Planning and Regulation

Route Planning

New Lines Programme

Capacity analysis

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1 EXECUTIVE SUMMARY

1.1 This workstream provides a key input to the investigation into whether there is a strategic business case for building one or more New Line(s) as additions to the national rail network. It tests the hypothesis that a gap will arise at a future date between railway demand and supply. It considers the capability of the rail lines to satisfy passenger and freight demand both today and at a future date. It assesses whether further intervention is necessary, such as the construction of a new line, if existing lines are seen to be operating at full capacity.

1.2 The study geography is bound by the five 'classic line' route corridors that radiate in an arc to the west and north of London. These are the Great Western, Chiltern. West Coast, Midland and East Coast main lines.

1.3 Demand data has been sourced from the PLANET Strategic Model and the Network Modelling Framework to ensure a consistency of approach with the appraisal of other investment schemes such as HLOS. The baseline route and passenger carrying capability of the railway system was established from existing published data, including Route Utilisation Strategies and the Strategic Business Plan from Network Rail, HLOS from Department of Transport and as agreed in a series of capacity baselining workshop with Network Rail planners. A key part of this analysis has been to establish what impact planned and assumed interventions will have on the demand-capability gap in the planning year- 2019/20.

1.4 This paper concludes that each of the classic line route corridors will be at or close to capacity in terms of the quantum of services that can be operated given the current or planned service mix. Therefore a significant capacity gap exists in this respect if demand growth were to be met by future proposals/bids for the operation of more trains. The major programmes, Thameslink and Crossrail, deliver a step change in capacity on three route corridors. Rolling stock replacement schemes including IEP provide a significant opportunity to enhance capacity on many services.

Great Western Main Line (GWML)

1.5 On the GWML there is no significant demand-capability gap in 2020. The route was considered to be the least constrained as, although the notional 2020 timetable increases capacity utilisation to levels similar to those seen on other lines, it represents a very significant enhancement over today's timetable. The major schemes – Crossrail and IEP - provide the step change in capability.

Chiltern

1.6 On Chiltern the demand-capability gap can be met through the unique Franchise that runs to 2021. The Chiltern Railways Evergreen 3 programme should meet the capacity and demand requirement to the end of the franchise. There is believed to be further scope to accommodate growth beyond 2021 through further train lengthening.

West Coast Main Line (WCML)

1.7 On the WCML there is a significant demand-capability gap in 2020. Completion of route modernisation has led to a step-change in capability in terms of speed to the West Midlands and North West. However, the impact on overall passenger capacity has been less dramatic. Further schemes committed or assumed likely to happen will achieve only a modest increase in peak hour passenger capacity.

1.8 The route is now effectively full over key route sections. Although a number of schemes are proposed, few suggested make the step change necessary to meet future demand. Only a radical solution, such as building more running lines (e.g. the Coventry corridor), more platform faces at intermediate stations (e.g. Watford Junction) and/or new grade separation (e.g. at Ledburn Junction) will provide the necessary capability and capacity for the diversity of traffic and future demand.

Midland Main Line (MML)

1.9 On the MML there is no passenger demand capability gap in 2020 because of the significant increase in capacity delivered through the Thameslink programme, but the route cannot carry any additional services on most route sections. Completion of the Thameslink programme will lead to the route being effectively full south of Bedford, both peak and off-peak. This will impose substantial planning and performance risk and will severely limit freight capacity. MML Thameslink paths must match those planned on ECML and through the Thameslink core or there is a risk that the planned quantum of trains on both routes cannot be achieved. Similarly longer distance services must be planned around the Thameslink pattern in order for the route to perform effectively.

1.10 North of Bedford, capacity is likely to be similarly constrained unless significant upgrade and reinstatement of the Slow Lines is undertaken. It is considered that no significant further enhancements to train service frequency will be possible.

East Coast Main Line (ECML)

1.11 On the ECML there is no demand gap but the route cannot carry any additional services on most route sections. The HLOS and Thameslink programme of upgrades meet stakeholder aspirations for enhanced long-distance, outer and inner-suburban and Thameslink services if delivered in full. However, this is at the cost of very high capacity utilisation and a tightly-constrained timetable. As noted above ECML Thameslink paths must match those planned on the MML or there is a risk that the planned quantum of trains for both routes cannot be achieved.

1.12 Following implementation of such a timetable, it is difficult to see how any further increase in capacity could be provided, although works in the Welwyn area would probably allow some flexibility. No freight paths will be available on the ECML south of Doncaster, and there will be significant constraints north thereof.

Passenger Demand

1.13 Forecasts show a similar level of unconstrained demand growth on all four main lines (excluding Chiltern). Between 2006/07 and 2019/20 the West Coast Main Line shows a 30% increase in a.m. peak hour demand for travel into London, the Great

Western Main Line has a 32% increase, the Midland Main Line has a 31% increase and the East Coast Main Line has a 26% increase.

Freight Demand

1.14 Freight growth is expected to continue to be strong, and this will continue to exert pressure on the accommodation of freight paths. Such growth will place an increasing pressure on a network seeking to provide capability for growth in both passenger and freight traffic.

Overall

1.15 The demand-capability gaps identified in this report should be used to inform the generation of new line(s) options and also the associated changes to the classic routes. Generation of options should focus on relieving the demand-capability gap on the WCML followed by the MML and ECML.

1.16 Option generation on the GWML should be a lower priority unless the selection and sifting of target destinations identifies a particular business case benefit beyond the expected relief of the classic main line.

2 INTRODUCTION

2.1 The study geography is bound by the five 'classic line' route corridors that radiate in an arc to the west and north of London. These are the:

- Great Western Main Line (GWML)
- Chiltern (Marylebone to Birmingham via High Wycombe)
- West Coast Main Line (WCML)
- Midland Main Line (MML)
- East Coast Main Line (ECML)

2.2 The structured programme of work culminates in a recommendation as to whether to progress to a more detailed investigation of one or more new lines as a next phase of work.

Workstream 3: Demand-capability gap

2.3 A key purpose of this workstream is to test the hypothesis that a gap will arise at a future date between railway demand and supply. This workstream takes outputs from workstreams 1 - Baseline capability of the railway system and workstream 2 – Rail travel demand forecasts, and using existing tools and data available forms a robust, but essentially strategic view of the demand-capability gap by applying experience and judgement to these outputs.

2.4 It considers the capability of the rail lines to satisfy passenger and freight demand both today and at a future date. It assesses whether further intervention is necessary, such as the construction of a new line, within rail industry planning horizons, if the existing lines are operating at full capacity.

2.5 This workstream provides key inputs in the:

- Generation of options for new line(s);
- Generation of options for the redeployment of classic line capacity and paths released by the transfer of demand to the new line(s); and
- Preparation of a reference case against which a new line option will be compared

2.6 This workstream considers if there is a need to significantly increase rail capacity by 2019/20 when all currently committed and likely schemes will have been delivered. We also look beyond to 2029/30 to see how the demand-capability gap grows.

2.7 It does this by drawing together the following elements:

- Demand forecasts sourced from the Department for Transport (DfT) Network Modelling Framework (NMF) Model; and
- An assessment of the capacity available to carry that demand.

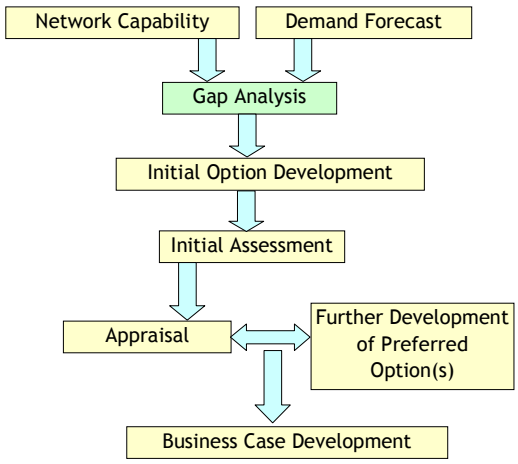
Workstream 3: Assumptions made

2.8 The data used is the best available, but certain limitations are highlighted to ensure that a correct interpretation of the analysis presented can be made.

Workstream 3: Relationship with overall study and other workstreams

2.9 How the gap analysis feeds the initial option generation is shown in Figure 2.1 below:

FIGURE 2.1 WORKSTREAM 3 - GAP ANALYSIS



Demand-capability gaps

2.10 Demand-capability gaps arise from a number of factors but fundamentally it refers to the complex relationship between passenger and freight demand and the railway network capability to satisfy and carry it. Actual passenger demand is a response to the train service offered and rail's competitive position in the market for travel. Many factors influence that response including cost, quality and ease of access. The capability gap is often referred to as a capacity gap.

2.11 For the purposes of this analysis a 'capacity gap' has been defined as follows:

'A capacity gap occurs where the current capacity of the network is exhausted. A capacity gap can manifest itself in a number of ways. One manifestation of this gap occurs when sufficient capacity cannot be provided between two places so that all passengers who wish to travel can do so in appropriate comfort. Another manifestation of a capacity gap can be seen when markets between origin and destination pairs cannot be served with an appropriate level of rail service.'

GWML, WCML, MML and ECML 'classic line' corridors

2.12 These four corridors will be considered separately to determine whether the shortfall in capacity on any one will support the development of a New Line. This work is to be regarded as a preliminary investigation, at the pre-GRIP stage in accordance with the industry's Guide to Railway Projects (GRIP). This route by route analysis does not presuppose that the impact of any new line option generated will be solely confined to one of the existing corridors.

Chiltern Main Line

2.13 The Chiltern main line via High Wycombe is within the study geographical scope, but it was agreed that the existing franchise agreement, which runs until 2021, provides sufficient flexibility to meet any demand-capability gaps. It is clear that there remains significant further scope to lengthen trains on the Chiltern route to meet passenger growth for the foreseeable future, and the TOC is currently developing an investment scheme (Evergreen 3) as part of their franchise agreement with the DfT. We believe that this would provide for both capacity enhancement and other benefits to further complement that already delivered through the earlier Evergreen 1 and 2 schemes and other ongoing TOC investment. Evergreen 3 and other planned capacity improvements should provide sufficient route capacity to franchise expiry in 2021. Beyond that date it is believed that further growth can be accommodated through further train lengthening. This analysis concentrates, therefore, on the other four 'classic line' corridors.

Terminology used

2.14 Throughout this document the current generic franchise TOC names are generally used for simplicity. We note that some franchises have changed operator, been remapped or have been re-branded during the periodicity of data collection. There will be further changes associated with the Thameslink and Crossrail programmes and DfT's planned re-franchising programme.

2.15 The London 'terminus' is the point at which the passenger demand data is measured for the lines being studied as part of this work. On all routes studied this represents the point of peak passenger demand. In some cases the trains do not actually terminate at this station, as the platforms used by these services are on through lines. This is particularly true in respect of both the Thameslink services from the MML and ECML where St Pancras International is the London 'terminus' and Crossrail services from the GWML where Paddington is the London 'terminus'. The ECML already has two London 'termini' and in future will have three.

2.16 Capability is measured at the busiest point of the route as described in this report.

Glossary of Terms used throughout this Report

TABLE 2.1 ABBREVATIONS USED FOR ROUTES AND RUNNING LINES

Classic Main Line Routes	
GWML	Great Western Main Line
WCML	West Coast Main Line
MML	Midland Main Line
ECML	East Coast Main Line
Running Lines	
ML	Main Line (On GWML)
RL	Relief Line (On GWML)
FL	Fast Line
SL	Slow Line
DC	DC lines (On WCML between Camden Junction and Watford Junction via Stonebridge Park)

TABLE 2.2 ABBREVIATIONS USED TO DESCRIBE TOCS

	DfT Franchise / Open Access/ Concession TOC name*	Current branding as used by TOC*	Previous branding
GW	Greater Western	First Great Western	N/A
ICWC	Intercity West Coast	Virgin Trains	N/A
LM	West Midlands	London Midland	Silverlink County or Central Trains
LO	London Overground	London Overground	Silverlink Metro
EM	East Midlands	East Midlands Trains	Midland Mainline or Central Trains
TL	Thameslink/Great Northern	First Capital Connect (Thameslink Route)	Thameslink
GN	Thameslink/Great Northern	First Capital Connect (Great Northern Route)	WAGN
ICEC	Intercity East Coast	National Express East Coast	GNER
SC	South Central	Southern	N/A
SR	ScotRail	First ScotRail	N/A
HEx*	Heathrow Express	Heathrow Express	N/A
HC*	Heathrow Connect	Heathrow Connect	N/A
XR*	Crossrail	Crossrail	N/A

*Notes: All TOCs are let as Franchises by Department for Transport except the following:

1. London Overground is a concession let by Transport for London.

2. Heathrow Express is an open access TOC (between Paddington and Airport Junction) and is owned by BAA. The route from Airport Junction to Heathrow Airport T4 and T5 is unregulated infrastructure owned by BAA.

3. Heathrow Connect is a joint venture TOC (First Group and BAA) and is run as part of the Greater Western franchise between Paddington and Hayes and Harlington and as an open access operation from Hayes and Harlington to Airport Junction (and on to Heathrow T4 on BAA infrastructure).

4. Crossrail is the name used to describe the project and services operated on the new East-West cross London route that connects the GWML and the Great Eastern main line between Paddington and Liverpool Street.

3 STRATEGIC CONTEXT

3.1 The strategic context is important for understanding the framework within which any decision on future investment in the rail network must be considered. Over the past few years there have been a number of initiatives that provide the basis and the strategic backdrop for this study.

3.2 Four recent key publications now shape how investment in the railways should be considered. These are:

- Stern Review October 2006
- Eddington Transport Study December 2006
- Delivering a Sustainable Railway July 2007
- Towards a Sustainable Transport System October 2007

Stern Review

3.3 Stern's Review was a jointly commissioned report by HM Treasury and the Department for Transport. It concluded that developed countries must cut CO_2 emissions by at least 60% by 2050.

3.4 The UK commitment to climate change goals are enshrined in Climate Change Bill, enacted in November 2008. This commits the UK government to cutting greenhouse gases by 80% by 2050.

Eddington Transport Study

3.5 Shortly after the Stern Review, Sir Rod Eddington published a report that confirmed transport's vital role to the UK economy. He suggested two principal conclusions:

- That there should be a targeted approach to the most seriously congested parts of the UK transport network; and,
- That making best use of the existing networks should be regarded as as important as initiating infrastructure investment.

3.6 The Secretary of State confirmed the government's commitment to developing modern sustainable rail system that supports:

- Economic growth including housing development; and,
- The climate change agenda.

Delivering a Sustainable Railway

3.7 The White Paper, 'Delivering a Sustainable Railway', was published in July 2007. It set out the government's vision for the railways over the short, medium and long-term.

Towards a Sustainable Transport Strategy

3.8 'Towards a Sustainable Transport System' (TaSTS) was the government's response to the Stern Review and the Eddington Transport Study. It set out the DfT's policy and investment plans for the period to 2013-14, equivalent to the current railway Control Period (CP4). The document also sought to advance a new approach to long-term transport strategy, as per the model proposed by Sir Rod Eddington.

3.9 TaSTS has five broad goals:

- Maximise **competitiveness and productivity** of the economy – making best use of existing networks, targeted new infrastructure investments, adapting to changing demand;
- Address **climate change** – cut emissions of CO_2 and other greenhouse gases through carbon pricing, technological innovation and removing barriers to action;
- Protect people's **safety, security and health** – addressing the negative impact on people's health, tackling crime and improving safety of users and workers;
- Improve **quality of life** – healthy natural environment and meeting people's expectations on comfort, convenience and quality of service; and,
- Promote **greater equality of opportunity** – ensuring access to transport for everyone, and opportunities to redress inequalities and enhance social inclusion.

TABLE 3.1 HOW NEW LINES PROJECT SUPPORTS TASTS GOALS

	TaSTS Broad Goals	New Lines
1	Maximise competitiveness and productivity	Greater connectivity between major population and employment centres will boost economic output and reduce travel time.
2	Address climate change	Increased attractiveness of rail will encourage people to move from congested highways, and high speed rail will provide a credible alternative to domestic air travel.
3	Protect people's safety, security and health	Rail is a statistically safer mode of travel than car, and new lines will encourage that switch to public transport.
4	Improve quality of life	New rail lines will offer the travelling public a step-change in the transport experience – both existing users and those switching from alternative modes – a more comfortable, convenient and faster service to meet public expectations.
5	Promote greater equality of opportunity	Generating additional capacity can make existing rail lines more accessible, and high speed connectivity between regions can bring geographically distant places closer together.

3.10 Investment must be underpinned by robust evidence that includes long-term demand projections, a clear understanding of the capacity of existing networks and full account of relevant geographical, technical and environmental considerations.

3.11 There are a number of key patterns and issues facing national transport, including:

- Highway – motoring costs, congestion, road building, demand management
- Aviation – domestic, inter-liners, runway capacity, landing charges
- Rail – emerging issues, challenges, new capacity

3.12 Against this backdrop are a number of factors that will need to be considered in the development of the case for new lines and other strategic transport decisions. These include political, economic, social, technological, legal and environmental matters.

4 DEMAND

4.1 Demand data has been sourced from two well-established national models, both maintained and held by the Department for Transport. This is to ensure a consistency of approach with the appraisal of other investment schemes such as HLOS. The two models are:

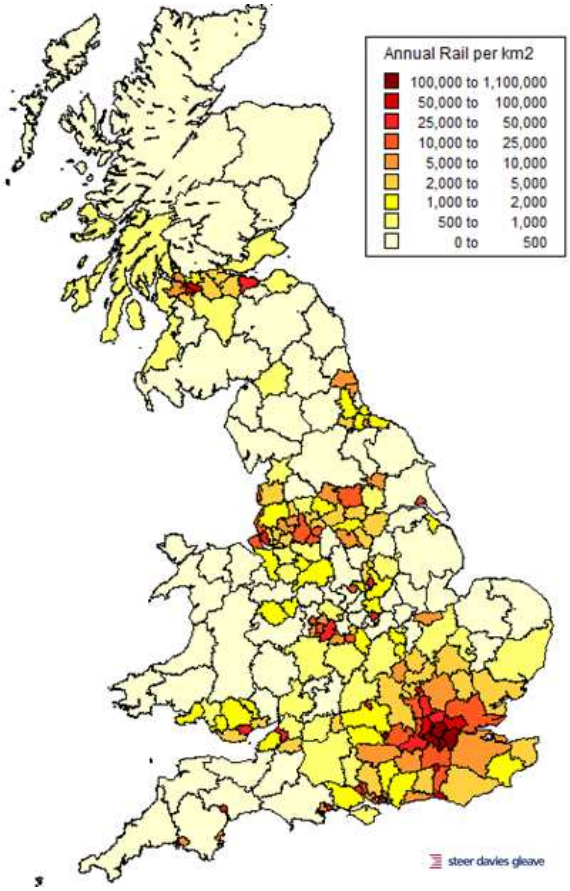
- Planet Strategic Model (PSM) with a demand matrix based on LENNON (formerly known as CAPRI) data containing 235 zones; and
- Network Modelling Framework (NMF) with a more recent base demand matrix and a spatial structure of 808 zones.

4.2 For the subsequent discussion of demand, both models have been used to seek to understand the patterns of rail demand.

Current Demand

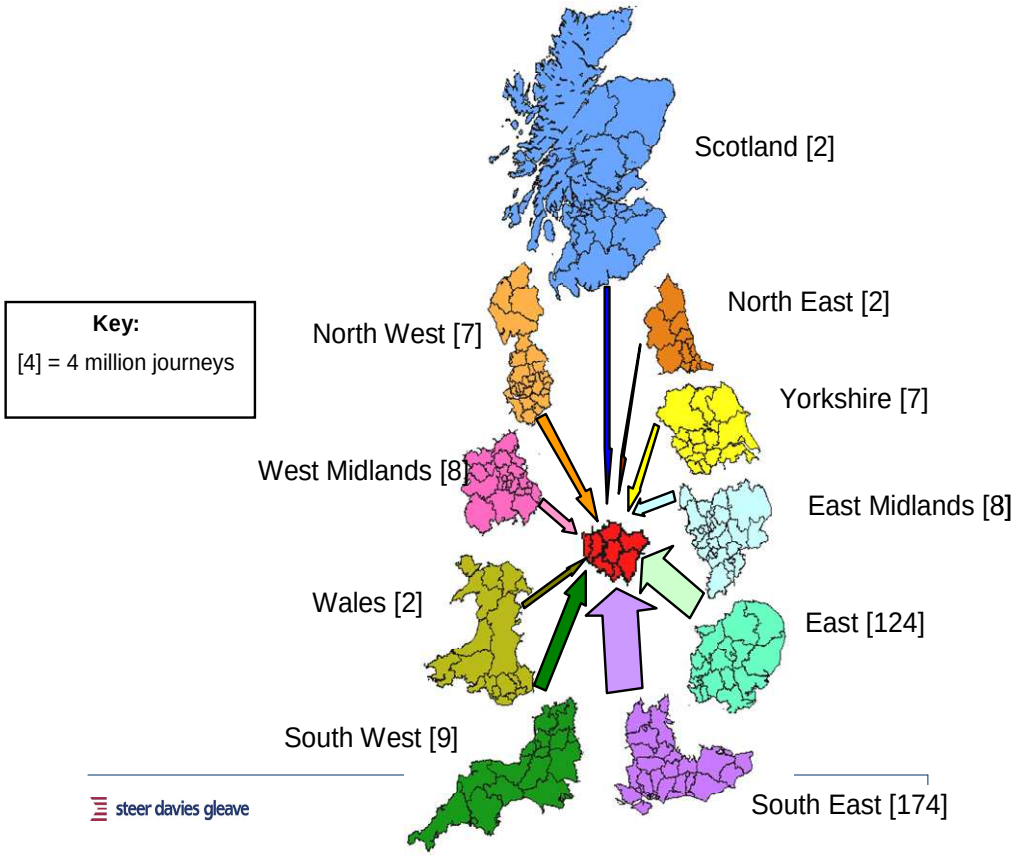
4.3 Figure 4.1 illustrates the current pattern of rail demand, sourced from the Planet Strategic Model.

FIGURE 4.1 DISTRIBUTION OF RAIL TRIPS IN 2000



4.4 Figure 4.1 shows the concentration of rail trips in London and the South East, the major urban areas and the Central Belt of Scotland as measured in terms of rail trips per square km. A further map of interest is that which shows the relative attractiveness of journeys to London. Figure 4.2 reveals the dominance of trips to London from the South East and the East government office regions and these are themselves dominated by commuting. The numbers of journeys from other government office regions to London is therefore much less, as the time/cost makes then unattractive for commuters.

FIGURE 4.2 RAIL JOURNEYS TO LONDON IN 2007



Recent changes in demand patterns

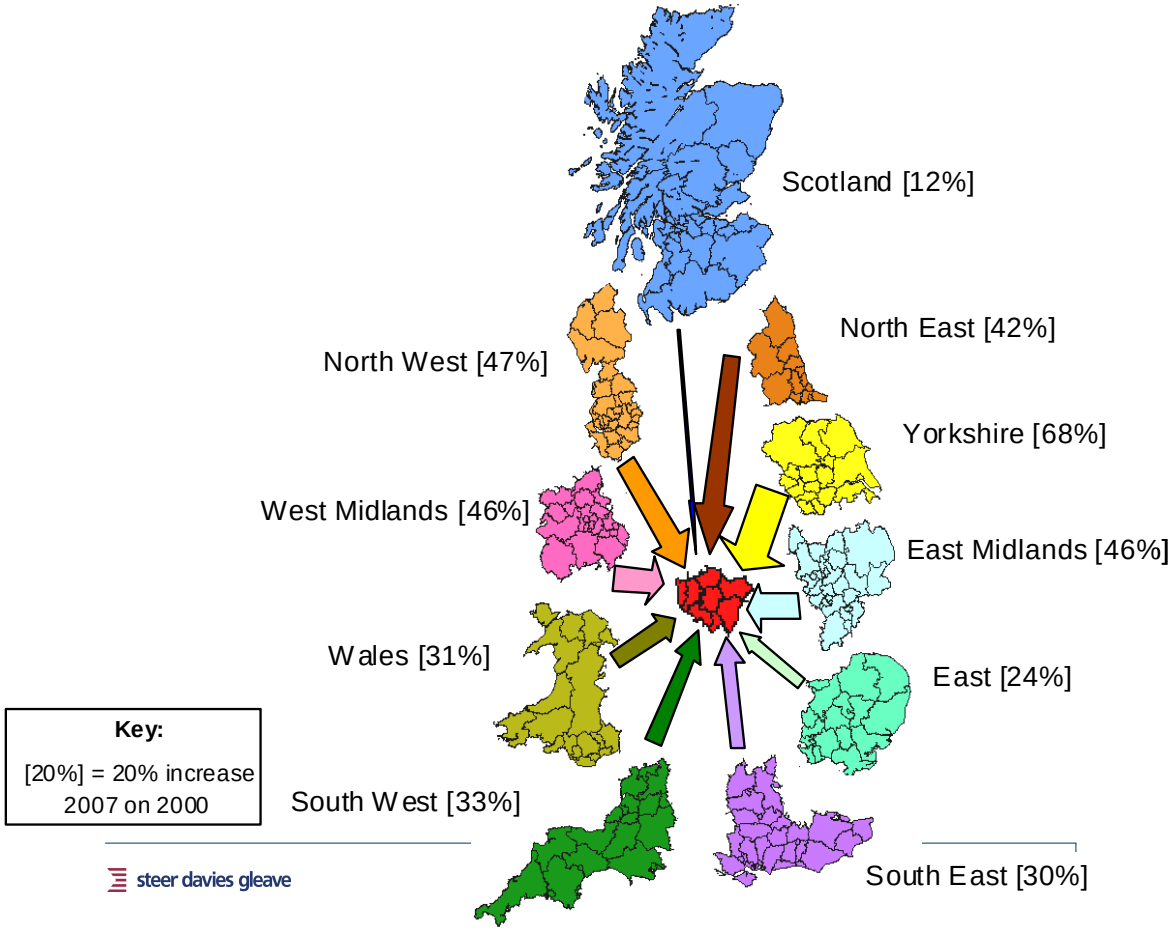
4.5 Related to the previous figure is an appreciation of the growth in demand over time. Recognising that there are capacity pressures on some of the longer distance services radiating to/from London, it is informative to consider the change in demand that there has been over recent years.

4.6 It is evident that some of the biggest increases in demand for journeys to and from London have come from the north of England and the Midlands as shown in Figure 4.3. Yorkshire has seen an increase of 68%, whilst increases in excess of 40% have occurred in the North West, North East, West Midlands and East Midlands government office regions. Growth from Scotland has been noticeably lower, and perhaps this reflects the emergence of low cost airlines, whilst demand growth from the Wales and the South West is also less strong.

4.7 What underlies these variances is less clear, but it may reflect that the impact of train service changes over time. For example, the so-called 'commuterisation' of the GWML has seen the service evolve from being a traditional Intercity route focussed on Bristol, South Wales and the West Country to being a long distance commuter service more focussed on the rapidly growing Thames Valley corridor. This means that many longer distance journeys are both slower and stop more than hitherto. Poor performance and several serious incidents on the route may also have had some impact.

4.8 Elsewhere service improvements, more focus on yield management and active encouragement to fill up seats coupled with improved performance may explain some of these changes where rail is strong competitively.

FIGURE 4.3 CHANGES IN PATTERNS OF RAIL DEMAND, 2000 TO 2007



Forecast Passenger Demand

4.9 For the purposes of the Gap Analysis, the DfT's Network Modelling Framework (NMF) has been used to forecast rail demand. It has been chosen for two main reasons:

- It reports demand by route section such that a reasonably disaggregate understanding of demand patterns can be considered; and

- It is the model that is currently used to develop and test the High Level Output Specification (HLOS) schemes by the DfT.

4.10 This latter reason is particularly important because it ensures that a consistency of approach is maintained between a Network Rail project and that used by the DfT to determine its future rail plans.

4.11 The NMF model produces forecasts for a number of future years – 2014, 2020 and 2030. A base year of 2006/07 is used.

4.12 The NMF model reports by time periods as follows:

- a.m. Peak Hour: 08:00 to 08:59
- p.m. Peak Hour: 17:00 to 17:59
- a.m. Shoulder Peak: 07:00 to 07:59 and 09:00 to 09:59
- p.m. Shoulder Peak: 16:00 to 16:59 and 18:00 to 18:59
- Off Peak: All other times

4.13 The model contains the stopping pattern and loads for all national rail trains.

4.14 For the purposes of this study, a planning horizon year of 2020 is assumed. However, the knowledge of how demand is expected to grow through to 2030 is helpful in appreciating how soon beyond 2020 there is likely to be pressure on the available capacity.

Model limitations

4.15 It should be noted there are limitations with the NMF demand. Whilst the total number of arrivals into a London terminal may be reasonably accurate, the allocation of demand between TOCs by time period may not be so reliable.

4.16 "The NMF calibrates well for all services running over a particular route. However when NMF results are disaggregated by TOC, NMF is known to underestimate the loadings of fast non-stop services and overestimate the loadings of some stopping services" (source DfT).

Testing the model

4.17 During the course of the preparation of the demand data, this issue became very apparent for a.m. peak arrivals at London Euston. At the time of the analysis, and in the absence of counts for ICWC services, data from Managed Station counts for 2007 were used. This suggested 11,500 passengers alighting from the 23 ICWC services scheduled to arrive between 07.00 and 09.59. This number appeared high – an average of 500 passengers per train. If a constant occupancy rate were assumed, this would result in 4,500 ICWC passengers arriving during the 0800-0859 peak hour.

4.18 In addition, passenger counts for LO and LM TOC services were sourced from the PIXC survey to compare with the NMF model outputs. These were undertaken in the autumns of 2006 and 2007 respectively.

4.19 Table 4.1 shows the difference between the observed demand from passenger counts and the constrained demand outputs from the NMF model. It demonstrates that the observed counts from the PIXC surveys (LM and LO) is much lower than the numbers output by the NMF model, whereas the ICWC count data is much higher.

TABLE 4.1 EUSTON UP PASSENGER ARRIVALS IN AM PEAK (08:00-08:59) BY TOC

	NMF Model		Observed		Notes
TOC	Trains	Load	Trains	Load	
ICWC	9	1,952	9	4,500	Network Rail count 2007
LM	10	7,393	12	6,252	TOC count Autumn 2007
LO	3	1,276	3	737	TOC count Autumn 2006
TOTAL	**22**	**10,621**	**24**	**11,489**	

4.20 The overall demand assumed into Euston is broadly the same, though there are clear imbalances between different operators. This aligns with DfT's assessment of the NMF models strengths and weakness (see section 4.16).

4.21 Subsequent to this analysis, independent count data was provided by the Department for Transport that indicated the count data for ICWC services may be too high. This is possible as Managed Station counts are taken from one day, whereas the independent counts were across a period of several weeks.

4.22 Another factor which also creates a little uncertainty is the reliability in allocation of demand between National Rail and LUL Underground services where they run on the same lines and serve the same stations, as on the WCML, or where passengers interchange with LUL lines en route such as Finsbury Park on the ECML.

4.23 This applies to the WCML where LUL's Bakerloo line trains operate on the DC lines between Harrow and Wealdstone and Queens Park. LUL's Bakerloo line trains share passenger demand (and revenue) with London Overground and London Midland TOC services although their London 'terminus' is London Baker Street.

4.24 Given the level of uncertainty over the allocation of demand between TOC operators, it was decided that the results should be considered in aggregate for all services.

Constrained and Unconstrained demand forecasts

4.25 Table 4.2 sets out the unconstrained and constrained demand forecasts for the four classic main line routes within the study area.

TABLE 4.2 NMF MODEL UNCONSTRAINED AND CONSTRAINED PASSENGER DEMAND FORECASTS

	Year						
Route	**2004 /05**	**2006 /07**	**2008 /09**	**2009 /10**	**2013 /14**	**2019 /20**	**2029 /30**
Unconstrained Demand – a.m. Peak Hour (08:00 to 08:59) Arrivals at London							
WCML	12,972	13,369	14,107	14,437	15,779	17,386	18,511
GWML	15,989	15,492	16,553	16,987	18,560	20,518	21,876
MML	18,234	18,022	18,745	20,253	21,876	23,567	24,561
ECML	18,074	17,369	18,185	18,700	20,238	21,933	22,976
Constrained Demand – a.m. Peak Hour (08:00 to 08:59) Arrivals at London							
WCML	10,160	10,621	10,563	11,460	12,208	13,074	13,668
GWML	10,786	10,968	11,511	12,245	12,951	13,692	14,162
MML	12,954	12,782	13,107	15,617	16,405	17,120	17,541
ECML	14,620	14,347	14,811	15,542	16,359	17,243	17,742

4.26 The NMF model produces both constrained, i.e. with the effects of crowding, and unconstrained demand. For this study the focus is an understanding of the unconstrained demand as this represents the underlying level of demand that exists for rail travel. This analysis is seeking to demonstrate what level of capacity would be needed to satisfy this demand.

4.27 The current NMF model has some limitations in that not all committed and likely schemes are modelled. These include, for example Crossrail and the full Thameslink programme schemes. These schemes are expected to generate some new demand through achieving better generalised journey times on many cross London flows and particularly on the GWML where Crossrail will significantly improve access to the City and Docklands.

4.28 However, as the key benefit of these schemes is the provision of increased capacity, the unconstrained demand forecasts will still be valid if a little understated. Not enough is known about the final service patterns or actual timings of trains to consider this further at this stage. However this factor does limit the applicability of the constrained demand forecast.

4.29 Table 4.2 above shows the constrained demand to enable comparisons to be made with current demand levels.

4.30 The analysis in Section 6 adopts the unconstrained metric as the basis upon which future demand-capacity gap should be considered. Constrained numbers are also

shown to demonstrate the degree of suppression inherent in current demand levels and the enable comparisons with known load levels.

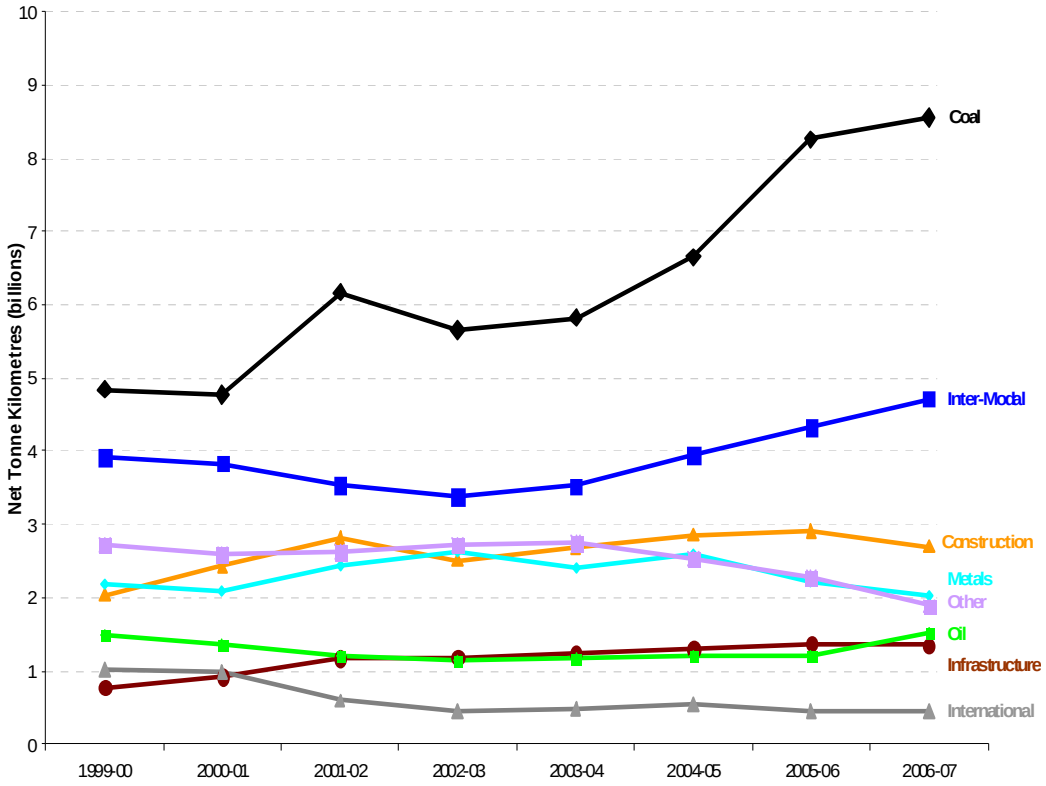
4.31 Table 4.2 shows a similar level of unconstrained demand growth on all four main lines. Between 2006/07 and 2019/20 the West Coast Main Lines show a 30% increase in a.m. peak hour demand for travel into London, the Great Western Main Line has a 32% increase, the Midland Main Line has a 31% increase and the East Coast Main Line has a 26% increase.

Freight Forecasts

4.32 An assessment has been made of the likely growth in freight traffic. This has assumed that the forecasts undertaken for the Freight Route Utilisation Strategy (RUS) from 2007 to 2014 can be extrapolated on to 2020 in a linear fashion.

4.33 Figure 4.4 shows the growth in rail freight between 2000 and 2007 by commodity, including that carried for the rail industry to support infrastructure maintenance.

FIGURE 4.4 RAILFREIGHT GROWTH BY COMMODITY 2000-2007



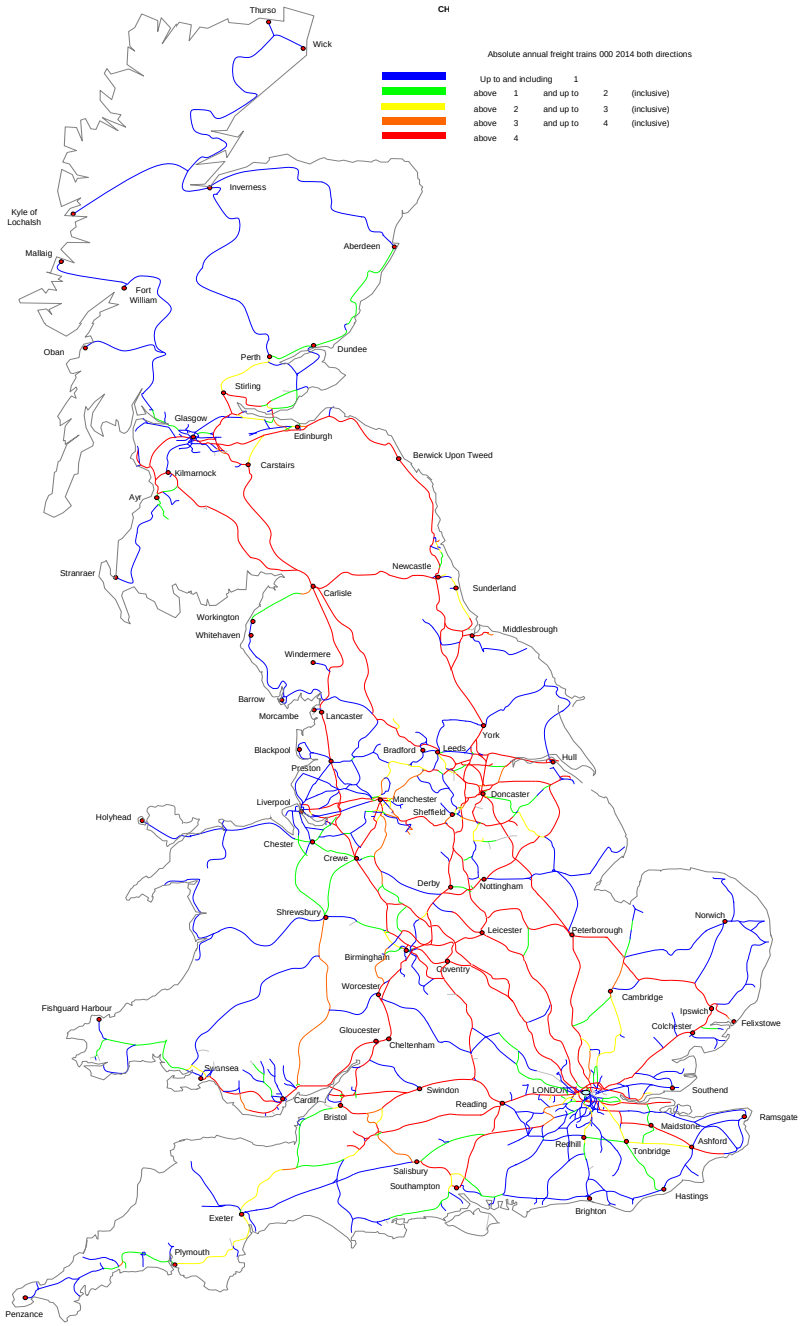
4.34 Between 2000 and 2007, total freight moved increased from 19 billion net tonne kilometres to 22 billion net tonne kilometres. The strong growth in coal, which dominates the traffic moved, reflects the steadily increasing reliance on imported sources and the long distances from port to point of consumption. Inter-modal traffic from port to inland distribution also grew significantly.

4.35 More recent data, not included here, suggests that the economic recession has quickly reversed the growth in the short term at least. Unlike the passenger railway,

where the trains still run even if demand falls, on the freight railway the trains will not run if there is no traffic. Much of this new information has arrived during the later stages of preparation of this report and it is probably too early to speculate what the long term impact will be on growth, trends and changes within the Railfreight sector itself.

4.36 Figure 4.5 shows the forecast of freight demand from 2007 to 2014 as prepared for the Freight RUS document.

FIGURE 4.5 FREIGHT DEMAND 2007-2014 FROM THE FREIGHT RUS



4.37 The freight forecasts were agreed within the Stakeholder Management Group for the Freight RUS, a group of industry stakeholders comprising Network Rail, freight operators and the Rail Freight Group. In gaining the support and buy-in of these organisations, it was concluded that the industry supports the basis and the outputs from the Freight RUS.

4.38 The main data source for the forecasts was the TOPS ACCTRAF database that records the movement of freight trains. This reflects the actual number of trains carrying freight on the network. The importance of this base metric is that it draws the distinction between actual traffic carried rather than the planned (or allocated) number of paths for freight trains.

4.39 Some goods and minerals traffic flows transported across the rail network are frequent and regular such that the timetabled freight paths operate as planned on a daily basis. Other traffic flows are less predictable and the trains operate irregularly leading to empty freight paths. Nationally, it is estimated that less than 50% of planned freight paths are actually occupied but the operators suggest that the inherent flexibility is essential to meet customer needs.

4.40 During the preparation of this analysis, it was confirmed that the Freight RUS forecasts are inevitably approximations of reality. Not only is there a difficulty mapping planned freight paths with the actual trains operated, but also there is significant variability between different traffic flows. In addition, assumptions have had to be made regarding the routeing used by freight operators. The exact rail routes used may vary depending on path availability, access rights or more practical matters such as route restrictions, driver route knowledge and location of depots etc. Estimates have been made in the Freight RUS, and these have been maintained for the purposes of the Gap Analysis to extend the forecasts through to 2020.

4.41 For example, coal movement by rail is dependent on the price of coal on the world market, and there is also the issue of where coal is transported from and to within Britain – whether from south west Scotland, or imported through the east of England ports such as Immingham. Other goods may also fluctuate depending on the capability of ports, the economic environment, the taxation policies affecting road haulage and the ability of the rail network to handle larger container sizes.

4.42 Notwithstanding the comments above, the conclusion on freight growth is that it is expected to continue to be strong, and that this will continue to exert pressure on the accommodation of freight paths. For example, the growth in freight trains between 2007 and 2020 is forecast to be 47% in the Western region, 38% in the London-North West corridor and 32% on the London North East route.

4.43 Such growth will place an increasing pressure on the existing network seeking to provide for the mix of passenger and freight traffic.

5 ROUTE CAPACITY

Introduction

5.1 The route capacity element of the gap analysis has been drawn from the work undertaken in Workstream 1: Baseline capability of the railway system. Details of the assumptions, methodology and findings can be seen in the technical note titled 'Capacity Analysis Appendix'.

5.2 Following a series of capacity baselining workshops, a methodology was agreed to define the capability of the existing and foreseeable future networks in terms of capacity. This was established through:

- Base capacity utilisation;
- Considering the potential impact of alternative timetables and/or infrastructure and signalling enhancement (including new technologies such as ERTMS Level 2) to deliver more capacity on the existing network;
- Considering the potential capability of the network to support longer, heavier or wider trains as opposed to additional trains; and
- Considering the potential capability rolling stock enhancements to deliver more carrying capacity. This is covered in Section 6.

5.3 The output is an estimation of the future capacity of the rail network and builds upon the Route Utilisation Strategies (RUSs) and the Route Plans developed by Network Rail. The study applied standard rail industry tools such as train path analysis.

5.4 Future year service specification were developed for each route taking into account HLOS schemes, the introduction of IEP rolling stock and the implementation of the Thameslink and Crossrail programmes. Other more speculative capacity schemes were not generally included at this stage of the study.

5.5 It is important to stress that the analysis has attempted to identify the maximum quantum of train paths that the infrastructure can accommodate once committed enhancements and likely schemes have been delivered. It was not possible in the time available to optimise notional timetables to maximise train paths.

5.6 Another key assumption was also made that future rail services would have to serve broadly the same markets as today and therefore that the following would not significantly change:

- Existing balance between freight and passenger;
- Fast and slow services; and
- Links between station pairs.

5.7 The number of services that can be accommodated on a particular route section is influenced by the mix of services. The removal of either fast trains or slow trains from a particular section of track would significantly increase the potential capacity of the infrastructure for the remaining services. If all trains have the same operating

and performance characteristics and the same calling patterns then route capacity is optimised. This is why metro networks such as London Underground achieve circa 30 tph in each direction on their busiest routes. However the adoption of uniform services on the national rail network would mean that a number of markets cannot be served in the manner in which they are today.

5.8 It should also be noted that the allocation of rolling stock between individual trains has not been optimised, and that the analysis at this stage is concerned with the aggregate position. However, given the variable mix of loadings on peak services depending on their origin and calling patterns, there would be scope at a more detailed level of train planning to control the load factors for a period of time.

5.9 This could be achieved through fares policy and associated new restrictions as recently adopted by some London commuter TOCs. However, there is no clear evidence that this has any measurable impact on peak loads and at best it would only serve to delay the point in time when demand exceeds supply.

Route Capacity Analysis - GWML

Impact of infrastructure and rolling stock changes on route capability

5.10 The GWML has a number of significant infrastructure schemes and rolling stock changes proposed for delivery before 2020, which will significantly increase capacity.

5.11 The key committed and likely schemes assumed for this analysis are:

- Reading station area re-development;
- Crossrail to Maidenhead and Heathrow T123 and 4;
- Cotswold re-doubling;
- Swindon-Kemble enhancement;
- Re-modelling of Paddington station with longer platforms; and
- IEP delivering longer train formations to all high-speed services (and possibly some regional services, either directly or via rolling stock cascades).

5.12 The result of the above schemes is that, in contrast to the WCML and MML, the timetable structure in 2020 is likely to be significantly different to the current timetable. Electrification of the GWML may dictate another timetable approach.

5.13 DfT is currently considering options for Electrification of the GWML but these are unlikely to further change the pattern of services at the London end of the route as described in this report.

5.14 Removal of the Reading bottleneck will allow more services between Paddington and Reading and vice-versa on the Main Lines. Currently, capacity through Reading is effectively limited to 10 trains per hour (tph) on the Down Main through Platform 4, and this, combined with the hard wired Heathrow Express (HEx) 15 minute even interval timetable structure between Paddington and Airport Junction, severely limits capacity for additional high-speed services. Completion of the Reading re-modelling would allow a theoretical maximum of 20 tph in each direction between

Paddington and Reading, although more realistically 16-18 tph is the most that could be achieved. Increasing the utilisation of the Main Lines is also likely to require removal of most station stops at Slough and other intermediate stations served by trains on these lines.

5.15 The Relief Lines timetable structure will be driven by Crossrail, which will also remove a significant number of services from Paddington station platforms (estimated at four equivalent platforms). This will, in turn, facilitate the re-modelling of Paddington to allow platform lengthening for IEP trains.

5.16 Other infrastructure schemes will ease planning restrictions and improve performance but are unlikely to lead to a step-change in capacity.

Assumed future timetable structure

5.17 Since no one complete and consistent timetable matching all of the known enhancements has been developed to date, a notional timetable for analysis has been developed using the DfT's IEP standard hour(s) timetable, with additional analysis undertaken to assess the likely effect of the Crossrail service pattern.

5.18 The Crossrail timetable assumed is that developed for performance analysis in 2005-2006, although development work continues on the Crossrail timetable, the service quantum has not changed significantly.

5.19 The likely passenger timetable structure post-Crossrail delivery is therefore:

- Main Lines
  - 4tph even interval HEx service to Heathrow as far as Airport Junction using existing Class 332 units;
  - 14tph Intercity and regional commuter services to the Bristol, South Wales, West of England, Oxford and Cotswold using new IEP train sets;
- Relief Lines
  - 4tph Crossrail services to Maidenhead using 10-car 23m new trains;
  - 4tph Crossrail service to Heathrow T4 using 9-car 23m new trains; and
  - 4tph other regional and inner-suburban services operated by 2x4-car Class 172 units and/or new high capacity electric units.

Summary of capability analysis

5.20 The capability, in terms of train paths, of the GWML has been examined between London Paddington and Reading.

5.21 The Main Lines are highly occupied during the peak hours, particularly in the morning peak. Although the Heathrow Express services diverge at Airport Junction, the effect of this is cancelled out by an increased planning headway west thereof. In addition, some services call at Maidenhead while others do not, which increases the effective occupation.

5.22 Once the Crossrail services are incorporated, utilisation of the Relief lines is also high throughout the day.

Route Capacity Analysis - WCML

Impact of infrastructure and rolling stock changes on route capability

5.23 Timetables and services on the WCML have been significantly affected by the major programme of renewals and enhancements on the route over many years. With this work now largely completed, a period of stability (in terms of the timetable plan) is expected with few additional disruptive schemes proposed. Capacity for additional passenger or freight trains as additions to the December timetable 2008 plan are known to be limited.

5.24 The key committed and likely schemes assumed for this analysis are:

- Completion of WCML upgrade;
- Replacement of Class 321/1 units with Class 350/1 and 350/2 units
- Bletchley re-modelling;
- Stafford re-modelling;
- Crewe re-modelling;
- Nuneaton re-modelling and chord;
- Power supply upgrade (i.e. no constraint on number or type of electric trains);
- Lengthening of all Class 390 Pendolino services to 11 vehicles; and
- Introduction of high capacity 5-car IEP train sets on some commuter and regional services to Northampton and beyond. These are assumed to be operated in 2x 5-car formation between Northampton and London Euston and in the peak and otherwise as required.

5.25 Other changes that may impact of capacity are:

- Further electric locomotive haulage of freight trains north of Preston that may provide additional paths; and
- The Felixstowe to Nuneaton project may free some paths south of Nuneaton.

Assumed future timetable structure

5.26 In this analysis it is assumed that the timetable structure in 2020 is broadly similar to the December 2008 VHF timetable, as the scope for additional services is limited without significant further new infrastructure.

5.27 The current WCML Rules of the Plan (RotP) and Rules of the Route (RotR) have been utilised in this analysis. These rules dictate a three minute minimum headway. The only known further intervention on the route that could impact upon these rules is a future introduction of ERTMS/ETCS that could allow headways to be closed, but this will create only limited ‘white’ space within the timetable structure to be taken as a performance benefit.

5.28 The entire WCML timetable structure is effectively dictated by the 20-minute even interval service pattern between London Euston and each of Birmingham New Street and Manchester Piccadilly.

5.29 This pattern is inherently incompatible with maximum utilisation on key route sections including London Euston and Milton Keynes Central where the RotP planning headway is 3 minutes. With at one or more repeating 20 minute even interval services in each hour the theoretical quantum is reduced by 2tph.

5.30 There is, therefore, effectively a cap below 100% by virtue of this passenger presentation and marketing led timetable structure to maximise revenue. Further specific constraints on this route section are:

- the disparate performance of Class 350 and Class 390 formed trains on the fast lines;
- the passenger and franchise requirement for certain fast line services to stop at Watford Junction; and
- freight pathing.

Summary of capability analysis

5.31 Four key WCML route sections have been examined:

- London Euston and Milton Keynes Central;
- Rugby and Birmingham New Street;
- Cheadle Hulme and Manchester Piccadilly; and
- Preston and Carlisle.

5.32 The analysis has identified that the December 2008 VHF timetable structure leads to very high occupation of trains paths on all of the above route sections.

5.33 However constraints on capacity on each of the above route sections are different as:

- Between London Euston and Milton Keynes Central and between Rugby and Birmingham New Street it is the volume of traffic that is the most significant factor;
- Between Cheadle Hulme and Manchester Piccadilly it is the number of crossing moves and platform capacity at Manchester Piccadilly that are most significant; and
- North of Preston the mix of high speed passenger and slow speed freight traffic becomes most significant factor in limiting capacity.

5.34 In addition to the above it is also expected that with train lengthening on many services operated by the franchised TOCs there will also be platform capacity constraints at London Euston, Manchester Piccadilly and Glasgow Central. Without knowing the final deployment of longer trains post HLOS it has not been possible at this time to examine this aspect further.

5.35 It is clear that there are no planned or foreseeable infrastructure enhancement schemes that could deliver a step-change in capacity on any of the route sections that have been examined.

5.36 Between London Euston and Milton Keynes Central and between Rugby and Birmingham New Street, given the current mix of traffic, only the addition of further running lines over long sections of route would be likely to provide any meaningful increase in capacity. This may also require further grade separation around Milton Keynes Central particularly to facilitate fast line train movements to and from the Northampton line with even tighter headways and more trains overall.

5.37 Between Cheadle Hulme and Manchester Piccadilly, enhanced route capacity would be dependent on significant grade separation and enhanced platform capacity at Manchester Piccadilly.

5.38 Between Preston and Carlisle, increased electric haulage of freight services would allow some improved use of existing capacity through improved running times. Any further increase would require additional freight passing loops, which would need to be sufficient in length to be dynamic in operation for maximum efficiency. This is unlikely to be warmly welcomed by the freight train operators or their customers because of significantly increased resource costs and extended journey times.

Route Capacity Analysis - MML

Impact of infrastructure and rolling stock changes on route capability

5.39 There are significant changes planned on the MML to infrastructure, rolling stock and timetables between now and 2020. The Thameslink programme dominates these changes and is now in the process of delivery. It has three key stages:

- Key Output 0 in March 2009 – Including closure of the Midland branch to Moorgate and the (re)introduction of through train running between the MML and the South Eastern routes using eight car trains to/from Sevenoaks, Orpington and Ashford (Kent). Also introduction of Class 377 units on Thameslink services to supplement the Class 319 dual voltage fleet;
- Key Output 1 planned for December 2011 – Including introduction of some 12-car trains on Thameslink services (with existing units); and
- Key Output 2 planned for 2015 – scheme completion with all new train fleet and 24tph through the Thameslink core with 16tph to/from MML and 8tph to/from ECML. This will see platform lengthening for (primarily) 12-car fixed formations (with some residual 8-car fixed formation trains serving routes south of the Thames where platforms are not lengthened), enhancements and layout changes at Bedford Midland to both facilitate longer trains turning back and stabling.

5.40 In addition to the Thameslink programme the other key committed and likely schemes on the MML are:

- Capacity enhancement on the Slow Lines between Wigston and Syston Junctions as part of the Felixstowe to Nuneaton gauge and capacity enhancement scheme;
- Some linespeed enhancements route-wide to improve journey times; and
- Introduction of replacement trains on some or all East Midlands (EM) train services. The exact nature of EM train replacement in unknown but the HST

fleet currently deployed on many services will be life expired and the Class 222 fleet cannot be further strengthened.

5.41 For this analysis the assumption was made that all EM trains will be replaced and that they are operated by IEP self powered sets. Should the route be electrified north of Bedford, to Nottingham, Derby and Sheffield, then higher capacity IEP electric sets or displaced Class 390 sets are two of many alternative rolling stock options.

Assumed future timetable structure

5.42 As on the GWML no one complete and consistent timetable matching all of the known enhancements has been developed. The final infrastructure, train service pattern and associated timetable for Thameslink programme KO2 are not yet clear and these will dominate the way much of the route will be planned operationally.

5.43 The December 2008 timetable change has increased the EM services to five per hour throughout the day although the structure varies around the existing Thameslink service and to meet the needs of longer distance commuting. The lack of capacity for freight on the slow lines is already known to be proving problematic, with no current firm plans for resolution. It is clear that this service pattern is unlikely to work well post Thameslink KO2 even if the freight issues are resolved.

5.44 Paths south of Bedford are almost entirely dictated by Thameslink services and by the lack of platform capacity for EM trains at St Pancras (high level). North of Bedford the mix of stopping and non-stopping passenger with freight is also a major constraint. In future the EM timetable pattern will need to recognise the structure and clockface set by the Thameslink service into and out of the core route section. If the route was electrified north of Bedford and/or further infrastructure was planned then other options may be available.

5.45 In workstream 1 it was assumed that the timetable structure in 2020 was likely to be similar to that in December 2008. In this workstream, looking at the demand-capability gap it was assumed that one additional Thameslink service can be accommodated, as without it, the 24tph core section Thameslink service is probably undeliverable.

5.46 The peak hour pattern south of Bedford is therefore assumed to be:

- 5tph fast line EM service from north of Bedford to St Pancras (High level);
- 8tph fast line TL service from Bedford to St Pancras (Low level);
- 4tph slow line TL service from Luton to St Pancras (Low level); and
- 4tph slow line TL service from St Albans City to St Pancras (Low level).

5.47 There will be little or no flex in the final Thameslink timetable on the MML as it will interact and will be fixed by the structure and pattern necessary to deliver 24 tph through the Thameslink core section from St Pancras to Blackfriars and by the relationship with both Thameslink and other services on the ECML and South Eastern and Brighton main lines.

Summary of capability analysis

5.48 In 2020, it appears that both Fast and Slow Lines will be nearly totally occupied between London St Pancras and Leicester, both peak and off peak, with freight occupying the vacant Thameslink paths off peak. Freight paths are likely to be very limited and constrained.

5.49 South of Bedford, the volume of trains is the principal factor, while north of Bedford the mixture of four, three and two-track alignment and the mix of passenger and freight traffic is most significant.

5.50 Therefore, it can be concluded that, beyond 2015, it will not be possible to provide any additional paths on the MML, beyond the December 2008 timetable plus the planned additional Thameslink services.

5.51 An enhancement scheme north of Bedford would assist in providing additional capacity, principally for freight traffic, but there are currently no firm plans for such schemes which can be quantified for this study.

Route Capacity Analysis - ECML

Impact of infrastructure and rolling stock changes on route capability

5.52 More so than any of the other routes examined, the ECML has a number of significant infrastructure schemes and rolling stock changes proposed for delivery before 2020 along the route length.

5.53 The key committed and likely schemes assumed for this analysis are:

- Completion of the Thameslink scheme;
- King's Cross additional Platform 'Y';
- Four-minute planning headways on the Finsbury Park-Moorgate branch;
- Finsbury Park to Alexandra Palace upgrade, additional platforms on the Down Slow 2 and upgrading of the Up Goods to Up Slow 2 status with provision of platforms;
- Power system upgrade (removal of all power constraints);
- Longer platforms at many stations;
- Hitchin flyover;
- Peterborough additional platforms and centre turnback for Thameslink services;
- Joint Lines upgrade and possible flyover at Werrington (little conventional freight will remain on the ECML between Peterborough and Doncaster);
- Bi-directional signalling at Loversall;
- Grade separation of Shaftholme Junction; and
- Four-tracking of Holgate Junction.

Assumed future timetable structure

5.54 The result of the above schemes is that, in contrast to the WCML and MML, the timetable structure in 2020 is likely to be significantly different to the current timetable. New Lines Programme has therefore prepared a notional 2020 timetable based on known service aspirations and known schemes.

5.55 The Joint Lines Upgrade and removal of remaining constraints, in particular those at Finsbury Park and Hitchin, are intended to allow six long distance, high speed IEP services per hour off-peak, and eight in the peak.

5.56 Thameslink, in addition to delivering longer trains, will also remove many services from the suburban platforms at King's Cross. There will be eight Thameslink services per hour in the peak (four Peterborough, two Cambridge and two Letchworth) and six off-peak.

5.57 The Moorgate branch upgrade will allow up to 14tph on the Moorgate branch in the peak, and 8tph off-peak.

Summary of capability analysis

5.58 Overall, it is clear that of the route sections analysed, the section between Alexandra Palace and Knebworth presents the most significant constraint on route capacity at all times. The primary cause of this is the Welwyn viaduct. This will clearly be the major constraint on whole-route capacity from 2015 onwards, since other schemes will have removed bottlenecks elsewhere.

5.59 In the peak period, it is clear that the enhanced 2020 service frequency is also leading to very high occupation levels elsewhere, including south of Alexandra Palace and between Peterborough and Doncaster.

5.60 Furthermore, there is a constraint on platform capacity at King's Cross (for longer, IEP services), which will prohibit any major increase in paths beyond the 2020 level.

5.61 There will be little flex in the final Thameslink timetable on the ECML as it will interact, and will be fixed, by the need to deliver 24 tph through the Thameslink core section from St Pancras to Blackfriars, and by the relationship with both Thameslink and other services on the Midland Main Line (MML), the South Eastern main line and the Brighton main line. It is possible that ECML Thameslink services could be regulated on the connecting route between St Pancras and the ECML junction to aid timetabling - although this will add to the already longer journey times for commuter trains to and from London when compared to today.

5.62 It was noted that the timetable consistently uses almost all of the available capacity throughout long route sections, which is anticipated to present a performance risk. Furthermore, Thameslink paths could not be accommodated in a way that would allow optimal working on and off the Thameslink core.

5.63 Overall, therefore, it is concluded that the 2020 long distance and outer suburban service level is at or close to the whole-route capacity of the ECML south of Doncaster.

Network schemes

5.64 The only network-wide enhancement that is worthy of note is the proposed introduction of ERTMS/ETCS Level 2 signalling. This can enhance capacity by allowing reduced headways and junction margins through reduction and optimisation of block lengths and by continuous 'sighting' of signal aspects. As noted above the 'white' space created can be used to enhance route performance and the structural robustness of the timetable itself.

5.65 Work previously undertaken has established that the theoretical capacity enhancements provided by ERTMS/ETCS are likely to result on approximately one additional path per hour becoming available in each direction on each route corridor, once a desired performance benefit has been taken into account.

5.66 Achievement of this benefit on busy routes may require a complete timetable recast or other infrastructure changes, such as additional platform capacity at terminal or intermediate stations. It may also be incompatible with planned even interval service patterns planned and therefore has not been taken into this analysis as a capacity benefit.

6 PASSENGER CARRYING CAPACITY

Definition of Passenger Carrying Capacity

6.1 In order to establish an a.m. peak hour passenger capacity into London we have calculated the expected service quantum; rolling stock type and train formations and available seating/ standing capacity. This was undertaken using publicly available information on railway rolling stock as outlined in more detail below.

6.2 In line with the PIXC (Passengers in Excess of Capacity) standards set out by the Department for Transport, capacity has been defined as equalling seated capacity for services that do not stop within twenty minutes of the London terminus. Where services do stop within twenty minutes of the London terminus, standing capacity has been included in the capacity figures.

6.3 Where possible, stock specific data has been used to define standing capacity. However, where no specific information is available on standing capacities 35% of seating capacity has been assumed, in line with typical PIXC standards. Where rolling stock has been reconfigured to allow for additional standing capacity this has been taken into account.

Base Year (2006/07) Capacity Calculations

6.4 The calculation of the passenger capacity into London termini in the morning peak hour should be a straightforward exercise, but there are a number of complexities.

6.5 Rolling stock deployment can vary day by day due to operational consideration, service perturbation or maintenance regimes. Even within the same rolling stock class a number of different variants can be in operation with different internal configurations. For example there are five types of class 319 in use on Thameslink services today and all with different seating capacities. Therefore, an assumption was made regarding typical rolling stock types to provide a representative estimate. It was not assumed that actual daily variations have any material impact upon overall capacities.

Future Year (2019/20) Capacity Calculations

6.6 Although current year capacity is subject to daily alterations it can be assumed to fall within a reasonably tight range. However future year capacity is much more complex to estimate. Some decisions regarding future year schemes have not yet been made, like the Thameslink service pattern or the deployment of the 8 and 12 car fleet. This is due to where these schemes are in the development process. Furthermore current thinking and planning for future year schemes may be subject to change as these schemes develop.

6.7 To estimate future year capacity into London termini, future year timetables have been developed which include likely schemes and known commitments.

The key schemes assumed within this analysis are:

- Intercity Express Programme(IEP);

- Thameslink Programme;
- Crossrail; and
- HLOS capacity schemes in CP4.

The type of rolling stock expected to operate services has been estimated. Given the level of development of future year schemes and the availability of information in the public domain assumptions have had to be made with regard to rolling stock types and stock capacities. Examples of key assumptions are:

- Thameslink Programme Rolling stock assumed to be as specified in the ITT for the rolling stock procurement programme with the high standing to seat ratios.
- The capacity of Crossrail stock in terms of seating and standing density is assumed to mirror the specification for Thameslink rolling stock requirements.
- For the purpose of capacity it is assumed that the full 24 tph Thameslink service can operate in the peak hour although in workstream 1 it was not possible to generate a timetable in the time available for the output.

6.8 It is expected that in some cases DfT, or others, will have or be using more up-to-date assumptions and information, and this should be borne in mind when interpreting the results of the gap analysis.

6.9 Where information is not currently in the public domain regarding future rolling stock deployment plans our judgement has been applied.

Great Western Main Line

6.10 The most significant change on the Great Western Main Line is the introduction of the Crossrail services. Whilst a timetable for this could be cast in a number of ways, the assumption from the work undertaken is that there will be 8 trains during the peak hour, 4 from Maidenhead and 4 from Heathrow. The eastbound 'starters' from Paddington to Liverpool Street that provide the balancing frequency of 24tph are excluded from this analysis.

6.11 Table 6.1 shows the 2006-07 capacity assumed.

TABLE 6.1 GWML A.M. PEAK HOUR CAPACITY 2006-07 (08:00-08:59)

GWML Arrivals at London Paddington 2006/07

TOC	Trains	Seats	Capacity
GW	22	9,604	10,604
HEx	4	1,520	1,520
HC	2	514	694
Total	**28**	**11,638**	**12,818**

6.12 Table 6.2 represents the 2019-20 position and shows the percentage capacity increase from 2006/07.

TABLE 6.2 GWML A.M. PEAK HOUR CAPACITY 2019-20 (08:.00-08:59)

GWML Arrivals at London Paddington 2019/20

TOC	Trains	Seats	Capacity	% Capacity increase on GWML from 2006/07
GW	18	10,060	11,520	103%
XR	8	5,212	11,428	
HEx	4	1,520	1,520	0%
Total	30	16792	24468	91%

6.13 In the absence of a clear rolling stock formation, the Crossrail trains are assumed to be formed of similar stock to that which will be employed on the Thameslink programme. These are assumed to be high density configurations, delivering considerable more capacity than that currently available.

6.14 The long-distance services are provided by IEP trains. These are self powered and have lower seating capacity than those assumed to be employed on the ECML. There are variations in capacity according to route, with the higher density stock serving the outer suburban markets of Newbury and Oxford.

West Coast Main Line

6.15 The principal changes assumed for the WCML are the introduction of the December 2008 Very High Frequency (VHF) timetable, the lengthening of all Pendolino sets to 11-cars and the introduction of high density IEP sets on some of the outer suburban/ regional services to Northampton and the Trent Valley local stations.

6.16 Table 6.3 below shows the train formations and passenger capacity on the UP a.m. peak arrivals at London Euston between 08:00 and 08:59 in 2006-07.

TABLE 6.3 WCML UP A.M. PEAK HOUR CAPACITY 2006-07 (08:00-08:59)

WCML arrivals at London Euston 2006-07

TOC	Trains	Seats	Capacity
ICWC	9	4,023	4,023
LM	10	6,727	8,137
LO	3	684	924
Total	**22**	**11,434**	**13,084**

6.17 Table 6.4 below represents the increase in frequency and capacity achieved for the timetable year 2019-20.

TABLE 6.4 WCML UP A.M. PEAK HOUR CAPACITY 2019-20 (08:00-08:59)

Arrivals at London Euston 2019/20

TOC	Trains	Seats	Capacity	% Capacity increase on WCML from 2006/07
ICWC	12	6,839	6,839	70%
LM	9	5,484	6,624	-19%
LO	3	642	1254	36%
Total	24	12,965	14,717	12%

6.18 A comparison of the tables above shows that two extra train paths have been assumed, and that this together with rolling stock changes increases both seats and total capacity for all WCML arrivals at London Euston in the high peak hour. The current plan to complete the replacement of Class 321 units, which have 3+2 high density accommodation, with Class 350 units (and high density Class IEP sets at a later date) will see some reduction of seating on trains currently formed of 3x4 car Class 321 units. This does explain why the increase overall is not as striking as it might otherwise be.

6.19 Capacity of the Intercity West Coast services (ICWC) increases by 70% and achieved through the assumed:

- Operation of three more ICWC services in the high peak hour;
- Lengthening all Class 390 Pendolino sets to 11 cars; and
- Operation of the London-Chester service with 2x5-car Class 221 Voyager units

6.20 Capacity of the London Overground DC line service is increased through the currently planned replacement of the existing Class 313/508 3-car units with new

Class 378 4-car units. The Class 378 units have layouts similar to Underground sub-surface stock with longitudinal bench seating and large standing capacity.

6.21 London Midland services have a reduction in both seated and standing capacity and this is a reflection of the change in rolling stock deployed.

6.22 The South Central service between Milton Keynes Central and Clapham Junction via London Kensington Olympia is excluded for train capacity purposes as this service is deemed not to serve a London 'terminus' in this analysis although it does occupy a valuable path into London Euston every hour.

6.23 LUL's Bakerloo line trains that operate on the WCML route where the equivalent London 'terminus' is London Baker Street are also excluded from this analysis.

Midland Main Line

6.24 MML capacity is significantly modified through the introduction of new rolling stock. All East Midland services are assumed to be operated by 10-car IEP self powered sets. The capacity increases for Thameslink services are also considerable. Although the Thameslink programme specifies 16 tph on this route, the preliminary timetabling exercise based on the December 2008 timetable has only been able to path 15 trains. Whilst the workstream 1 only assumed 15 tph in the peak in the absence of a new timetable the actual frequency is specified at 16 tph and for the purpose of the gap analysis this has been assumed to have been delivered. Table 6.5 shows the 2006-07 capacity assumed.

TABLE 6.5 MML A.M. PEAK HOUR CAPACITY 2006-07 (08:00-08:59)

MML arrivals at London St Pancras/ King's Cross Thameslink 2006/07

TOC	Trains	Seats	Capacity
EM	5	2,414	2,414
TL	15	8,858	11,954
Total	**20**	**11,272**	**14,368**

6.25 Table 6.6 shows the 2019-20 capacity assumed post completion of the Thameslink programme and with the existing East Midlands HST sets and Class 222 units replaced with IEP SP (IEP self powered) trains.

TABLE 6.6 MML A.M. PEAK HOUR CAPACITY 2019-20 (08:00-08:59)

MML Arrivals at London St Pancras International 2019/20

TOC	Trains	Seats	Capacity	% Capacity increase on MML from 2006/07
EM	5	2,670	2,670	11%
TL	16	10,072	26,192	119%
Total	**21**	**12,742**	**28,862**	**101%**

6.26 The tables show that whilst only one extra train is provided between 2006-07 and 2019-20, there is assumed to be a significant capacity increase.

6.27 The introduction of 10-car IEP SP trains on East Midlands Intercity services yields a modest 11% capacity increase through provision of 256 additional seats.

6.28 More striking is the 101% increase in Thameslink capacity on Inner and Outer suburban services south of Bedford. The current 15x8-car 317/319 mixed fleet of units provide 8,858 seats (or 11,954 total capacity), whereas the introduction of 12x12-car units and 4x8-car units with designs offering much greater standing capacity delivers a total of 10,072 seats or 26,192 total capacity more than doubling capacity overall on the MML to London.

6.29 It is clear that there is only a modest increase in seats across both TOCs and that the capacity increase is delivered through standing on Thameslink services south of Bedford. As many Thameslink journeys are in excess of 1 hour it is quite likely that a high proportion of long distance passengers will stand for part of their journey in the peak.

PIXC on Thameslink services from St Albans

6.30 Public timetable journey times for UP non-stop Thameslink services from St Albans City to St Pancras are generally between 19 and 21 minutes. In this analysis the capacity figures for Thameslink services retain the long standing interpretation of the PIXC rules, as enshrined within the current franchise that all non-stop services from St Albans City to St Pancras are ‘suburban’ trains and that standing loads are allowable under the PIXC guidelines.

East Coast Main Line

6.31 Table 6.7 shows capacity on the East Coast Main line 2006-07.

TABLE 6.7 ECML A.M. PEAK HOUR CAPACITY 2006-07 (08:00-08:59)

ECML Arrivals at London King's Cross/ Moorgate 2006/07

TOC	Trains	Seats	Capacity
ICEC	5	2,680	2,680
GN	25	12,598	15,861
Total	**30**	**15,278**	**18,541**

6.32 Table 6.8 represents the 2019-20 position after the introduction of the Thameslink programme KO2 services, IEP and GN inner rolling stock replacement.

TABLE 6.8 ECML A.M. PEAK HOUR CAPACITY 2019-20 (08:00-08:59)

ECML Arrivals at London King's Cross / Moorgate/ St Pancras (Low level) 2019/20

TOC	Trains	Seats	Capacity	% Capacity increase on ECML from 2006/07
ICEC	7	4,391	4,391	64%
GN	18	6,964	12,988	72%
TL	8	5,488	14,288	
Total	**33**	**16,843**	**31,667**	**71%**

6.33 Table 6.8 demonstrate the 10% increase in train arrivals at the three ECML London termini. This is matched by an overall total capacity increase of nearly 71%, with a more modest 10% increase in overall seating capacity.

6.34 Within these overall figures, it is worth highlighting the additional 103 seats per train that the IEP trains offer compared to the current HST or 225 sets used on ICEC services. With an extra two trains in the peak hour, the seating capacity increases by over 65% - an extra 1,800 seats.

6.35 There is a noticeable increase in capacity on the Finsbury Park-Moorgate branch and this is achieved through the successful delivery of the current HLOS scheme which will enable the operation of 14tph on the route together with later replacement of the Class 313 fleet with new trains. The branch infrastructure limits rolling stock to 6x20m car length units (or multiples up to that figure).

6.36 The most significant gains are derived on the St Pancras and King's Cross services where the introduction of 12-car and 8-car high capacity Thameslink stock provides a step-change in provision. In addition, two services (assumed to be those from Letchworth) are covered by also covered by the same 8-car TL trains.

6.37 Because of the modelling limitations referred to earlier in Section 4, it has not been possible to look further at the impact of changes in distribution across London from interchange hubs such as Finsbury Park. It is likely that the peak passenger loads for many GN services toady is approaching Finsbury Park, but this may change post the introduction of the Thameslink KO2 service from 2015.

7 GAP ANALYSIS

7.1 The gap analysis draws together the outputs from the previous sections:

- Section 3: Demand;
- Section 4: Route Capacity; and
- Section 4: Passenger Carrying Capacity

7.2 For the purposes of the gap analysis, train carrying capacity has been measured in terms of total capacity. For Intercity and longer-distance commuter trains capacity equals seats. For suburban trains the capacity is deemed to be seats + an additional 35% standing capacity in line with DfT crowding standards. For new trains, where more information available or assumed about the train design and the associated seat/standing ratios, this is included in future capacity.

7.3 It should be reiterated that the carrying capacity metric used is dependent on the assumptions used in Workstream 1 unless otherwise noted. This derived the operational capability for each route in terms of a quantum of train paths assuming certain committed rolling stock and network enhancements. It did not consider further refinement to service calling patterns, nor rolling stock redeployment and/or refurbishment to meet future train loadings.

7.4 For each route, a series of simple graphs have been prepared that demonstrate the capability of the route - as defined by the arrival to or departure from the London terminus – to satisfy the forecast demand levels relative to the carrying capacity.

7.5 The analysis presented here does not explicitly take into account variability in load factors between services e.g. between trains serving different locations or arriving at different times within the peak hour. In reality crowding is likely to occur on services long before aggregate demand exceeds aggregate capacity across a route. To some extent these variations in load factors across trains could be smoothed by the use of variable pricing and modified stopping patterns but experience suggests that these opportunities are limited.

7.6 The gap analysis looks at peak hour arrivals in London 08:00-08:59. This hour is when demand is at its highest and the network capability is tested the most. As aggregate demand is generally lower in the shoulder peaks it is assumed that, if demand is met in the peak hour, then it is unnecessary to look further at the shoulder peak periods.

Great Western Main Line

7.7 The assumed future year GWML timetable delivers considerable extra capacity. Figure 7.1shows the relationship between demand and capacity for UP arrivals at London Paddington between 08:00 and 08:59 for years 2006/07, 2019/20 and 2029/30. The figures exclude new demand generated by Crossrail as noted in Section 4.

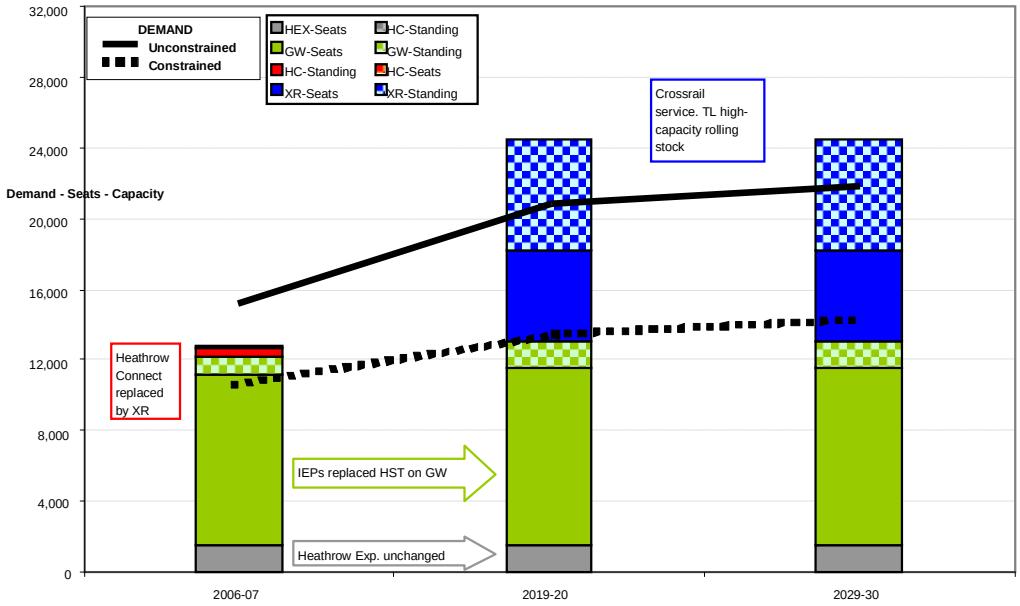
7.8 Suburban services are transformed by the introduction of high density Crossrail services. These are assumed to be operated with a 23m rolling stock type not too dissimilar to that proposed for the Thameslink programme and therefore have a very high standing to seat ratio.

7.9 Longer distance services benefit from more frequent and higher capacity IEP trains. with the higher density units deployed on the outer suburban routes, e.g. Newbury and Oxford. The lower density IEP trains, still offering seating capacity akin to the current HST sets, are assumed to serve the West Country, Bristol and South Wales.

7.10 At an aggregate level passenger demand on this route is satisfied into the future. This is achieved through having a better timetable structure, rolling stock suited to meet the demand requirements of different markets, and an increased service frequency.

7.11 It should be appreciated that much of this capacity will not be realised until the latter stages of the 2015-2020 period.

FIGURE 7.1 GWML UP ARRIVALS AT PADDINGTON – A.M. PEAK HOUR (08:00-08:59)



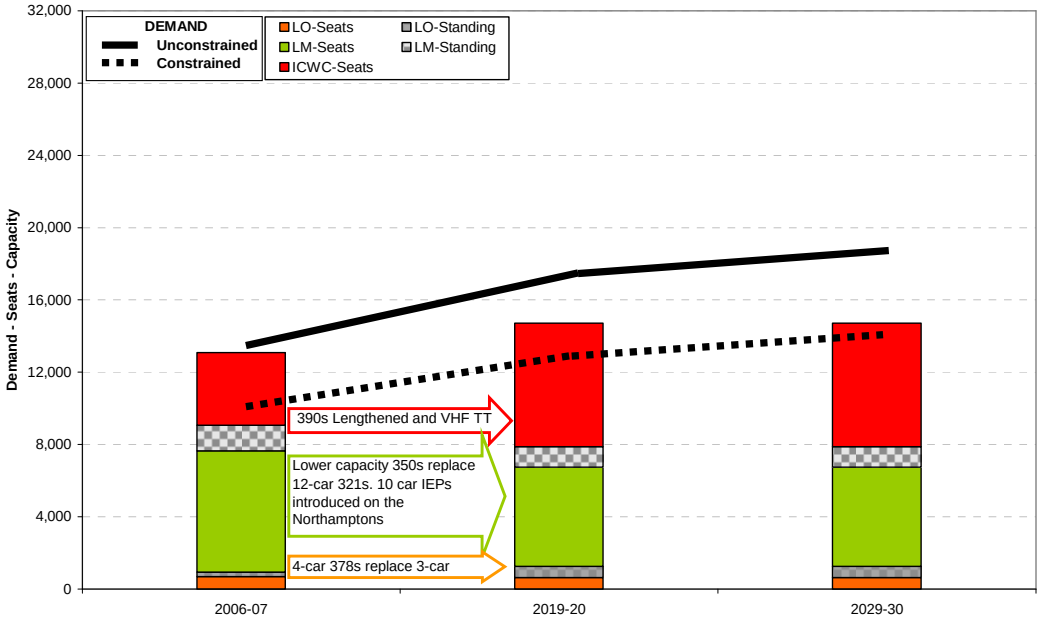
West Coast Main Line

7.12 Figure 7.2 shows the relationship between demand and capacity for UP arrivals at London Euston between 08:00 and 08:59 for years 2006/07, 2019/20 and 2029/30. This shows a relatively small increase in both seated and total capacity, whilst demand continues to grow.

7.13 Unconstrained demand is forecast to exceed the ability of the network to provide capacity. As described in Section 4 the analysis has not drilled too far into the allocation of demand between train operators due to the limitations of the NMF model to accurately reflect observed data. However, the graphs do show that the

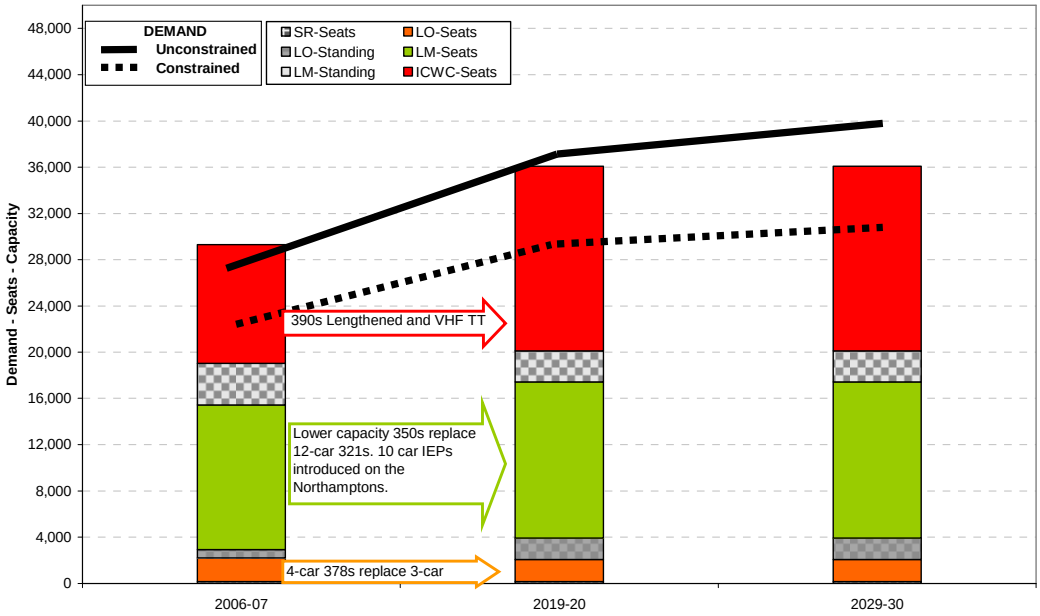
overall unconstrained demand exceeds supply, and that the creation of new capacity would be beneficial to passengers on this route.

FIGURE 7.2 WCML UP ARRIVALS AT EUSTON – A.M. PEAK HOUR (08:00-08:59)



7.14 As is shown above NMF is predicting a significant gap between unconstrained demand and capacity in 2020. Therefore, for WCML, it was considered appropriate to consider demand over the full peak and shoulder peak from 07:00-09:59. Figure 7.3 shows the relationship between demand and capacity for UP arrivals at London Euston over the peak period. Whilst the gap is not as big it is still significant. As noted in section 4 is unlikely that the peak demand gap can be mitigated by providing extra capacity in the shoulder peaks even if the network has the capability to deliver it.

FIGURE 7.3 WCML UP ARRIVALS AT EUSTON – A.M. PEAK+SHOULDER PEAKS (07:00-09:59)



Midland Main Line

7.15 The significant increase in total capacity is driven by the high standing capacity assumed on Thameslink services (in accordance with the Thameslink rolling stock procurement ITT). For example, 1100 standing spaces are assumed per 12-car train. Demand figures exclude demand generated by Thameslink as noted in Section 4.

7.16 Please note that in 2006/07 Thameslink services arrived at King's Cross Thameslink. For simplicity of diagrams this has been shown as St Pancras.

7.17 The combination of more trains, longer trains and much higher standing capacity delivered through the Thameslink programme will have a dramatic effect on relieving the current demand constraint for commuter trains on the MML. This latter point is clearly seen in Figure 7.4 where the total capacity comprises a much higher percentage of standing capacity in future years than the 2006-07 position.

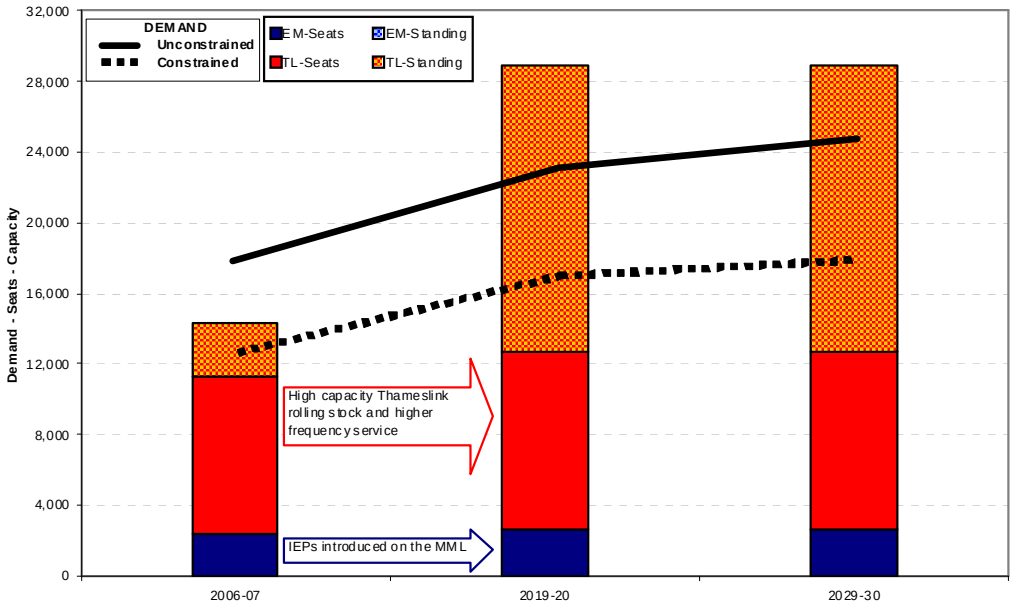
7.18 The provision of this capacity means that the route is well capable of meeting passenger demand at an aggregate level. Whilst this extra capacity is directed towards Thameslink services from Bedford inwards, there is also additional capacity assumed to be provided on East Midlands services as the existing mix of HST sets and Class 222 units is replaced with new trains. This equates to an additional 11% seats through the introduction of IEP rolling stock compared to the current HST and Class 222 formed trains.

7.19 As current long distance Intercity passenger demand on East Midlands services is broadly met with the current capacity, there is not expected to be a serious mismatch between demands and supply in 2019/20 and particularly as Thameslink

service will provides relief between Bedford/ Luton/ Luton Airport Parkway and London.

7.20 Electrification of the MML north of Bedford provides further opportunity to better balance capacity on route and by use of trains with a better seat/ train length ratio.

FIGURE 7.4 MML UP ARRIVALS AT ST PANCRAS – A.M. PEAK HOUR (08:00-08:59)



East Coast Main Line

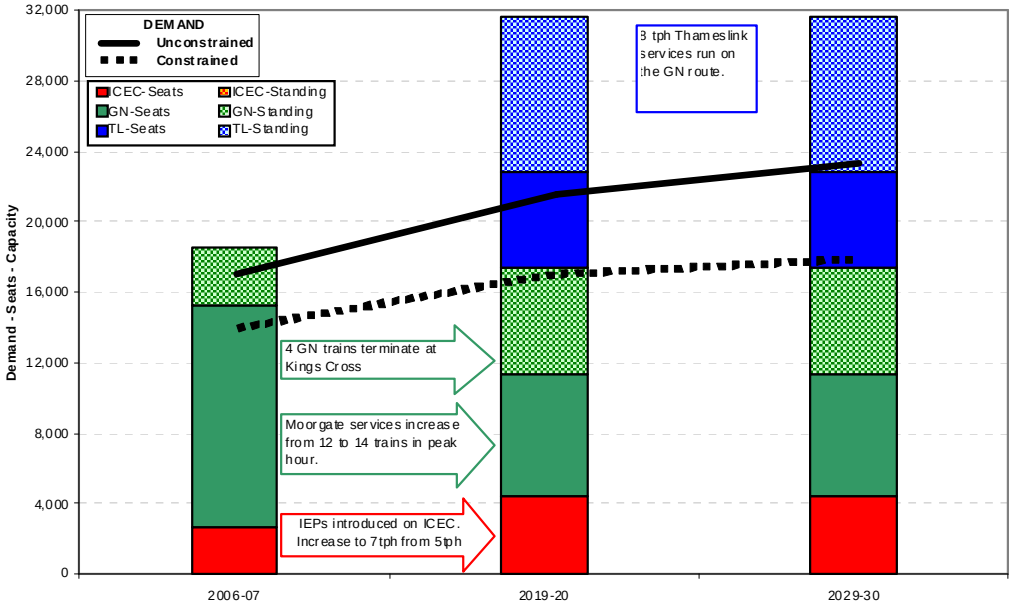
7.21 The significant increase in total capacity is driven by the high standing capacity assumed on Thameslink services (in accordance with the Thameslink rolling stock procurement ITT). For example, 1100 standing spaces are assumed per 12-car train. Demand figures exclude demand generated by Thameslink as noted in Section 4.

7.22 The introduction of IEP rolling stock is also assumed on this route leading to an increase in seating capacity for the longer distance services. The additional capacity that will be provided, and its ability to meet forecast demand, is illustrated in Figure 7.5. It shows a similar pattern to that for the MML. While there is a relatively small increase in the number of seats, new rolling stock generates considerable extra total capacity through a better design of the units more suited to the passenger market on Thameslink and GN Inner services. For the longer distance services, the IEP rolling stock and the additional two trains arriving into King's Cross deliver an extra 64% seats.

7.23 The additional capacity is forecast to be more than adequate to satisfy the growing passenger demand.

7.24 There are no open access operators today or assumed in future years in the busiest Up peak hour for arrivals in London from the ECML.

FIGURE 7.5 ECML UP ARRIVALS AT ST PANCRAS / KINGS CROSS / MOORGATE – A.M. PEAK HOUR (08:00-08:59)



8 CONCLUSIONS

8.1 This workstream has provided a strategic overview of the classic main line routes capability to accommodate forecast demand within the study geography. It has looked at the capability of the infrastructure, timetables and rolling stock deployed to satisfy demand both today and as forecast going forward. To this end, it has achieved its goal of identifying the route(s) that are anticipated to experience a demand-capability gap in the medium-term. This has importance, not only as a stand-alone conclusion, but also as a key input to the generation of new line options and for the classic lines affected, in other workstreams of this study.

8.2 It is important to place this study in the context in which it is written. Many assumptions and judgements about what the routes will look like in 2020 have had to be made. Therefore it does not represent a definitive position of exactly what will happen by service group. It was concluded however, that for the purpose of indicating which routes have a demand-capability gap, then it gives a very clear answer.

8.3 The initial desire to understand the demand between different TOC service groups and individual trains in more detail, highlighted the limitations of the modelling tools available. However, the purpose of this exercise was to provide that strategic picture of demand-capability gap.

8.4 The investigation into capacity, in terms of train paths, has indicated that the demand-capability position for each of the classic line route corridors is subtly different. However, a key conclusion is that each of the classic line route corridors studied are at or close to capacity in terms of the quantum of services that can be operated given the current or future planned service mix and associated timetable structure. It seems likely there will be difficulty in providing an appropriate level of rail service in all markets between origin and destination pairs on these routes in future. Therefore a significant capacity gap exists in this aspect.

8.5 The classic route corridors capability is constrained by three features:

- Train path availability;
- Platform capacity at the terminal stations; and
- Train configuration and length

8.6 The major schemes, Thameslink and Crossrail, deliver a step change in capacity on three of the route corridors and that they tackle all three capability constraints in some measure through:

- Requiring a major timetable recast and service restructuring;
- Eliminating the terminal constraint by pushing the trains across London; and
- Changing the seating/standing balance and the operation of longer trains.

8.7 Rolling stock replacement schemes including IEP on four routes and the replacement of life-expired trains on London Overground and GN Inner services provide a significant opportunity to enhance capacity on many service groups.

Conclusions by classic line route corridor

GWML

8.8 On the GWML, completion of the Reading remodelling to remove the bottleneck will, in contrast to the other routes, allow a genuine step-change increase in train paths on the Main Lines. Crossrail will also enhance terminal capacity by removing trains from the Paddington Station. This will also facilitate longer platform lengths and therefore train lengths for other services that still terminate there.

8.9 Overall, the GWML was considered to be the least constrained of the classic routes as, although the prepared sample timetable increases capacity utilisation to levels similar to those seen on other routes, it represents a very significant enhancement over today's timetable.

8.10 Crossrail also has the capacity to absorb more arrivals from the GWML to match the 24tph capacity through the core section between Paddington and Whitechapel. This may require additional infrastructure enhancement and/or further timetable restructuring to achieve this.

Chiltern

8.11 The Chiltern Railways unique 20 year franchise provides a vehicle to deliver any necessary enhancements to meet the demand-capability gap through infrastructure enhancement and additional rolling stock. To date, Chiltern Railways has an excellent track record of delivering these, as evidenced through the Evergreen 1 and Evergreen 2 programmes.

8.12 Whilst not yet committed, Evergreen 3 as other capacity schemes such as train lengthening should meet the capacity and demand requirement to the end of the franchise in 2021 and beyond. It is clear that much of this will be achieved through train lengthening, though as on other routes, train path capacity is similarly constrained. This is particularly so on the approaches to London between Neasden Junction and Marylebone.

8.13 If this section of route or the terminus at Marylebone were ultimately the determining capability constraint then the overflow of trains could be diverted via Old Oak Common and the GWML into the spare eastbound Crossrail starter slots at Paddington. This would require both electrification of some or the entire Chiltern route and a major upgrade of the line between Northolt Junction and Old Oak Common.

WCML

8.14 On the WCML, the completion of the route modernisation has led to a step-change in route capability in terms of speed to the major cities of the West Midlands and North West. However, the impact on overall passenger capacity has been less

dramatic. Further schemes committed or assumed likely to happen will achieve a modest 12% increase in peak hour passenger capacity by 2020.

8.15 It is clear that the route is now full over key route sections. Although a number of further schemes have been proposed for this route few suggested make the further step change necessary to meet future demand.

8.16 Overall it was judged that, at most, two additional long-distance paths to and from London Euston might be possible without any further significant enhancement beyond that already being considered likely. The gives a total of 15tph on the fast lines in each direction including the via Northampton fast trains. However, the structure of the timetable is such that it is extremely unlikely that any major improvement in service levels to inner and outer-suburban or regional stations will be possible.

8.17 Further train lengthening may possible for inner-suburban London Midland and London Overground DC line services but this increases the pressure on London Euston which probably cannot handle so many long trains without a complete rebuild of the station and approaches.

8.18 It was concluded that only a radical solution will provide the necessary capability and capacity for the diversity of traffic and future demand on the WCML

MML

8.19 Completion of the Thameslink programme, with the delivery of KO2, will lead to the MML being effectively full south of Bedford, both peak and off-peak. This will impose substantial planning and performance risk and will severely limit freight capacity. MML Thameslink paths must match those planned on ECML and through the Thameslink core or there is a risk that the planned quantum of trains on both routes cannot be achieved. Similarly longer distance services must be planned around the Thameslink pattern in order for the route to perform effectively.

8.20 Future electrification may relieve key bottlenecks such as Bedford through extending some Thameslink trains north to Kettering but only if other enhancements are delivered at the same time. The need to cross so many trains between the fast and slow lines across low speed flat junctions is a further significant constraint that may need to be addressed.

8.21 North of Bedford, capacity is likely to be similarly constrained unless significant upgrade and reinstatement of the Slow Lines is undertaken. It is considered that no further enhancements to train service frequency or stopping pattern will be possible on the MML post-Thameslink KO2.

ECML

8.22 The HLOS and Thameslink programme of upgrades are sufficient to meet stakeholder aspirations for enhanced long-distance, outer and inner-suburban and Thameslink services if delivered in full. However, this is at the cost of very high capacity utilisation and a very tightly-constrained timetable that may not be commercially attractive, in terms of connectivity or journey times.

8.23 As noted above the conclusion was made that ECML Thameslink paths must match those planned on the MML or there is a risk that the planned quantum of trains for both routes cannot be achieved.

8.24 Following implementation of such a timetable, it is difficult to see how any further increase in capacity could be provided, although works in the Welwyn area would probably allow some flexibility. No freight paths will be available on the ECML south of Doncaster, and there will be significant constraints north thereof.

Network Freight

8.25 The conclusion on freight growth is that it is expected to continue to be strong, and that this will continue to exert pressure on the accommodation of freight paths. For example, the growth in freight trains between 2007 and 2020 is forecast to be 47% in the Western region, 38% in the London-North West corridor and 32% on the London North East route. Such growth will place an increasing pressure on the existing network seeking to provide for passenger and freight traffic.

Conclusions overall

8.26 The work undertaken in this study that looks at the demand-capability gap must be considered within the context of this report only. It is recognised that there may be additional levels of detail that might provide greater clarity on the picture for individual routes. But the purpose of this report is to highlight the route(s) where the expected provision of capacity is likely to be insufficient to meet forecast demand at a strategic level.

8.27 To that end, the identification of the West Coast Main Line as the route where this is expected to be a major issue is an important conclusion.

9 RECOMMENDATIONS

9.1 The demand-capability gaps identified in this report should be used to inform the generation of new line(s) options and also the associated changes to the classic routes.

9.2 Generation of options should focus on relieving the demand-capability gap on the WCML followed by the MML and ECML.

9.3 Option generation on the GWML should be a lower priority unless the selection and sifting of target destinations, as part of Workstreams 2 7 and 8, identifies a particular business case benefit beyond the expected relief of the classic main line.