsoft Live Search Maps, http://maps.live.com/

Stewartby Chord

4.36 The southern route requires a connection between the Marston Vale line and the Midland Main Line, which has nominally been located in the vicinity of Stewartby to give the best balance between infrastructure costs and journey time. This curve could potentially move northwards to provide a direct connection through the proposed new Wixams station on the south side of Bedford. Figure 4.2 shows the area and indicates the range of possible locations for the chord.

FIGURE 4.2 STEWARTBY



Original Aerial downloaded from Microsoft Live Search Maps, http://maps.live.com/

Hitchin Chord (North – East)

4.37 The central route would require a north to east chord from the ECML to the Cambridge line for direct through services if a reversal was not to take place at Hitchin. This chord would need to tie into the planned Hitchin Flyover. This flyover is currently being progressed by Network Rail with a Transport and Works Act Order in the summer of 2009 and completion by the end of 2013. The current design neither includes nor specifically excludes provision for the connection of a north to east chord.

Stevenage

4.38 The Luton-Stevenage link is designed to allow through running from Bletchley to Cambridge using the existing grade separation at Langley Junction and the proposed grade-separation at Hitchin[3]. The latter would bypass the existing flat junction to allow trains from the Stevenage direction towards Cambridge to diverge from the Down Slow line without crossing the other lines. It is understood that the scheme envisaged is based on a bridge over all four ECML tracks in open ground to the north of Hitchin, rather than within the urban area.

4.39 These arrangements, however, do not allow for through running from the Luton direction towards Stansted Airport via Hertford. It would be undesirable to cross the ECML without interchange, so any scheme involving a south-facing junction towards Hertford North has been discounted. Given that a scheme has already been examined (albeit some time ago) for an approach to Stevenage from the south, it was decided to retain this and assume that Stansted trains would reverse at Stevenage. However, without additional infrastructure, this would not be acceptable as it would involve significant bidirectional use of the reversible Down Slow line and excessive occupation of Platform 4 at Stevenage. It has therefore been assumed that a 5th, bidirectional track from Langley Junction to Stevenage together with a 5th platform at Stevenage can be provided. The 5th platform would only need to be long enough for EWR trains – as with Bletchley High Level.

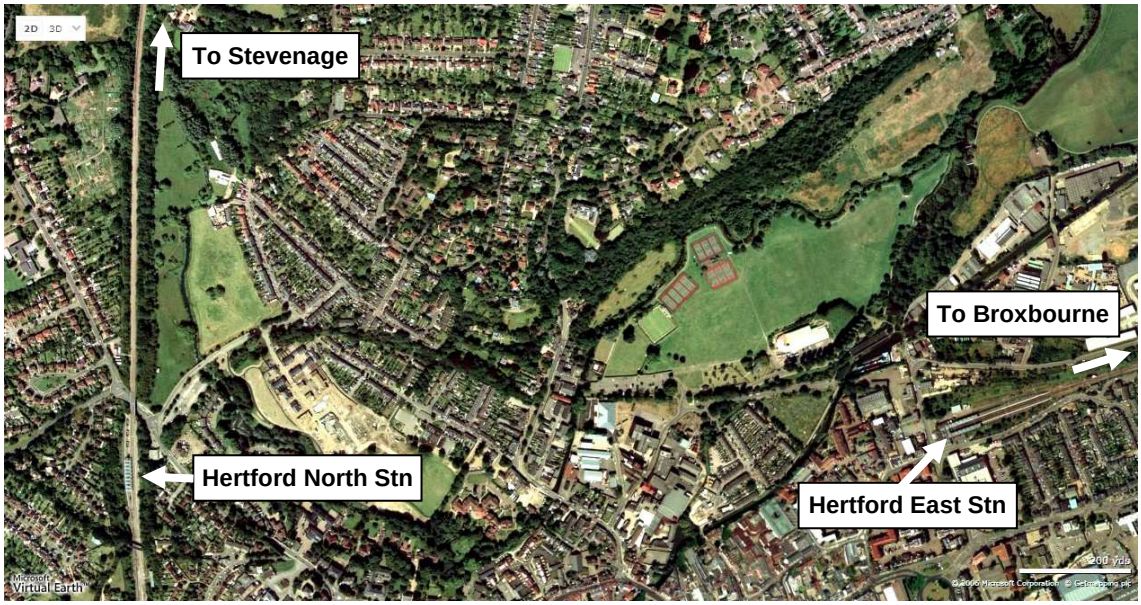
4.40 This arrangement would enable EWR trains to run parallel to the Down Slow line and reverse independently of the through lines, and would mean that EWR Stansted trains reversing at Stevenage would conflict with other trains only on the underpass section of the Down Hertford line.

Hertford Chord

4.41 Hertford is served by two lines – the former Great Northern Hertford loop via Hertford North and the Great Eastern branch from Broxbourne to Hertford East. There was formerly a link between the two provided by a branch from Welwyn Garden City to Hertford East. However, the junction of this line with the Hertford loop faced south (i.e. towards London) and the line was closed many years ago. Despite this, the alignment is still clearly visible on aerial photographs (see Figure 4.3) and encroachment by development appears relatively limited. There would no doubt be objections to reopening, especially after a long period of closure, but it appears technically possible to re-establish a railway, probably limited to single track (as was the original line) along the old route.

[3] The ECML Route Utilisation Strategy (RUS) includes this scheme as part of the strategy to deliver the outputs required by Government as defined in the High Level Output Specification (HLOS). The scheme is also included in the April 2008 update to Network Rail's Strategic Business Plan (which is part of the rail industry's response to HLOS) at an estimated cost of £50m, and in the ECML Route Plan 2008.

FIGURE 4.3 HERTFORD CHORD LOCALITY



Original Aerial downloaded from Microsoft Live Search Maps, http://maps.live.com/

4.42 More problematic is the construction of a north-facing chord to join the Hertford loop in the Stevenage direction. This would cross open green space (current use unknown) close to an existing residential area, on a sharp curve and probably elevated. There would therefore be the potential for significant visual and noise impacts.

4.43 At first sight, therefore, the new connection appears technically feasible, although doubts must be cast over its public acceptability and deliverability.

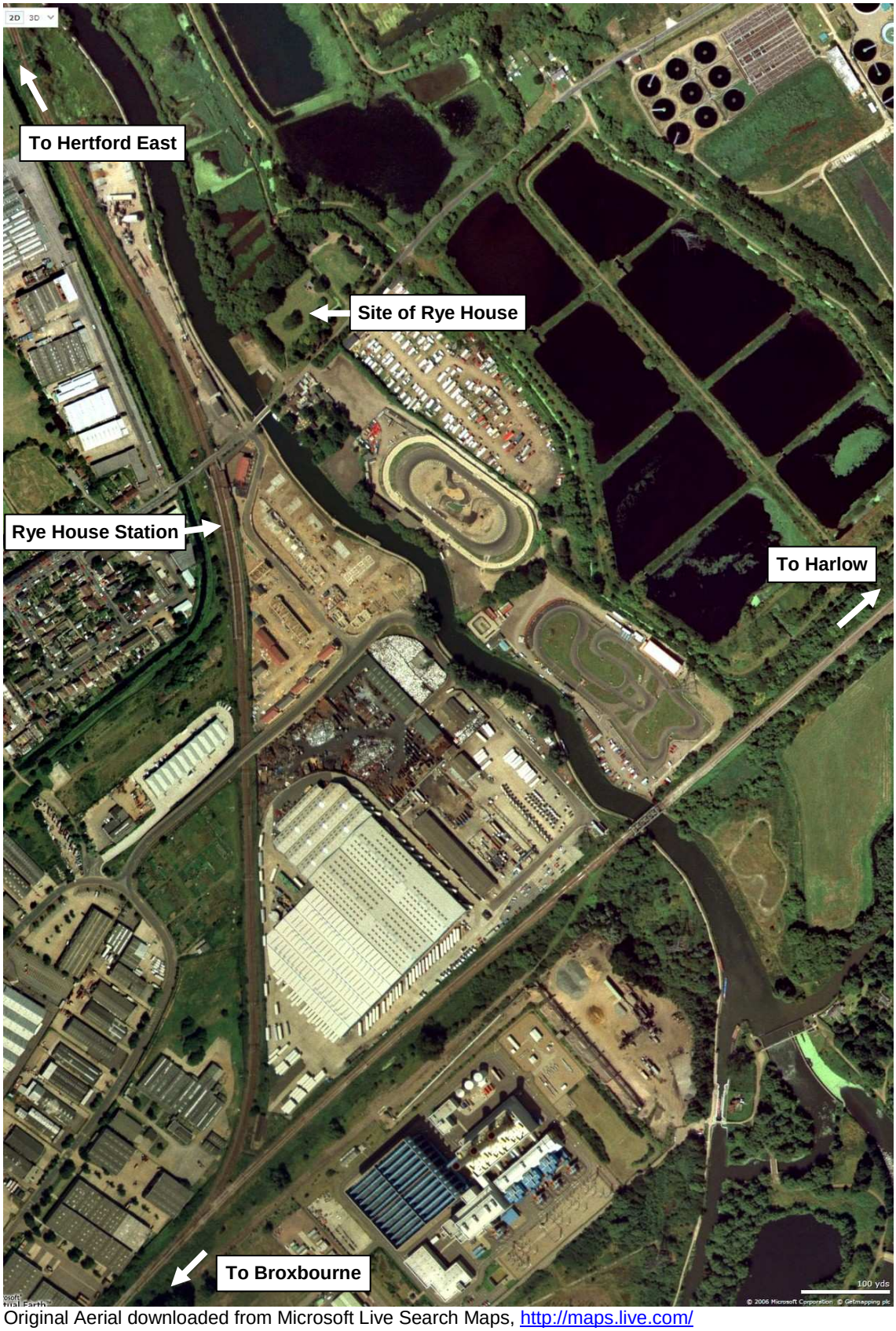
Rye House Chord

4.44 The Hertford East branch joins the Great Eastern Cambridge line at Broxbourne Junction (see Figure 4.4) facing London, and a direct chord facing towards Harlow would be required for Stansted trains. This would form a triangular junction with the existing lines.

4.45 The land uses in the angle of the two lines are mixed and include some residential development immediately east of Rye House station, warehousing close to the junction itself and leisure uses (speedway and karting tracks) to the east of the River Lea. In addition, the historic Rye House site including the extant Gatehouse is located on the east side of the river, and there are nature reserves to the north.

4.46 A chord south of Rye House station would minimise land take by making use of the warehouse site only, but would result in a very sharply curved alignment (radius 200m). A longer chord branching off the Hertford line north of the station would be very constrained by the neighbouring land uses and would probably not be acceptable because of the proximity of both the residential area and the site of Rye House. The most likely solution would be a longer chord avoiding the development but even this would bring problems with negotiating the nature reserves to the north.

FIGURE 4.4 RYE HOUSE CHORD LOCALITY



Original Aerial downloaded from Microsoft Live Search Maps, http://maps.live.com/

Capital Costs

4.47 We have not prepared detailed capital cost estimates for the infrastructure needed to enable EWR Central Section services, but we have estimated order-of-magnitude costs based on the quoted costs of rail infrastructure schemes elsewhere. These are set out in Table 4.5.

TABLE 4.5 ORDER OF MAGNITUDE INFRASTRUCTURE CAPITAL COSTS

Scheme	Order of Magnitude Cost (£m)	Options				
		1A	1B	1C	2A	2B
Bletchley N-E chord	40	Yes	Yes	Yes	Yes	Yes
Stewartby chord	30	Yes	Yes	Yes	No	No
Luton-Langley Junction	220	Yes	Yes	Yes	No	No
Stevenage 5th platform	15	Yes	Yes	No	No	No
Langley Jn-Stevenage 5th track	15	Yes	Yes	No	No	No
Bedford-Sandy	150	No	No	No	Yes	Yes
Hitchin N-E chord	50	No	No	No	No	Yes
Hertford chord	40	Yes	Yes	No	Yes	Yes
Rye House Chord	40	Yes	Yes	No	Yes	Yes
Total cost by option (£m)		**400**	**400**	**290**	**270**	**320**

4.48 For comparison purposes the cost of the central route, if services only go to Cambridge (option 2C) would be in the order of £250m.

5. DEMAND AND REVENUE FORECASTS

Overview

5.1 The proposed East-West Rail Central Section services provide a number of new journey opportunities for the communities served by the route, providing links where rail is not currently a viable option. Because of this, the 'industry standard' demand forecasting models and techniques, elasticity based models which rely upon a base level of demand from which to project, are not appropriate. Therefore, a bespoke approach has been developed to forecast potential demand and revenue for service options along the route.

5.2 A number of modelling methodologies were tested, including a mode-choice model for the corridor. However the most successful methodology tested was a form of gravity model. The theory behind the gravity model is that the propensity to travel by rail between two stations is determined by the demand potential of each station, the distance between the two stations, the quality of rail service between the stations and the quality of alternative modes of travel between the communities served by the stations. Demand potential is usually measured by the catchment population, catchment employment and other attractors such as retail and other commercial activity.

Model Calibration

5.3 The model developed was calibrated on the basis of around 1000 non-London rail flows within the wider South East area, using LENNON data to provide the observed demand levels for each of these flows, and undertaking the calibration based upon the following characteristics:

- Origin population within 500m, 1km, 3km of the station
- Destination population as above
- Destination employment within 1km of the station
- Rail distance between the stations
- Rail Generalised Speed (rail distance divided by generalised journey time, calculated using MOIRA)
- Road journey time minus Rail journey time (to capture the relative journey times of car and rail)

5.4 Using Excel's multiple regression functionality, eighteen different model functional forms for both non-season and season tickets were derived and tested to achieve the best model fit, which was measured through a number of criteria including forecasts versus actual demand, the distribution of errors, and the elimination of 'systematic' errors within the model. The model chosen was then validated on a range of similar flows to those along the East-West Rail corridor, and generally the model performs well against the validation data set. In order to ensure the robustness of the model, some of the model parameters were 'fixed' to PDFH-consistent elasticities.

5.5 The final model functional form and modelling parameters to be used for the central case was as follows.

TABLE 5.1 GRAVITY MODEL FUNCTIONAL FORM AND FORECASTING PARAMETERS

LN (JNYS) is equal to	Non Seasons	Seasons
1/Generalised Speed	-30.17	-30.17
LN (Population within 0.5km of origin station)	0.50	0.50
LN (Population within 0.5-3.0km of origin station)	0.50	0.50
LN (Destination employment within 1km of station)	1.00	1.00
LN (Distance between origin and destination)	-2.43	-1.67
LN (GJT-IVT)		-0.96
LN RJT – LN IVT	3.07	1.82

5.6 With these parameters, the elasticity to generalised speed is variable, but is -0.9 where generalised speed is 30 mph. This is broadly consistent with the Generalised Journey Time elasticities recommended within PDFH.

5.7 Once constructed, the model was validated against a range of flows, in order to test the robustness of the model, but also to test the level of uncertainty related with the forecasts. Given that the gravity model is only able to capture a set of quantifiable parameters, then there is always likely to be a degree of uncertainty when applying the model, simply because every town/city in the UK has a number of characteristics that are not measurable, but which impact upon demand for travel and demand for rail. The following table shows the model forecast compared with actual annual demand data, for an example set of flows.

TABLE 5.2 MODELLED VERSUS ACTUAL DEMAND (ANNUAL 2005/06)

	Actual (000s)	Forecast (000s)	% Error
Reading-Oxford	384	390	1.6%
Watford Junction-Milton Keynes C	91	73	-20%
Peterborough-Cambridge	85	101	19%
Thetford - Norwich	102	68	-33%
Swindon - Bristol TM	180	189	5%
Chippenham - Bristol Temple M	153	213	39%

Model Application

5.8 The forecasting equation shown in Table 3.1 was operationalised within a spreadsheet model. The key inputs to the model are as follows:

- Base rail demand and revenue (2005/06), split by season and non-season tickets for a selection of station-station flows, chosen on the basis that they would receive an improved service if East-West Rail was built. All stations within the

core area are included, plus a range of longer-distance flows that would benefit from significantly improved connectivity (Source: MOIRA);

- Base rail distances and rail Generalised Journey Times for all of the relevant flows (Source: MOIRA);
- Population within 0.5km and 3km of each station;
- Employment within 1km of each station;
- Forecasts of population and employment growth by location for the study area;
- 'With EWR' rail distances;
- 'With EWR' Generalised Journey Times.

5.9 The model includes a 'base case' and 'with EWR' scenario, in terms of rail Generalised Speeds and distances. The base case Generalised Speeds and distances are derived from the Winter 2005 timetable in MOIRA.

5.10 For the 'with EWR' scenario, the EWR services for the options tested were coded into MOIRA, and new GJTs generated by running MOIRA with the new services. For new stations the GJTs have been calculated by interpolation using existing stations. 'With EWR' rail distances (as EWR shortens the rail distance for flows affected) have been derived from the network model which was created for the 2003 EWR Business Case. .

5.11 Given that many of the flows either do not have current fares, or have expensive 'via London' fares, fares for the new service are distance based. These are based upon the 2005/06 South East non-London average of £0.13 per mile for seasons, and £0.16 per mile for seasons.

5.12 Given that MOIRA is likely to be more accurate than the gravity model for those flows where there is currently a reasonable rail service, or where East-West Rail does not have a significant impact on overall journey times, we set a minimum threshold where the gravity model takes precedence over MOIRA. For those flows where the Generalised Journey Time is improved by more than 30%, the Gravity Model is employed. For other flows, the MOIRA forecast of increased demand and revenue is used.

5.13 The model calculates incremental demand and revenue for each flow for the following years:

- 2005
- 2011
- 2016
- 2021
- 2031

Background Growth and Assumptions

5.14 The gravity model described in the previous chapter forecasts annual demand for a base year position of 2005. Therefore, even the 'with EWR' forecast is based upon a 2005/06 position.

5.15 Future year growth is forecast based upon the PDFH4.1 framework, with flows within the EWR catchment area modelled using the 'Non London South East' recommended parameters from PDFH, and flows in the wider study area being allocated appropriate elasticities based on flow types.

5.16 The model uses assumptions on the following:

- Population growth (land use)
- Employment growth (land use)
- Airport Growth
- GDP per capita
- Car Ownership
- Fares Growth

Detailed Land Use Assumptions for EWR Catchment Area

5.17 For the EWR catchment area, detailed information on proposed housing and employment sites has been collated.

5.18 Between the years of 2001 and 2011 assumptions were primarily based on the existing allocations of housing and employment made in planning documents such as local plans.

5.19 Beyond 2011 the assumptions have been developed in collaboration with the EWR Consortium members and informed by strategic planning documents.

Summary of Population and Employment Assumptions

5.20 The detailed land use assumptions described above have been combined with TEMPRO v5.3 forecasts for the study area to create forecasts of population and employment growth for each zone in the model. The following tables summarise the forecasts used in the model by county, for the EWR study area.

TABLE 5.3 YEAR-ON-YEAR POPULATION GROWTH ASSUMPTIONS

Year on year growth	2006-2011	2011-2016	2016-2021	2021-2031	Total Growth 2006-2031
Bedfordshire	0.8%	0.8%	0.9%	0.7%	21.1%
Buckinghamshire	1.0%	1.2%	1.1%	0.7%	26.3%
Cambridgeshire	0.9%	0.9%	1.0%	0.8%	24.8%
Essex	0.4%	0.6%	0.6%	0.5%	14.0%
Hertfordshire	0.4%	0.5%	0.6%	0.5%	13.3%
Luton	0.5%	0.5%	0.6%	0.5%	13.6%
Milton Keynes	1.6%	2.5%	2.1%	1.6%	59.0%
Norfolk	0.7%	0.7%	0.8%	0.7%	18.4%
Oxfordshire	0.7%	0.6%	0.8%	0.6%	18.4%
Reading	0.5%	0.5%	0.6%	0.5%	13.6%
Suffolk	0.6%	0.7%	0.7%	0.6%	17.4%

TABLE 5.4 YEAR-ON-YEAR EMPLOYMENT GROWTH ASSUMPTIONS

Year on year growth	2006-2011	2011-2016	2016-2021	2021-2031	Total Growth 2006-2031
Bedfordshire	0.4%	0.5%	0.3%	0.3%	9.1%
Buckinghamshire	1.7%	1.4%	0.6%	0.6%	27.5%
Cambridgeshire	1.5%	1.3%	0.7%	0.6%	26.7%
Essex	1.0%	0.9%	0.4%	0.4%	16.5%
Hertfordshire	0.9%	0.7%	0.4%	0.4%	14.3%
Luton	1.3%	1.2%	0.5%	0.5%	22.0%
Milton Keynes	2.0%	2.3%	1.5%	1.2%	50.0%
Norfolk	0.1%	0.4%	0.2%	0.2%	5.7%
Oxfordshire	1.6%	1.3%	0.5%	0.5%	24.7%
Reading	1.3%	1.2%	0.5%	0.5%	22.0%
Suffolk	0.4%	0.4%	0.3%	0.3%	8.9%

5.21 Note that whilst county-level projections are shown here, the model contains detailed assumptions on population and employment growth for each station catchment area.

5.22 The wider study area uses TEMPRO v5.3 assumptions for population and employment growth.

Airport Growth

5.23 The EWR services provide new direct links to both Luton Airport and Stansted Airport. Both airports are expected to expand dramatically over the coming years –

we have based our assumptions of passenger growth on the latest planning assumptions for both airports. The table below shows the assumed passenger growth over the study period.

TABLE 5.5 YEAR-ON-YEAR EMPLOYMENT GROWTH ASSUMPTIONS

Annual Passenger Numbers	2006	2011	2016	2021	2031
Stansted	23.7	25.6	31.7	39.2	60.0
Luton	9.4	11.9	15.0	18.9	30.0

5.24 This growth is assumed to have a directly proportionate impact upon rail passenger growth from the new services.

Car Ownership

5.25 TEMPRO assumptions on car availability per household by region are used.

Other Key Assumptions

5.26 The following table outlines other key forecasting assumptions.

TABLE 5.6 KEY FORECASTING ASSUMPTIONS

Parameter	Assumption
GDP per capita growth	2.4% p.a. throughout
Road journey time increases	0.5% p.a. throughout
Fares on new flows (2005/06 prices)	Non seasons £0.16 per mile Seasons £0.13 per mile
Fares growth	RPI+1% on all flows
GDP elasticity	1.2
Fares elasticities	Non seasons -0.9 Seasons -0.6

Model Results

5.27 The model has been used to forecast demand and revenue for each of the options. The following table summarises the forecasts of **incremental** UK Rail revenue, journeys and the expected **total** operating revenue for the services. The table also shows the incremental UK Rail revenue over and above the Western Section Local rail option, which is assumed to be the base case service level for this scheme. For the purposes of this report this assumes that the scheme is up and running in 2011, although this assumption can be easily flexed for the purposes of business case analysis.

TABLE 5.7 SUMMARY FORECASTS (REVENUE IN £M 2005/06 PRICES)

Revenue (£m)	2011	2016	2021	2031
Option 1A				
Incremental UK Rail Revenue	**11.6**	**14.1**	**17.1**	**24.7**
Operating Revenue	24.4	29.6	35.9	52.0
Net Abstraction	*12.8*	*15.5*	*18.8*	*27.3*
Incremental to Western End	*6.1*	*7.4*	*9.0*	*13.2*
Option 1B				
Incremental UK Rail Revenue	**13.5**	**16.4**	**19.8**	**28.5**
Operating Revenue	25.9	31.3	37.8	54.4
Net Abstraction	*12.3*	*14.9*	*18.0*	*25.9*
Incremental to Western End	*8.0*	*9.7*	*11.7*	*17.0*
Option 1C				
Incremental UK Rail Revenue	**13.9**	**16.7**	**20.1**	**28.8**
Operating Revenue	26.1	31.5	37.9	54.3
Net Abstraction	*12.2*	*14.8*	*17.8*	*25.4*
Incremental to Western End	*8.3*	*10.0*	*12.0*	*17.3*
Option 2A				
Incremental UK Rail Revenue	**9.3**	**11.3**	**13.6**	**19.5**
Operating Revenue	22.5	27.3	33.1	47.3
Net Abstraction	*13.2*	*16.1*	*19.4*	*27.8*
Incremental to Western End	*3.8*	*4.6*	*5.5*	*8.0*
Option 2B				
Incremental UK Rail Revenue	**11.5**	**13.9**	**16.7**	**23.8**
Operating Revenue	24.2	29.2	35.2	50.0
Net Abstraction	*12.7*	*15.3*	*18.5*	*26.3*
Incremental to Western End	*6.0*	*7.2*	*8.6*	*12.3*

5.28 The table below provides a breakdown of how much additional revenue is earned by (a) extending EWR services on the Midland Main Line beyond Bedford, (b) extending to the East Coast Main Line and (c) extending east of the East Coast Main Line (Cambridge, Stansted Airport etc.), as forecast in 2031. Note that this is revenue that is incremental to the assumed base Western Section services.

TABLE 5.8 BREAKDOWN OF INCREMENTAL REVENUE 2031 (£M 2005/06 PRICES)

	Total Incremental Revenue	(a) Midland Main Line	(b) East Coast Main Line	(c) East of ECML
1A	**13.2**	4.9	3.0	5.3
1B	**17.0**	5.0	2.9	9.1
1C	**17.3**	5.0	3.0	9.3
2A	**8.0**	1.2	2.9	3.8
2B	**12.3**	1.1	2.6	8.6

6. OPERATING CASE

Introduction

6.1 In this chapter we bring together the revenue and operating cost estimates to show the relationship between them, how this changes over time and the net impact on rail finances in terms of subsidy.

Operating Case Assumptions

6.2 In addition to the assumptions set out in the preceding two chapters, specific assumptions relating to the operating case were made as follows:

- Costs and revenues are presented in real values (i.e. excluding base inflation) in 2007/08 prices
- Real wage growth is assumed at 1.5% p.a.
- Non-wage costs are assumed to be constant in real terms
- New revenue is assumed to 'ramp-up' to mature levels over the first three years at the rate 60%, 85%, 100%
- 10% of year 1 operating costs are incurred in the preceding year for training etc

Assumptions from the revenue forecasts and operating cost estimates of particular relevance are as follows:

- Fares increase at 1% pa in real terms (Table 5.6)
- Central Fixed Track Access Charge (FTAC) assumption (Paragraph 4.14)
- Service strengthening to alleviate crowding (Table 4.3)

Revenue and Operating Cost Comparisons

6.3 The treatment of revenue and operating costs in this work is slightly different from the way in which these were compared in the Western Section work. In that work, comparisons were made of the 'EWR TOC' revenues and costs as well as the net figures for the UK rail network as a whole. This was because the Western Section is capable of implementation within the lives of existing franchises, and therefore it is necessary to consider the actual revenues gained and costs incurred by the TOC that operates the EWR service before any account is taken of gains by other operators from trips beyond the EWR (or indeed losses by other operators from abstraction). In addition, the Western Section services are almost self-contained, so that interactions with other services are relatively minor.

6.4 For the Central Section, the situation is rather different. The services tested cross boundaries between TOCs' operating areas and interact with existing services over a much wider area, for instance between Harlow and Stansted and between Stevenage and Cambridge. East of Cambridge, they absorb the existing services to Ipswich and Norwich. Moreover, these interactions vary considerably between the options, making comparisons complex – Option 1A does not serve Cambridge and so does not absorb the Ipswich and Norwich services, but it would be unrealistic to include these services in the EWR 'pot' in comparing the options. While it is possible to assess the EWR TOC operating position, therefore, this is of little help in comparing options.

6.5 The Central Section is also a longer term scheme, and all services that interact will have been refranchised by the time it comes into operation. It is assumed that it will be possible to factor the revenue and cost impacts on other TOCs into the new franchises and hence there is no need to consider the operating case for a stand-alone TOC.

6.6 For comparative purposes, therefore, the main analysis has been based on the 'UK Rail' operating position, with a supplementary assessment of the TOC operating position for the most favourable option.

6.7 There is another reason for analysing the results in a different way from those for the Western Section. Because implementation of the Western Section is much closer in time, operating costs for that scheme were analysed both as the net costs, after deduction of the costs of replaced services, and as gross costs, assuming these costs could not be recovered, at least in the short term. The Central Section is sufficiently far in the future to assume that the cost savings can be recovered in full as part of the franchising process, and hence net costs have been used throughout.

6.8 It should be remembered that this assessment covers on the operating position, i.e. it does not take account of infrastructure capital costs.

Year on Year Operating Position

Complete EWR Service

6.9 This section considers the scheme as a whole, i.e. the entire EWR service as a single scheme compared with no EWR. A later section covers the incremental operating position taking the Western Section as a starting point.

6.10 Figure 6.1 to Figure 6.5 show the operating position over time for the five options. In each graph the solid blue line shows incremental revenue over time – with the steeper initial increase being the result of the assumed ramp-up. Later growth is a combination of market growth and assumed real increases in fares.

6.11 The two dashed lines show operating costs over time, the higher one including and the lower one excluding rolling stock leasing costs. The small steps in the cost lines show the impact of future service strengthening, while the initial steady gradient relates to the phasing in of FTAC over the first twenty years of operation. The inflating impact of real wage growth is relatively minor as can be seen in the relatively low growth in operating costs after 2032/33 when FTAC reaches equivalent full levels.

FIGURE 6.1 UK RAIL OPERATING POSITION – OPTION 1A

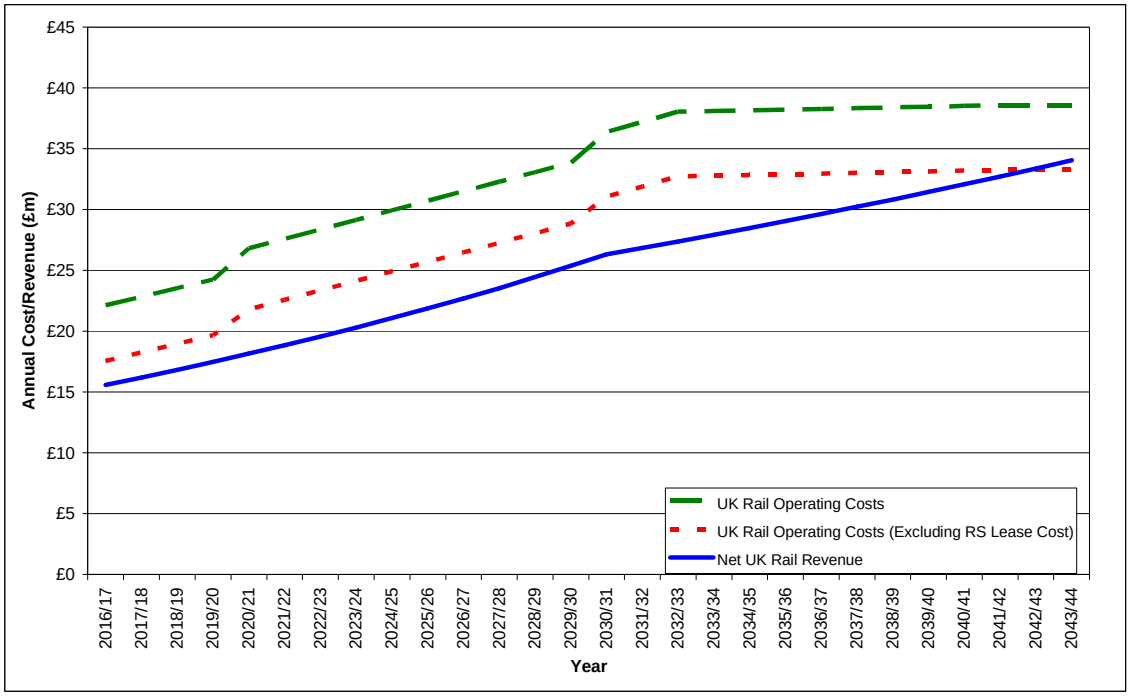


FIGURE 6.2 UK RAIL OPERATING POSITION - OPTION 1B

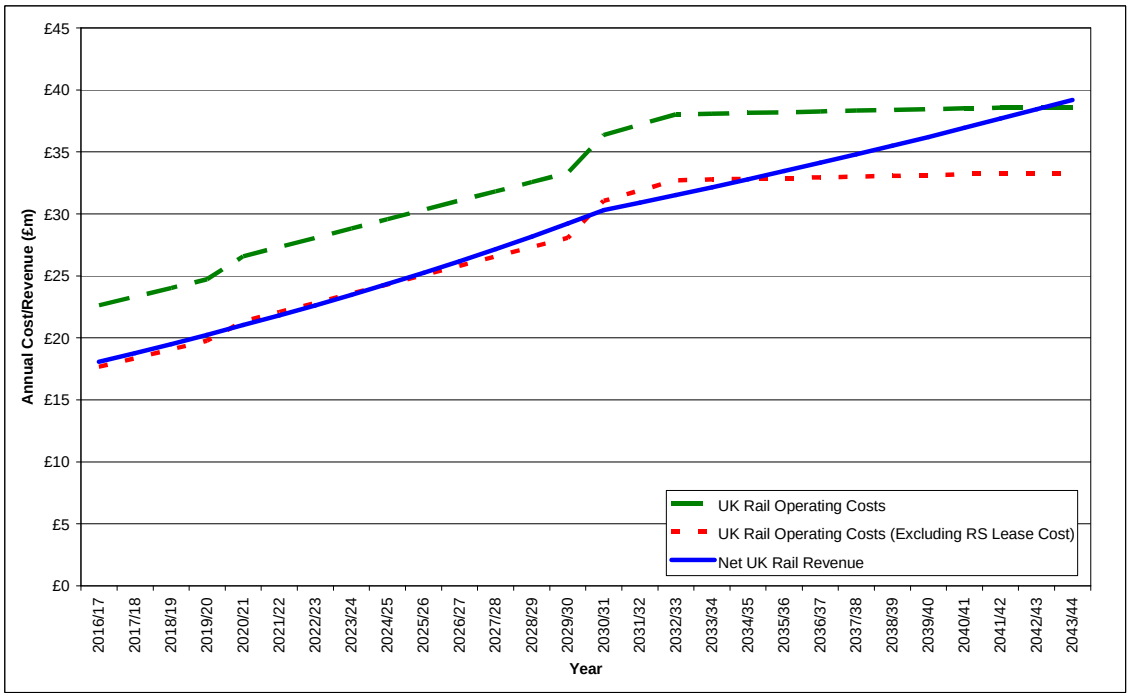


FIGURE 6.3 UK RAIL OPERATING POSITION - OPTION 1C

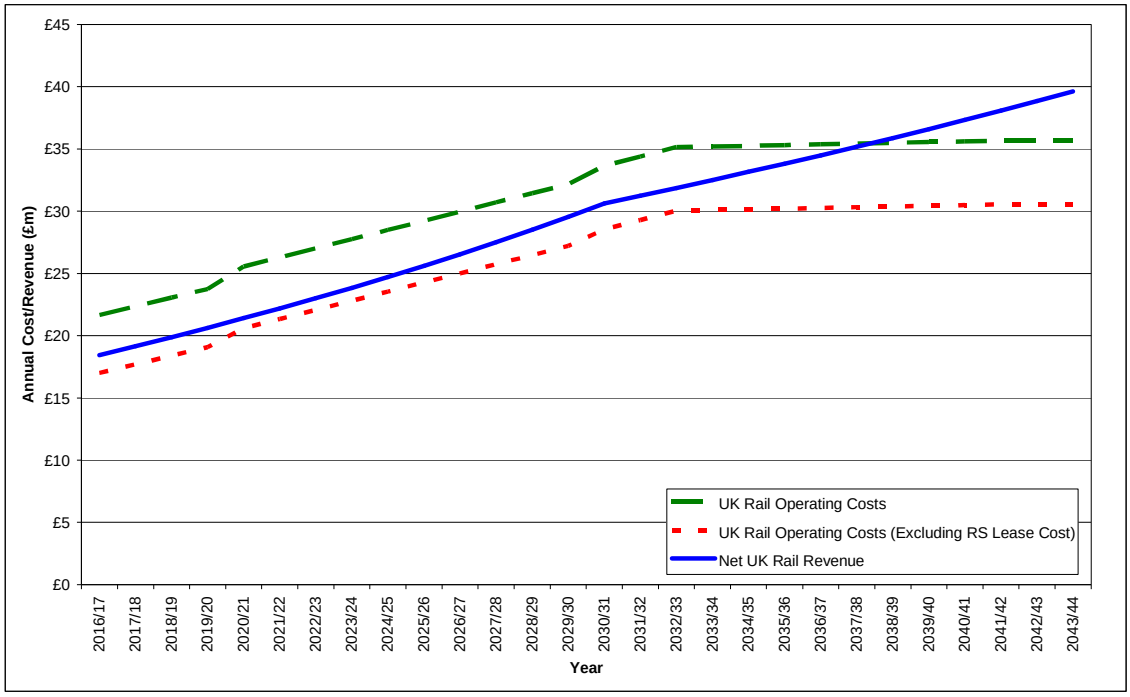


FIGURE 6.4 UK RAIL OPERATING POSITION - OPTION 2A

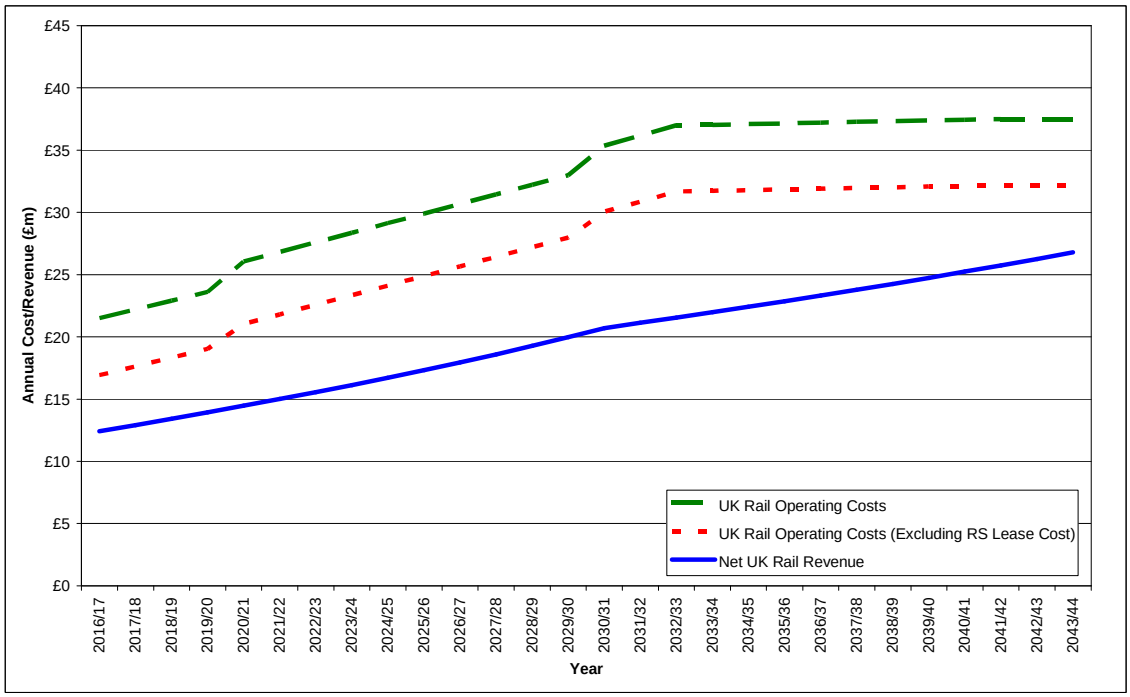
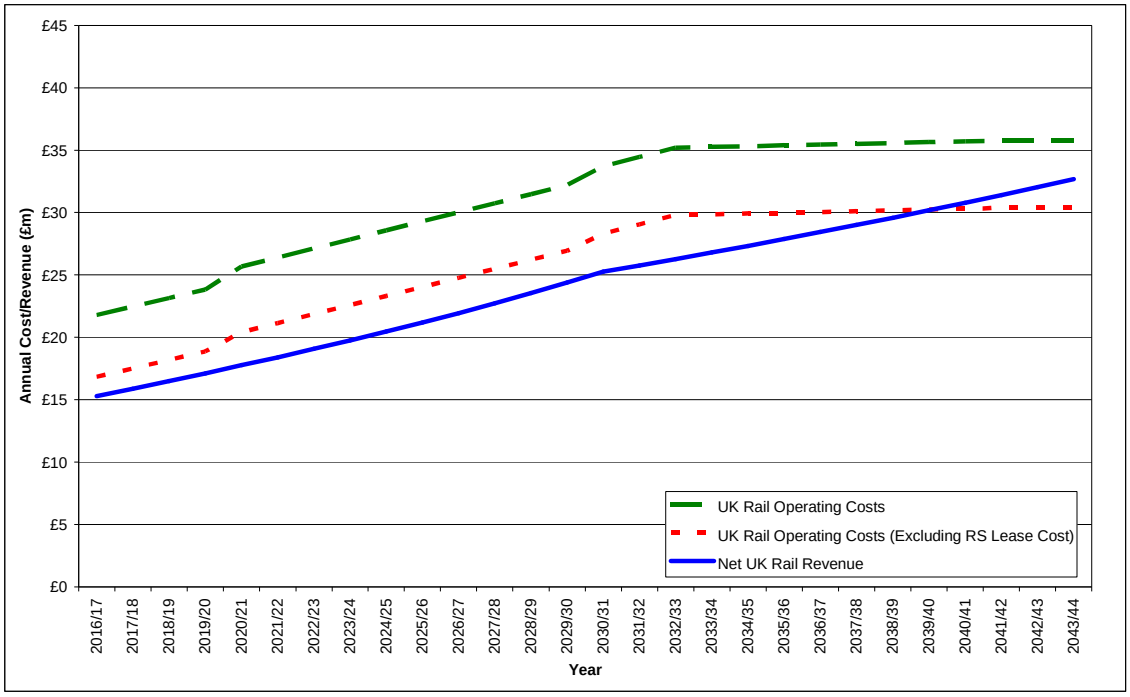


FIGURE 6.5 UK RAIL OPERATING POSITION - OPTION 2B



6.12 Several general conclusions can be drawn from the above figures:

- Options 1A-1C perform better overall than Options 2A and 2B, although the variation between sub-options means that Option 2B is on a par with Option 1A.
- Options service Cambridge perform better than options serving Stansted:
  - Among the southern route options via Luton, 1C (which has 2 tph to Cambridge and beyond) has the best operating case. The additional UK Rail revenue generated by the option covers the additional operating costs if rolling stock is provided free of lease charges, and is not far short of covering total operating costs. For Option 1B, with 1 tph to each destination, revenue is very close to operating costs net of leasing, while Option 1A, with 2 tph to Stansted, is the poorest performer of the three.
  - Of the two central routes via Sandy, the one with a service to Cambridge and beyond (2B) is again the better performer.
- None of the options breaks even in terms of total operating costs, but the best performing options do not fall far short of the break-even point and ongoing subsidy, however channelled, would not represent a large proportion of operating costs.

Incremental Operating Case

6.13 In Figure 6.6 to Figure 6.10 we present the same data but with the revenue and operating costs of the Western Section (Local Rail Option 8A) deducted to give the incremental operating impact of the Central Section options.

6.14 Note that these graphs are plotted on the same vertical scale as those for the complete service.

FIGURE 6.6 UK RAIL INCREMENTAL OPERATING POSITION - OPTION 1A

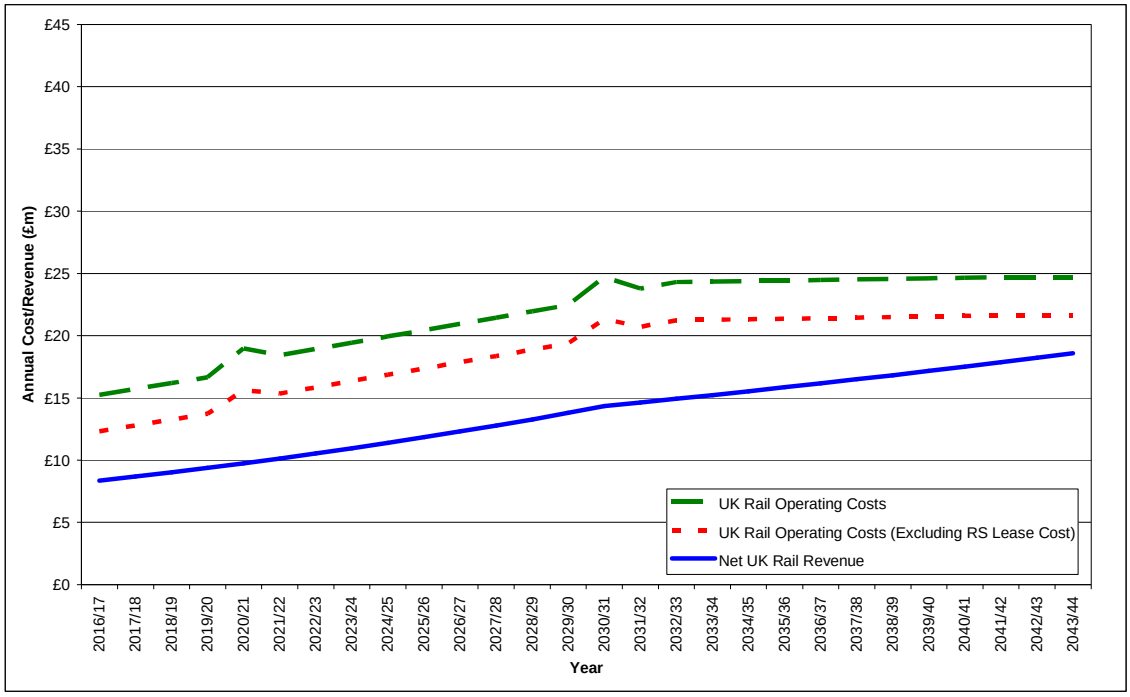


FIGURE 6.7 UK RAIL INCREMENTAL OPERATING POSITION - OPTION 1B

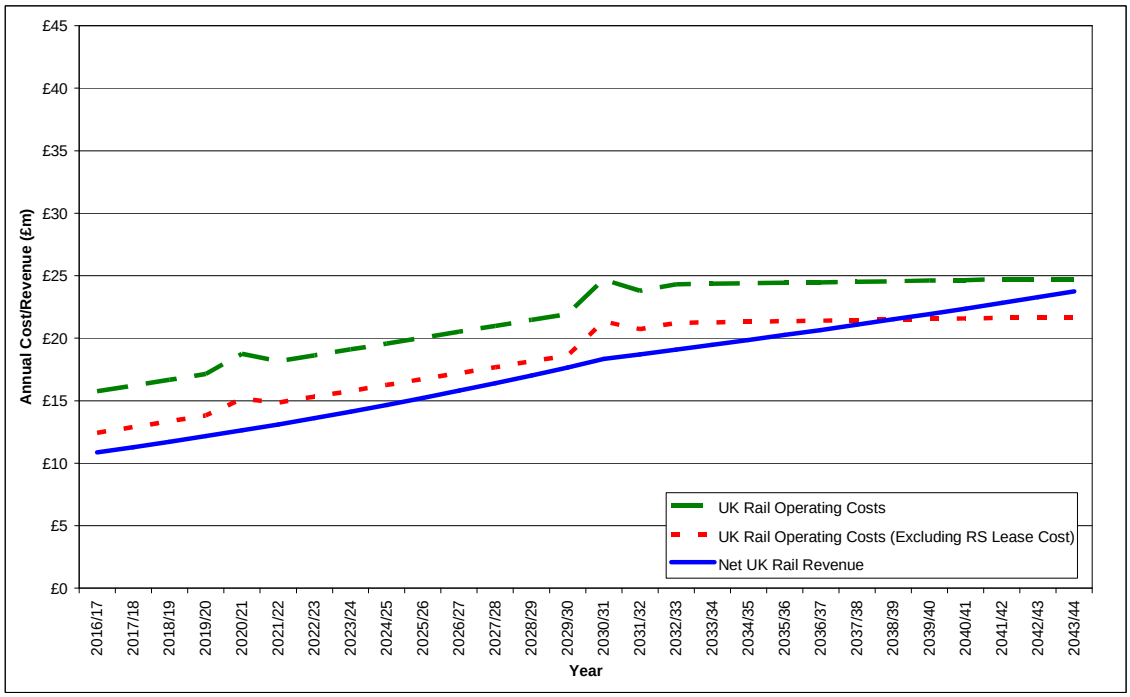


FIGURE 6.8 UK RAIL INCREMENTAL OPERATING POSITION - OPTION 1C

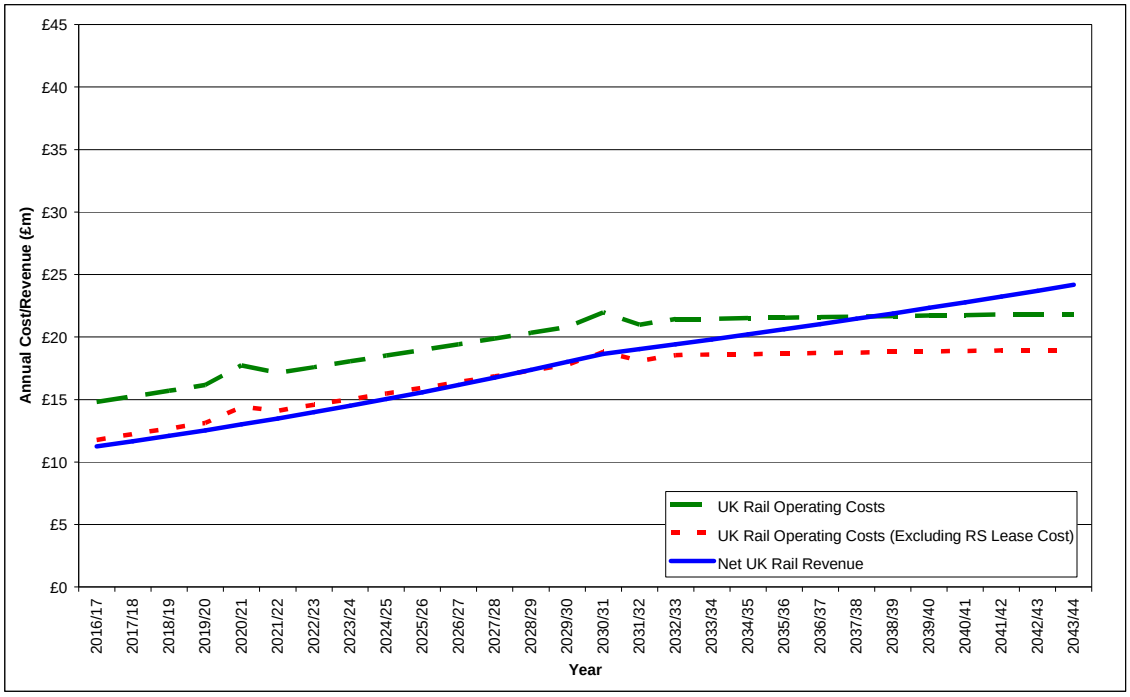


FIGURE 6.9 UK RAIL INCREMENTAL OPERATING POSITION - OPTION 2A

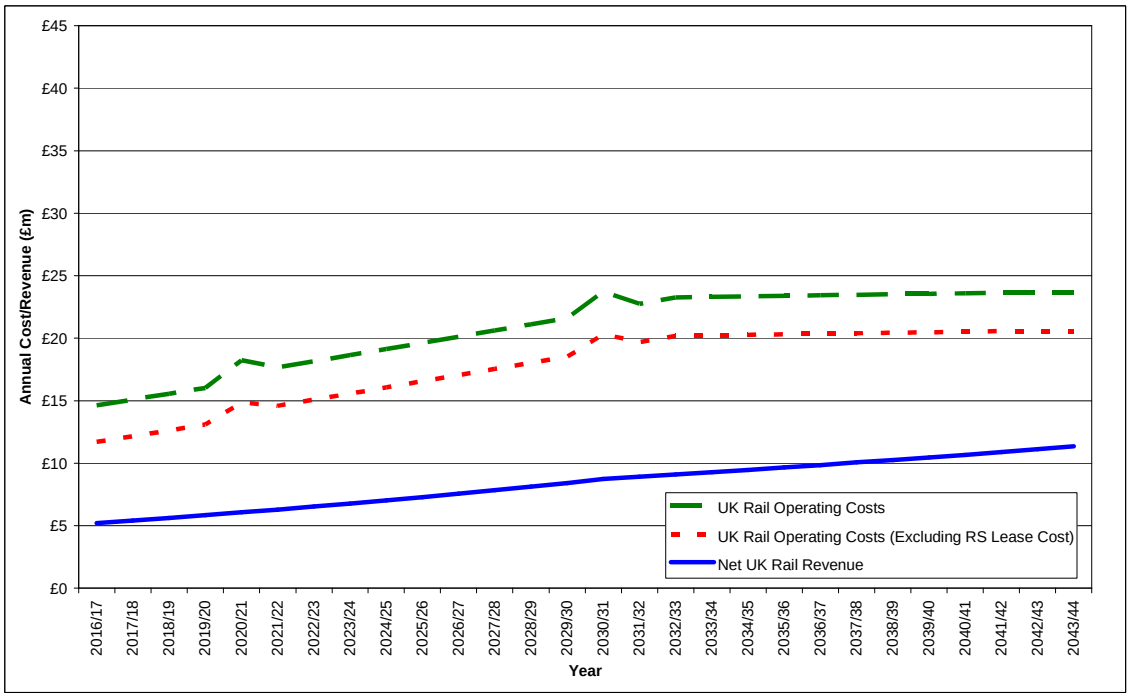
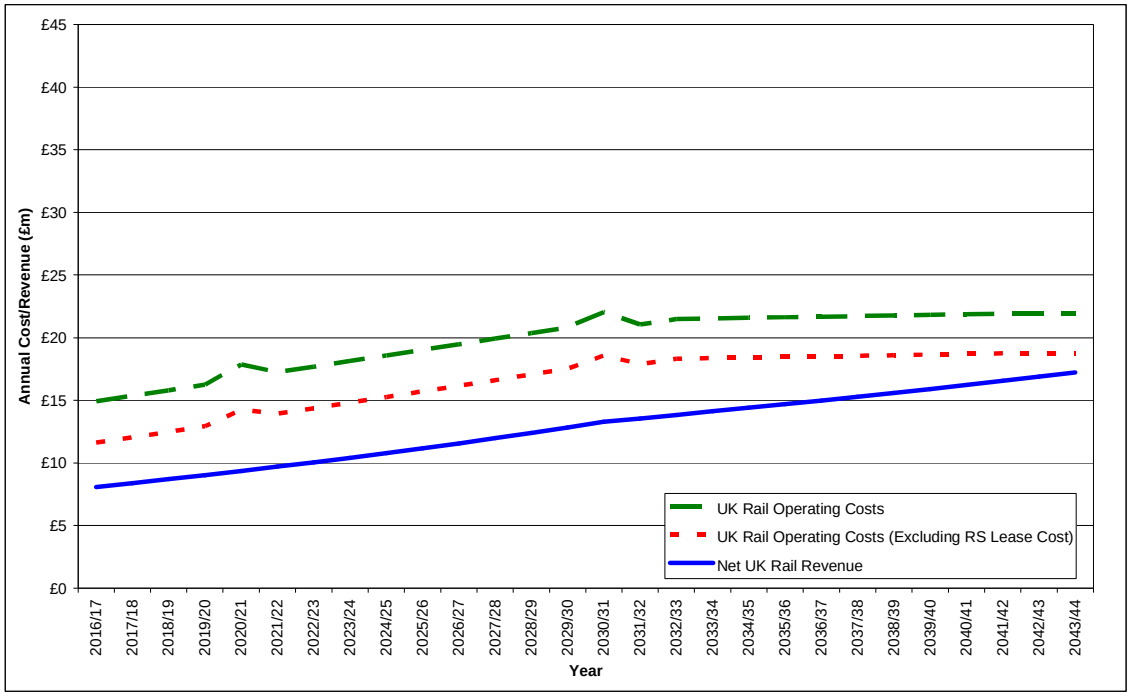


FIGURE 6.10 UK RAIL INCREMENTAL OPERATING POSITION - OPTION 2B



6.15 In general, the extension of services represented by the Central Section worsens the operating case, with the incremental revenues falling some way short of the incremental operating costs. This is to be expected to some extent, given the focus of the Western Section services on two strong demand generators and the relatively small fleet and train mileage required to link them.

6.16 However, since all the Central Section options are being treated as increments to the same Western Section scheme, the same relativities apply between them, with the southern options performing better than the central options, and Cambridge appearing more attractive then Stansted as an eastern objective.

6.17 Moreover, since Western Section Option 8A comes fairly close to covering its total operating costs[4] (assuming full recovery of the cost of services replaced), the conclusions set out in paragraph 6.12 largely apply. In particular, Option 1C more or less covers its operating costs in the incremental case as well as the overall case, if rolling stock leasing is externally funded.

6.18 The deduction of a fixed amount of costs and revenue in the incremental case also magnifies the differences between the options. Option 2A performs particularly poorly on this basis, its incremental revenue covering less than half of its incremental operating costs, even when rolling stock leasing costs are excluded.

[4] Western Section Operating and Business Case Report, Figure 5.5

EWR TOC Operating Case

6.19 As mentioned in 6.4 above, the EWR TOC operating case cannot easily be compared between options because of significant differences between the sections of train services formed from the absorption of existing services east of Cambridge. Moreover, the geographical coverage of the Central Section services, from Reading in the west to Stansted, Norwich and Ipswich in the east, is much greater than for the Western Section, and there is more parallel running with existing services. The effects of the new services on demand will therefore be more complex and a significant proportion of ridership is likely to be abstracted. Hence the TOC operating position is not particularly helpful in assessing the scheme.

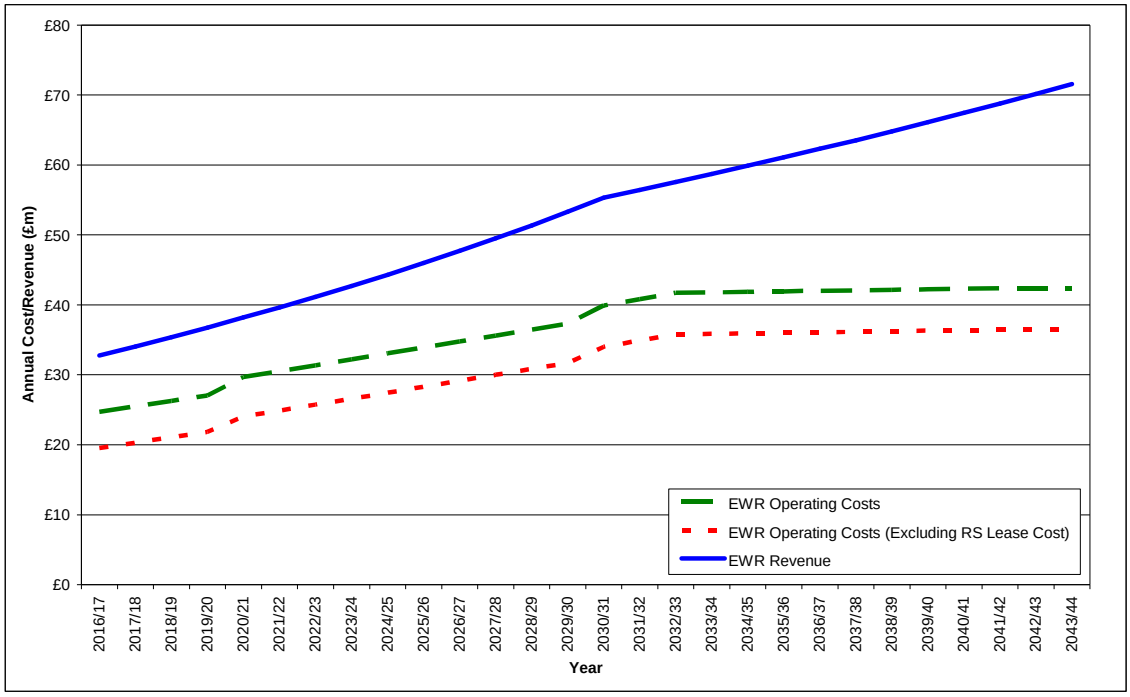
6.20 In this section we have therefore concentrated on two of the options:

- Option 1A, serving Stansted but not Cambridge
- Option 1C, serving Cambridge but not Stansted

6.21 In each case we have compared the total revenue captured by EWR trains (including revenue abstracted from other services) and the total operating costs of the EWR services (without deducting the costs of the services replaced by them).

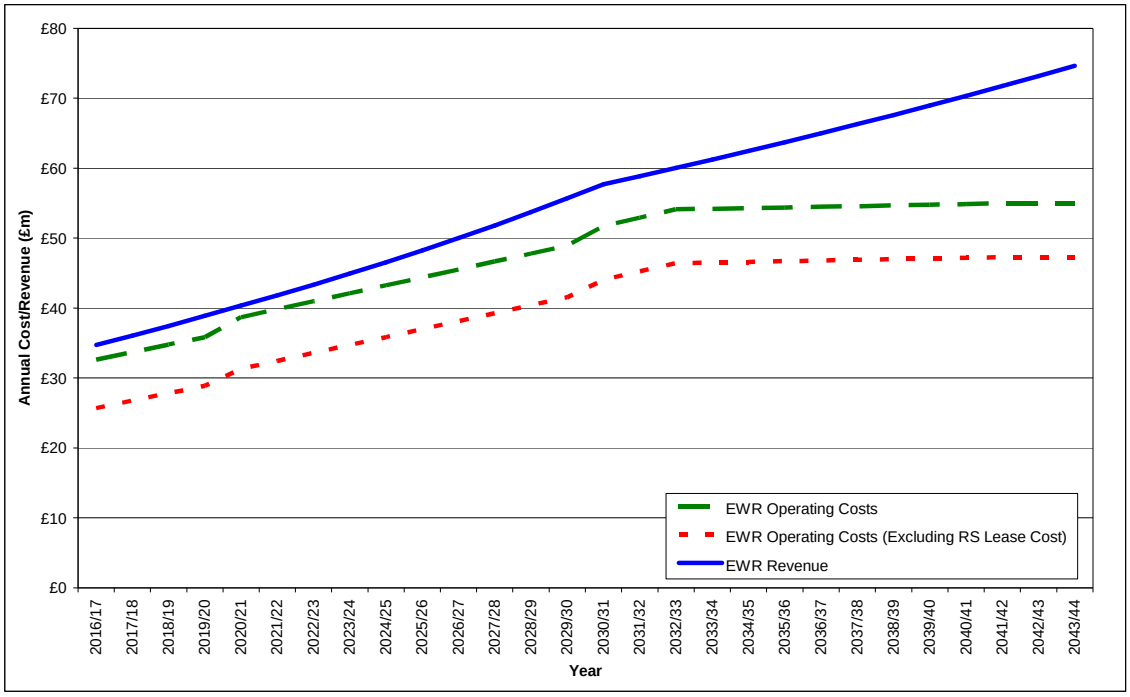
6.22 Figure 6.11 shows the TOC operating position for Option 1A. Because Option 1A does not absorb any existing services other than Oxford-Bicester and Bletchley-Bedford, the cost lines are not very much higher than those in Figure 6.1, the difference being the estimated cost of those two services. The operating position is clearly very positive, with revenue exceeding costs by a substantial margin. However, a comparison of the revenue lines in Figure 6.11 and Figure 6.1 shows that a substantial proportion of revenue (around half) is abstracted, and therefore the services are effectively performing an 'ORCATS raid' on the network. While the EWR services themselves would be highly profitable, a large part of this would be at the expense of parallel services.

FIGURE 6.11 EWR TOC OPERATING POSITION - OPTION 1A



6.23 The TOC operating position for Option 1C is shown in Figure 6.12. In this case the cost lines are significantly above those in Figure 6.3, which shows the equivalent UK Rail operating position. This is because in this option the TOC operating costs include the entire Cambridge-Norwich/Ipswich services. However, the revenue line is still above the total operating costs, indicating that the EWR services would be operationally profitable on a stand-alone basis when the effects of abstraction are ignored.

FIGURE 6.12 EWR TOC OPERATING POSITION - OPTION 1C



APPENDIX A

STANDARD HOUR TIMETABLES

STANDARD HOUR - OPTION 1A

Eastbound

					every 2 hours	
Reading	d	07	-	33½	-	-
Oxford	a	36	-	02½	-	-
Oxford	d	38	-	04½	-	-
Bicester Town	d	50	-	16½	-	-
Aylesbury	d	-	48	-	-	-
Aylesbury Parkway	d	-	52	-	-	-
Bletchley HL	a	04½	09½	31	-	-
Bletchley HL	d	05½	10½	32	-	-
Milton Keynes	a	16	-	-	-	-
Milton Keynes	d	-	-	-	-	55
Bletchley LL	d	-	-	-	43	-
Fenny Stratford	d	-	-	-	45½	-
Bow Brickhill	d	-	-	-	49	-
Woburn Sands	d	-	17½	-	53	06½
Aspley Guise	d	-	-	-	54½	-
Ridgmont	d	-	-	-	59	
Lidlington	d	-	-	-	03	-
Millbrook	d	-	-	-	06	-
Stewartby	d	-	-	-	09	-
Kempston Hardwick	d	-	-	-	13	-
Bedford St Johns	d	-	-	-	18½	-
Bedford	a	-	36	-	25	-
Luton	a	-	-	01	-	31
Luton	d	-	-	02	-	32
Luton Airport Parkway	d	-	-	05	-	35
Stevenage	a	-	-	19	-	49
Stevenage	d	-	-	23	-	53
Hertford East	d	-	-	39	-	09
Harlow Town	d	-	-	56	-	26
Bishops Stortford	d	-	-	06	-	36
Stansted Airport	a	-	-	16	-	46

Westbound

			every 2 hours			
Stansted Airport	d	22	-	-	-	52
Bishops Stortford	d	31	-	-	-	01
Harlow Town	d	41	-	-	-	11
Hertford East	d	58	-	-	-	28
Stevenage	a	13	-	-	-	43
Stevenage	d	17	-	-	-	47
Luton Airport Parkway	d	32	-	-	-	02
Luton	a	34	-	-	-	04
Luton	d	35	-	-	-	05
Bedford	d	-	43	08½	-	-
Bedford St Johns	d	-	47	-	-	-
Kempston Hardwick	d	-	52½	-	-	-
Stewartby	d	-	57	-	-	-
Millbrook	d	-	00½	-	-	-
Lidlington	d	-	03½	-	-	-
Ridgmont	d	-	09	-	-	-
Aspley Guise	d	-	13	-	-	-
Woburn Sands	d	-	15½	25½	-	30½
Bow Brickhill	d	-	19½	-	-	-
Fenny Stratford	d	-	22½	-	-	-
Bletchley LL	a	-	26	-	-	-
Milton Keynes	a	-	-	-	-	43
Milton Keynes	d	-	-	-	25	-
Bletchley HL	a	04	-	33	38	-
Bletchley HL	d	05	-	34	39	-
Aylesbury Parkway	d	-	-	54	-	-
Aylesbury	a	-	-	59	-	-
Bicester Town	d	20½	-	-	54½	-
Oxford	a	33	-	-	07	-
Oxford	d	35	-	-	09	-
Reading	a	04	-	-	38	-

STANDARD HOUR - OPTION 1B

Eastbound

					every 2 hours	
Reading	d	07	-	33½	-	-
Oxford	a	36	-	02½	-	-
Oxford	d	38	-	04½	-	-
Bicester Town	d	50	-	16½	-	-
Aylesbury	d	-	48	-	-	-
Aylesbury Parkway	d	-	52	-	-	-
Bletchley HL	a	04½	09½	31	-	-
Bletchley HL	d	05½	10½	32	-	-
Milton Keynes	a	16	-	-	-	-
Milton Keynes	d	-	-	-	-	55
Bletchley LL	d	-	-	-	43	-
Fenny Stratford	d	-	-	-	45½	-
Bow Brickhill	d	-	-	-	49	-
Woburn Sands	d	-	17½	-	53	06½
Aspley Guise	d	-	-	-	54½	-
Ridgmont	d	-	-	-	59	
Lidlington	d	-	-	-	03	
Millbrook	d	-	-	-	06	
Stewartby	d	-	-	-	09	
Kempston Hardwick	d	-	-	-	13	-
Bedford St Johns	d	-	-	-	18½	-
Bedford	a	-	36	-	25	-
Luton	a	-	-	01	-	31
Luton	d	-	-	02	-	32
Luton Airport Parkway	d	-	-	05	-	35
Stevenage	a	-	-	19	-	49
Stevenage	d	-	-	21	-	53
Hitchin	d	-	-	27	-	-
Letchworth	d	-	-	33	-	-
Royston	d	-	-	44	-	-
Cambridge	a	-	-	00	-	-
Norwich	a	-	-	even hrs ~20*	-	-
Ipswich	a	-	-	odd hrs ~20*	-	-
Hertford East	d	-	-	-	-	09
Harlow Town	d	-	-	-	-	26
Bishops Stortford	d	-	-	-	-	36
Stansted Airport	a	-	-	-	-	46

* varies by hour according to calling pattern

Westbound

			every 2 hours			
Stansted Airport	d	-	-	-	-	52
Bishops Stortford	d	-	-	-	-	01
Harlow Town	d	-	-	-	-	11
Hertford East	d	-	-	-	-	28
Ipswich	d	even hrs ~10*	-	-	-	-
Norwich	d	odd hrs ~20*	-	-	-	-
Cambridge	d	38	-	-	-	-
Royston	d	53	-	-	-	-
Letchworth	d	04	-	-	-	-
Hitchin	d	10	-	-	-	-
Stevenage	a	15	-	-	-	43
Stevenage	d	17	-	-	-	47
Luton Airport Parkway	d	32	-	-	-	02
Luton	a	34	-	-	-	04
Luton	d	35	-	-	-	05
Bedford	d	-	43	08½	-	-
Bedford St Johns	d	-	47	-	-	-
Kempston Hardwick	d	-	52½	-	-	-
Stewartby	d	-	57	-	-	-
Millbrook	d	-	00½	-	-	-
Lidlington	d	-	03½	-	-	-
Ridgmont	d	-	09	-	-	-
Aspley Guise	d	-	13	-	-	-
Woburn Sands	d	-	15½	25½	-	30½
Bow Brickhill	d	-	19½	-	-	-
Fenny Stratford	d	-	22½	-	-	-
Bletchley LL	a	-	26	-	-	-
Milton Keynes	a	-	-	-	-	43
Milton Keynes	d	-	-	-	25	-
Bletchley HL	a	04	-	33	38	-
Bletchley HL	d	05	-	34	39	-
Aylesbury Parkway	d	-	-	54	-	-
Aylesbury	a	-	-	59	-	-
Bicester Town	d	20½	-	-	54½	-
Oxford	a	33	-	-	07	-
Oxford	d	35	-	-	09	-
Reading	a	04	-	-	38	-

* varies by hour according to calling pattern

STANDARD HOUR - OPTION 1C

Eastbound

					every 2 hours	
Reading	d	07	-	33½	-	-
Oxford	a	36	-	02½	-	-
Oxford	d	38	-	04½	-	-
Bicester Town	d	50	-	16½	-	-
Aylesbury	d	-	48	-	-	-
Aylesbury Parkway	d	-	52	-	-	-
Bletchley HL	a	04½	09½	31	-	-
Bletchley HL	d	05½	10½	32	-	-
Milton Keynes	a	16	-	-	-	-
Milton Keynes	d	-	-	-	-	55
Bletchley LL	d	-	-	-	43	-
Fenny Stratford	d	-	-	-	45½	-
Bow Brickhill	d	-	-	-	49	-
Woburn Sands	d	-	17½	-	53	06½
Aspley Guise	d	-	-	-	54½	-
Ridgmont	d	-	-	-	59	-
Lidlington	d	-	-	-	03	-
Millbrook	d	-	-	-	06	-
Stewartby	d	-	-	-	09	-
Kempston Hardwick	d	-	-	-	13	-
Bedford St Johns	d	-	-	-	18½	-
Bedford	a	-	36	-	25	-
Luton	a	-	-	01	-	31
Luton	d	-	-	02	-	32
Luton Airport Parkway	d	-	-	05	-	35
Stevenage	a	-	-	19	-	49
Stevenage	d	-	-	21	-	51
Hitchin	d	-	-	27	-	57
Letchworth	d	-	-	33	-	03
Royston	d	-	-	44	-	14
Cambridge	a	-	-	00	-	30
Norwich	a	-	-	-	-	~50*
Ipswich	a	-	-	~20*	-	-

* varies by hour according to calling pattern

Westbound

			every 2 hours			
Ipswich	d	~10*	-	-	-	-
Norwich	d	-	-	-	-	~50*
Cambridge	d	38	-	-	-	08
Royston	d	53	-	-	-	23
Letchworth	d	04	-	-	-	34
Hitchin	d	10	-	-	-	40
Stevenage	a	15	-	-	-	45
Stevenage	d	17	-	-	-	47
Luton Airport Parkway	d	32	-	-	-	02
Luton	a	34	-	-	-	04
Luton	d	35	-	-	-	05
Bedford	d	-	43	08½	-	-
Bedford St Johns	d	-	47	-	-	-
Kempston Hardwick	d	-	52½	-	-	-
Stewartby	d	-	57	-	-	-
Millbrook	d	-	00½	-	-	-
Lidlington	d	-	03½	-	-	-
Ridgmont	d	-	09	-	-	-
Aspley Guise	d	-	13	-	-	-
Woburn Sands	d	-	15½	25½	-	30½
Bow Brickhill	d	-	19½	-	-	-
Fenny Stratford	d	-	22½	-	-	-
Bletchley LL	a	-	26	-	-	-
Milton Keynes	a	-	-	-	-	**43**
Milton Keynes	d	-	-	-	**25**	-
Bletchley HL	a	04	-	33	38	-
Bletchley HL	d	05	-	34	39	-
Aylesbury Parkway	d	-	-	54	-	-
Aylesbury	a	-	-	59	-	-
Bicester Town	d	20½	-	-	54½	-
Oxford	a	33	-	-	07	-
Oxford	d	35	-	-	09	-
Reading	a	04	-	-	38	-

* varies by hour according to calling pattern

STANDARD HOUR - OPTION 2A

Eastbound

					every 2 hours	
Reading	d	07	32	-	-	-
Oxford	a	36	01	-	-	-
Oxford	d	38	03	-	-	-
Bicester Town	d	50	15	-	-	-
Aylesbury	d	-	-	13	-	-
Aylesbury Parkway	d	-	-	17	-	-
Bletchley HL	a	04½	29½	34½	-	-
Bletchley HL	d	05½	32	35½	-	-
Milton Keynes	a	16	-	43	-	-
Milton Keynes	d	-	-	-	-	55
Bletchley LL	d	-	-	-	38	-
Fenny Stratford	d	-	-	-	40½	-
Bow Brickhill	d	-	-	-	44	-
Woburn Sands	d	-	-	-	48	06½
Aspley Guise	d	-	-	-	49½	-
Ridgmont	d	-	-	-	54	-
Lidlington	d	-	-	-	58	-
Millbrook	d	-	-	-	01	-
Stewartby	d	-	-	-	04	-
Kempston Hardwick	d	-	-	-	08	-
Bedford St Johns	d	-	-	-	13½	-
Bedford	a	-	55	-	20	25
Bedford	d	-	59	-	-	29
Sandy	d	-	17	-	-	47
Hitchin	d	-	29	-	-	59
Stevenage	a	-	34	-	-	04
Stevenage	d	-	36	-	-	06
Hertford East	d	-	52	-	-	22
Harlow Town	d	-	09	-	-	39
Bishops Stortford	d	-	19	-	-	49
Stansted Airport	a	-	29	-	-	59

Westbound

						every 2 hours
Stansted Airport	d	-	42	-	12	-
Bishops Stortford	d	-	51	-	21	-
Harlow Town	d	-	01	-	31	-
Hertford East	d	-	18	-	48	-
Stevenage	a	-	33	-	03	-
Stevenage	d	-	34	-	04	-
Hitchin	d	-	40	-	10	-
Sandy	d	-	52	-	22	-
Bedford	a	-	09½	-	39½	-
Bedford	d	-	13½	-	43½	48
Bedford St Johns	d	-	-	-	-	52
Kempston Hardwick	d	-	-	-	-	57½
Stewartby	d	-	-	-	-	02
Millbrook	d	-	-	-	-	05½
Lidlington	d	-	-	-	-	08½
Ridgmont	d	-	-	-	-	14
Aspley Guise	d	-	-	-	-	18
Woburn Sands	d	-	-	-	00½	20½
Bow Brickhill	d	-	-	-	-	24½
Fenny Stratford	d	-	-	-	-	27½
Bletchley LL	a	-	-	-	-	31
Milton Keynes	a	-	-	-	13	-
Milton Keynes	d	25	-	59	-	-
Bletchley HL	a	31	34	05	-	-
Bletchley HL	d	32	37	06	-	-
Aylesbury Parkway	d	52	-	-	-	-
Aylesbury	a	57	-	-	-	-
Bicester Town	d	-	52½	21½	-	-
Oxford	a	-	05	34	-	-
Oxford	d	-	07	36	-	-
Reading	a	-	36	05	-	-

STANDARD HOUR - OPTION 2B

Eastbound

					every 2 hours	
Reading	d	07	32	-	-	-
Oxford	a	36	01	-	-	-
Oxford	d	38	03	-	-	-
Bicester Town	d	50	15	-	-	-
Aylesbury	d	-	-	13	-	-
Aylesbury Parkway	d	-	-	17	-	-
Bletchley HL	a	04½	29½	34½	-	-
Bletchley HL	d	05½	32	35½	-	-
Milton Keynes	a	16	-	46	-	-
Milton Keynes	d	-	-	-	-	55
Bletchley LL	d	-	-	-	38	-
Fenny Stratford	d	-	-	-	40½	-
Bow Brickhill	d	-	-	-	44	-
Woburn Sands	d	-	-	-	48	06½
Aspley Guise	d	-	-	-	49½	-
Ridgmont	d	-	-	-	54	-
Lidlington	d	-	-	-	58	-
Millbrook	d	-	-	-	01	-
Stewartby	d	-	-	-	04	-
Kempston Hardwick	d	-	-	-	08	-
Bedford St Johns	d	-	-	-	13½	-
Bedford	a	-	55	-	20	25
Bedford	d	-	59	-	-	29
Sandy	d	-	17	-	-	47
Hitchin	a	-	28	-	-	58
Hitchin	d	-	-	-	-	59
Stevenage	a	-	-	-	-	04
Stevenage	d	-	-	-	-	06
Hitchin	a	-	-	-	-	-
Hitchin	d	-	32	-	-	-
Letchworth	d	-	38	-	-	-
Royston	d	-	49	-	-	-
Cambridge	a	-	05	-	-	-
Norwich	a	-	even ~25*	-	-	-
Ipswich	a	-	odd ~25*	-	-	-
Hertford East	d	-	-	-	-	22
Harlow Town	d	-	-	-	-	39
Bishops Stortford	d	-	-	-	-	49
Stansted Airport	a	-	-	-	-	59

* varies by hour according to calling pattern

Westbound

						every 2 hours
Stansted Airport	d	-	42	-	-	-
Bishops Stortford	d	-	51	-	-	-
Harlow Town	d	-	01	-	-	-
Hertford East	d	-	18	-	-	-
Ipswich	d	-	-	-	even ~10*	-
Norwich	d	-	-	-	odd~ 15*	-
Cambridge	d	-	-	-	35	-
Royston	d	-	-	-	50	-
Letchworth	d	-	-	-	01	-
Hitchin	a	-	-	-	06	-
Hitchin	d	-	-	-	-	-
Stevenage	a	-	33	-	-	-
Stevenage	d	-	34	-	-	-
Hitchin	a	-	36	-	-	-
Hitchin	d	-	40	-	10	-
Sandy	d	-	52	-	22	-
Bedford	a	-	09½	-	39½	-
Bedford	d	-	13½	-	43½	48
Bedford St Johns	d	-	-	-	-	52
Kempston Hardwick	d	-	-	-	-	57½
Stewartby	d	-	-	-	-	02
Millbrook	d	-	-	-	-	05½
Lidlington	d	-	-	-	-	08½
Ridgmont	d	-	-	-	-	14
Aspley Guise	d	-	-	-	-	18
Woburn Sands	d	-	30½	-	-	20½
Bow Brickhill	d	-	-	-	-	24½
Fenny Stratford	d	-	-	-	-	27½
Bletchley LL	a	-	-	-	-	31
Milton Keynes	a	-	43	-	-	-
Milton Keynes	d	25	-	29	-	-
Bletchley HL	a	31	-	35	04	-
Bletchley HL	d	32	-	36	07	-
Aylesbury Parkway	d	52	-	-	-	-
Aylesbury	a	57	-	-	-	-
Bicester Town	d	-	-	51½	22½	-
Oxford	a	-	-	04	35	-
Oxford	d	-	-	06	37	-
Reading	a	-	-	35	06	-

* varies by hour according to calling pattern

CONTROL SHEET

Project/Proposal Name: EAST WEST RAIL

Document Title: Central Section - Operating Case

Client Contract/Project Number:

SDG Project/Proposal Number: 202869-E

ISSUE HISTORY

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