East Coast Main Line

Route Utilisation Strategy

February 2008

Foreword

I am pleased to present Network Rail's Route Utilisation Strategy for the East Coast Main Line. This is one of the busiest and most successful railway lines in Britain. As well as being an absolutely vital north-south artery for long distance traffic from London to Scotland via Yorkshire and the North East, the line serves many commuter and regional passenger markets and carries significant amounts of rail freight.

In November 2007, Network Rail published its Strategic Business Plan (SBP) for 2009 – 2014. This explained the extent to which passenger and freight demand is growing, and set out an ambitious agenda for growing the capacity of Britain's railway to meet this demand.

There are few places where growth will be more in evidence than on the East Coast Main Line. This will need to accommodate a significant growth in passengers on both long distance services and London commuter routes. This growth is excellent news, and it presents a real challenge on what is already a busy and capacity-constrained route.

This strategy builds on the SBP and offers a more detailed perspective on how to grow capacity, and improve the quality of service, along the East Coast Main Line.

The Route Utilisation Strategy proposes a number of improvements to increase peak capacity on passenger services by making provision for more or longer trains. These include power supply upgrades; grade separation at key points; additional and longer platforms; as well as enhancing the Hertford Loop. It proposes upgrading the line from Peterborough via Spalding to Doncaster for increased freight use to relieve the East Coast Main Line, as well as gauge enhancements on key freight arteries to allow for larger trains. Additionally, infrastructure works to prepare for the Intercity Express Programme will take place.

These enhancements will deliver improved connectivity between London and Yorkshire, the North East and Scotland through additional services and reduced journey times. Meanwhile, upgrades such as the Hertford Loop and the freight relief line will be crucial in helping us offer a consistent timetable to meet passenger and freight demand each day of the week.

Additionally, there will be a progressive lengthening of outer suburban services to twelve cars, as well as additional services as a result of growth on inner suburban flows.

This strategy was initially published as a draft for consultation in June 2007. Its production has been led by Network Rail, but it is a strategy developed by the whole industry. A large number of organisations, including our customers, the passenger and freight operators, have been fully involved in getting us to this stage. I would like to thank them, and everyone who responded to the consultation, for their contribution.

Iain Coucher
Chief Executive

Executive summary

The East Coast Main Line is an exceptionally valuable asset in the national transport system. It provides the fastest surface transport between London and the Yorkshire and Humber region, North East England and Edinburgh, and is faster than or competitive with air over these distances. It provides a key route into London from the East Midlands and East of England, two of the fastest growing English regions. It is of vital importance for freight, particularly as part of the link from major ports to distribution centres in large conurbations, and to coal-fired power stations. It remains the most popular route in the country for 'open access' (non-franchised) passenger operators. And it supports a long-distance passenger franchise that is expected to pay a substantial premium to Government, reducing the level of taxpayer support needed for the railway as a whole.

The challenges on the route are principally associated with volume of traffic and reliability of the services. Growth over the next 10 years is expected to be substantial in almost all the markets served by the route. The pressure will be felt most where the route is already busiest, on its southern half. Some of the growth can be accommodated within the existing train services – lengthening of some trains is contained in the strategy – but additional passenger and freight trains will be required. The most effective solution is to invest in a way that not only delivers the extra capacity required by the passenger and freight markets, but that also makes the route much more flexible on the occasions when parts of it are not available for traffic, whether because of planned engineering work or an operational problem.

The strategy is therefore to use timetable solutions to optimise the use of existing infrastructure in the short term, to invest in longer passenger trains at peak times where this is practical (for example, local services in the North East and many of the London commuter services), and to expand the infrastructure capacity around the main bottlenecks on the route. The section of the route between King's Cross/Moorgate and Alexandra Palace is already very congested at peak times and requires significant investment to improve capacity. Further north, there is a well-known constraint where the four-track main line becomes two for a short distance through Welwyn North because of the local topography. It would not be practical in the next decade to widen the railway at this point, but improvements to the timetable and to the capability of the parallel route via Hertford will make maximum use of the main line capacity and contribute to the flexibility and resilience of the railway on its approach to London. Similarly, on the busy, predominantly two-track section between Peterborough and Doncaster, improvements to the parallel route via Spalding and Lincoln will create effectively four tracks over this section.

The benefits of this approach are huge. Firstly, it will create sufficient capacity to deliver growth: both the 10-year growth forecast produced during the development of this strategy, and the growth required up to 2014 by the governments in London and Edinburgh as set out in their High Level Output Specifications published in July 2007. Secondly, it will allow the railway to operate much closer to the normal level of service when not all of the infrastructure is available. This will mean more passenger trains at

weekends, helping to deliver the '7-Day Railway' concept currently being developed by Network Rail and train operators. It will mean more capacity for freight trains at night as well as during the day. It will mean that all services can recover faster from an incident that requires diversion along one of these parallel routes. It will reduce the railway's reliance on replacement bus services, which require inconvenient interchanges and encourage people to travel by car instead. It will deliver all this while providing sufficient access for engineers to maintain the railway for the increased traffic expected to use it.

The strategy takes account of the wide variety of changes underway on this long and complex route. The most significant among these are as follows:

- The Thameslink Programme will be completed in 2015, linking outer suburban services from the East Coast Main Line directly via St. Pancras International to the City of London, as well as a wide range of destinations further south.
- The new Intercity Express trains will be introduced to the route and by 2020 should be in use on the majority of long-distance services.
- The route's ability to carry freight traffic will be improved. On the East Coast Main Line between Peterborough and Yorkshire, and on routes connecting Peterborough with East Anglian ports and the West Midlands, structures above the railway are being enlarged so that freight trains can carry larger standard containers on standard-height wagons. Priorities for further improvements to the capacity and capability of the infrastructure are being considered in the context of the development of a Strategic Freight Network.

Scope

The aim of the Route Utilisation Strategy (RUS) programme is to identify a strategy for the railway to meet expected future requirements in a way that is deliverable, affordable and consistent with performance and safety improvements.

The East Coast Main Line (ECML) RUS sets out the relevant background information on the East Coast Main Line and North East routes, identifying the issues that are currently faced on these routes and those that are predicted to arise over the next decade.

The ECML RUS encompasses all long distance high speed and London commuter services into King's Cross and Moorgate (via Finsbury Park), all local services in North East England and various other regional and longer distance services covering parts of the route. It includes all freight services within or traversing the RUS area.

Approach

The process has sought to establish agreement within the rail industry wherever possible and is based on openness and discussion with all stakeholders.

Analysis of the railway's current ability to carry passengers and freight reliably, and its ability to cope with predicted demand, led to the identification of 'gaps'. Options to address these gaps were derived from a standard 'toolkit' of option types, such as: timetable solutions to change service patterns or the mix of trains; deployment of different types of rolling stock; train lengthening; and infrastructure solutions.

Each option was assessed and solutions were developed by combining the options that were best value and most effective at addressing one or more of the gaps. The solutions were then structured into a strategy.

A formal consultation took place between June and September 2007, when 87 written responses were received. The comments made were analysed and taken into account in development of the strategy set out in this document.

Short-term strategy (2008 – 2009)

The most acute issue on the ECML is accommodating the forecast growth in both passenger and freight traffic, although a number of performance issues are also apparent. Significant additional capacity cannot be delivered in this timescale, although development work will continue on a number of proposed initiatives for delivery after 2009.

Small scale power supply improvements will be made to facilitate additional London suburban services to address peak crowding on the Cambridge route, with enhanced switching arrangements in the Alexandra Palace area and enhanced booster transformers between Hitchin and Cambridge. Platforms will be lengthened at Cambridge and Royston. These additional services are those proposed by First Capital Connect in their Cambridge Capacity Study.

Medium-term strategy (2009 – 2014)

In July 2007, High Level Output Specifications (HLOSs) were published for England and Wales, and for Scotland. The HLOSs set out the improvements in the safety, reliability and capacity of the railway system which the Secretary of State for Transport and Scottish Ministers want to secure during the period 2009 – 2014.

Network Rail's Strategic Business Plan identifies the schemes required to meet these outputs: the Plan produced in October 2007 aligned with the emerging conclusions of the ECML RUS Draft for Consultation and the revision to the Plan to be published in April 2008 will incorporate the final conclusions of this RUS.

The strategy in the medium term consists of measures to increase capacity for peak passenger services into London and other urban centres, to increase and improve long distance passenger services throughout the day and to provide capacity for freight growth. In addition, work will commence on the development of measures expected to be required in later years. The England and Wales HLOS makes special mention of the Thameslink Programme, for which funding has been identified. Thameslink Key Output 2, which connects the ECML to the cross-London tunnels, will not be complete until 2015, but enabling works will be carried out during the preceding years. This RUS identifies elements of the Thameslink Programme, particularly improvements to the power supply, platform extensions at outer suburban stations, and additional stabling and maintenance facilities, as being critical to the delivery of the required outputs during the years 2009 – 2014.

London inner suburban services

Inner suburban peak services that are currently three cars long will increasingly be run at full six-car length. This requires work to upgrade the power supply.

Additional six-car morning and evening peak inner suburban services will be operated to/from Moorgate with priority given to the Hertford North route. This will require a significant range of infrastructure enhancements.

Additional inner suburban services will be run between the peaks, at evenings and weekends to move towards an all-day frequency of four trains per hour on the Hertford and Welwyn routes.

Inner suburban services on the Hertford Loop will be less disrupted by diversions when there is engineering work or other disruption on the route via Welwyn, because of improvements to the capability of the route via Hertford North.

London outer suburban services

Outer suburban peak services that are currently eight cars long will increasingly be run at full 12-car length. This requires works to upgrade the power supply, provide additional stabling and maintenance facilities, and lengthen platforms at a number of stations. Much of this work is within the scope of the Thameslink Programme, but is likely to be needed before the Programme currently plans to deliver it. Network Rail will work with the Department for Transport to prioritise those items that are within the scope of the Programme and to develop schemes to deliver the other enhancements that are required to deliver HLOS outputs for 2014.

Outer suburban services will be less disrupted by engineering work or other disruption on the route via Welwyn, through improvements to the capability of the diversionary route for this section via Hertford North.

Long distance passenger services to/from London

Additional long distance high speed passenger services will run to and from King's Cross in the peak (up to eight trains per hour) and off-peak (six trains per hour) in a standard hour or two-hour repeating timetable[1]. This is best delivered as a combined approach that also caters for medium-term freight growth through investment in infrastructure capacity between Peterborough and Doncaster. Services will be less disrupted by engineering work or other disruption on the route via Grantham, because of improvements to the capability of the main diversionary route. Infrastructure enhancements will also be required south of Peterborough to enable the peak level of service to operate reliably. This approach will meet expected growth, while creating the potential to improve connectivity, make best use of capacity and reduce long-distance journey times.

Long distance passenger services will be less disrupted by engineering work or other disruption on the route via Welwyn, through improvements to the capability of the diversionary route for this section via Hertford North.

Pre-series Intercity Express trains are expected to be introduced on some services.

1 South of Doncaster the repeating pattern will be off-peak only to allow the calling patterns of peak services to be optimised

Non-London long distance passenger services
The CrossCountry franchise is committed to deliver additional capacity, and capacity on cross-Pennines services is being addressed in the Yorkshire and Humber RUS.

Regional passenger services
Trains will be lengthened in the North East to provide increased capacity on the busiest peak trains to/from Newcastle and Middlesbrough.

Freight services (south of Doncaster)
Additional freight paths will be provided to support the level of demand forecast in the Freight RUS. This is best delivered by a combined approach that also caters for medium-term passenger growth through investment in infrastructure capacity between Peterborough and Doncaster. Services will be less disrupted by engineering work because of the availability of a parallel route for this section of the ECML. This approach will not only meet expected growth as forecast in the Freight RUS, but provide capacity for much more traffic in future years, potentially including paths for trains between East Anglia and the north at peak times because their route will have minimal conflict with the peak passenger flows.

Freight services (north of Doncaster)
Continued freight growth will be enabled by the provision of additional capacity at constrained locations identified in the Freight RUS: reinstatement of Boldon East curve (to relieve the section between Port of Tyne and Tursdale Junction); modification of Shaftholme and Joan Croft Junctions (to remove the need for freight services crossing the ECML to use the section of the route north of Joan Croft Junction); and works to improve progressively the capability of freight routes as funds can be identified.

Delivering the outputs
A variety of infrastructure enhancements is required to deliver the outputs outlined above; these are described in Section 8.5 of this document. Delivery of a completely restructured timetable to realise all the benefits of the investments in capacity will depend upon renegotiation of some existing track access contracts.

The longer term

It is increasingly becoming necessary to prepare plans for the next decade in the context of possible longer term requirements; a point reinforced by the 2007 Government White Paper 'Delivering a Sustainable Railway'. The White Paper anticipates continuing growth in passenger and freight traffic and suggests that there could be an overall doubling of traffic over the next 30 years. Against this background the RUS has considered as a scenario what this level of growth would mean for the ECML and North East routes. This scenario is developed and discussed in Chapter 9.

In 10 years' time the East Coast Main Line will look very different from today. The measures in this strategy are to ensure that it is fit for purpose at that time; and thereafter capable of further development in an efficient way if, as anticipated, the demand for railway services continues to grow in the longer term.

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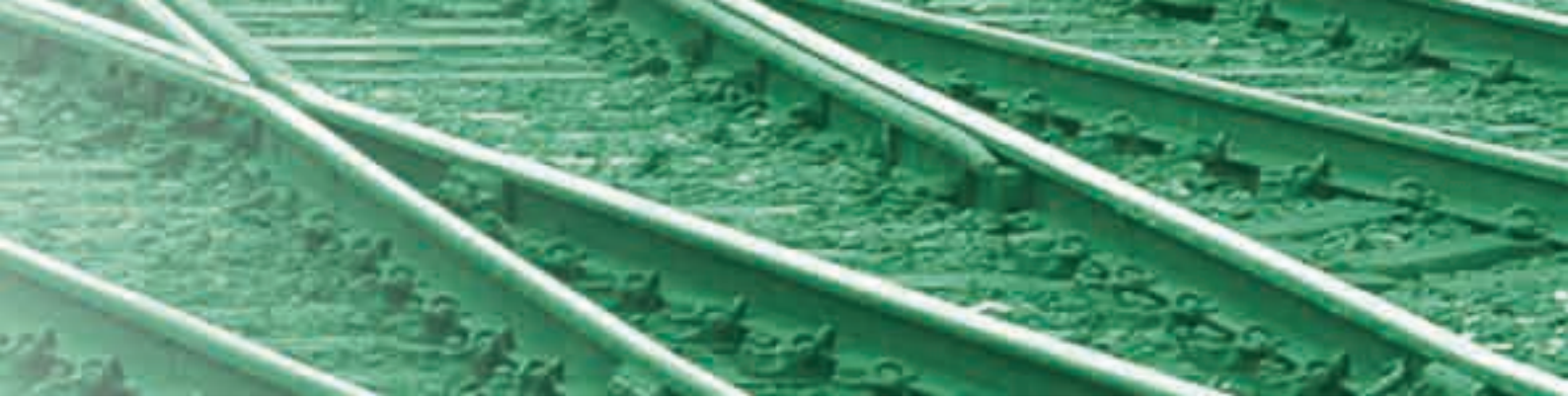


1. Background

1.1 Introduction

Following the Rail Review in 2004 and the Railways Act 2005, The Office of Rail Regulation (ORR) modified Network Rail's network licence in June 2005 to require the establishment of RUSs across the network. Simultaneously, the ORR published guidelines on RUSs. A RUS is defined in Condition 7 of the network licence as, in respect of the network or a part of the network[1], a strategy which will promote the route utilisation objective. The route utilisation objective is defined as:

> "the effective and efficient use and development of the capacity available, consistent with funding that is, or is reasonably likely to become, available during the period of the route utilisation strategy and with the licence holder's performance of the duty".
>
> Extract from ORR Guidelines on Route Utilisation Strategies, June 2005

The "duty" referred to in the objective is Network Rail's general duty under Licence Condition 7 in relation to the operation, maintenance, renewal and development of the network. The ORR guidelines also identify two purposes of RUSs, and state that Network Rail should balance the need for predictability with the need to enable innovation. Such strategies should:

> a) "enable Network Rail and persons providing services relating to railways better to plan their businesses, and funders to plan their activities; and
>
> b) set out feasible options for network capacity, timetable outputs and network capability, and the funding implications of those options for persons providing services to railways and funders."
>
> Extract from ORR Guidelines on Route Utilisation Strategies, June 2005

The guidelines also set out principles for RUS development and explain how Network Rail should consider the position of the railway funding authorities, the likely changes in demand and the potential for changes in supply. Network Rail has developed a RUS Manual which consists of a consultation guide and a technical guide. These explain the processes used to comply with the Licence Condition and the guidelines. These and other documents relating to individual RUSs and the overall RUS programme are available at www.networkrail.co.uk.

The process is designed to be inclusive. Joint work is encouraged between industry parties, who share ownership of each RUS through its Industry Stakeholder Management Group. There is also extensive informal consultation outside the rail industry by means of a Wider Stakeholder Group.

1 The definition of network in Condition 7 of Network Rail's network licence includes, where the licence holder has any estate or interest in, or right over a station or light maintenance depot, such station or light maintenance depot.

The ORR guidelines require options to be appraised. This is initially undertaken using the DfT's appraisal criteria and, in Scotland, the Scottish Executive's STAG appraisal criteria. To support this appraisal work RUSs seek to capture implications for all industry parties and wider societal implications, in order to understand which options maximise net industry and societal benefit rather than that of any individual organisation or affected group.

RUSs occupy a particular place in the planning activity for the rail industry. They utilise available input from processes such as the DfT's Regional Planning Assessments and Wales Planning Assessment, and Transport Scotland's Scotland Planning Assessment. The recommendations of a RUS and the evidence of relationships and dependencies revealed in the work to reach them in turn form an input to decisions made by industry funders and suppliers on issues such as franchise specifications, investment plans or the High Level Output Specifications.

Since the East Coast Main Line (ECML) RUS Draft for Consultation was published, the Government have published their High Level Output Specification (HLOS). These documents lay down the growth, safety and reliability targets for the industry to meet during Control Period (CP) 4 up to 2014. For England and Wales the accompanying white paper "Delivering a Sustainable Railway" provides the Govenment's view on long term plans for the industry. In order to respond to the HLOS and the White Paper, Network Rail has published its Strategic Business Plan (SBP), which details the schemes (many developed in the RUS) required to meet the HLOS targets. The SBP also contains the rail industry's view on longer term strategy. The final version of the RUS therefore not only proposes the strategies required to meet growth within the original RUS timescales, but also contains a view on the longer term strategy for meeting strong growth in many of the markets served by the route.

Network Rail will take account of the recommendations from RUSs when carrying out its activities; particularly they will be used to help to inform the allocation of capacity on the network through application of the normal Network Code processes.

The ORR will take account of established RUSs when exercising its functions.

1.2 Structure of the document

The remainder of this chapter describes the structure of the RUS.

Chapter 2 covers the geographic scope of the RUS, its time horizon and the planning context within which it was developed.

The current capabilities and usage of the strategic routes within the RUS area are summarised in **Chapter 3**, drawing on input from key industry stakeholders, and particular issues are highlighted.

Chapter 4 discusses the schemes already planned to enhance or improve the routes and services covered by the study. This helps to identify the benefits which will flow from these improvements, as well as the potential for synergy between committed or expected schemes and those developed by the RUS.

Chapter 5 sets out the changes expected to demand in future years in each of the markets served by the route.

A key step in the process is the sifting of the issues and analysis of the future year forecasts in order to identify gaps and develop options for addressing them. These gaps and options are analysed in **Chapter 6**.

Chapter 7 covers the consultation process, including a summary of the responses received and how these are taken into account in the final document.

Chapter 8 deals with the strategy itself by covering the key considerations, our recommendations for better use of resources and investment proposals for meeting growth. Our recommendations are summarised by time band using railway industry five-year control periods. The document shows how these interventions meet government targets for the 2009 – 2014 period.

Chapter 9 looks at a longer term scenario of a doubling of growth over a 30-year period and considers what strategies might be deployed to meet such a challenge.

Finally, **Chapter 10** identifies the mechanisms for implementing the recommendations in the RUS.

The appendices contain supporting analysis.

2. Context and scope

2.1 Objectives

The ECML RUS is required for a number of reasons. The primary drivers are to inform:

- identification of ways in which capacity could be used more efficiently, in the context both of the railway and wider transport issues, consistent with the Department for Transport's and Transport Scotland's strategies
- the decision making process regarding allocation of scarce capacity between different rail markets
- the development of a future service specification and timetable structure for the ECML
- solutions to the gaps in the ECML RUS area which were identified in the Freight RUS
- the development of infrastructure enhancement schemes
- the procurement process for the Intercity Express Programme (IEP) to provide a replacement for the High Speed Train fleet
- optimisation of the output specification for infrastructure maintenance and renewals.

The ECML RUS will therefore:

- propose options to achieve the most efficient and effective use and development of the rail network for both passenger and freight services aligned with the Government's rail White Paper ('Delivering a Sustainable Railway') and Scottish Minsters' 'Scotland's Railways'
- ensure that capacity usage is optimised to best meet passenger and freight demand, performance requirements and journey time aspirations
- enable Network Rail to develop an informed renewals, maintenance and enhancements programme in line with the Department for Transport's and Transport Scotland's aspirations and the reasonable requirements of train operators and other key stakeholders
- assist the Passenger Transport Executives, Transport for London and other potential funders in determining whether to seek any increments or decrements to services
- enable local and regional transport plans and freight plans to reflect a realistic view of the future rail network.

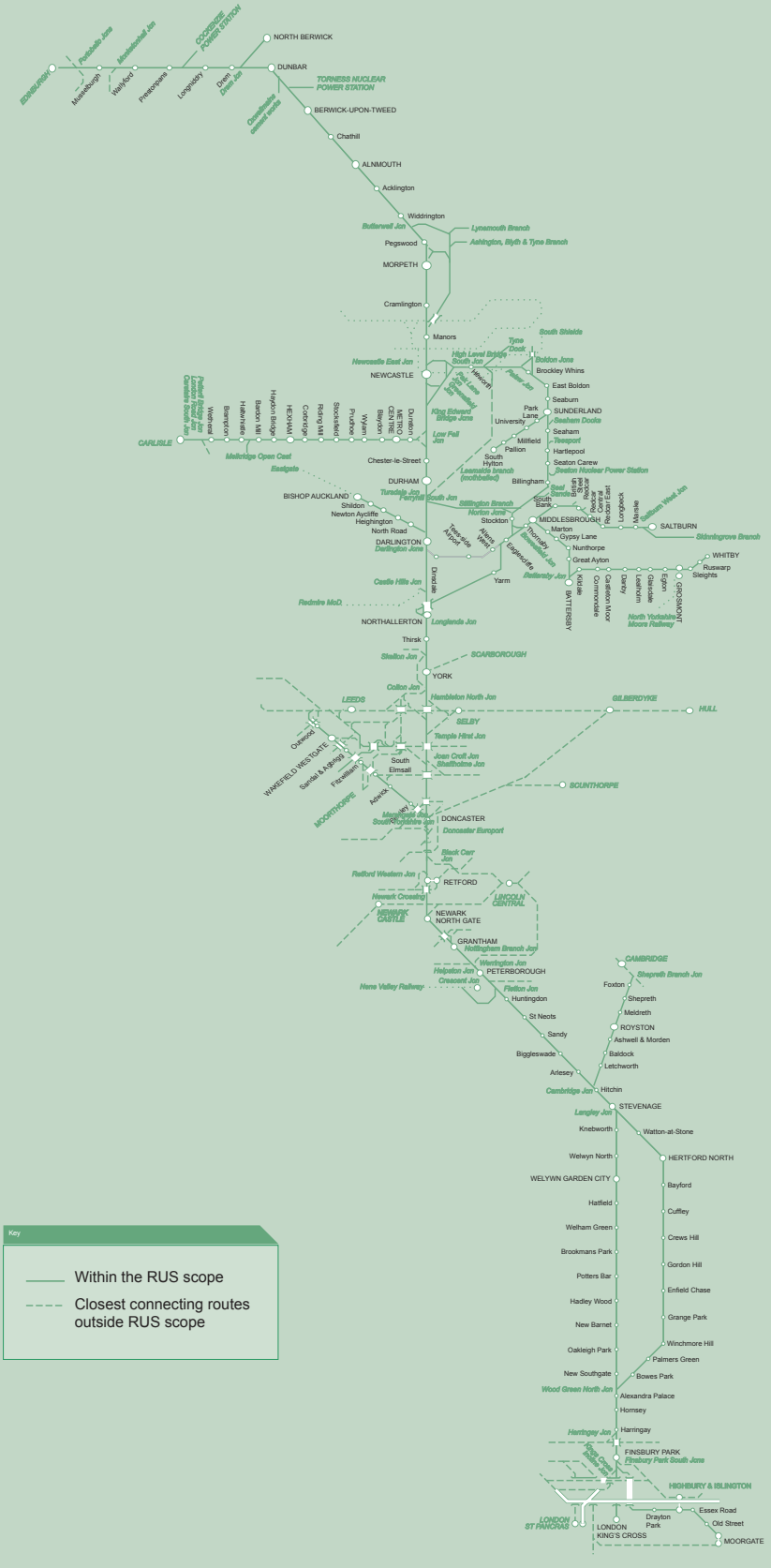
2.2 Geographic scope

2.2.1 Infrastructure network

The ECML RUS covers the network defined by Network Rail's Strategic Routes 8 and 9. This is depicted in geographical and schematic format in Figures 1 and 2 respectively. It includes the main line from London King's Cross to Leeds and Edinburgh, the line from Hitchin towards Cambridge (beyond which some services are extended to King's Lynn), the Hertford Loop and the Moorgate branch. It also includes all secondary, rural and freight only routes in North East England, and the North Berwick branch in Scotland.

Figure 1 – Geographic scope

Figure 2 – Schematic map



2.2.2 Services considered

The RUS considers all services that use these routes for part or all of their journeys to the extent necessary to achieve the route utilisation objective - and includes appropriate analysis of those traffic generators outside the scope area which have a significant effect on the pattern of demand within it.

2.3 Stakeholders

The ECML RUS Stakeholder Management Group (SMG) met on several occasions at each key stage during the development of this RUS, chaired by Network Rail. The following organisations (in alphabetical order) were represented:

Train Operating Companies (TOCs)

- First Capital Connect
- First Keolis TransPennine Express (TPE) - also representing First ScotRail
- Grand Central Railway Company
- National Express East Coast - previously Great North Eastern Railway (GNER)
- Hull Trains
- Nexus (Tyne & Wear Metro)
- Northern Rail

Association of Train Operating Companies (ATOC) representing

- CrossCountry - previously Virgin Cross Country and parts of Central Trains
- East Midlands Trains - previously Midland Mainline and parts of Central Trains
- National Express East Anglia (previously 'One')

Freight Operating Companies (FOCs)

- English Welsh and Scottish Railway (EWS)
- Freightliner Group
- First GBRf

Passenger Transport Executives (PTEs)

- Nexus (Tyne and Wear PTE)
- South Yorkshire PTE (SYPTE)
- West Yorkshire PTE (WYPTE)

Others

- Department for Transport (DfT)
- Network Rail
- The Office of Rail Regulation (ORR) - attended as observers
- Transport for London (TfL)
- Transport Scotland

The SMG delegated much of the detailed cross-industry work to a number of sub groups, particularly on passenger demand and option appraisal.

Wider stakeholder briefings were held, at which the context, scope and broad options were outlined and input on local issues was obtained. These were attended by representatives from the local authorities, statutory bodies, Community Rail Partnerships, Passenger Focus, rail user groups and a variety of other stakeholders.

Bidders for the replacement Intercity East Coast Franchise attended Stakeholder Management Group meetings as observers.

In addition, a number of one-to-one meetings were held with various stakeholders to discuss issues raised through the consultation process.

2.4 Linkage to other RUSs

This RUS has interfaces with the following existing RUSs and those under development:

- Scotland RUS, between Portobello Junction and Edinburgh Waverley
- Yorkshire and Humber RUS, principally at and between Doncaster, Leeds and York
- Lancashire and Cumbria RUS and the planned West Coast Main Line RUS, at Carlisle
- The East Midlands RUS and the Strategic Rail Authority's Midland Main Line RUS, on generally east – west routes utilising sections of, or crossing, the ECML around Peterborough, Grantham and Newark

- Greater Anglia RUS, at Cambridge and Peterborough
- Cross London RUS, at the connections between ECML and the North London and Gospel Oak to Barking lines
- Freight RUS, throughout the route (mainly growth on the main ECML route in relation to intermodal and coal flows)
- Network RUS, principally in relation to long distance cross country flows (which utilise the northern section of the ECML), alternative London – Scotland routes, alternative London – Yorkshire routes and various national initiatives
- South London, Kent and Sussex RUSs. This interface is at the proposed connection between the ECML and the Thameslink route, near the new St. Pancras International low-level platforms. This is to take into account through running between the ECML and south of London following completion of the Thameslink Programme.

2.5 Linkage to other studies and activities

This RUS is related to a number of broader Regional Planning Assessments (RPAs) and similar documents published by Transport for London and Transport Scotland. These strategies provide a medium-to-long-term planning framework:

- A Rail Strategy for London's Future: Statement of Case – Rail 2025 (published Autumn 2006, Transport for London)
- the East of England RPA (published in February 2006)
- the East Midlands RPA (published in May 2007)
- the Yorkshire and Humber RPA (published in June 2007)
- the North East RPA (published in March 2006)
- the Scottish Planning Assessment.

The following more detailed rail strategies for specific areas have been published covering parts of the RUS area:

- Scotland's Railways (produced by Scottish Ministers in December 2006)
- West Yorkshire Rail Plan 6 (West Yorkshire PTE)
- South Yorkshire Rail Strategy (South Yorkshire PTE)
- Rail Strategy (as included in the 2006-2011 Tyne and Wear Local Transport Plan by Nexus).

Finally, the following unpublished document has also helped shape thinking about the RUS:

- Great Northern/Thameslink Rail Corridor Plan (Transport for London).

2.6 Assumptions regarding other schemes

The ECML RUS has made assumptions regarding the following key schemes:

- the recently implemented timetable change to increase services to Leeds and to introduce direct London to Sunderland trains were both regarded as committed during the analysis
- the Thameslink Programme is treated as committed
- the IEP, to replace the HST fleet, is treated as committed.

Further details are provided in Chapter 4.

2.7 Timeframe

The RUS primarily examines a time period to 2016. It does, however, look further into the future in line with the 30-year timescale adopted in the rail White Paper and the Scottish Ministers' HLOS to identify significant factors which might influence development of the route strategy.

3. Current capacity, demand and delivery

3.1 Introduction

Within the extensive geographical coverage of the ECML RUS there are diverse passenger and freight markets. The passenger flows include long distance travel (both for business and leisure journeys), commuting (almost entirely into major conurbations) and local journeys (including connections onto longer distance services). Freight markets include coal, containers and steel products, with imports through ports being a key factor.

This chapter considers current passenger and freight demand, infrastructure characteristics, capacity and capability, performance and engineering access.
Further information is provided on our website at www.networkrail.co.uk.

3.2 Overview of the passenger market

3.2.1 Introduction

The following sections describe the passenger markets on the route. The descriptions focus on the main passenger flows and usage of train services within the RUS area.

Information regarding current journey patterns comes from the following primary data sources:

- ticket sales
- passenger counts on trains and at stations
- passenger surveys.

3.2.2 Context

There are four major modes of transport available for passengers wishing to make journeys relevant to this RUS:

- rail (including both National Rail services and London Underground)
- private car
- air
- bus and express coach services.

Passenger services on the ECML compete mostly with the private car over the shorter distances and with air over longer distances, although coach services also operate between most of the main centres.

A significant number of journeys are made by car on roads that are parallel to the ECML route. The A1/A1(M) and M1 provide relatively fast and reliable north to south routes, linking all the main centres. However, rail has increasing advantages over the private car by offering:

- faster journey times, especially for longer journeys
- direct access to city centres, avoiding traffic congestion and the need for parking.

The relative costs of road and rail travel are a key factor in determining modal choice, particularly for leisure travel.

Over shorter distances rail also competes with other public transport, such as bus services, into city centres. In particular, the North East has an extensive complementary network of frequent bus services.

Air is extensively used for longer distance journeys, especially between London and Glasgow, Edinburgh, Inverness and Newcastle. Journey times by rail between London and Scotland are over four hours, putting rail at a disadvantage, though the recent tightening of airport security arrangements has reduced the overall time differential. As with car, the relative costs of air and rail travel are a major factor in determining modal choice (low cost airlines are now a significant feature), together with the relative locations of airports and stations to the start and end points of passenger journeys.

Passenger demand for rail has been growing strongly over recent years. This is believed to be due to a combination of several factors, particularly economic growth and increasing road traffic congestion. On many routes the growth has been stimulated by additional services and ticketing initiatives that have been developed by operators to encourage off-peak travel.

As a result many trains operating within this RUS area now suffer from significant crowding. Key issues are:

- morning and evening peaks for commuter services to and from London
- morning and evening peaks for services into other major city centres, notably Leeds, Newcastle and Edinburgh
- a more sustained “peak period”, spread throughout much of the day on longer distance flows, as a result of ticket restrictions during the peaks
- weekend peaks on Friday and Sunday afternoons and evenings, with significant “weekend away” demand that interacts with commuting flows
- crowding associated with travel to major events.

Overcrowding on individual trains is generally defined using the standard industry measure of Passengers In Excess of Capacity (PIXC). This is based on a target specifying that all passengers on journeys of longer than 20 minutes’ duration should have a seat, with reasonable standing conditions for shorter journeys. This is a formal requirement for London commuter services and DfT’s strategic target for other services. Not all trains meet this standard at present.

3.2.3 Passenger service types

The passenger market in the RUS area is served by the following general operational groups:

- long distance high speed services
- London & South East commuter services
- regional, interurban and local services.

The key characteristics of each of these service groups are described in sections 3.3. to 3.5.

3.3 Long distance high speed passenger services (LDHS)

The main LDHS services covered by this RUS connect London King’s Cross via the ECML with the East Midlands, the Yorkshire and Humber region, the North East, and various locations in Scotland.

3.3.1 Major population centres

The following major towns and cities lie directly on the ECML:

- London
- Peterborough
- Doncaster
- Leeds
- York
- Darlington
- Newcastle
- Edinburgh.

The following locations are not directly on the ECML, but are relevant to the demand for certain LDHS journeys made on it:

- the London airports, since these can be reached by connections from King’s Cross or Peterborough

- Lincoln, as this can be accessed by a change of train at Peterborough, Newark, Retford or Doncaster
- Sheffield, since this can be accessed by a change at Doncaster or Retford
- the area around the Humber estuary, since this can be accessed via some direct trains or by changing, generally at Doncaster
- Bradford, Huddersfield, Halifax and other centres in West Yorkshire, since these can be accessed generally by a change at Leeds or Wakefield
- Sunderland and towns in the Tees Valley: direct trains from Sunderland to London commenced in December 2007, otherwise these locations can be accessed using services to York, Darlington or Newcastle
- Paris, Brussels and Lille can be accessed by Eurostar services from St. Pancras International (which is adjacent to King's Cross). These three locations then offer interchange opportunities for direct services to many other European destinations
- Strathclyde, Central Scotland and the Highlands: these have some direct services to London and connections available at Edinburgh at other times.

3.3.2 London based services

The most significant use of long distance trains is for business and leisure travel to and from London. The high numbers of passengers travelling between London and cities such as Leeds, Newcastle and Edinburgh are due to the size and significance of these major conurbations, with the transport links between them being of national economic importance. Other cities that attract large numbers of visitors include York and Durham.

The locations of stations on the ECML route makes rail particularly competitive for city centre to city centre journeys, even from London to Edinburgh. However, only a small proportion of the passengers seeking to travel to London require access to the immediate King's Cross area, giving rise to significant interchange to the London Underground system at this terminal and services using the adjoining St. Pancras International, as well as taxis and bus services. Other stations on the route serve as feeders for a wider area, with local and regional train services, car parks, taxis and local buses.

3.3.3 Non-London based services

There is significant demand for travel between most key centres of population. Typical examples of journeys relevant to this RUS include the following:

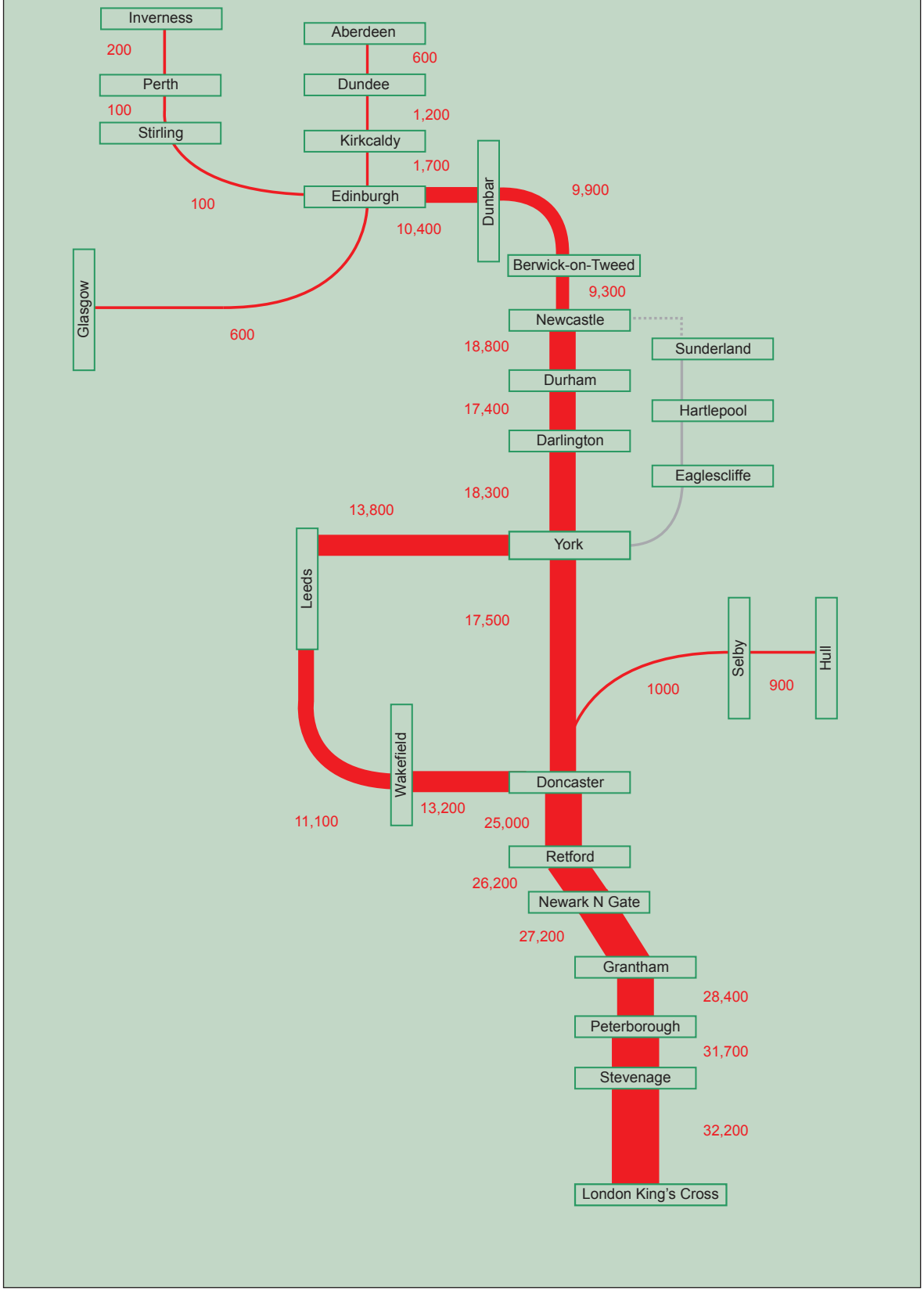
- the North East to Scotland (eg. Newcastle to Edinburgh)
- the Home Counties to Northern England or Scotland (eg. Peterborough to Leeds)
- the North East to South Yorkshire (eg. Newcastle to Sheffield)
- the North East to the Midlands (eg. Darlington to Birmingham)
- shorter distances in the North East (eg. Darlington to Newcastle)
- shorter distances in Yorkshire (eg. Doncaster to York).

This market generally competes with the road network within England and with the airlines for longer distance services to Newcastle and Scotland.

3.3.4 LDHS passenger numbers

Figure 3 shows the average number of passenger journeys that were made on LDHS services over each key route segment on weekdays in 2006. This includes GNER and Hull Trains flows into King's Cross, plus Virgin Cross Country and Transpennine Express services (described in 3.5.1) at the northern end of the ECML.

Figure 3 - LDHS passenger journeys per weekday



Source: Atkins, PLANET Strategic
Numbers shown represent the total flow (ie. in both directions) for LDHS operators

3.3.5 LDHS operators

The franchised operator of services to and from London King's Cross from December 2007 is **National Express East Coast**. These services were previously operated by **Great North Eastern Railway** (GNER).

In addition, the following Open Access operators have rights to run LDHS services on parts of the ECML:

- **Hull Trains** provides up to seven services per day each way between King's Cross and Hull
- **Grand Central Railway Company Ltd** recently started to operate three return services per day between King's Cross and Sunderland.

CrossCountry operates services over the northern part of the ECML, linking Scotland, the North East and Yorkshire with the East Midlands, the West Midlands, and the South West. This franchisee took over the former Virgin Cross Country services from November 2007.

In addition, **East Midlands Trains** operates certain peak services between St. Pancras and Leeds, running over a limited part of the ECML. This franchisee took over these services from Midland Mainline in November 2007.

Figure 5 shows the sections of route utilised by LDHS operators.

3.3.6 LDHS capacity

Figure 5 shows the typical LDHS train service level, based on the December 2007 weekday timetable.

The majority of London services operating wholly on the ECML are operated using 125mph Class 91 electric locomotives hauling nine passenger coaches. Services extending beyond the electrified network are operated by diesel traction throughout, using a combination of Class 43 HSTs and Class 222 diesel units, as are the East Midlands Trains services.

CrossCountry services are operated mainly by four-car or five-car Voyager units (Class 220 & 221).

Figure 5 – LDHS train service levels

From	To	Peak frequency	Off-peak frequency	Notes
King's Cross	Edinburgh	2tph	1 – 2tph	Some services are extended to Glasgow, Aberdeen or Inverness.
King's Cross	Newcastle	2 – 3tph	2tph	Includes the Edinburgh services above.
King's Cross	Leeds	2 – 3tph	2tph	Some services are extended to Bradford, Skipton or Harrogate.
King's Cross	Hull	1tph	approx. 1 every 2 hours	
King's Cross	Sunderland	3 trains per day each way		
Birmingham	Edinburgh via Leeds	1tph	1tph	Some services are extended to Glasgow or Aberdeen.
Birmingham	Newcastle via Doncaster	1tph	1tph	

Figure 4 - Map of LDHS operators

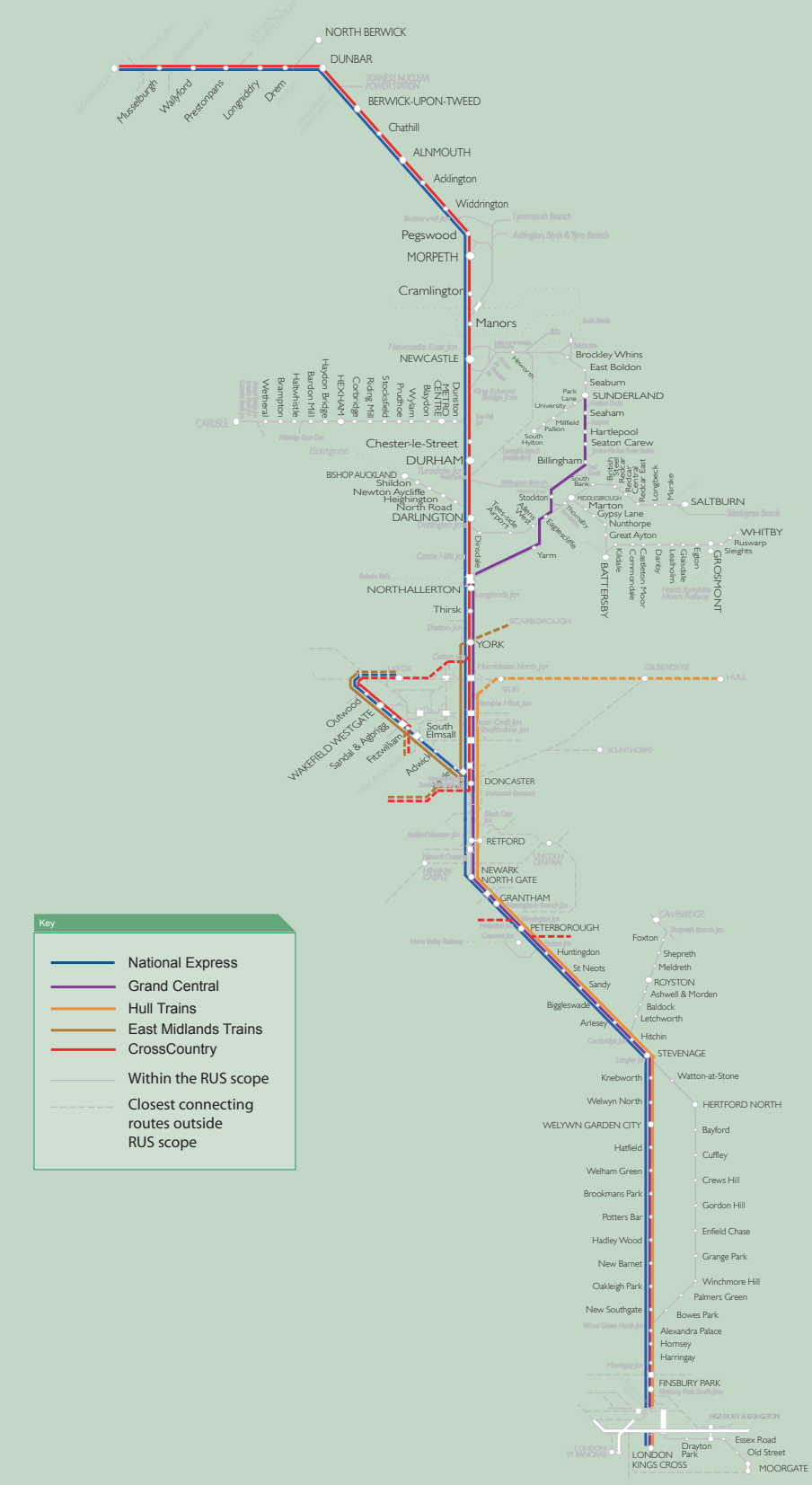
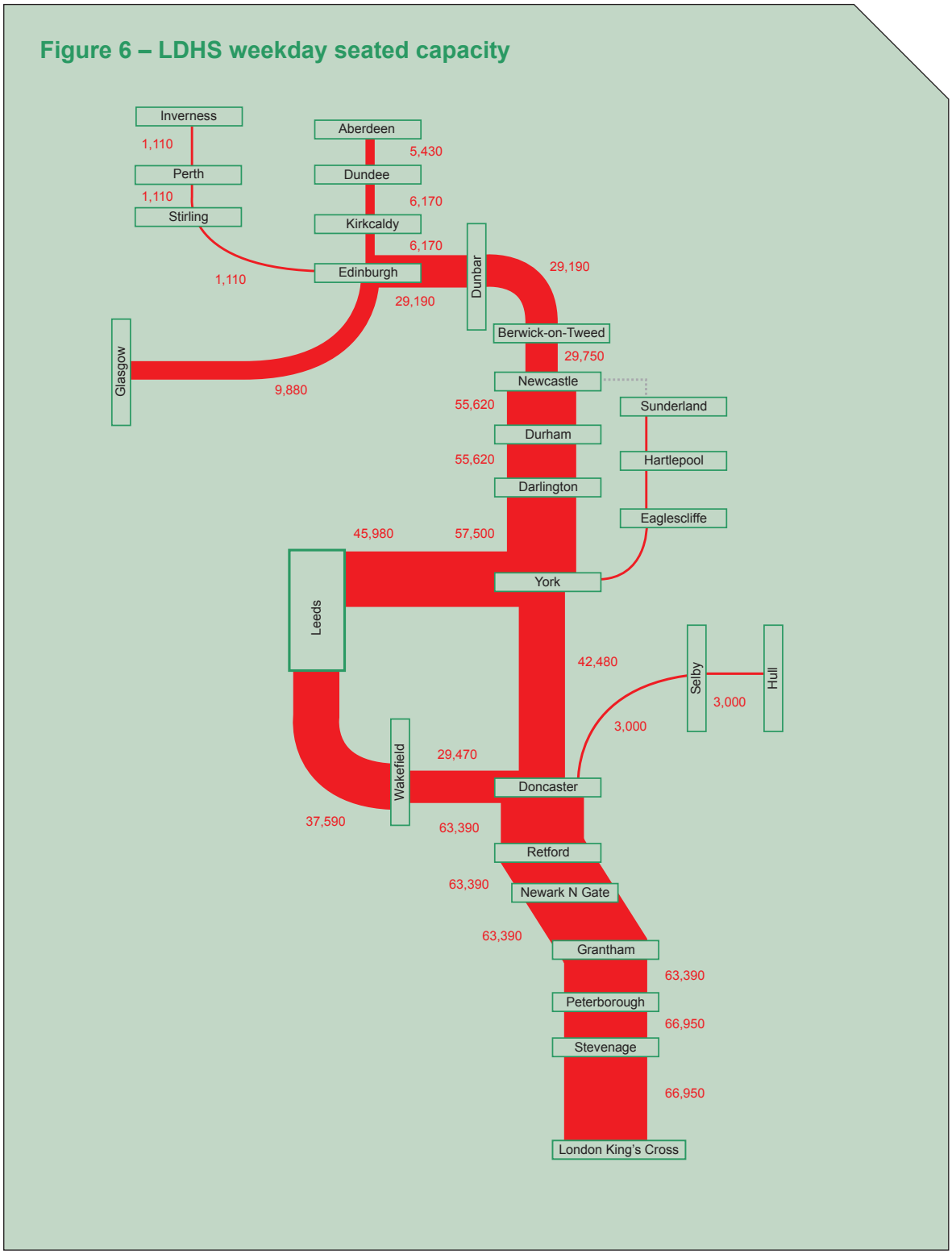


Figure 6 is a representation of LDHS weekday capacity (seats on trains) in 2007. It includes GNER and Hull Trains services into and out of King's Cross, plus Virgin Cross Country and Transpennine Express services at the northern end of the ECML. As mentioned above, the GNER services are now operated by National Express East Coast and the CrossCountry franchise has taken over the Virgin Cross Country services.

Figure 6 – LDHS weekday seated capacity



Source: Atkins, PLANET Strategic. Numbers shown represent total capacity in both directions. This includes only capacity provided by LDHS operators

3.3.7 Historic LDHS passenger growth

Figures 7 and 8 show the historic changes in the numbers of passengers using LDHS services between key stations on the ECML. Demand is highest between London and Peterborough and this key flow has shown very strong growth in recent years. The highest rate of growth, on individual flows, has generally been between London and stations within an approximate 90-minute journey time of King's Cross, reflecting an increase in commuting from areas further away from London. However, the historic rate of growth, particularly at Grantham, Newark and Retford, appears to have stabilised over the last few years.

Flows between London and Scotland, and London and Newcastle, have been affected by competition from low cost airlines within the time period shown. However, rail passenger numbers on these flows has recently been increasing, due to security issues at airports and the consequent increase in end-to-end journey times for air passengers. There have been significant increases in passenger numbers on non-London flows into Newcastle and elsewhere.

The recent major improvements in services between London and Hull have triggered a significant growth in demand on this flow, which is continuing.

Figure 7 – Historic growth (LDHS London flows)

Passengers journeys to/from London between 1998/99 – 2004/05

Station	1998/99	2004/05	% Change
Grantham	235,000	420,000	80
Hull	120,000	210,000	75
Newark	250,000	430,000	70
Retford	55,000	85,000	60
Leeds	930,000	1,300,000	40
Peterborough	1,275,000	1,745,000	35
York	620,000	810,000	30
Wakefield	245,000	325,000	30
Darlington	255,000	305,000	20
Doncaster	355,000	385,000	10
Newcastle	815,000	920,000	10
Edinburgh	730,000	565,000	-25

Source: Atkins, based on LENNON ticket sales data. Numbers shown are a summation of flows in both directions

Note: Total passengers journeys have been rounded to the nearest 5,000 and percentages shown to the nearest 5%.

Figure 8 – Recent growth (non-London flows on ECML North)

Passenger journeys between 1998/99 – 2004/05

Between stations		1998/99	2004/05	% Change
York	Newcastle	185,000	315,000	70
Durham	Newcastle	545,000	840,000	55
Darlington	Newcastle	185,000	290,000	55
Edinburgh	Newcastle	230,000	350,000	50
Darlington	York	105,000	140,000	35

Source: Atkins, based on LENNON ticket sales data. Numbers shown are a summation of flows in both directions.

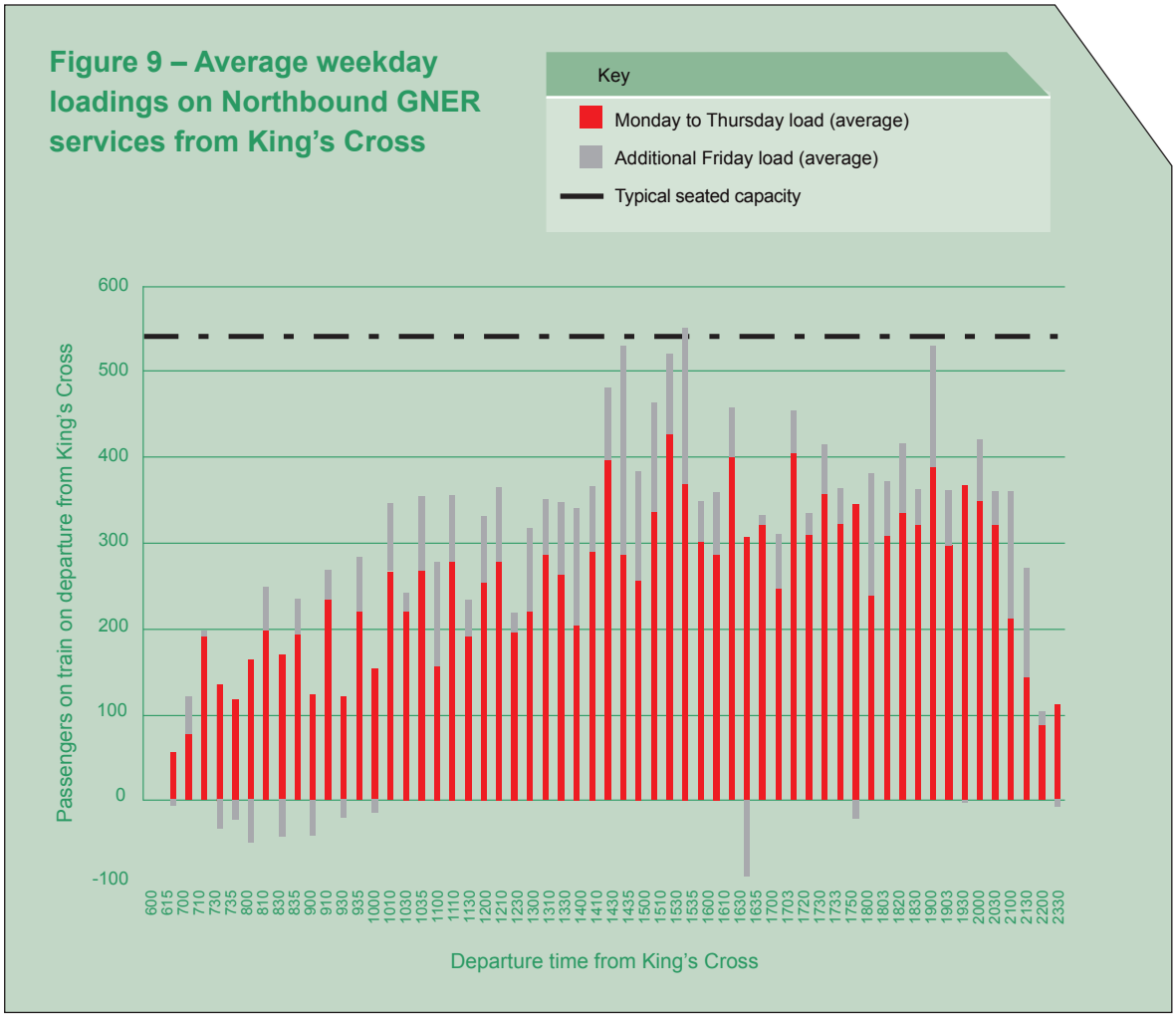
Note: Total passengers journeys have been rounded to the nearest 5,000 and percentages shown to the nearest 5%.

3.3.8 Spread of demand along the route

The PLANET Strategic model was used, through Atkins, to produce a representation of LDHS loadings in 2006. This was shown as an all day ratio of passengers to seats for key route sections.

It revealed that passenger capacity is most intensively used between Wakefield/York and London, although the range of average weekday loadings along the route is far less than the range of loadings over time, as identified in the next section.

Figure 9 – Average weekday loadings on Northbound GNER services from King's Cross



Source: GNER, January – March 2007 data

3.3.9 Spread of demand throughout the day

Figure 9 highlights recent average loadings on weekday northbound GNER services on departure from King's Cross in early 2007. Services on Fridays are shown separately as these are used by higher numbers of passengers – by business, commuter and weekday leisure travellers (as for the rest of the week) plus weekend travellers.

3.3.10 Current crowding – LDHS

LDHS services suffer from significant overcrowding at certain times. On the busiest trains it is not uncommon for passengers to have to stand, especially between London and Peterborough with an average current peak loadings between 70 to 80 percent in this area. Standing can extend to Leeds and York or further on some busy weekend trains.

It can be seen from Figure 9 that weekday demand is significantly affected by ticket restrictions. During the period covered, GNER prevented the use of "Saver" type tickets on services between the following times:

- morning peak trains departing London before 09:30 (or arriving London before 11:15)
- evening peak trains departing London between 14:59 and 18:59.

The above has a peak-spreading effect, with services either side of the evening peak period suffering from crowding.

Over recent years there has been an increased use of airline-style advance purchase ticketing by operators to encourage an optimum spread of demand across services throughout the day.

There is significant demand for first class travel and provision of meals on LDHS services, reflected in the layout of trains operating these routes. However, first class accommodation provides fewer seats per carriage than standard class.

Cross country services were enhanced with a significant increase in frequency across the country in 2002. This led to a substantial increase in passenger demand, but these trains are relatively short (four-car or five-car) and hence can suffer from crowding at times.

LDHS services are also used for relatively short distance commuting flows (eg. Wakefield to Leeds and Dunbar to Edinburgh). It can be difficult to optimise train layouts to provide commuting capacity for these short distance journeys whilst meeting the needs of longer distance travellers.

Passengers from Peterborough generally use LDHS services to London as these offer faster journey times than the outer suburban services. Passengers at Stevenage have some limited opportunities to use LDHS services from London, though not towards London during the morning peak hours. Providing capacity for these commuters on LDHS services is a significant issue during the morning and evening peaks.

3.4 London and South East commuter services

First Capital Connect (FCC) operates the commuter service at the southern end of the ECML, linking King's Cross and Moorgate with the London suburbs, Hertfordshire, Bedfordshire and Cambridgeshire as shown in Figure 10.

The predominant usage of trains is for commuting to and from London. This is characterised by very high levels of utilisation in the morning and evening peaks, and generally quieter periods for the remainder of the day – the exception being the fast Cambridge services which are busy throughout the day.

The commuting market is relatively captive to heavy rail, with the alternative options of travelling by car or bus generally taking significantly longer within built-up areas. In addition, car usage costs in these areas are higher.

Within London, there is significant demand for local services throughout the northern part of the city, including suburbs such as Barnet and Enfield. Just beyond the London boundary there is increasing demand from locations such as Hertford, Hatfield and Potters Bar.

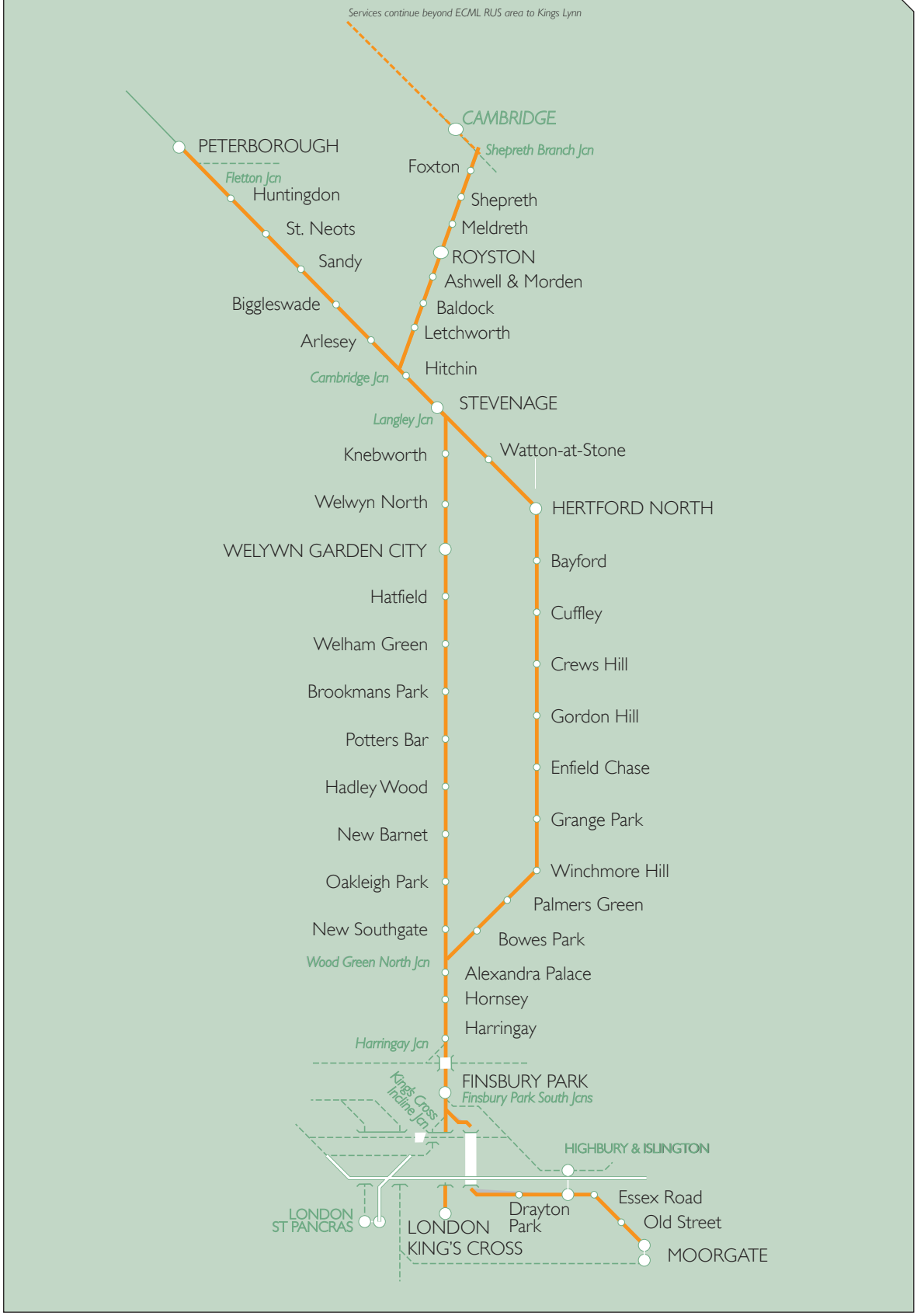
The London Underground Piccadilly and Northern Lines (High Barnet branch) run broadly parallel with the southern most sections of the RUS area. Many passengers in northeast London therefore have a choice between using main line or underground services for their journey.

FCC services can broadly be split into two distinct groups: outer and inner suburban services.

3.4.1 Outer suburban

This service group operates between London King's Cross and Peterborough/ Cambridge (with some trains extending beyond to King's Lynn). Services run fast on the approaches to and from London, generally only calling at Finsbury Park.

Figure 10 – FCC routes



Services are operated by Class 317 and 365 electric multiple unit trains. The maximum length of all services (with a few exceptions in the peaks) is eight-car, due to platform length constraints at several key stations, including platforms 9 - 11 at King's Cross.

There is significant interchange from these services onto the London Underground at King's Cross (providing connections to the City and the West End) and at Finsbury Park (providing interchange to Moorgate services as well as to the Underground).

Passengers from Cambridge have a choice of services to King's Cross or to Liverpool Street (via the Lea Valley Line). Journeys into King's Cross via the ECML are faster and are used by approximately 84 percent of Cambridge to London passengers (2001 LATS data). However, Liverpool Street is closer to the City of London and Docklands so can be more convenient for some passengers.

3.4.2 Inner suburban

These services generally operate between Moorgate and Welwyn Garden City/Hertford North. Most services call at all stations. Occasional services are extended north of Welwyn Garden City (in the peaks) and north of Hertford (all day). After approximately 22:00 and at weekends, services run into King's Cross, rather than Moorgate. Some peak services also operate into King's Cross.

Weekday services are operated by Class 313 electric trains. These units have dual voltage power supply capability (the Moorgate branch is electrified with the third rail DC system as opposed to overhead AC). All services are three-car or six-car, the latter being the length of platforms on the sub-surface Moorgate branch.

Trains call at Highbury & Islington (except when operating to King's Cross), providing an easy cross-platform interchange onto the Victoria Line for the West End. This station also provides interchange to London Overground. Interchange with the London Underground is also available at Finsbury Park (Piccadilly and Victoria lines), Old Street (Northern Line - Bank branch) and Moorgate (Northern Line - Bank branch and Circle/ Metropolitan/Hammersmith & City lines).

3.4.3 L&SE train service levels

Figures 11 and 12 represent the FCC train service, based on the May 2007 weekday timetable. Each line represents a train service operating into London in the hour shown.

Figure 11 – FCC morning high peak train service

Inner and outer suburban trains operating into London during the high peak hour (08:00 - 08:59)

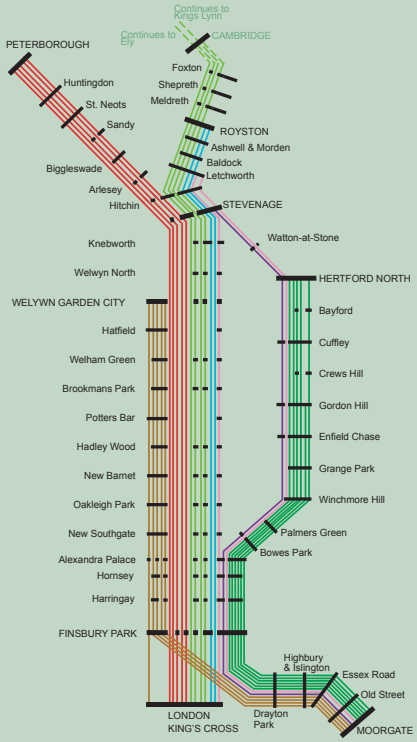
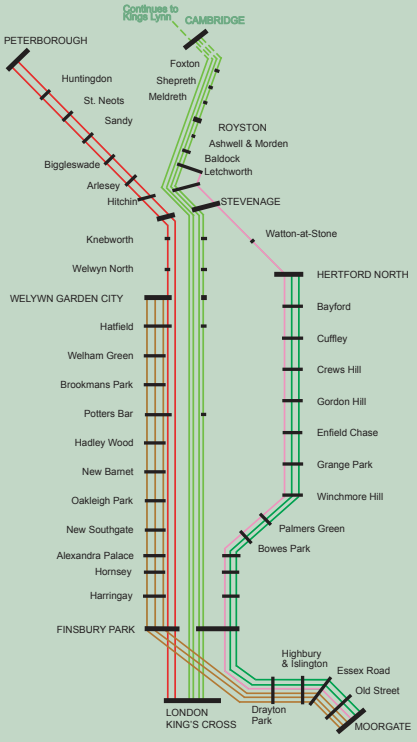


Figure 12 – FCC inter-peak train service

Inner and outer suburban off-peak standard hour train service



Further details of train service levels are given in Figure 13.

Figure 13 – FCC train service levels

From	To	Average Peak	Inter-Peak
King's Lynn/Ely/Cambridge (fast)[1]	King's Cross	2tph	2tph
Peterborough (semi-fast)	King's Cross	2tph	1tph
Cambridge (stopping)	King's Cross	2tph	2tph[3]
Royston (stopping)	King's Cross	1tph	–
Peterborough (stopping)	King's Cross	2tph	1tph
Letchworth (stopping via Welwyn)	King's Cross	1-2tph	–
Welwyn Garden City	Moorgate	4tph	3tph
Hertford Loop[2]	Moorgate	6-8tph	3tph

1 Peak services call at selected intermediate stations on the Cambridge line.

2 Typically 2tph peak/1tph off peak extended to Letchworth/Stevenage.

3 1tph is a semi-fast service.

3.4.4 Current crowding – London & South East

There is currently severe overcrowding in the morning and evening peak periods on many FCC services.

Figures 14 and 15 show PIXC (Passenger In Excess of Capacity) levels in Autumn 2006, calculated as described in the Glossary.

Figure 14 – FCC morning peak PIXC

Inner service groups	Number of trains	PIXC (average)
Welwyn route	11	1.7%
Hertford route	18	2.9%
Outer service groups	**Number of trains**	**PIXC (average)**
Cambridge limited stop	7	13.4%
Cambridge stopping	11	2.1%
Peterborough	10	4.0%

Source: First Capital Connect

Figure 15 – FCC evening peak PIXC

Inner service groups	Number of trains	PIXC (average)
Welwyn route	11	0.0%
Hertford route	16	2.4%
Outer service groups	**Number of trains**	**PIXC (average)**
Cambridge limited stop	6	17.3%
Cambridge stopping	11	0.0%
Peterborough	11	1.2%

Source: First Capital Connect

From Figures 14 and 15 it can be seen that:

- the highest inner suburban crowding levels (with significant standing, typically south of Gordon Hill) occurs on morning peak Hertford Loop services
- the highest outer suburban crowding levels (with significant standing for lengthy periods) occurs on fast evening peak services to Cambridge. Passenger journeys to Cambridge increased by 18 percent in the 2000 - 2006 period.[1]

The most significant outer suburban flows are as follows[1]:

- Cambridge to London
  2.7 million journeys per year
- Peterborough to London
  1.8 million journeys per year
- Stevenage to London
  1.6 million journeys per year
- Hitchin to London
  1.1 million journeys per year
- Welwyn Garden City to London
  1.0 million journeys per year.

1 Source: FCC Capacity study, December 2006

Figure 16 indicates relative levels of station usage in the L&SE area. This shows a broad distribution of busy stations along the routes concerned.

Figure 16 – Relative station usage in L&SE area

Source: Prepared by MVA for Transport for London, Rail Corridor Plan. 2001 data for morning peak boarders.

3.5 Regional and local services

3.5.1 Inter-urban and regional

A number of medium distance services operate within and beyond the RUS area. There is considerable demand for rail journeys to and from the regional centres, for commuting, business and leisure travel.

The most significant interurban service relevant to this RUS is the North Cross-Pennines route, linking the North East and Yorkshire with the North West. These services run on the Manchester – Leeds – York – Newcastle/ Middlesbrough/Scarborough route.

Other examples include the South Cross-Pennines route (which crosses the ECML at Doncaster), the Birmingham to Stansted Airport service (which crosses the ECML at Peterborough) and the Norwich to Liverpool service (which runs on the ECML between Peterborough and Grantham).

Interurban services are operated by diesel rolling stock of Classes 158, 170 and 185. Trains are typically two, three or four-car in length although a few North Cross-Pennines services are six-car in the peaks.

3.5.2 Local services

The main local network covered by this RUS is in North East England, broadly covering the Tyne, Wear and Tees valleys. The most common use of these routes is for local journeys into and between the major towns, notably Newcastle, Middlesbrough, Sunderland, Darlington, Hartlepool and Hexham. Local services also provide connections into long distance trains while the Newcastle to Carlisle service provides a connection between the ECML and the WCML. The Esk Valley line (to Whitby) and the Bishop Auckland branch are Community Rail Partnerships, providing specific local functions. The only regular local service on the ECML in the North East is between Newcastle and Morpeth, with a very limited all stations service (two trains per day each way) extended to Chathill.

The Doncaster to Leeds line, used by LDHS Leeds trains, is served by a regular local service calling at all stations, as well as local services from Sheffield which use part of this corridor. These services operate over one of a number of radial routes around Leeds and Sheffield, hence they interface significantly with issues that will be covered by the Yorkshire and Humber RUS.

A number of local east – west services use small lengths of the ECML, such as Nottingham – Lincoln services (which cross the ECML by means of a flat crossing at Newark) and several services which cross the ECML in the Doncaster station area (eg. Sheffield – Scunthorpe and Sheffield – Hull/Bridlington).

In Scotland a local service operates between Edinburgh and North Berwick.

These local services are characterised by relatively old rolling stock, using Classes 142, 150, 153 and 156, and some have poor journey times. Trains are usually one, two or three-car in length. The North Berwick to Edinburgh and Doncaster to Leeds services are operated using four-car electric units.

3.5.3 Regional and local operators

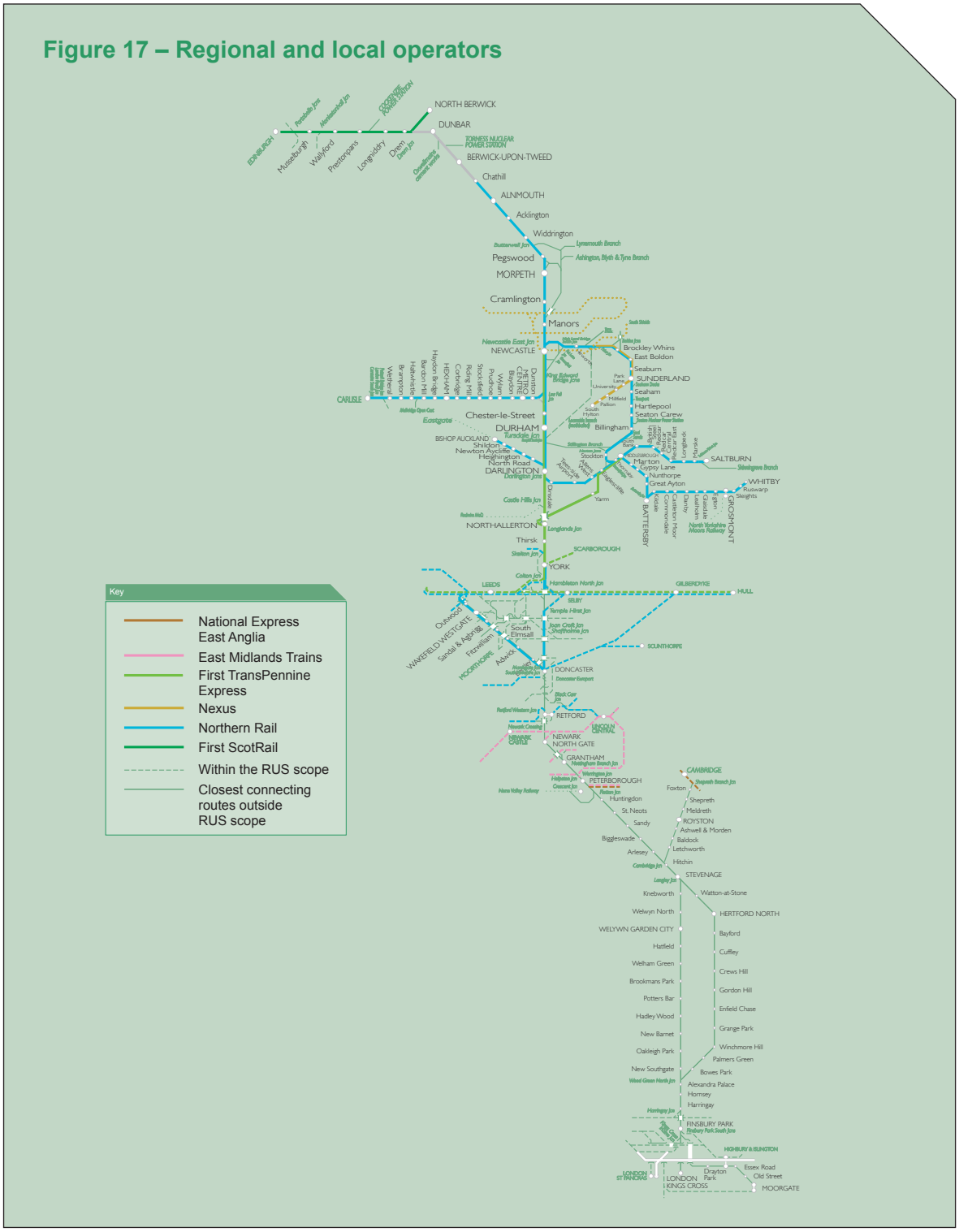
Regional and local services on the route are provided by the following operators:

- **Northern Rail**, which operates Passenger Transport Executive (PTE) supported and other local services in Yorkshire and the North East.
- **First Keolis Transpennine Express** (TPE) which provides interurban services from Liverpool/Manchester Airport to Newcastle, Middlesbrough, Scarborough and the area around the Humber estuary.
- **East Midlands Trains,** which operates services using the route between Peterborough and Grantham, and at Newark and Doncaster. These serve the East of England and the East Midlands.
- **CrossCountry,** which operates the Birmingham - Stansted Airport service.

- **National Express East Anglia,** which operates services between Peterborough and London Liverpool Street via Ely and Ipswich
- **First ScotRail,** which provides local services on the route from North Berwick to Edinburgh.
- **Nexus (Tyne and Wear PTE),** which operates the Tyne & Wear Metro light rail service as an Open Access operator between Tyneside, Sunderland and South Hylton.

Figure 17 shows the usage of the route by regional and local operators:

Figure 17 – Regional and local operators



3.5.4 Regional and local train service levels

Figures 18-20 show the frequency of selected regional services in the RUS area, based on a weekday in the May 2007 timetable.

Figure 18 – Regional services ECML South

From	To	Frequency	Notes
Birmingham	Stansted Airport	1tph	Crosses ECML at Peterborough
Liverpool	Norwich	1tph	Runs on ECML between Grantham and Peterborough
Leicester	Lincoln	1tph	Crosses ECML at Newark
Peterborough	Spalding/Lincoln	Approx. 1tph	Runs on ECML between Peterborough and Werrington Junction
Peterborough	Ipswich	Approx 1 train per 2 hours	Uses platform on ECML at Peterborough
Nottingham	Skegness	1tph	Uses platform on ECML at Grantham

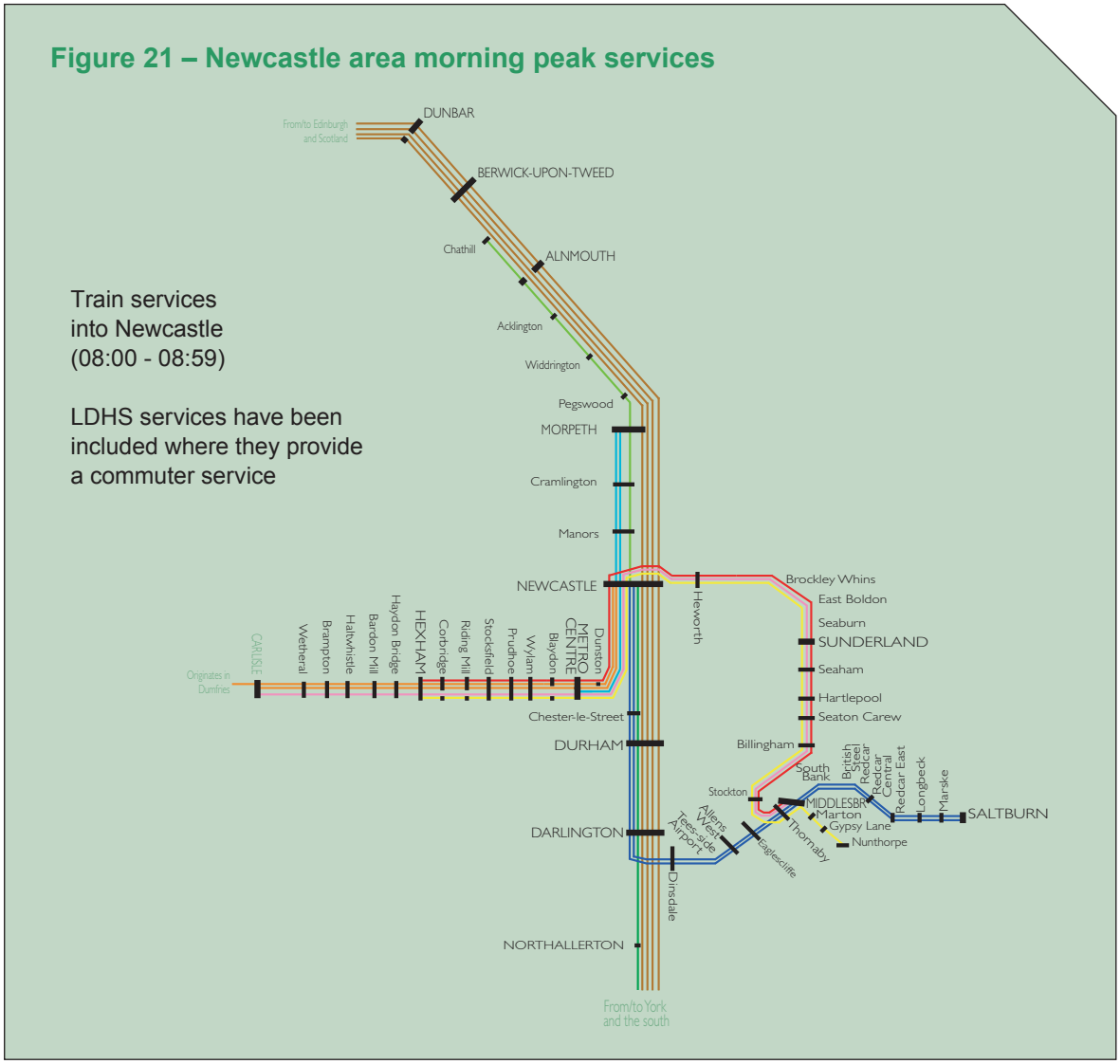
Figure 19 – Yorkshire train service levels

From	To	Frequency	Notes
Leeds	Doncaster	1tph	Local stopping service
Cleethorpes	Manchester Airport	1tph	Crosses ECML at Doncaster
Scunthorpe	Sheffield	1tph	Crosses ECML at Doncaster
Scarborough	Liverpool Lime Street	1tph	Crosses ECML at York
Sheffield	Adwick	1tph	Runs on ECML between Doncaster and Adwick
Sheffield	Hull/Bridlington	1tph	Crosses ECML at Doncaster
York	Leeds via Harrogate	1tph	Runs on ECML between York and Skelton Junction

Figure 20 – North East England and Scotland train service levels

From	To	Frequency	Notes
Newcastle	Manchester Airport	1tph	Runs on ECML between Newcastle and York
Middlesbrough	Manchester Airport	1tph	Runs on ECML between Northallerton and York
Darlington	Saltburn	2tph	Approximately 1 in 3 trains operates to/from Bishops Auckland
Middlesbrough	Newcastle	1tph	Local stopping service via Durham Coast
Middlesbrough	Newcastle	3 trains in morning peak	Local stopping service via ECML (2 trains per day start at Saltburn)
Middlesbrough	Whitby	4 trains per day	Local stopping service
Newcastle	Hexham	2tph	Local stopping service (with approximately half of services extending to Carlisle, Glasgow or Stranraer)
Newcastle	Morpeth	1tph	Local stopping service (with some services extending to Chathill)
South Hylton / Sunderland	Newcastle Central Low Level	5tph	Metro service (runs on Nexus network between Pelaw Junction and Newcastle)
Edinburgh	North Berwick	1-2tph	Local stopping service (2tph in peaks)
Edinburgh	Newcraighall	2tph	Local stopping service runs on ECML between Portobello Junction and Edinburgh

Figure 21 – Newcastle area morning peak services



For the Newcastle area, Figure 21 represents the peak service into the city, based on the May 2007 timetable. Each line represents a train service operating in the high peak hour.

3.5.5 Historic regional growth

An examination of regional historic growth has been undertaken for West Yorkshire and for the North East of England. The analysis shows that for both regions there has been strong growth in passenger demand over the last ten years.

3.5.6 Historic growth: North East England

Analysis of historic data showed that between 1998/99 and 2004/05 rail journeys within the area grew by around 35 percent. A review of historic timetables shows that there had only been relatively small supply side changes over this time and these do not explain the level of growth seen. It is thought that other factors, such as road congestion and changes in the types and location of employment, have been responsible.

Application of the standard industry PDFH methodology failed to predict the rate of rail growth seen in the Newcastle area.

Figure 22 – Crowding on Northern Rail trains arriving into Newcastle between 08:00 – 08:59

	Route			
	Sunderland	Hexham	Darlington	Morpeth
Peak trains (Northern Rail only)	2	2	2	2
Passengers	335	280	330	255
Trains with standing	1-2[1]	1-2[1]	2	1
Passengers standing	90	50	120	15[2]
Duration of standing	approx. 30 minutes (Sunderland)	approx. 25 minutes (Wylam)	approx. 20 minutes (Durham)	approx. 15 minutes (Cramlington)[2]
Trains over capacity	1	1	2	1
Load Factor (% of seats)	130%	110%	155%	85%
Load Factor (% of capacity[3])	90%	75%	115%	60%

Source: Northern Rail passenger counts Autumn 2007

1 Nexus data indicates passengers standing on both services. (Figures shown above are based on Northern Rail counts).

2 Passengers standing on departure from Cramlington. However, Nexus data indicates standing from Morpeth to Newcastle which would mean some passengers standing for possibly 25 minutes.

3 The capacity figure includes Northern Rail's seating capacity plus a standing allowance which varies by rolling stock type.

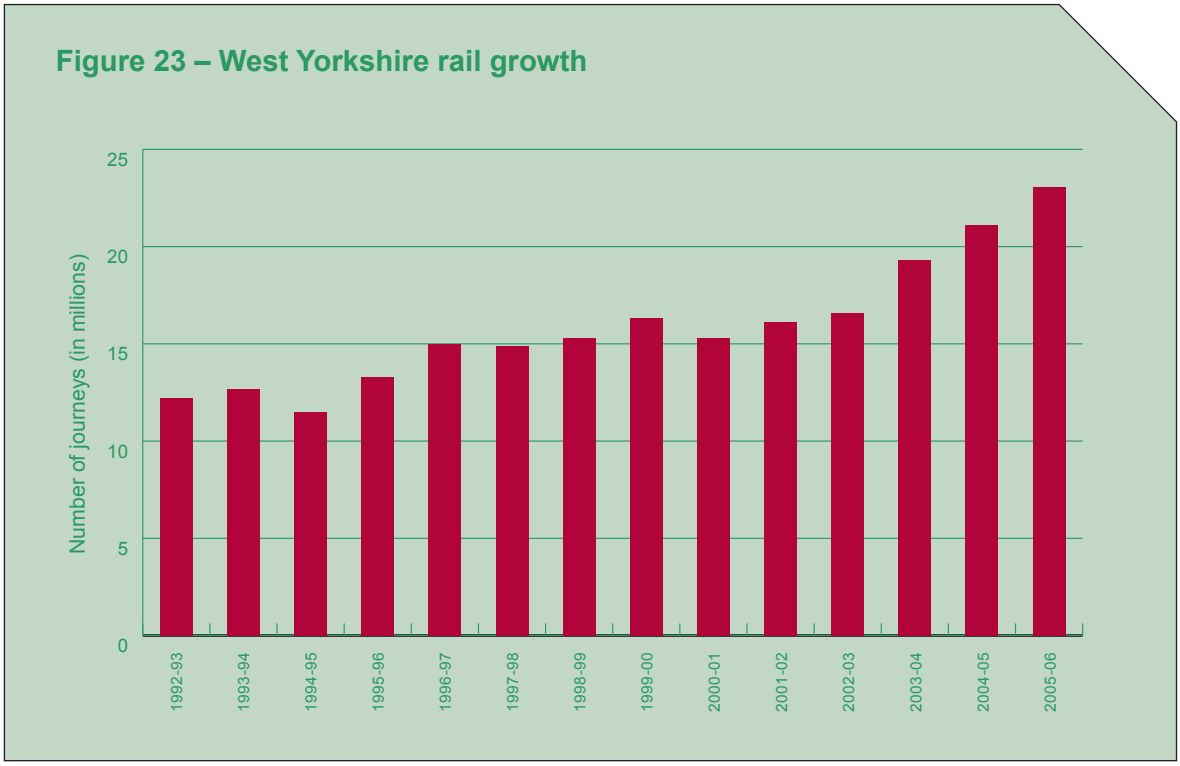
3.5.7 Current crowding: North East England

As a result, standing in crowded conditions now occurs on some peak services approaching Newcastle, Middlesbrough and Sunderland. Figure 22 shows the levels of crowding on Northern Rail services into Newcastle on the four heavy rail corridors into the city.

During the morning peak a number of TOCs provide a variety of different types of services into Newcastle. The majority of local stopping services are provided by Northern Rail along the Durham Coast and from Hexham to Newcastle, with ScotRail operating one service from Dumfries to Newcastle (via Hexham). On the Darlington to Newcastle and Morpeth to Newcastle corridors a number of TOCs provide services. These are National Express East Coast, CrossCountry and TPE, which provide faster long distance services, and Northern Rail who provide local stopping services into Newcastle from Saltburn (via Darlington), Morpeth and Chathill.

Based on count data from Autumn 2007, provided by Northern Rail, and surveys of loadings into Newcastle undertaken by NEXUS in November 2006, the RUS has reviewed the crowding that occurs on peak services on the key corridors arriving into Newcastle. The crowding is mainly on the local stopping services arriving into Newcastle in the high peak hour between 08:00 and 08:59. The NEXUS data also identifies a couple of CrossCountry and TPE services which arrive heavily loaded.

Figure 23 – West Yorkshire rail growth



Source: WYPTE

3.5.8 Historic growth: West Yorkshire area
Figure 23 shows rail usage in West Yorkshire. Between 1996/97 and 2005/06 rail journeys in this area grew by 55 percent. Excluding growth arising from the electrification (and associated improvements) of the Airedale and Wharfedale lines, other rail journeys in the area over the same period grew by about 40 percent. Again, the industry standard passenger forecasting methodology does not fully explain these high levels of growth.

3.5.9 Current crowding – West Yorkshire
Northern Rail's count data from autumn 2005 indicates similar crowding issues on some local service groups in the high peaks between Doncaster to Leeds.

3.6 Stations

Figure 24 – ECML main station usage

Station	Annual footfall (2005/06)
London King's Cross	20,300,000
Peterborough	3,700,000
Grantham	940,000
Newark North Gate	400,000
Doncaster	2,840,000
Wakefield Westgate	1,850,000
York	6,150,000
Darlington	1,910,000
Durham	1,740,000
Newcastle	6,110,000

Source: ORR Station Usage (2005/06)

3.6.1 Station footfall

Figure 24 shows the average annual number of passengers using key stations on the ECML within the RUS area.

In the London & South East commuter area, stations vary considerably in usage, with the busiest stations generally being those in areas of the greatest population density. However, this can be affected by the frequency, speed and capacity of the train service on offer compared to nearby alternatives.

In the North East the main regional stations such as Middlesbrough and Sunderland are busy, though relatively less so than those on the ECML. However, the majority of stations away from major towns have low usage, to varying degrees. There are a few stations which have particularly low patronage, the main examples are shown in Figure 25.

Figure 25 – Low footfall stations in the North East (2005/06)

	Average weekday station usage
Durham Coast Line	
Seaton Carew	58
Tees Valley Line	
British Steel Redcar	<5
South Bank	7
Tyne Valley Line	
Dunston	<5
Bardon Mill	12
Blaydon	14
ECML stations between Newcastle and Berwick	
Acklington	<5
Chathill	8
Pegswood	10
Widdrington	24

Source: MOIRA OR23 June 2005 timetable

Closure of low footfall stations was reviewed against potential journey time benefits to other users of removing the additional stop. The ECML RUS is not recommending closure of any stations though it is recommended that a further appraisal is carried out should major works be required on any of the low footfall stations.

3.6.2 Congestion at stations

Several of the bigger stations have an element of overcrowding at certain times of day. The key issues are:

- King's Cross is congested in both the main station concourse and the stairs down to the London Underground system.
- Finsbury Park is congested, particularly in the subway between platforms which also links to the London Underground. This is a particular issue when football matches are played at Arsenal's new Emirates stadium, located near the station.
- Peterborough station suffers from congestion on the overbridge between platforms and around the station entrance.

Congestion at King's Cross will be alleviated by the major redevelopment scheme detailed in Chapter 4 which includes a new western concourse with a mezzanine level for retail facilities. Work is already underway to examine development opportunities at Peterborough station, in conjunction with third parties. In addition, the options identified in Chapter 6 to address increasing demand on London inner suburban services include works at Finsbury Park station. As part of work on the Network RUS, the issue of station capacity will be reviewed from a network perspective.

3.6.3 Platform lengths

Platform lengths at stations within the RUS area have evolved over time to suit the service mix and stopping patterns of passenger operators. In general, platform lengths across the route are adequate for the operation of existing service levels with current rolling stock. However, limitations exist at a number of stations on the route where meeting growth in demand through train lengthening is constrained. Major constraints are listed below:

- The eight main train shed platforms and three suburban platforms at King's Cross are fully utilised during the peaks and the suburban platforms are unable to accommodate more than eight-car trains.
- Moorgate branch stations are limited to six-car trains and the ability to extend (or increase the number of) platforms would be extremely difficult in the underground section between Drayton Park and Moorgate.
- Limited number of outer suburban stations have twelve-car capacity.
- A combination of the number of platforms and the existing track layout at Peterborough limits the ability of the station to accommodate growth.
- Whilst the platforms in the North East can accommodate three vehicles of 23 metres there are a handful of stations which would require platform extensions to cater for trains formed of four 23-metre vehicles.

These constraints have been incorporated into the options which are discussed in Chapter 6.

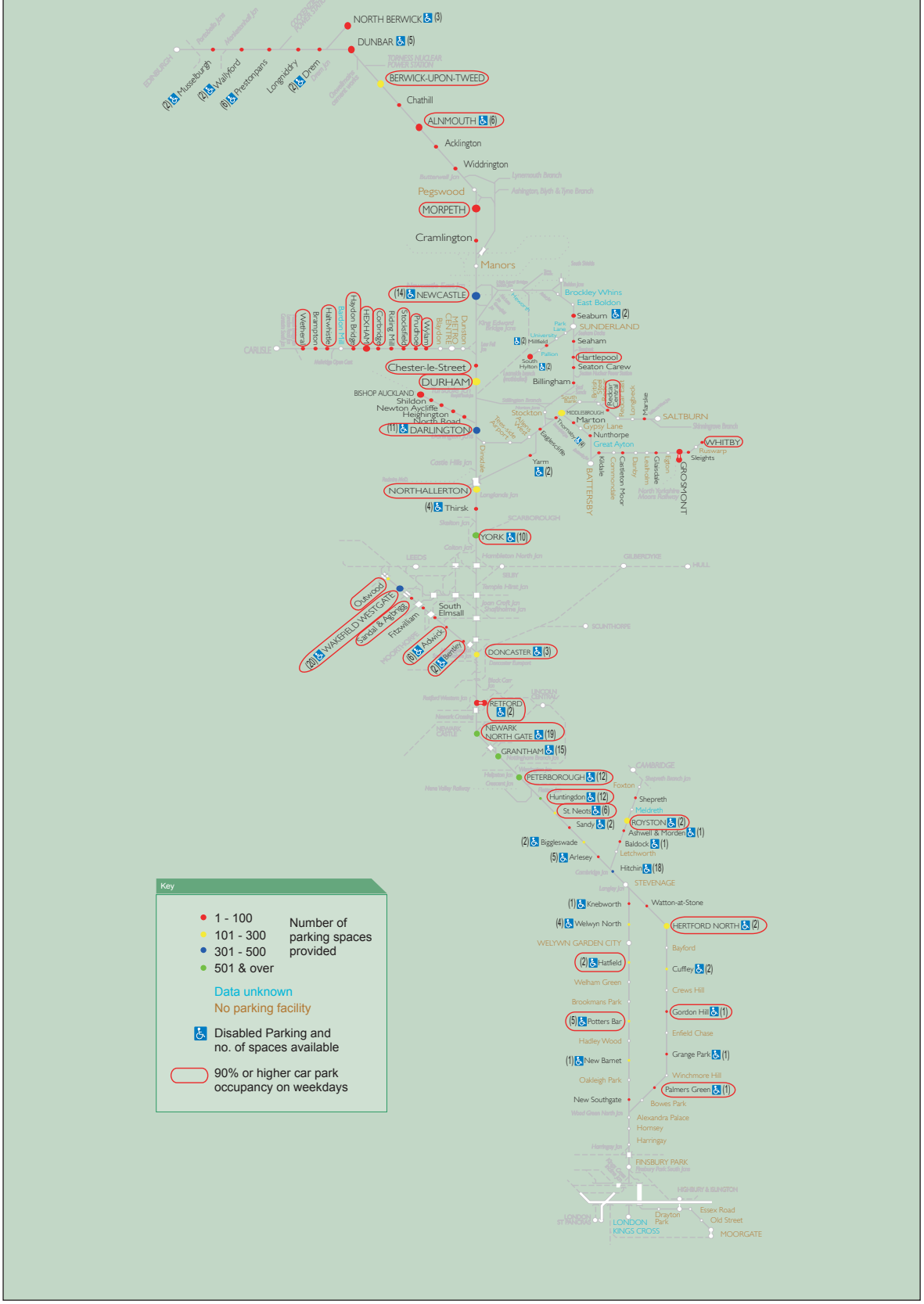
3.6.4 Car Parks

The availability of car parking at stations varies across the RUS area, from the provision of a small number of spaces within the station area, to large station car parks such as that at Peterborough or multi-storey facilities close to stations such as the car park in the Frenchgate shopping centre at Doncaster. Approximately a third of stations have no parking facilities and / or no disabled parking spaces. Car park provision tends to be lower at intermediate stations on routes in the North East which are more lightly used, such as the Middlesbrough to Whitby line, or at stations close to London where available land is limited and more people choose to walk to the station than travel by car. The majority of car parks within the RUS area charge fees except those facilities operated by Northern Rail in the South and West Yorkshire PTE areas which are generally free.

There is evidence to suggest that the availability of car parking at stations influences passenger decisions on where and when to travel. The decision criteria are complex and include additional factors such as the journey to and from the station. Network Rail's Strategic Business Plan includes provision for the development of travel plans for all its managed stations and a commitment to support the development of plans for franchised stations. These plans will include an assessment of the factors preventing people from travelling by train because they cannot conveniently get to a station and will recommend a cost-effective, environmentally friendly package of interventions to improve access.

Work is already progressing on schemes to redevelop Stevenage, Peterborough and Wakefield stations to include increased car parking and interchange facilities, in conjunction with third parties and car parking expansion at Huntingdon, Royston and St. Neots.

Figure 26 – Car Park Facilities



3.6.5 Station Improvements

The DfT has announced funding for a National Stations Improvement Programme (NSIP), aimed at improving the station environment for passengers, as well as the continuation of the Access for All Programme, which provides stations with step-free access from at least one entrance to all platforms. Candidate stations for the NSIP are subject to modification in the light of further development and the availability of local funding. However, the current list includes the following stations:

- Darlington
- Finsbury Park
- Grantham
- Harringay
- Hatfield
- Hitchin
- Middlesbrough
- Newark
- Peterborough
- Potters Bar
- Retford
- Royston
- Stevenage
- Welwyn Garden City.

In addition, the stations listed below have been included in the Access for All Programme:

- Highbury & Islington
- Huntingdon
- Letchworth
- Finsbury Park
- Metro Centre (Gateshead)
- Middlesbrough.

3.7 Passenger stock depots and stabling

Figure 27 shows the main stabling locations relevant to passenger services in the RUS area.

In addition there are a number of depots outside the RUS area which are used by services operating within it. Particular examples include Neville Hill (Leeds) and Craigentinny (Edinburgh).

Figure 27 – Passenger stock depots and stabling

Depot	Main Use	Status
King's Cross Station	Stabling and servicing for LDHS	Network
Ferme Park Down Sidings	Stabling and servicing for LDHS	Part of site is a light maintenance depot, operated by National Express East Coast.
Hornsey Depot	Maintenance, servicing and stabling for inner and outer suburban services	Light maintenance depot, operated by FCC
Hornsey Carriage Sidings	None at present	Out of use
Bounds Green Depot	Maintenance and stabling for LDHS	Light maintenance depot, operated by National Express East Coast.
Hertford North	Stabling and servicing for inner suburban services	Network
Welwyn Garden City	Stabling and servicing for inner suburban services	Light maintenance depot, operated by FCC
Letchworth	Stabling and servicing for outer suburban services	Light maintenance depot, operated by FCC
Nene Sidings	Stabling and servicing for outer suburban services	Light maintenance depot, operated by FCC (part Network)
Doncaster Station	Stabling and servicing for regional services	Network
York Siemens Depot	Maintenance, servicing and stabling for inter-regional services	Light maintenance depot, operated by Siemens Transportation Systems to maintain the TPE fleet
York Station	Stabling and servicing for regional services	Network
Darlington Station	Stabling and servicing for regional services	Network
Tyne Yard and Depot	Stabling and servicing for LDHS	EWS sub-lease to CrossCountry
Heaton Depot	Maintenance, servicing and stabling for LDHS and regional services	Light maintenance depot, operated by Northern Rail
Cambridge (off route)	Stabling and servicing for outer suburban services	Light maintenance depot, operated by National Express East Anglia
Neville Hill (off route)	Maintenance, stabling and servicing for LDHS and local services	Two light maintenance depots, one operated by Northern Rail and the other by East Midlands Trains
Craigentinny (off route)	Maintenance, servicing and stabling for LDHS	Light maintenance depots, operated by East Midlands Trains and Northern Rail Light maintenance depot, operated by National Express East Coast

A strategic solution to the provision of adequate depot and stabling facilities is a network wide issue and will therefore be considered as part of the Network RUS. However, the major capability and capacity limitations within the existing facilities are explored below:

- Hornsey depot is operating close to capacity and opportunities for expansion of the existing facility are limited due to lack of available land in the vicinity. Discussions with FCC are ongoing concerning the possibility of providing three additional sidings.
- Similar constraints exist at Bounds Green depot which is also operating at close to capacity but with limited opportunities available for expansion.
- The sidings at Welwyn Garden City provide six-car capability for Moorgate services and currently have no spare capacity available.
- Hertford North sidings require improved security and other enhancements for overnight stabling.
- Lack of road access to Nene Sidings limits the type of activities which can be carried out at this facility. The sidings are utilised to maximum available capacity, although some roads are unusable due to the condition of the infrastructure. Twelve-car trains can be accommodated on one siding only.
- Rail access and egress to Neville Hill depot is inflexible which causes performance delays to escalate if there is a problem on the depot. Development work is progressing on a potential scheme to provide an additional access to the depot from the Leeds direction, an additional loop facility and improvements to the east end departures.

Where the above constraints limit the ability to accommodate the growth forecast, they have been addressed in the depot strategy which is discussed further in Chapter 8.

3.8 Freight

3.8.1 Overview

Some of the busiest freight corridors in the UK are within the ECML RUS area. Approximately 30 percent of all rail freight movements in Great Britain use the ECML for at least part of their journey.

A strategy for accommodating the forecast freight traffic across the national network was set out in the Freight RUS, published in March 2007. The Freight RUS also highlighted a number of “gaps”, specific to the ECML RUS area, which are dealt with in chapters 5, 6 and 8.

3.8.2 Freight Operating Companies

The following FOCs run trains in the ECML RUS area:

- **English Welsh and Scottish Railway** (EWS) – the largest freight operator in the UK and has a license to operate European services. There are four market based groups within EWS, these are Construction (including domestic waste), Energy (including coal), Industrial (including Metals and Petroleum) and Network (including international automotive and express parcels services).
- **Freightliner Group Limited -** has two divisions - Freightliner Limited and Freightliner Heavy Haul. Freightliner Limited (intermodal) is the largest rail haulier of deep-sea maritime container traffic. Freightliner Heavy Haul is a significant conveyer of bulk goods, predominantly coal, construction materials and petroleum, as well as a significant provider of infrastructure services to Network Rail.
- **First GBRf** (GBRf) is an operator of deep sea container and infrastructure services. They also run a number of services for bulk market customers, including coal, gypsum, and Royal Mail trains.
- **Direct Rail Services** (DRS) operates traffic for the nuclear industry within the UK. Over the past few years the company has expanded into the domestic and short sea intermodal markets.

Figure 28 – Freight terminals

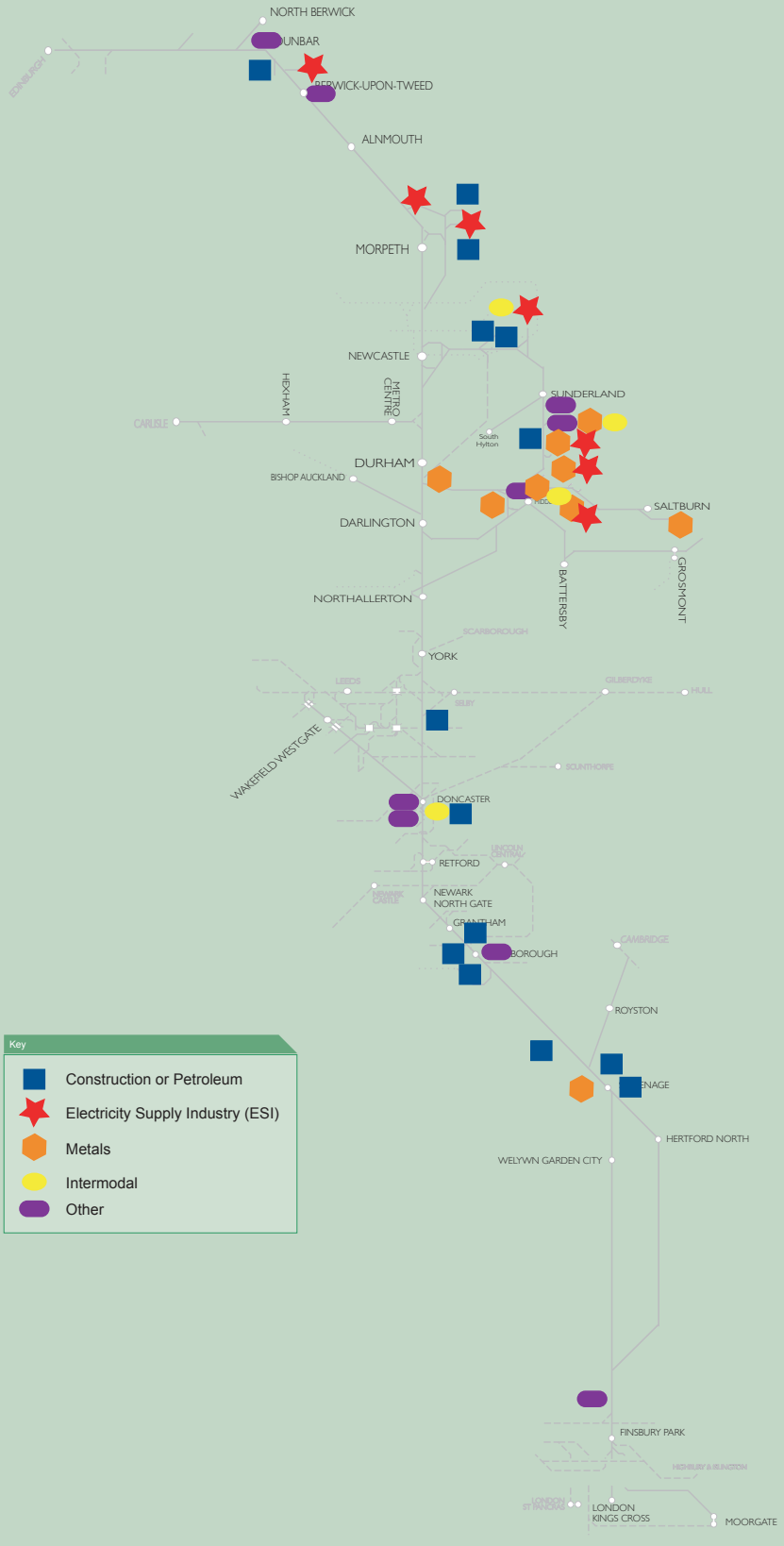
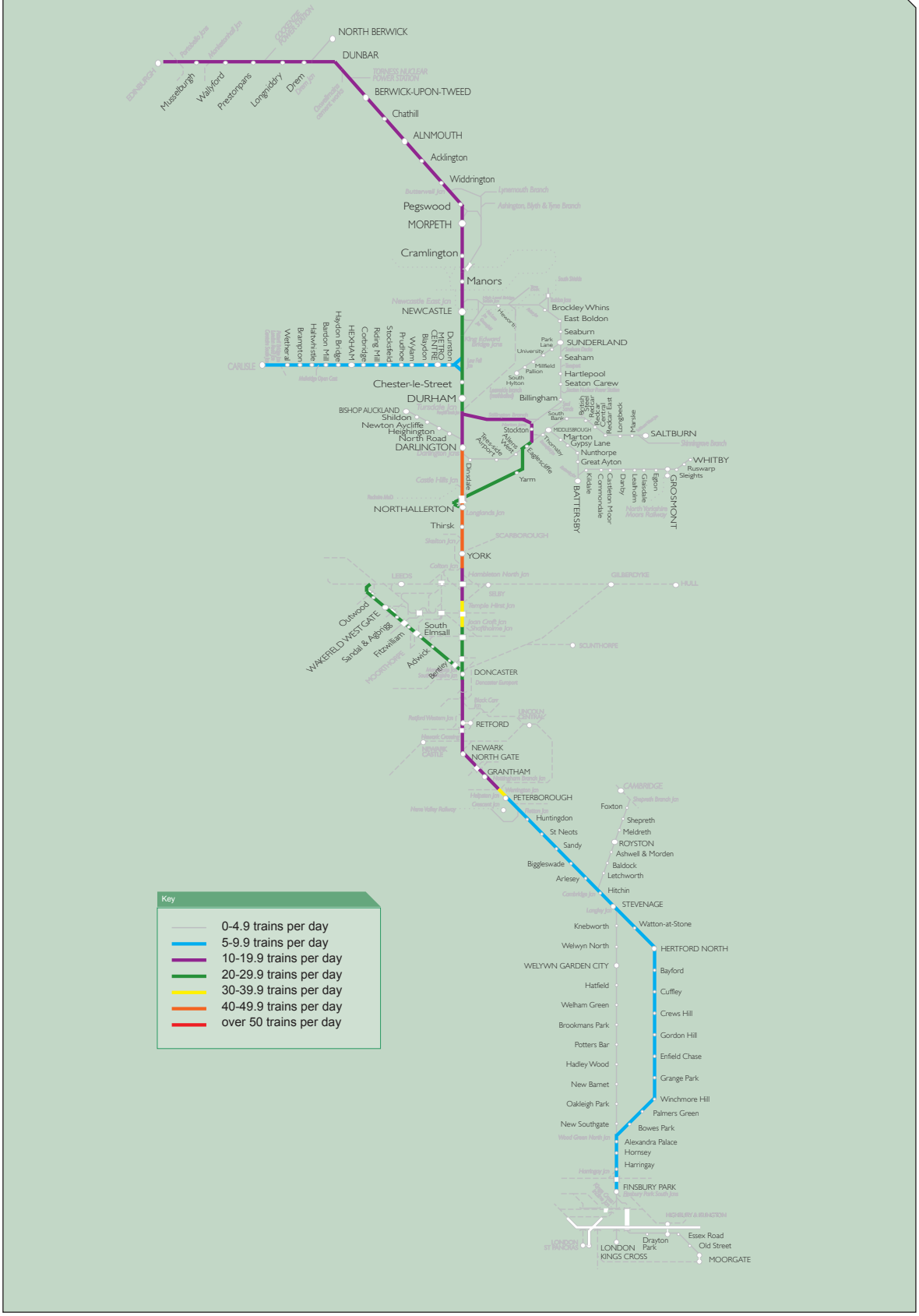


Figure 29A – Freight flows



3.8.3 Freight markets

The main markets served within the RUS area are described below.

Electricity Supply Industry (ESI) Coal

ESI coal flows constitute a significant proportion of the freight carried on the route. The largest are from various ports, in particular the port of Immingham, and from Scottish opencast sites, particularly in Fife, to the power stations at Drax, Eggborough and Ferrybridge in Yorkshire, and Cottam and West Burton in the lower Trent Valley. Some Scottish flows and those from the east coast ports of Tyne Dock, Redcar and Blyth utilise the route at least north of Colton Junction. Flows to the Aire Valley from Immingham traverse the ECML between Joan Croft and Hambleton South Junctions. Smaller flows are generated from the open cast mining sites in Northumberland and these also use the route north of Colton Junction.

Intermodal

In the intermodal market, deep sea containers are carried from Felixstowe and Tilbury to terminals in Yorkshire and the North East via Peterborough and Doncaster. Deep-sea container traffic from Southampton to Wilton is carried over the route north of Colton Junction. There are a smaller number of services for European intermodal traffic, in particular short sea traffic to and from Teesport, and flows via the Channel Tunnel to Doncaster and Wakefield.

The type of containers that can be conveyed on a service depends on the gauge of the overall end-to-end route. The ECML is presently W9 gauge cleared, which allows the above European traffic to be carried. Most other routes covered by this RUS are W8 which allows 8'6" high containers to be carried on standard deck height wagons.

9'6" high deep sea containers can only be carried on special wagons which can limit the weight of containers, and are much longer than the containers themselves thereby using maximum train length inefficiently. The various gauge profiles are shown in Figure 30.

Metals

Metals flows are significant on the route too, with sizeable volumes of steel from Scunthorpe and Lackenby using the route north of Doncaster. Smaller flows of aluminium are carried from Lynemouth in the North East along freight only routes to join the ECML just north of Newcastle.

Construction and petroleum

Construction material flows (such as aggregates, building blocks, cement and sand) are most significant from the Peak District and East Midlands quarries, the majority of which join or cross the ECML at Peterborough. Petroleum flows are carried on the ECML in small volumes. The majority of the traffic originates in the Immingham area and some of the flows use the flat crossing at Newark in the east/west direction.

Other traffic

Automotive, network services (general merchandise wagonload), premium logistics, power station waste (flyash/gypsum), paper

Figure 29B - Current freight usage

Route Section	2004/05 average actual usage[1] (maximum usage)	2007 sample average actual usage[2]
Peterborough Crescent Junction – Doncaster Loversall Carr Junction	14 (18)tpd	17tpd
Doncaster (South Yorkshire Junction – Marshgate Junction)	50 (86)tpd	45tpd
Hare Park Junction – South Kirkby Junction	23 (28)tpd	28tpd
Joan Croft Junction – Hambleton Junction	31 (44)tpd	N/A
Colton Junction – Northallerton	44 (55)tpd	39tpd

1 This is the average actual usage in the busiest direction for Thursdays throughout 2004/5
2 This is the average actual usage in the busiest direction for Thursdays in January and May 2007

and general merchandise all generate smaller flows along the ECML.

Network Rail's own engineering trains also run along the routes included in the RUS to support infrastructure maintenance, renewal and enhancement activities.

3.8.4 Current freight demand in the ECML RUS area

Figure 28 shows the active freight terminals on the route – these are detailed in Appendix 1. It should be noted that there are also many terminals located close to but not actually on this route, for example the power stations in the Aire and lower Trent Valleys.

Figures 29A and 29B show current freight usage of key sections of the ECML. The data covers the base year of the Freight RUS 2004/05 and some updated data to reflect 2007 demand. All data is for trains per day in one direction. It can be seen that the heaviest freight flows are around Doncaster and York, although there is a significant level of use over most of the route.

Freight services require more reserved paths in the WTT than are actually used to permit operational flexibility. Unlike passenger services, for most freight market sectors, if there is little or no demand for a freight service it is cancelled. The Freight RUS contains a national analysis of path utilisation and an explanation of the key factors in each market sector.

The FOCs are engaged in a number of initiatives to improve path take-up and efficiency of operations. EWS has developed the concept of the 'Big Freight Railway', the purpose being to maximise the use of each path on the network. The key focus is on running trains which are longer, heavier and potentially in some cases bigger (both in width and height).

3.9 Infrastructure

Infrastructure characteristics along the routes are varied, reflecting the diversity of historic service demands and development. This has resulted in different levels of current route capability.

3.9.1 Characteristics

The principal infrastructure, capability and capacity characteristics considered are:

- linespeeds
- junction layouts and speeds
- electrification and power supply capacity
- loop locations and lengths
- number of tracks
- platform lengths
- station parking
- loading gauge, which defines the size of vehicles that can be carried
- route availability, which defines the weight of vehicles that can be carried
- signalling headway, which is a measure of the minimum time gap between trains.

3.9.2 Capacity and capability

The East Coast Main Line has a strategic importance as a long distance rail route linking London with Yorkshire, the North East and eastern Scotland. Apart from the Welwyn area and the section from Huntingdon to Peterborough, the southern part of the ECML has four tracks to just short of Grantham. North of Grantham is predominantly two-track with overtaking loops, except between Colton, south of York, and Northallerton, which is four-track. The fast lines permit speeds up to 125 mph, with the slow lines generally allowing between 60 and 75mph.

Integrated Electronic Control Centres (IECC) and Power Signal Boxes (PSBs) control approximately 90 percent of the route, with the remaining 10 percent (between Morpeth and Berwick) under the control of three smaller signal boxes. Some level crossings and sidings are controlled locally. The route was last modernised in the late 1980s/early 1990s and is electrified throughout at 25kV AC. Mixed service requirements are reflected in the varying lengths of platforms on the route. Currently, the only stations long enough for all LDHS services or 12-car local services at the southern end of the

route are King's Cross (platforms 1 – 8 only), Finsbury Park, Stevenage, Hitchin, St. Neots, Huntingdon and Peterborough. Not all stations have platforms on all lines (eg. Hitchin, Sandy and Huntingdon) and this restricts operational flexibility when services are disrupted for any reason.

Figure 30 – Loading gauge envelopes and container sizes

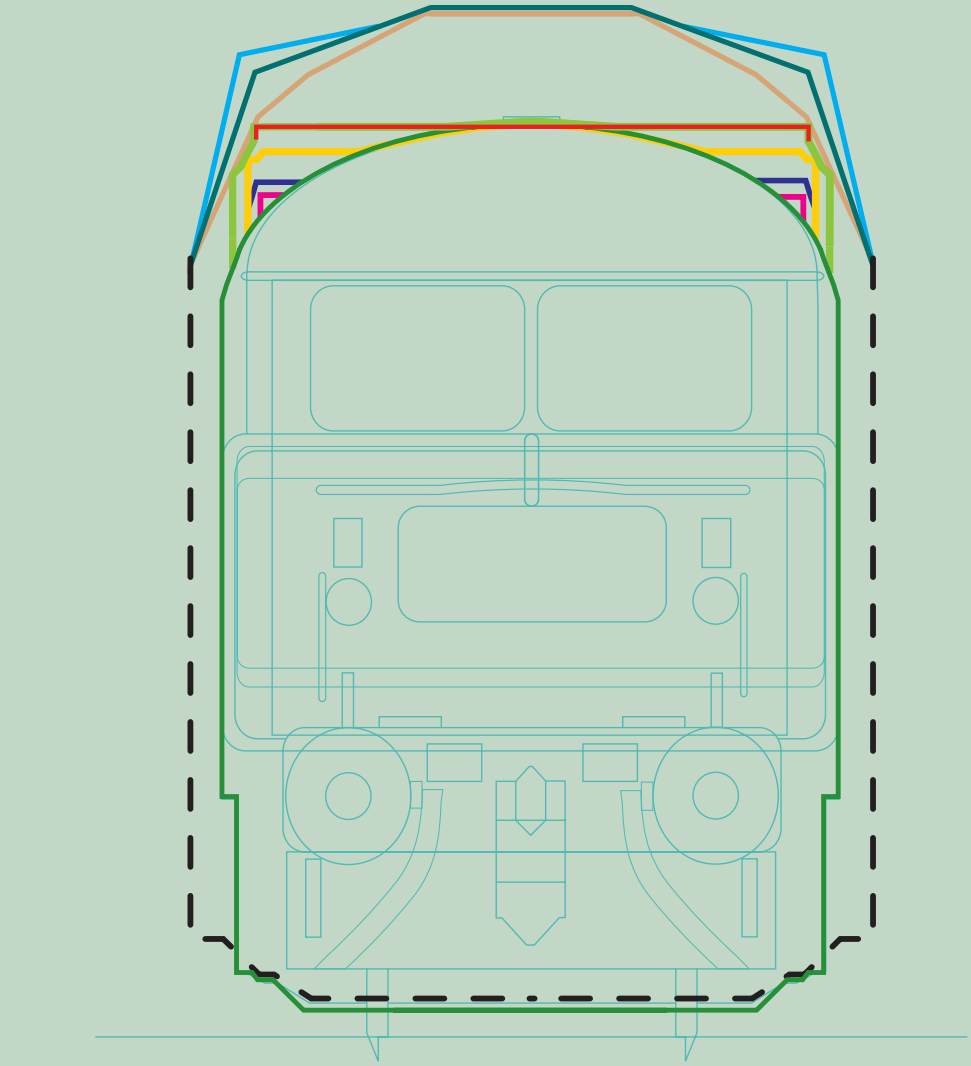
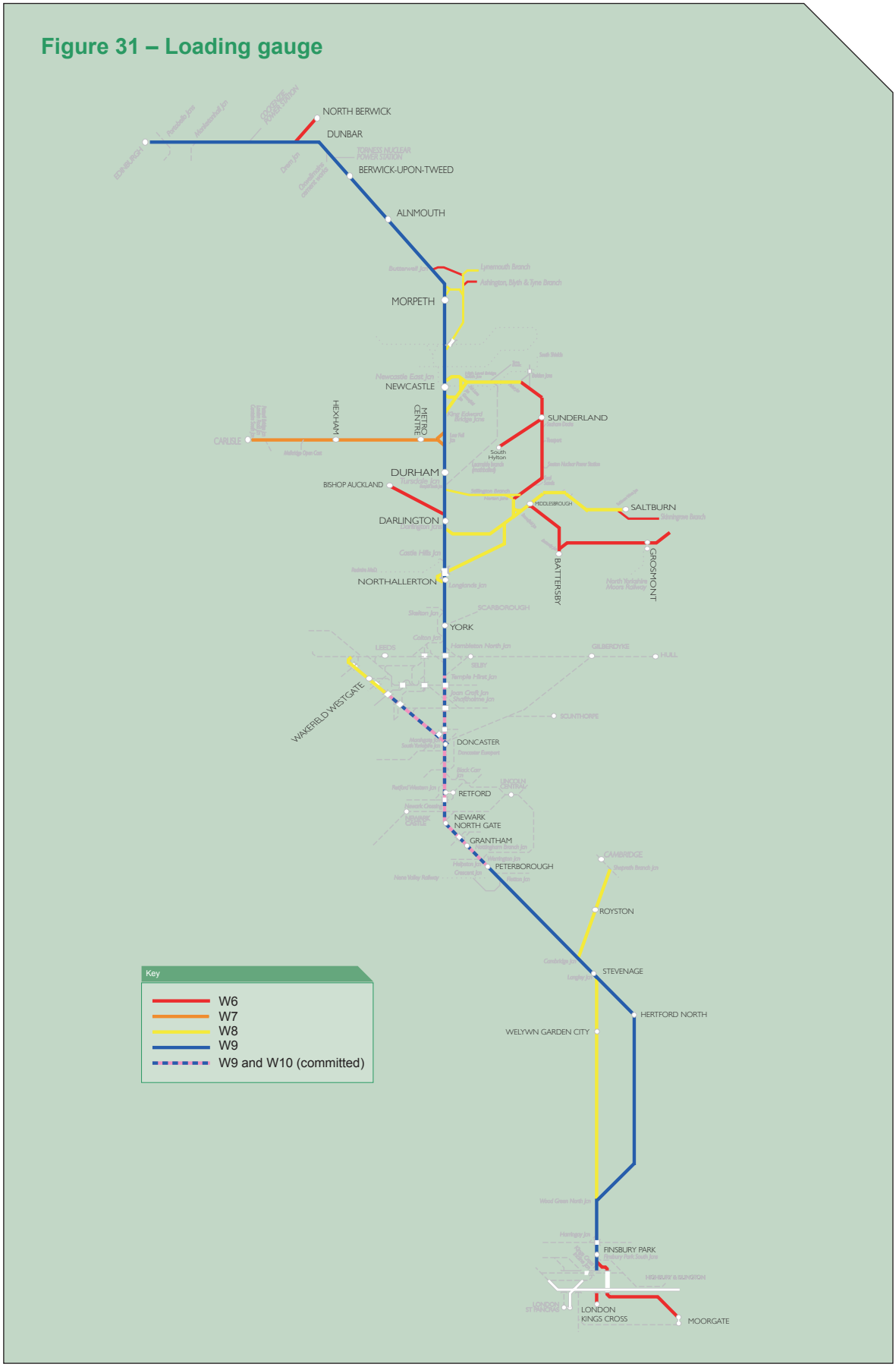


Figure 31 – Loading gauge



The data was collated from the Route Maps and produced by Network Rail for the ECML Route Utilisation Strategy process

Most of the ECML has clearance to W9 loading gauge, which enables 9ft deep sea containers to be transported on standard height wagons from the South East container ports to terminals in Yorkshire and the North. It also allows European-standard 2.6 metre wide containers and swap bodies, mainly arriving via the Channel Tunnel, to be accommodated. The exception is between Wood Green Junction (Alexandra Palace) and Langley Junction (Stevenage) so W9 traffic has to run via the Hertford Loop. However, the route can only accommodate the international, standard 9ft 6in High Cube containers, which are increasingly the preferred means of transport for the deep sea trade, on special 'well' wagons. This reduces payload by a third. In addition to these issues, freight is diverted onto sections of the route when parts of the WCML are closed due to engineering works.

Capacity is constrained by the two-track sections and various bottlenecks on the route. South of Peterborough the power supply further limits both the number and length of trains on this section of the route.

The **Hertford Loop** is a two-track section which runs from Langley Junction to Wood Green Junction, controlled by the PSB at King's Cross. The linespeed is mostly 70-75mph. As the loop is electrified at 25kV AC it is used as a diversionary route when the ECML is closed between Stevenage and Alexandra Palace for engineering works or other route blockage but signalling headways and power supply capability limit the number of trains that can be handled. This route is cleared for W9 gauge.

The **Moorgate branch** is a two-track route running predominantly in tunnel, branching off the main ECML at Finsbury Park. The linespeed is generally 30mph. The branch is controlled from the PSB at King's Cross. There is a changeover point between 25kV AC (overhead) electrification and 650V DC (the third rail system, which is used in the tunnels to Moorgate) at Drayton Park. No services currently run on this route late on weekday evenings (after around 22:00) or at weekends.

The **Cambridge branch** runs between Hitchin on the ECML via Royston to Shepreth Branch Junction just south of Cambridge and is a two-track line controlled by the PSBs at King's Cross and Cambridge. The branch is electrified at 25kV AC and the linespeed is up to 90mph.

The **Doncaster to Leeds line** is two-track, electrified to 25kV AC and is controlled by Doncaster PSB and York IECC. Linespeeds are mostly between 75 – 100mph.

The **Durham Coast route** is a two-track railway from Northallerton to Newcastle via Eaglescliffe, Hartlepool and Sunderland, with a Sunderland to South Hylton Tyne and Wear Metro branch. The linespeed is predominantly 75mph. Pelaw to South Hylton is the only electrified section on the route, with a 1500V DC overhead system for Metro services. The route includes some major bridges including the unique High Level Bridge over the River Tyne at Newcastle. It is controlled by a mixture of signal box types. This factor, combined with the signal spacing on the route, particularly at Hartlepool, makes any permanent traffic increases difficult and limits the overall capacity of the route. The lines between Pelaw and Sunderland are operating at close to capacity due to a combination of freight traffic from the Port of Tyne, Tyne and Wear Metro and local train services. The Durham Coast route is a diversionary route for traffic from the ECML when the main line is closed due to engineering works.

The **Bishop Auckland branch** is a predominantly 45mph, single track line from Darlington, with a short two track section between Heighington and Shildon. The branch is controlled by Tyneside IECC and a manually operated signal boxes at Heighington and Shildon. The line is a Community Rail Partnership route. The section of route between Bishop Auckland and Eastgate is operated by the Weardale Railway Project.

The **Tees Valley line** comprises the route from Darlington to Saltburn via Eaglescliffe and Middlesbrough which is mainly two-track. The linespeed for the majority of the route is between 50 and 60mph, except for sections around Thornaby and Saltburn which are between 15 and 35mph. The lines around Middlesbrough are operating at close to capacity due to an extensive freight train operation which exists alongside an intensive local train service and some regional interurban trains.

The **Esk Valley line** is a single track from Middlesbrough to Whitby. The linespeed for the route varies between 30 and 50mph and is mainly controlled by the manually operated signal box at Nunthorpe. The line is a pilot Community Rail Partnership route and is therefore not dealt with in this RUS.

The **Tyne Valley line** connects Newcastle and Carlisle with linespeeds between 60 and 65mph for the majority of the route, except for a short section between Newcastle and the Metro Centre which is between 25 and 45mph. The majority of the route is controlled by a number of small manually operated signal boxes and this makes permanently increasing traffic on the route difficult without signalling works, and possibly overtaking facilities. The Tyne Valley line is used as a diversionary route to Scotland when both the WCML and ECML are closed but is limited to W6a gauge clearance which prevents its use for some types of freight traffic, such as intermodal.

The **North Berwick branch** is a single track branch from Drem to North Berwick with a linespeed of 50mph. The line is electrified throughout at 25kV AC.

There are various **freight only routes** in the North East. In the main these see a relatively low level of traffic. However, the Norton Junction to Ferryhill line is increasingly used as a through freight route but is limited by having a signalling headway of nearly 20 minutes. The Blyth and Tyne line and Boulby branch serve industrial complexes. These various freight only routes are a mixture of single and double track, with speeds generally not being higher than 40mph.

In terms of freight capability, whilst some routes are gauge cleared to W9, the majority are W8. A number of loops have been recently renewed on the route to 775m, many however are much shorter in length. Whilst most routes can carry RA10 traffic, there are speed restrictions at number of locations on the route which restrict vehicle weights above RA8.

3.10 Route utilisation and congestion

3.10.1 Overview

In recent years, the industry has developed a measure of the level of congestion on the network, known as the Capacity Utilisation Index (CUI). The CUI is a measure of how much of the available capacity on a section of line is used by the train service. Although it cannot take account of every factor that impacts upon congestion at a local level, the CUI is based upon:

- route characteristics (eg. number of lines, etc)
- the number of trains in the timetable
- the order in which trains are timetabled and their mix of speeds
- headways.

Whilst CUI is a useful measure, it is of limited value as a planning tool since it does not include all the factors that need to be considered to make a timetable work.

Further work was therefore carried out at a more detailed level. Key results from the capacity analysis are included under the relevant sections below. The detailed analysis is in Appendix 2.

Despite this detailed work, there are significant limitations to any capacity assessment methodology that has not included a full timetable development and modelling according to standard rail industry processes.

Capacity is limited by a combination of a number of infrastructure features:

- plain line, where fast trains will catch up with slower trains
- junctions, where conflicting moves limit capacity
- station platforms, where the next train cannot arrive until the previous one has departed.

The following commentary highlights the key constraints on the route.

3.10.2 ECML - South of Peterborough

This section of route is shared between LDHS services, London suburban services and a limited amount of freight.

The main constraints are:

- platform capacity at King's Cross, which is particularly affected by several trains having long turnaround times in the current timetable
- the two-track section between Welwyn and Woolmer Green, exacerbated by some trains needing to stop at Welwyn North station
- the need for the fast lines to be shared by trains with different speeds and calling patterns, particularly between Finsbury Park and Potters Bar
- the capacity of the slow lines between Alexandra Palace and Finsbury Park, which is exacerbated by calling patterns, particularly in the evening peak in the current timetable
- limited power supply capability
- the flat junction where the Cambridge line diverges from the main line at Hitchin
- the limited number of trains that can be accommodated on the Hertford Loop
- short platform lengths at several stations.

The capacity analysis of the Down lines, south of Peterborough, in the evening peak for May 2006 timetable, shows that:

- the timetable uses almost 100% of capacity during the peak periods. The off-peak timetable uses around 70% of capacity. Although utilisation levels are currently lower outside the peak hours, it is not necessarily desirable to use all of this potential capacity as lower utilisation levels outside the peak hours can be essential to safeguard the overall performance of the timetable throughout the day.
- the two track section between Digswell Junction and Woolmer Green Junction is the most heavily used part of the route.
- there is a high level of usage between Finsbury Park and Potters Bar where differences in train speed consumes over 10 percent of the available peak capacity. Therefore, whilst there is some scope within the current timetable for additional train paths outside the peak, usage in the peak south of Hitchin would require a completely new timetable.
- north of Woolmer Green Junction the level of usage progressively reduces and the impact of differing train speeds is lower.
- in comparison to the two track sections further south, the section north of Holme Junction has a relatively low impact on overall capacity.

3.10.3 Cambridge line

This section of route is shared primarily by a mix of fast and semi-fast passenger services.

The main constraints are:

- the flat junction at Hitchin
- limited power supply capability
- short platform lengths at several stations
- the layout of Cambridge station, with limited platforms shared between ECML and Lea Valley services.

3.10.4 ECML – Peterborough to Doncaster

This long and busy section of mainly two-track route is a major timetabling restriction for LDHS and freight services.

The main constraints are:

- the route is mainly two-track throughout, leading to potential for fast trains to get held behind slow trains
- there are few overtaking loops and these are relatively short and have low entry/exit speeds
- serving the intermediate stations of Grantham, Newark and Retford leads to extended journey times for some services and therefore reduces capacity
- there are a limited number of platforms at Peterborough, with no platforms on the fast lines
- also at Peterborough, any traffic being routed from the Up Slow to the Up March line (for example East Coast Ports freight traffic) must cross over the main lines
- the layout of the through routes at Doncaster is restrictive, with a large number of crossing movements at both the north and south ends
- east – west services cross the ECML on the flat at Newark
- the parallel Peterborough – Lincoln – Doncaster route offers limited capability as a diversionary route, with lengthy journey times

The capacity analysis for Peterborough to Doncaster shows that:

- current utilisation is broadly similar in the peak and the off-peak, with 70 – 80 percent timetabled utilisation overall.
- Although the number of trains is quite low, as shown by the low level of ROTP usage, a large proportion of capacity over this section is consumed by differences in speeds and calling patterns of those trains, particularly between Stoke Junction and Claypole loop and between Newark and Loversall Carr Junction.

Factors relevant to both the Peterborough to Doncaster section and south of Peterborough, highlighted by the CUI analysis, are that:

- Additional overall capacity could be delivered through critical sections by greater standardisation of speeds and calling patterns.
- Timetabled usage of capacity is significantly higher than the usage on any single route section indicating linkage of constraints. This suggests that a review of the overall timetable structure could provide the opportunity for further capacity to be released.
- Finally, the difference between ROTP headways and the infrastructure limits consume a significant amount of capacity which indicates that there may be further opportunities from a review of the Rules of the Plan.

3.10.5 ECML - North of Doncaster

There are a number of further constraints at the northern end of the ECML:

- The Doncaster to Leeds section is a low speed mostly two-track section with several local stations. It is shared by LDHS, local services and freight. Journey times over this section are relatively poor.
- There is no direct connection between the route from Immingham docks to the route to Drax and Eggborough power stations at Shaftholme/Joan Croft Junctions (on the ECML between Doncaster and York), leading to east – west coal trains needing to use a circuitous route including parts of the ECML.
- The York station area is restrictive, primarily due to there being only three tracks between Holgate Junction and the station.
- There are no platforms on the main lines at Darlington station, leading to a number of crossing moves, some at low speeds.
- The Northallerton to Newcastle section is mostly two-track, shared between passenger and freight services.
- North of Newcastle, linespeeds on the ECML are lower than at the south end of the route due to a generally curved route alignment.
- There is only a platform on the Up loop at Dunbar, Down services calling at this station must therefore cross over the Up line.
- The parallel routes generally offer very limited diversionary capability and significant journey time extensions.

3.10.6 Other routes

Most routes away from the congested ECML generally have some capacity to run additional services should demand require it.

However, there are several exceptions which are often associated with longer signalling headways, single line sections or older signalling and track layouts.

3.10.7 Conclusions

A key factor which influences the effective utilisation of network capacity is the mix of rolling stock fleets and their varying capabilities in terms of performance. The number of train paths deliverable is affected by the variety of speeds, acceleration, braking characteristics, power draw and station dwell times of the different types of stock. Our analysis suggests that additional overall capacity could be delivered through critical sections by greater standardisation of speeds and calling patterns. The timetabled usage of capacity is significantly higher than the usage on any single route section indicating linkage of constraints. This suggests that a review of the overall timetable structure could provide the opportunity for further capacity to be released.

Maximising overall capacity is not only about increasing the number of trains that can be run on any given section of route. For both passenger and freight services it is necessary to ensure that on-train capacity is optimised, by running trains which are as long and full as possible and, for passenger services, ensuring an appropriate balance between standing and seated capacity and between standard and first class.

3.11 Performance

3.11.1 Generic and local contributing factors

A number of generic factors contribute to overall train service performance. These include the reliability of the infrastructure and rolling stock, the operability and structure of the timetable given infrastructure and rolling stock capability and the flexibility of the network to reduce overall delay through effective response and diversionary routeing.

In addition, there are many local variables that affect performance. The situation is complex as these features are often linked, varying in proportion on each route, and include:

- a broad mix of services with varying speeds and stopping patterns, ranging from local and long distance passenger, freight trains and empty coaching stock movements, further exacerbates delays on the sections of the route which are most highly utilised
- a large number of complex junctions and crossings that are usually on the level with train movements conflicting with one another, which is only worsened when trains are running out of sequence as a result of an incident
- crowding due to train capacity and length, causing station delays
- track and signalling infrastructure, on both rural routes in the North East and parts of the ECML, which do not feature flexible layouts. Where improved flexibility has been built into the route, such as the bi-directional signalling system between Northallerton and Berwick upon Tweed, which allows the relatively easy operation of trains over a single line when the other line is blocked, performance delays can be contained
- the lack of availability of suitable diversionary routes (particularly for electric trains or those restricted by loading gauge) increases the effect of any incidents, particularly on the two-track sections of the ECML
- location of both train and infrastructure maintenance depots, again contributing to the length of the delay incurred.

3.11.2 Overview of historical performance

One measure of passenger train performance is the Public Performance Measure (PPM), which was introduced by the SRA. The PPM combines figures for punctuality and reliability into a single performance measure and covers all scheduled services, seven days a week. The PPM measures the performance of individual trains against their planned timetable. The PPM is therefore the number of trains arriving 'on time' (defined as up to 10 minutes late for LDHS services) as a percentage of the total number of trains planned.

PPM for train operators on the route as at December 2007 was:

- **First Capital Connect (GN services) - 92.8%**
- **GNER/National Express East Coast - 82.4%**
- **Hull Trains - 84.0%**
- **Northern Rail - 88.3%**
- **First TransPennine Express - 91.6%**
- **Virgin Cross Country/CrossCountry - 86.3%**

Train delay minutes are captured by incident and location and are monitored at network level by Network Rail.

As a result of the structural changes to the industry which followed the 2005 Railways Act, Network Rail has been charged with a wider role in managing performance on the network. The prime process for cross-industry continuous performance improvement is the Joint Performance Process (JPP). This generates Joint Performance Improvement Plans (JPIP) in conjunction with each train/freight operating company, and a period-by-period reporting and review cycle.

Figures 32 and 33 provide an overview of performance on the ECML and the North East Routes. The historical trend in terms of both the PPM and delay minutes is shown for the main passenger operators on the route.

Figure 32 – Public Performance Measure trends

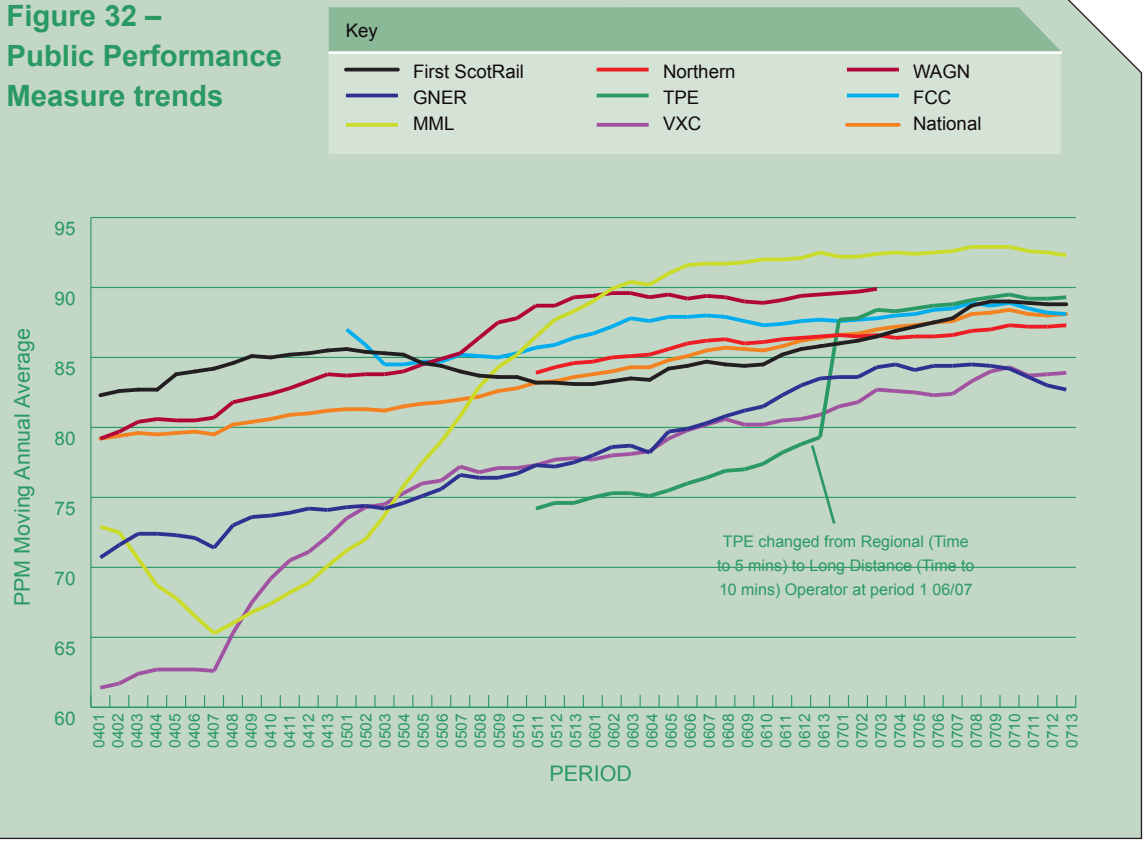
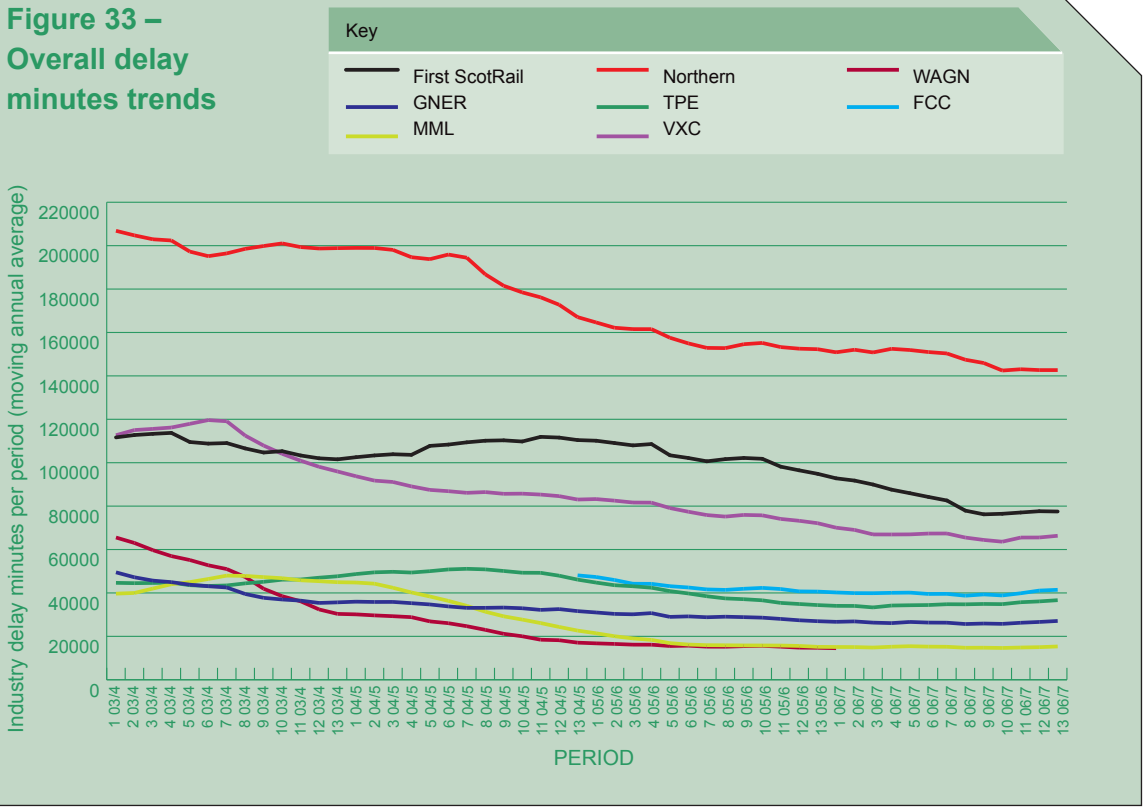


Figure 33 – Overall delay minutes trends



3.11.3 Detailed analysis of recent performance

In addition, delay has been analysed by location for train/freight operators between 1st April 2005 and 31st March 2007.

Whilst the analysis has included the primary causes of delay in order to illustrate performance as a whole within the RUS area, there are already a number of existing mechanisms within the rail industry for addressing these issues. The focus of the RUS is therefore on reactionary delay as this is where opportunities to improve the effective utilisation of the route will have most impact. Reactionary delay has been analysed based on the locations where the delay occurred, rather than the location of the primary cause of the delay, as this provides a better illustration of congested locations on the route. Full details of the analysis are shown in Appendix 3.

To summarise, analysis of historical data demonstrates that:

- Edinburgh is accumulating the largest amount of Network Rail delay and reactionary delay to passenger operators on the ECML which is a reflection of the number of services arriving late from further north, off the route. The remodelling of Edinburgh station and doubling of Portobello Junction, which is recommended in the Scotland RUS, would significantly improve performance on this section of route.
- For freight operators, the most significant amount of delay occurs between Temple Hirst Junction and Thorne Junction (Network Rail delay) and at Tees North Yard (reactionary delay).
- Away from the ECML there is significantly less traffic and lower total delay minutes than on the main line. The greatest amount of Network Rail and reactionary delay to passenger operators occurs within the Carlisle station area (where issues are generally out of scope of this RUS).

A more detailed review of reactionary delay incurred to passenger trains on the ECML from north to south, shown in Figure 34, indicates that the station areas around Edinburgh, York, Doncaster, London King's Cross, Peterborough and Newcastle all feature within the top 10 locations. This demonstrates that high levels of congestion exist within a number of the station areas along the ECML.

Figure 34 – Location of delay analysis

Looking from north to south, the majority of locations along the route incurring more than 10,000 minutes delay already have interventions proposed which would improve performance.

3.12 Maintenance and renewals

3.12.1 Typical work volumes

Engineering access on the ECML has developed piecemeal since electrification in the late 1980s. Recent initiatives, based on an industry-wide acceptance of the need for a more efficient, cost effective and less disruptive regime, resulted in a reversal of some of the imbalances that have occurred. The current arrangement broadly provides the following access:

- 4 – 7 hours on midweek nights depending on the location, for low level maintenance
- 8 – 14 hours at weekends for heavy maintenance/low level renewal
- periods of up to 54 hours for heavy maintenance and renewal.

An optimum level of engineering access on the route needs to be provided, balancing the need for maintenance, renewal and enhancement works with the growing demand for passenger and freight services, including at off-peak times and at weekends. Ongoing industry processes are examining current engineering access times and practices and these will be amended where necessary.

Strategies have been developed locally to improve the balance between engineering access availability and train operation for York, Doncaster, Newcastle and Edinburgh Waverley stations. The approach provides a cycle of line closures to permit maintenance to take place whilst providing sufficient platforms and access to train maintenance facilities, such as fuelling points and washers. A combination of rising renewal volumes, the increasing mechanisation of engineering activities and growth in train services, particularly demand for weekend services, will require the development of a more sustainable approach to ensure delivery of engineering efficiencies and meet the growth in demand for train services.

Access for maintenance is particularly difficult on the two-track sections of the route, especially on those sections where there is no diversionary route available. This is discussed in more detail by route section below.

3.12.2 Current engineering access

The **Hertford Loop** has a six-week cyclical maintenance strategy which provides mid-week engineering access of five hours and can be supplemented by standard possession opportunities on a Sunday night of between 2½ and 7¼ hours each week. The requirement to permanently maintain access to Bounds Green Depot severely limits engineering works on the section between Wood Green and Bowes Park. The route acts as a diversionary route when the ECML is closed between Alexandra Palace and Stevenage and is also the only cleared route for W9 freight traffic.

On the **Moorgate branch** long periods of engineering access are available on the route between 22:30 and 05:45 Monday to Friday and throughout the weekend if necessary.

The **Cambridge branch** has a six-week cyclic maintenance strategy which provides mid-week night engineering access of 6½ hours and can be supplemented by standard possession opportunities on a Sunday night of between five and ten hours every week.

On the **Doncaster to Leeds line** engineering access is available for five hours under single line working midweek and on Sunday nights, with weekend access of up to nine hours along the majority of the route.

The **Durham Coast route** generally only has up to nine hours of engineering access at weekends, due to the significant volumes of freight traffic using the southern end of route throughout the day.

The **Bishop Auckland branch** has ample time available for engineering access, with between nine and ten hours allowed every night of the week.

On the **Tees Valley line** engineering access between Darlington and Eaglescliffe is available at certain times of the year for eight hours at weekends and five hours per night between Sunday and Friday. Between Stockton Cut and Thornaby access is restricted to 8½ hours at weekends only. Access is also limited on the remainder of the route between Thornaby and Saltburn. Outside the weekend access of eight hours, mid-week access is limited to one section of the route at one time using either weaves or single line working with access to be maintained to Lackenby, Tees Docks and Redcar Ore Terminal at all times. Engineering access to the branch line between Saltburn and Boulby is limited to Saturday night and Sunday.

The **Esk Valley line** has sufficient time available for engineering access with between nine and eleven hours available every night of the week.

The **Tyne Valley** line allows between six and 11 hours access for engineering works each night of the week, although access has to be given up for the passage of time sensitive freight traffic. The line is a key diversionary route for Anglo-Scottish coal traffic when the Settle to Carlisle route is closed and this severely restricts access at certain times.

On the **North Berwick branch** the single line is blocked to permit engineering access for ten hours at weekends and six hours on mid-week and Sunday nights.

The North East **freight only routes** have varying arrangements to permit engineering access, dependent on the route concerned.

3.12.3 7-Day Railway

The 7-Day Railway intiative seeks to balance the need for enginering access with improvement for late night and weekend services where there is an industry business case to do so. The concept is being developed by Network Rail with industry stakeholders by examing appropriate route sections. The solution will vary between route sections.

4. Planned schemes

4.1 Introduction

This chapter highlights the most significant changes that are already planned for completion within the RUS period.

Where schemes are committed this RUS takes them as given and they therefore form part of the baseline. If schemes are not committed, the RUS cannot assume that they will take place. Instead, the RUS will only consider what effect implementation of such projects might have on the strategic recommendations the RUS proposes. It should be noted that RUSs remain live documents and they will be reviewed and, if necessary, updated whenever significant changes in circumstances arise, such as when a major proposed project becomes committed.

4.1.1 Asset age profile - Route 8

The ECML has been progressively renewed mainly in connection with electrification from the 1970s, starting in the south and working northwards, and completed in the early 1990s. The route is colour light signalled and controlled by nine signalboxes. The nature of the route's renewal means that the asset age profile of signalling, electrification, and switches and crossings (S&C) broadly has the oldest equipment at the south end and the newest at the north. The signalling and S&C in the King's Cross area is due for renewal in the middle of the next decade.

4.1.2 Asset age profile - Route 9

Unlike the core ECML artery there is no pattern to the asset age profile. Some of Route 9 is still controlled by semaphore signalling with the track layout being what was still required after rationalisation and S&C renewals have taken place. Even in the areas controlled by colour light signalling the track layouts have tended to evolve as renewals have become due at which time opportunities to rationalise have been taken.

4.2 Planned renewals

Major renewals offer the ability to consider synergy with enhancements and align capability with future requirements (the policy regarding gauging and track renewals being contained in the Freight RUS). Details of renewals over the next five years are contained in the Route Plan volume of Network Rail's Strategic Business Plan, which was published in October 2007. The scope for synergy with the RUS enhancements is limited as few renewals are due, but the situation can be summarised as follows:

Figure 35 - Planned renewals

Project Description	Output change	Completion
Hitchin Cambridge Junction signalling and S&C renewals	Improved performance.	2008/09
London King's Cross station renewals and redevelopment	Improved station facilities and additional passenger capacity through provision of a new station concourse. An additional platform is included in this scheme.	Phased between 2009/10 – 2013/14
London King's Cross signalling and S&C renewals	Improved performance and major opportunity to provide additional capacity.	2015
Durham Coast signalling renewals	Improved capacity, performance and diversionary capability through reduced signalling headways.	2009/10
Teesside signalling renewals	Improved performance and an opportunity to provide improved capacity and capability.	2013/14

4.3 Rolling stock schemes

4.3.1 Intercity Express Programme

The commencement of the procurement process for the Intercity Express Programme (IEP), which will replace the High Speed Train (HST) fleet, is now underway. It is intended that the initial phase of implementation will be a pre-series fleet, for use on the ECML from 2012. The scheme has been regarded by this RUS as committed, though the detailed employment will not be known until firm orders are placed with suppliers.

The following issues are potentially relevant to this scheme:

- Destinations off the main ECML such as Inverness, Aberdeen and Hull need to be served by diesel rolling stock, making long journeys over electrified routes. The current IEP specification would enable such services to use electric traction over the ECML.
- ECML services operated by electric traction cannot currently be diverted via alternative routes during engineering work or at times of perturbation unless hauled by a diesel locomotive. The introduction of IEP trains on the ECML could potenially allow increased diversionary route options to be developed, depending on the number of dual-traction sets procured.
- Some stakeholders have suggested that ECML services could split and join somewhere on route to provide services to some of the more secondary destinations. The current IEP specification would enable such a service pattern to operate, should it be compatible with patterns of demand and timetable/performance requirements.

The RUS will help inform the procurement process for the IEP. This significant national programme potentially provides an opportunity to deliver certain outputs on or near the ECML by enhancing train fleet capability rather than significant alteration of the infrastructure on the route.

4.3.2 Open Access operators

Grand Central is using refurbished HSTs for use on its Sunderland to London services which started in December 2007, and is seeking to introduce new-build rolling stock for future services.

Since going out to consultation Hull Trains is planning to change the current Class 222 fleet for Class 180s starting in March 2008, with the entire fleet being 180s by the end of the year.

4.3.3 Other rolling stock

Since going out to consultation the DfT has announced an intention to procure approximately 1400 additional carriages in Control Period Four (CP4) to ease overcrowding nationally.

Most options that respond to capacity gaps will require additional rolling stock, these are considered in Chapter 6.

4.4 Enhancements

A number of small scale enhancement schemes are currently under development for the RUS area through the normal industry processes. Where these respond to RUS issues that have been identified elsewhere in this document, analysis is being fed into the development work as appropriate.

Certain types of renewal provide a cost-effective opportunity to implement infrastructure enhancement work. In such cases the additional cost of increasing the scope of planned works can be significantly lower than implementing an enhancement scheme as a stand alone project. This is most likely to be relevant for switch and crossing renewals, signalling schemes or station renewal works. Small scale enhancement schemes can also be cost-effective in their own right, especially for schemes which increase capacity, improve performance or reduce journey times. Some examples of minor enhancement schemes are shown below. Full details regarding planned and potential schemes in the RUS area can be found in the current Network Rail Business Plan.

4.4.1 Recently completed and current schemes

The schemes in Figure 36 have recently been completed or are due to be completed before the start of CP4 in 2009:

Figure 36 - Recently completed and current schemes

Project Description	Output change	Completion
New booster transformers between Hitchin and Cambridge	Improved capacity	2008/09
Wood Green area - power supply modifications	Improved capacity	2008/09
Platform lengthening at Cambridge and Royston	Improved capacity	2008/09
Allington Chord	Improved performance and capacity	Completed
Darlington South Junction overlaps	Improved performance and capacity	Completed
King Edward Bridge linespeed increases	Improved performance	Completed
Peterborough – Werrington Junction bi-directional signalling	Improved performance and capacity	Completed
Thirsk platform extensions	Improved capacity for longer trains	2008/09

Under the terms of its franchise First Capital Connect has developed a new London King's Cross to Cambridge and Peterborough peak timetable to cope with crowding and future growth which is due to be implemented in December 2008. The first three schemes in Figure 36 allow this timetable to be introduced.

4.4.2 Committed enhancements (Thameslink Programme)

In July 2007, DfT announced funding of the Thameslink Programme in its HLOS which will see the implementation of through running of up to 12-car trains from the ECML to the Thameslink corridor, via St. Pancras International and Blackfriars from December 2015. This scheme provides upgraded power supply at the south end of the ECML, outer suburban platform lengthening, and additional stabling, as well as the connection between the two routes at Belle Isle (just north of King's Cross).

HPUK and TIF funded freight upgrades

W10 gauge clearance of the ECML from Peterborough to Hare Park and Temple Hirst Junctions is planned for completion by 2011 as part of a project to allow 9'6" deep sea containers to be carried from Felixstowe to four terminals in Yorkshire (Doncaster Europort, Selby Potter Group, Wakefield Europort and Leeds Stourton). This project will be funded by HPUK.

Since the publication of the Draft for Consultation of this RUS, DfT has announced progression of two relevant rail-based Transport Innovation Fund (TIF) schemes:

- Peterborough – Nuneaton enhancement to clear the line to W10 gauge, allowing conveyance of 9'6" containers on conventional rail wagons
- Improvements to the Gospel Oak – Barking line, enabling the line to transport more goods from ports in the south east and providing a diversionary route for freight trains when the North London Line is unavailable.

Strategic Freight Network

The Government's White Paper "Delivering a Sustainable Railway" was published in July 2007 and identified the desirability of a Strategic Freight Network, which would enhance the network used by freight trains and reduce conflict between freight and passenger traffic. The High Level Output Specification (HLOS) for the period 2009 – 2014, published as an appendix to the White Paper, allowed for expenditure of up to £200 million between 2010 and 2014 to facilitate the implementation of this concept. The rail industry is working with DfT to develop the Strategic Freight Network.

4.4.3 Proposed enhancements

A number of other schemes are being developed for possible implementation during or after CP4. These are listed in Appendix 4. These schemes have been considered alongside new ideas in order to develop options that meet the gaps identified (see Chapter 6).

5. Anticipated changes in demand

5.1 Introduction

This chapter provides a summary of the passenger demand and freight forecasts, including a description of the key factors that are expected to drive growth.

5.2 Forecast passenger growth

5.2.1 Methodology and data sources

The following section describes the methodology and data sources used to estimate passenger demand, together with some background information on regional growth plans relevant to the ECML.

5.2.2 Forecasting methodology

Future passenger demand is heavily dependent on economic activity (GDP growth), employment trends and population changes. It is also influenced by fare levels, the quality of the train service on offer, and competition from other modes (principally road and, for longer distance services, air). Relevant data with respect to all these key factors has been collected and used to develop demand forecasts for each of the passenger service types.

In particular the RUS has used the Passenger Demand Forecasting Handbook (PDFH) methodology (Version 4.1) to predict growth in trips over time. The forecasts are based on the standard PDFH methodology, except where historic trends have been found to be very different to future growth predictions. In these cases an alternative methodology (or overlay) based on historic evidence has been used. This has particularly been the case for regional services. However, some forecasts for long distance flows required further refinement since growth over the last five to ten years has been very different from that which would have been predicted using the standard PDFH methodology.

In instances where it has been necessary to depart from the standard methodology, the proposed alternative and forecasts have been agreed with relevant stakeholders.

All forecasts have been based on the assumption that regulated fares increase by RPI+1 percent, and as a simplifying assumption it has been assumed that unregulated fares also increase at the same rate. The level of growth is highly dependent on this assumption, especially for longer distance flows. Growth could also be significantly altered by factors affecting other transport modes, especially pricing and congestion issues on road and air.

The RUS has used a number of computer models to forecast the effect of growth on train loadings and also the impact of RUS options with respect to changing timetables and levels of capacity. These models are:

- **PLANET Strategic** – a frequency based model which captures the levels and patterns of passenger services across the network for a specified time period. It is a full mode-choice model, including information on competing air and highway modes covering the national transport system. A further advantage of this model is that it takes into account crowding effects.
- **PLANET South** – a public transport model which includes information on Travelcard movements within London and the South East, as well as demand associated with LUL and DLR lines. The model only covers the morning peak period (ie. between 07:00 and 10:00).
- **RAILPLAN** – a Transport for London model which is similar to PLANET South but is more detailed within the Greater London area.

- **MOIRA** – a rail only timetable model, based on ticket sales. This model can be used to predict how timetable changes will impact on passenger journeys. It does not include any estimation of changes in levels of crowding.

The models have been calibrated against data from the sources described in Section 3.2.1.

It is noted at this point that some stakeholders, principally Open Access passenger train operators, have expressed concern regarding the use of the standard rail industry models to assess passenger demand between centres that are poorly connected by rail at present. However, these models do provide a useful starting point from which to assess any proposed options.

5.2.3 Population and employment trends

To produce quantitative forecasts of passenger demand growth the RUS has used predictions of population growth and employment trends as taken from the Department for Transport's latest TEMPRO (Version 5) model. TEMPRO provides a single consistent view of future population and employment, taking into account the various spatial development plans, for use in transport planning.

Other data relating to the key drivers of passenger demand, such as GDP, were taken from Oxford Economic Forecasting's May 2006 predictions, or for regional forecasts, the Leeds Economy Handbook (August 2006).

5.3 LDHS passenger forecasts

5.3.1 Forecasts to 2016

In order to estimate future passenger demand, forecasts were produced for 2016 based on the PDFH methodology and analysis of the key demand drivers described in 5.2.2. These forecasts represent the estimated level of passenger demand assuming other factors (such as timetable and punctuality) remain constant. However, the forecasts include the effect of extra capacity provided by the recent introduction of a half-hourly service between London and Leeds throughout the day, and the new services between London and Sunderland from December 2007.

These forecasts are referred to as the 'do minimum'.

During the development of this RUS, stakeholders raised a number of issues with respect to the 'do minimum' forecasts, particularly connected with ensuring consistency with historic trends for the following flows:

- Edinburgh to London
- Newcastle to London
- Leeds to London
- Grantham/Newark/Retford to London
- Interurban non-London.

Bespoke analysis was therefore undertaken to assess how well the PDFH methodology would have explained historic growth on these key flows. Following discussions with stakeholders it was agreed that in order to depart from the PDFH methodology there would need to be clear evidence to form a concern, that an alternative methodology to forecast demand for these flows could be found, and that the alternative would result in a material change to the 'do

minimum' forecasts. After reviewing the data available and forecasts for each flow in turn it was agreed that two market sectors met all of these requirements and hence would need an adjustment in the form of an overlay added to the 'do minimum' forecasts. These were the Edinburgh and Newcastle flows to/from London.

For the Edinburgh – London flow, the original forecasts based on PDFH were over 60 percent growth to 2016. However, analysis of historic growth indicated that passenger journeys between 1998/99 and 2004/05 fell by 25 percent, implying that the PDFH methodology did not adequately capture demand for this flow. In this case, strong competition from low cost airlines is believed to explain much of the decline in passenger demand. An alternative forecast was developed on the basis that future rail growth would not be greater than the total market growth between Edinburgh and London (for both rail and air combined) and that future market growth would be similar to the background growth seen for rail before the impact of low cost airlines.

Similar reasoning was applied to the Newcastle – London flow, which also appears to have been affected by the increase in low cost flights.

However, recent security issues at airports and consequent increases in end-to-end journey times for air passengers has led to an increase in rail demand between both Tyneside and Edinburgh to London.

For the other flows listed above there was no clear evidence for departing from the 2016 'do minimum' forecasts based on the PDFH methodology.

Historic growth for the Leeds – London flow was similar to future forecasts once past service changes had been taken into account.

Whilst historic growth at Newark, Grantham and Retford has been very strong over the last ten years, much of this appears to have been driven by increasing commuter demand to London, believed to be the result of differences in house prices. More recent growth on these flows has levelled off and appears to have slowed down markedly. Given this, and the uncertainty in future house prices, no changes have been made to the forecasts for these flows.

Historic growth for the non-London flows has also been strong. However, given that the majority of these flows are beyond the most heavily used sections of the ECML route (i.e. Doncaster to London), no adjustment was considered necessary.

It was agreed that on flows where no adjustment had been made, any options would need to consider the possible impact of higher growth rates where appropriate to do so.

Figure 37 shows forecasts of growth for long distance flows to/from London (including the adjusted Edinburgh and Newcastle forecasts), assuming that capacity remains unchanged.

Figure 37 – Do minimum forecast growth in LDHS passenger journeys to/from London between 2006 – 2016

Station	Annual flow 2006	% Growth
Peterborough[1]	1,870,000	20
Grantham	440,000	22
Newark North Gate	450,000	22
Retford	90,000	23
Doncaster	400,000	18
Wakefield Westgate	350,000	53
Leeds	1,430,000	44
Hull	240,000	39
York	860,000	46
Darlington	370,000	48
Newcastle	940,000	22
Edinburgh	580,000	16
Overall growth (passengers at King's Cross)		**40**

Source: *Atkins PLANET Strategic* (assumes regulated and unregulated fares increase at RPI + 1%)

1 LDHS services only

It can be seen that significant growth is forecast by the RUS on LDHS services, especially on flows between London and Yorkshire.

Figure 38 shows the overall passenger growth predicted on LDHS flows to 2016, over the section of the route between Peterborough and King's Cross. This also shows what would happen should changes in average fare levels (regulated and unregulated) rise above RPI+1 percent. It can be seen that fare rises at the higher end of the range shown would significantly reduce the levels of passenger growth.

Figure 38 – Effect of potential fare increases on LDHS growth

2016 Do-minimum forecast growth (passengers at King's Cross)			
RPI+1%	**RPI+2%**	**RPI+3%**	**RPI+4%**
40%	23%	12%	2%

5.3.2 Effect on crowding

If the predicted levels of growth materialise (without a very high rate of fare increases) there will be significant overcrowding on many services.

Based on these forecasts, it is probable that passengers will need to stand on the majority of peak services into and out of King's Cross, especially those with the shortest journey times to and from the north.

5.4 London and South East passenger forecasts

5.4.1 Forecasts to 2016

Passenger demand forecasts for the London and South East (L&SE) commuter services focus on demand during the weekday morning peak (07:00 – 10:00), as it is this period that will experience the highest levels of demand.

As with the LDHS forecasts, the L&SE commuter forecasts are based on the relevant key drivers of passenger demand (described in 5.2.2) and application of the standard PDFH methodology.

Two 2016 forecasts for L&SE commuter services have been considered. The first provides an indication of the level of demand that would be generated if crowding levels remained at current levels (i.e. become no worse). This is referred to as "unconstrained" growth. This does not include any existing suppressed demand. The second is the level of passenger growth that would occur in the event that additional capacity, to maintain crowding at current levels, was not provided. This is referred to as "constrained" growth.

In the latter case, passenger demand is suppressed by the available peak capacity, which would increase crowding levels and hence deter passengers from travelling.

Figure 39 shows the growth forecasts for each of the service types.

The following schemes are relevant to the growth in demand for inner area services:

- committed PPP schemes on the High Barnet branch of the LUL Northern line would add capacity and improve journey times on a route which is broadly parallel to the southern end of the Welwyn route, and can thus be used as an alternative route into London for many passengers from this area
- on the LUL Piccadilly Line, committed PPP schemes would add capacity and improve journey times on a route which is broadly parallel to the southern end of both the Welwyn and Hertford North routes, and can thus be used as an alternative route into London for many passengers from this area.

Figure 39 – Forecast growth in L&SE peak passenger journeys 2004 – 2016

Service Group	AM peak boarders 2004	Growth to 2016 Constrained	Growth to 2016 Unconstrained
Cambridge	5,900	7%	17%
Peterborough	4,500	5%	21%
Inner (Welwyn/Hertford)	20,200	5%	14%

Source: Atkins, PLANET South AM 2016

Figure 40 shows the growth forecasts at selected representative stations.

Figure 40 – Typical growth at L&SE stations

	Forecast growth 2004 – 2016	
	Constrained	**Unconstrained**
Outer suburban services		
Cambridge	22%	26%
Hitchin	9%	18%
Stevenage	7%	14%
Inner suburban (Welwyn route)		
Potters Bar	7%	11%
Inner suburban (Hertford route)		
Hertford North	13%	18%
Palmers Green	9%	14%

Source: Atkins, PLANET South AM 2016

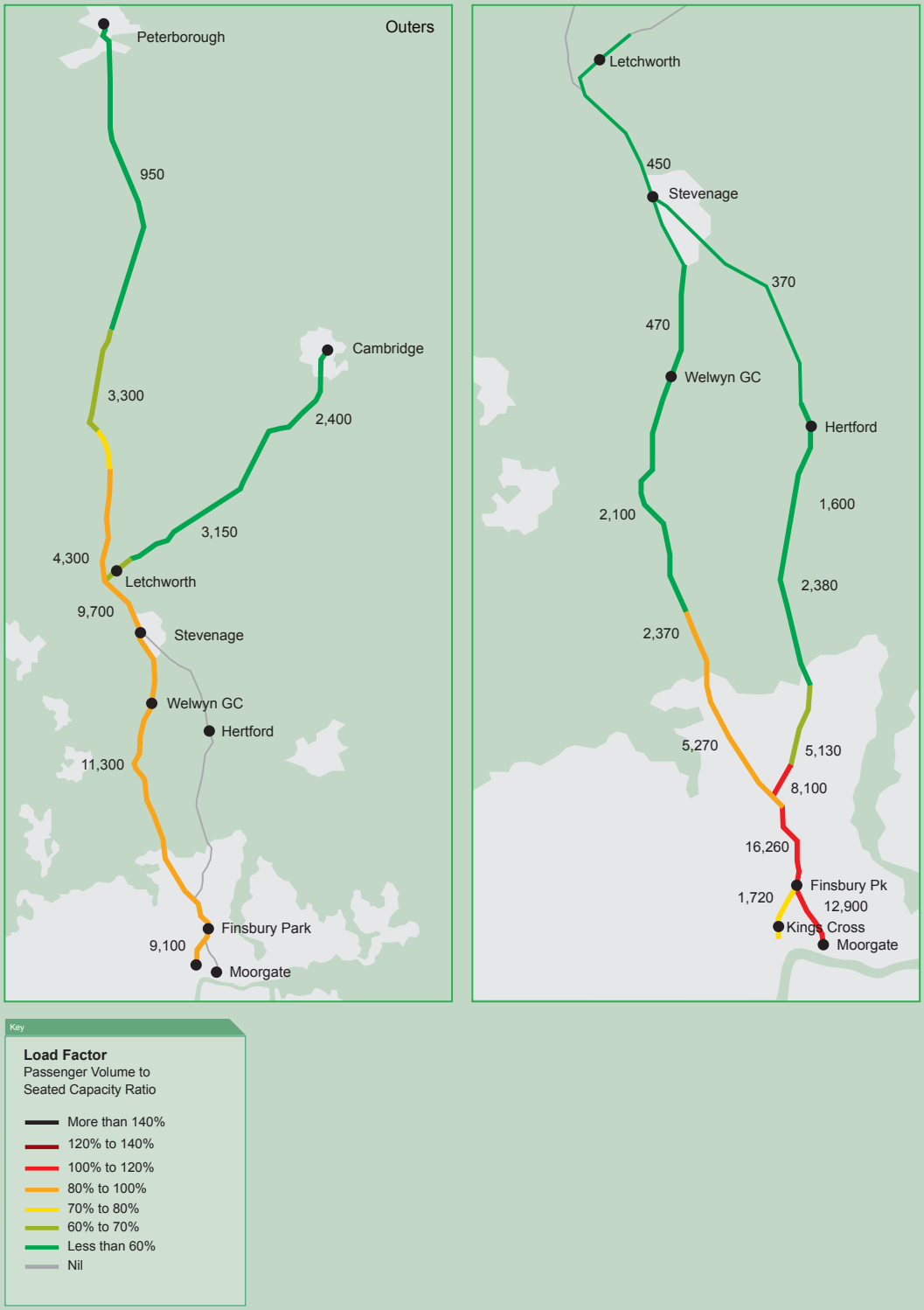
5.4.2 Effect on crowding

Figure 41 shows forecast peak crowding levels in 2016 on inner and outer suburban services, based on constrained growth.

This shows the total number of passengers travelling to London King's Cross and Moorgate for both inner and outer suburban services during the morning peak. The coloured lines indicate the estimated load factor (total passenger volume divided by seated capacity over the three-hour AM peak). It can be seen that there are high levels of crowding on the approaches to London, notably on inner suburban services via the Hertford Loop and outer suburban services from Stevenage and beyond.

It is worth nothing that crowding during the high peak hour (08:00 – 08:59) will be considerably higher than is reflected in Figure 41, as the load factor presented is averaged over the three-hour morning peak. In addition, whilst the level of crowding appears worse on the inners, the figure does not reflect that passengers will be standing on outer services, particularly during the high peak, for over twenty minutes.

Figure 41 – L&SE Forecast load factors 2016 (constrained)



Source: Atkins, PLANET South AM 2016

5.5 Regional passenger forecasts

5.5.1 Forecasts to 2016

Two growth scenarios were estimated for West Yorkshire and North East England. The key difference between these two scenarios is that the low growth forecast is based solely on the PDFH methodology and use of the standard economic growth projections for GDP, employment and population. The high growth scenario assumes that some elements of the historic rate of growth continue into the future. The forecasts are shown in Figure 42.

For the purpose of testing North East England options the RUS has used the high growth assumptions since these are consistent with observed historic trends. West Yorkshire options (see Section 6.9) will be appraised within the Yorkshire and Humber RUS, for which more comprehensive forecasts are being prepared.

5.5.2 Effect on crowding

Based on the above 'do minimum' forecasts, certain peak hour services into city centres (especially Newcastle, Middlesbrough and Leeds) will remain crowded under the low growth scenario, and would worsen significantly under the high growth scenario.

5.6 Changes since the publication of the consultation document

Since the consultation document was published, there have been a number of developments that could potentially have an impact on the forecasts of passenger demand for rail on the ECML. The purpose of this section is to briefly highlight these issues, and discuss their significance for the RUS and the demand forecasts presented earlier in this chapter.

A key change to operations on the ECML Route is the DfT's new contract with NXEC Trains Limited to operate the Intercity East Coast rail franchise. The new franchise agreement indicates that overall both regulated and unregulated fares are likely to rise by RPI +1.6 percent per annum throughout the duration of the franchise. Fare increases tend to reduce the demand for rail travel, as shown in Figure 39. However, the increase proposed is relatively small, and recent information about the strength of LDHS growth may counter balance the proposed fare increases.

Over the last few years, passenger demand for rail travel in all sectors has grown rapidly. Both L&SE and Regional services have seen an increase in passenger demand of around seven percent between 2005/06 and 2006/07, and over the same period the number of passengers using the LDHS services on the ECML increased by four percent. Current indications are that rapid passenger growth is continuing into 2007/08, fuelled by continuing economic growth and steady increases in employment levels. Meanwhile, in some Regional areas, strong city growth and demographic changes are also boosting the demand for rail.

Train operators have indicated that they believe overall passenger growth on the ECML will be approximately 50 percent by 2014/15, despite the proposed fare increases. They believe that demand for rail travel will continue to rise due to a number of factors, including gradually rising road congestion, greater awareness of rail's relative environmental benefits, and improved marketing strategies.

Figure 42 – Regional growth forecasts to 2016

Region	Low growth scenario	High growth scenario
West Yorkshire	9%	24%
North East England	0%	44%

The competitive nature of the franchising process also provides a strong incentive to operators to achieve high growth in demand. They can achieve this through yield management techniques, thereby offsetting the fare increases by stimulating demand with more effective marketing.

In general, if current rates of passenger growth continue, the original forecasts based on the PDFH framework could be exceeded in all sectors. There has been much debate within the industry about the underlying causes of the rapid growth in demand for rail travel. Recent work for the Passenger Demand Forecasting Council concluded that much (though not all) of the rapid growth seen in 2006/07 might be explained by "catch-up" from earlier years, in which demand grew by less than had been predicted by the PDFH framework. However, as growth in passenger demand appears to be continuing into 2007/08, the explanation that this is mainly "catch-up" becomes less plausible. Nevertheless, there is not sufficient evidence to conclude that the PDFH framework should be abandoned.

If the current evidence about demand for rail travel, the TOCs' expectations, and the DfT's HLOS forecasts were combined, the conclusion would be that the current rapid rates of growth might continue over the next few years. They would subsequently slow down to converge with the DfT's HLOS long-term forecasts, based on the PDFH framework. In this scenario, the demand forecasts presented above do not seem unreasonable, even taking into consideration the above-inflation fare increases on LDHS services.

Some specific flows on the ECML have grown particularly rapidly over the last two years. As noted in previous sections, recent issues affecting air travel (such as environmental concerns and the tightening of airport security) appear to have encouraged a return to rail, particularly on LDHS flows which directly compete with air. Recent evidence shows that passenger demand on the Edinburgh to London flow grew by 10 percent between 2005/06 and 2006/07. Whilst the same level of demand recorded in 1998/99 (before the proliferation of low cost airlines) has not yet been reached, the return to rail for these types of long-distance journeys is a very positive sign for the industry.

The demand forecasts presented in this chapter of the RUS were based on the best information and data available at the time of their development, and the relevant industry stakeholders were consulted to ensure their acceptability. The economic and social background to Britain's transport network is constantly changing, and whilst recent evidence shows very strong growth in demand for rail, the continuation of this trend will depend on numerous drivers which are not always easy to predict or always fully understood. Hence, given that there is always a degree of uncertainty in forecasting passenger demand, the RUS should be based upon a set of forecasts that are reasonably robust.

The key challenge is to understand whether any uncertainties about changing demand have a significant impact on the strategy being proposed. For example, it should be considered whether increasing LDHS service provision on the ECML would provide sufficient capacity to cope with an even higher level of demand growth than expected. It is believed that the forecasts presented in this chapter are still reasonable in the light of the latest available data, but that it is always prudent to consider how uncertainties about future changes in demand will impact upon any option or strategy that is proposed.

5.7 Freight forecasts

Forecasts of freight demand are taken from the Freight RUS, published by Network Rail in March 2007. Figure 43 shows the additional trains that are anticipated to be operating in 2014/15, over and above the 2004/05 Freight RUS base year[1]. In the case of imported coal growth from the east coast ports, more than 50 percent of this growth has already occurred, as projected during 2005/06 and 2006/07.

The Freight RUS forecasts are unconstrained and have been developed by the Rail Freight Operators' Association (RFOA), the Rail Freight Group (RFG) and the Freight Transport Association (FTA), in conjunction with Network Rail and other stakeholders. The RFOA used a bottom-up approach to forecasting, identifying changes to specific flows using market intelligence, whereas the RFG/FTA predictions were generated by the GB Freight Model which forecasts changes to market size and rail share by commodity. Despite the different approaches, similar predictions of unconstrained demand for rail freight were generated.

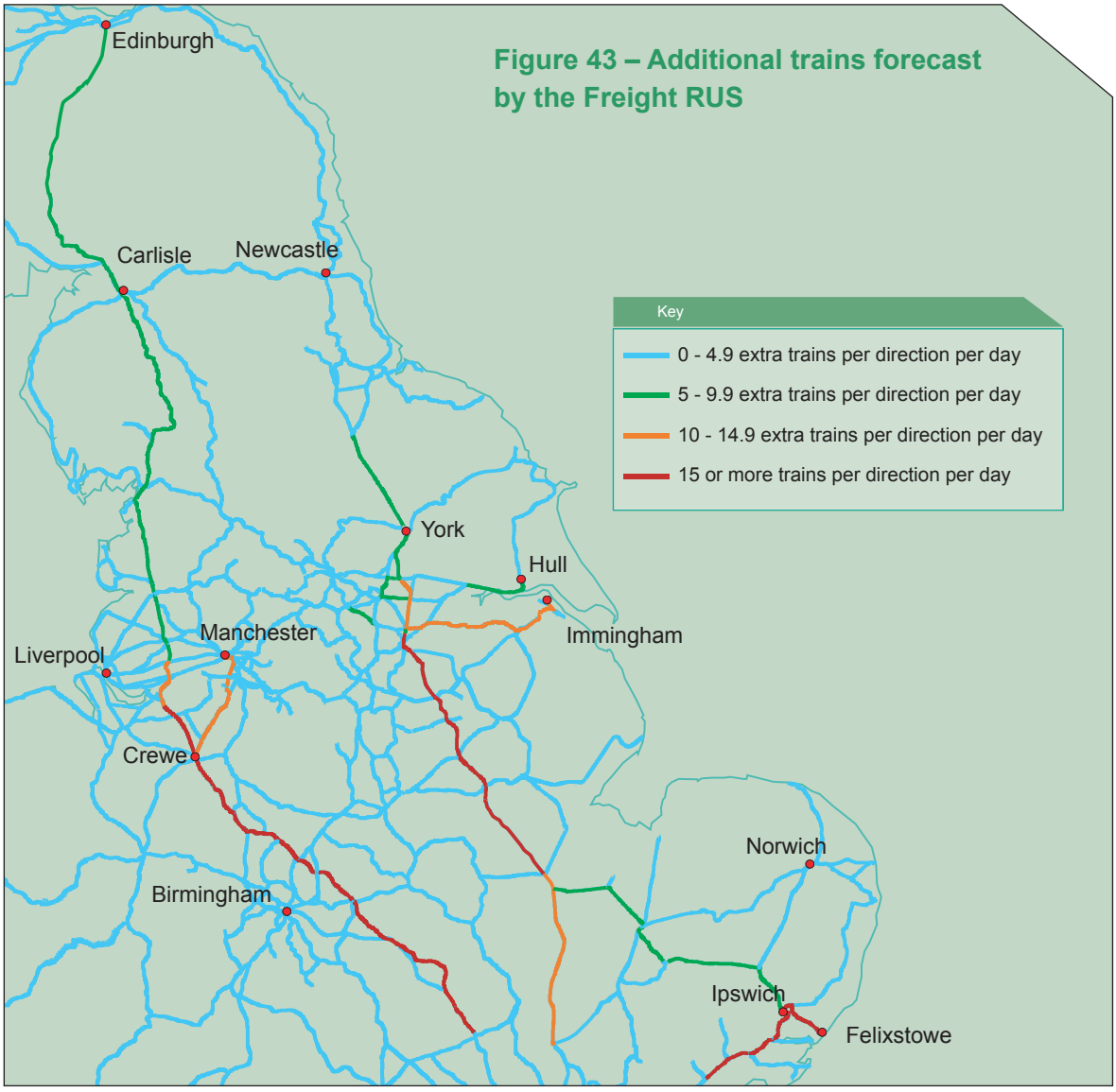


Figure 43 – Additional trains forecast by the Freight RUS

1 Figure 29 in section 3.8.4 details Freight RUS base year volumes on key ECML sections

The main current freight flows within the RUS area (as described in Section 3.8.3) are:

- coal domestically mined or imported, destined for the Aire Valley and Trent Valley power stations
- intermodal containers to and from major south eastern ports
- metals traffic between Lackenby and Scunthorpe, and South Wales and the Midlands.

The main changes envisaged in freight flows within the ECML RUS area are discussed in more detail below.

5.7.1 Coal

The continued use of fossil fuels to generate electricity for the UK will support demand for coal traffic to power stations for at least the next decade. This includes flows to service the Aire Valley power stations (Drax, Eggborough and Ferrybridge), some of which run on sections of the ECML.

With the closure of the Selby coalfields, and significant investment in the development of port capacity at Immingham, Hull, Port of Tyne, and Blyth, it is anticipated that the proportion of imported coal for the Aire and Trent Valley stations will continue to be high. Of the east coast import facilities, Immingham has the largest capacity (capable of handling up to 14 million tonnes per year) and has seen significant growth over the last two years. Import coal flows through Immingham to the Aire and Trent Valley utilise the ECML between Joan Croft and Hambleton Junctions.

Opencast mining in Fife and Ayrshire, and imports through Hunterston, Port of Tyne, Blyth, and Redcar, will mean continued demand for freight paths on the ECML north of Colton Junction. However, where possible, traffic from the Scottish sources will be routed via the Glasgow & South Western and Settle & Carlisle lines and away from the ECML. These lines are currently the subject of capacity enhancement schemes to accomodate additional freight traffic.

The balance between imported and indigenous coal is sensitive to a number of factors, therefore two demand scenarios were developed in the Freight RUS:

- the Base Case assumed that further decreases in UK mined coal will be offset by further increases in imports through the East Coast ports of Immingham, Hull, Port of Tyne, Redcar and Blyth
- Sensitivity Test 1 assumed further decreases in UK mined coal are offset by increased imports through Hunterston and increased forwardings from Scottish opencast sites.

Data in the Freight RUS, and data collected for this RUS, indicate that despite some increase in Anglo-Scottish coal traffic, over all the Base Case assumptions are closer to the current trend.

Connected to the continued use of the larger coal-fired power stations at Drax and Eggborough, and their fitment with Flue-Gas Desulphurisation (FGD) equipment, is the need for limestone trains to support the FGD process and gypsum trains to remove the residue of the process. Incremental growth in these flows is expected.

In the long term, a structural shift away from fossil fuels has been suggested. It is unclear what the balance will be between energy sources that require rail transport of fuel and those that do not. The RUS has therefore assumed that background demand for rail-borne coal (or other fuel for power stations) remains broadly as it is now.

5.7.2 Intermodal traffic

Deep sea container traffic into the UK has been growing at around 4 percent per annum, with the strongest growth from the Far East. There is every indication that this global economic trend will continue. There is strong pressure for growth of traffic on rail to meet this demand, given environmental and road/ portside congestion issues around all of the southern and eastern ports.

As a result, port developers have submitted plans for significant port expansions, all of which promote growth of rail traffic as a key element. The Secretary of State has approved the plans for Felixstowe (expansion of existing port) and Bathside Bay (Harwich)[2], and has approved a new deep sea facility at London Gateway Port on north Thameside. Additionally the north east ports of Hull, Immingham and Teesport are expecting to expand their intermodal operations.

Potential rail demand arising from the port expansion proposals over the next 10 years is forecast to increase the number of daily train paths required between the Haven Ports and the North East from five in 2004/05 to twelve by 2014/15. Analysis of the current service patterns from Felixstowe highlights that some of this projected growth has already occurred.

The destination of the additional traffic is expected to remain the same as existing east coast port services.

The shift towards the use of 'high cube' 9' 6'' deep sea containers by the freight industry in general will have significant implications for the rail network within the RUS area. The Freight RUS reports approximately 40 percent of deep sea TEU are presently 9' 6" high. Forecasts from recent port planning inquiries suggest this figure could reach 50 percent within the time horizon of this RUS. These containers, when carried on standard 1000mm deck height wagons, are incompatible with some structures on the rail network and, whilst they can be carried on modified wagons, this reduces payload by a third, thereby affecting competitiveness in the market.

An alternative and preferred solution to the above would be to expand the network of W10 gauge cleared routes allowing 9' 6" high containers to be carried to their destinations on standard 1000mm deck height wagons. As noted in Chapter 4, the RUS assumes as a committed scheme W10 gauge clearance between the Haven Ports and the Wakefield, Leeds, Doncaster and Selby terminals. This will mean the conveyance of 9' 6" high boxes on standard height wagons will be possible between these locations.

5.7.3 Construction

Nationally, the volumes of construction materials moved by rail are anticipated to increase by up to 20 percent in the period to 2016 and the pattern of movement will remain broadly similar to now.

5.7.4 Automotive

There is potential interest in developing new flows from Nissan at Washington, BMW at Thorne North and potentially Toyota near Derby to a range of destinations.

5.7.5 The logistics market

The logistics market is very active in considering proposals for new distribution centres with growing indications that rail served facilities will play a key part in development proposals. Rail served distribution centres are currently being considered at Tursdale (near Durham) and Rossington (near Doncaster). There is also an aspiration for the proposed distribution centre at Alconbury near Huntingdon to be rail served in the future. The totality of demand for freight paths to serve these proposed new distribution centres is still in development.

2 These ports are known as the Haven Ports

5.7.6 ECML gaps identified in the Freight RUS

The Freight RUS considered the ten-year demand forecast detailed above against presently available capacity within the ECML RUS area. Four key capacity gaps were identified.

For the first of these, Freight RUS Gap 12 (Tyne Yard – Tursdale Junction), the Freight RUS recommended reinstatement of the Boldon East curve. This would allow some new imported coal services from the Port of Tyne to be routed via the Durham Coast, avoiding the mostly two track section of the ECML between Northallerton and Newcastle.

The remaining three specific capacity gaps identified to be addressed through the ECML RUS process are summarised in Figure 44 below.

The Freight RUS also identified that the container traffic market is particularly dependent on the availability of routes with W10 gauge clearance if it is to develop and grow. The following key areas were identified:

- confirmation of the importance of the gauge clearance scheme for W10 between Felixstowe/Bathside Bay and the Yorkshire area (via Ely and the ECML)
- the aspirations for further gauge clearance on the ECML for W10 between London and Peterborough, Yorkshire and Edinburgh/ Teesport.

Figure 44 – Gaps identified for the ECML RUS by the Freight RUS

Gap	Location	Issue
A	Hare Park Junction – South Kirkby Junction	Freight crossing movements between Moorthorpe and Hare Park Junction conflicting with passenger movements on the Leeds – Doncaster route.
B	Joan Croft Junction – Hambleton Junction	Current infrastructure requires east – west coal trains to use parts of the north – south ECML. This involves freight crossing moves to the Down line at Joan Croft Junction and to the Up line at Hambleton Junction.
C	Peterborough Crescent Junction – Doncaster Loversall Carr Junction	The speed differential (freight to passenger) on the two-track section Stoke Junction to Doncaster. Access from the Up slow and Peterborough Yard to the Up March line.

6. Gaps and options

6.1 Context

Previous chapters have presented baseline data (the current capability and requirements of the network), forecasts of future demand and other drivers of change.

The next stages are:

- identification of “gaps”
- identification of feasible “options” to address the gaps
- appraisal of the options.

6.2 Gap identification

The following headline groupings of “gaps” were identified. These include some gaps identified through specific requests from stakeholders, these are highlighted.

6.2.1 London inner suburban services

In previous sections it has been stated that, at present, there is crowding on many peak services into London. The demand forecasting work has shown that crowding levels will increase further as demand grows, especially from the Hertford Loop area. Whilst DfT’s PIXC standards allow for standing on short journeys (up to 20 minutes duration) predicted growth would cause these permitted standing levels to be significantly exceeded. As a result of the growth, peak travel will become further constrained by the capacity available and some passengers may need to amend their journey patterns.

On both the Hertford and Welwyn routes, the off-peak frequencies (3tph daytime between the peaks, 2tph evenings and 2tph on most weekends) do not meet the Mayor of London’s 4tph metro-standard level of service.

6.2.2 London outer suburban services

There is significant crowding on many peak services in and out of London at present. The demand forecasting work has shown that crowding levels will increase further as demand grows, especially on the Cambridge route. As a result peak growth will become constrained by the capacity available, with significant standing in excess of the permitted 20 minutes threshold.

6.2.3 Long distance high speed (LDHS) services

Significant growth is anticipated on long distance services using the ECML, particularly on flows between the North East, Yorkshire and London. Certain services at peak times of the day, week and year have standing passengers at present but many services will become more crowded as a result of the growth with standing becoming more common for long distances, potentially during most peak periods of demand into and out of King’s Cross.

Several stakeholders have highlighted the desire to reduce journey times between London and Yorkshire, the North East and Scotland. However, this is potentially in conflict with other aspirations to improve services at the smaller stations such as Grantham, Newark North Gate, Retford, Northallerton, Morpeth, Alnmouth, Berwick-upon-Tweed and Dunbar.

Service patterns to destinations off the main ECML route are also an issue, since direct services to these destinations generally operate less than once per hour and would therefore need careful consideration in any repeating pattern timetable. This applies to some locations in Scotland, Hull, West Yorkshire and Sunderland. Furthermore, some operators have aspirations to introduce direct services from London to Bradford (via

Halifax) and Lincoln. Connecting services to these and other locations off the main route are also significant, with optimum provision of connections sought for locations such as Bradford, Harrogate, Skipton, Huddersfield, Teesside, Grimsby and Lincoln.

The RUS has highlighted that the current timetable pattern on the ECML is unusual as it is not based on a repeating standard pattern of services. This factor is currently a constraint since it limits the optimum usage of capacity, affecting trains over an area well beyond the RUS boundary.

The RUS gap identification has made no specific assumptions regarding the allocation of paths between franchised and open access operators on the route beyond those Track Access Agreements currently in place.

6.2.4 ECML north service spread

Passenger services on the northern end of the ECML (north of Doncaster) are provided by a mixture of London, cross country, cross-Pennines and local services. The pattern and timetable spread of services in this area has been identified as sub-optimal.

The need for an appropriate level and timetable spread of services over both the York – Newcastle and Newcastle – Edinburgh sections of route have been highlighted, particularly with respect to the interaction between the London and cross country services and how best to serve stations such as Northallerton, Morpeth, Alnmouth and Dunbar.

Transport Scotland and other stakeholders have identified aspirations for additional local services over parts of the Scottish section of route and these have also been examined by the RUS.

The North East RPA identified aspirations for additional services over parts of this section of route that have been specifically examined by the RUS.

6.2.5 South and West Yorkshire services

There is significant crowding on certain peak services between Doncaster and Leeds. This two-track mixed traffic corridor has limited overall capacity and six local stations and there is a need for the RUS programme to determine an optimum service mix. It is noted that end-to-end demand for journeys between Leeds and Sheffield can be either met by services running via Wakefield Westgate (partly within the scope of this RUS) or by services running via Barnsley (outside the scope of this RUS).

The demand for services to London from the Doncaster/Rotherham/Sheffield area via both the Midland Main Line (MML) and ECML is interlinked, since services on the ECML generally have significantly better journey times and frequencies. It is therefore possible that some growth from this area could be catered for by interventions on the MML rather than the ECML.

A number of aspirations for additional services from SYPTE and WYPTE have been considered. However the majority of local issues in South and West Yorkshire will be considered by the Yorkshire and Humber RUS.

6.2.6 Tees Valley services

In peak hours, a small number of local services into Middlesbrough are crowded.

In addition there are a number of aspirations for additional services and new stations from the North East RPA that have been specifically examined by the RUS.

There are only limited journey opportunities from this area to the ECML at present.

6.2.7 Tyneside local services
Several peak services into Newcastle are crowded.

In addition there are a number of aspirations for additional services from the North East RPA that have been specifically examined by the RUS.

6.2.8 Network flexibility
In previous sections it was identified that the capacity, capability and operating flexibility of the route is limited at several locations.

The Department for Transport's High Level Output Statement (HLOS) has a number of performance targets which the RUS needs to take in to account, both in terms of specific infrastructure schemes, and to ensure that the impact of recommendations is understood and any negative effect on performance is mitigated.

The key issues relevant to this gap are:

- the limited capability (including gauge, route availability, train length and electrification) and capacity of diversionary routes
- the limited opportunities to recover from delay and perturbations due to the number of bottleneck locations and sections
- engineering access almost anywhere on the route has a very significant impact
- responding to the other gaps will potentially exacerbate pressure on capacity, performance and engineering access
- understanding the benefits of the infrastructure enhancement schemes listed in Chapter 4 (or any others) and determining which of these should be progressed.

6.2.9 Freight
Accommodating freight growth on a mixed traffic railway close to the limit of capacity (at certain locations) has the potential to lead to pressure on the reliable operation of the route.

A number of specific gaps were identified in the Freight RUS and have been carried forward as highlighted in Section 5.7. Some potential infrastructure schemes to address most of these gaps are included in Chapter 8, while growth between Doncaster, South Kirkby Junction and Hare Park Junction will be examined in the Yorkshire and Humber RUS.

The main capability issue is related to gauge enhancement, with the industry's aspirations identified in the Freight RUS. Other issues include the ability to operate longer trains and increased opportunities to use electric haulage.

6.2.10 Station capacity and facilities
Certain stations are currently congested at peak times and would become more congested as a result of the forecast passenger growth. Extensive infrastructure works may be required to accommodate passengers at stations, notably at King's Cross, Finsbury Park and Peterborough.

A number of stakeholders have highlighted that facilities at some stations are inadequate to meet current or future customer needs.

6.3 Summary of Gaps

Based on previous sections, the general groups and specific gaps shown below were identified. The general groups are those described above, with the specific gaps being the issues that it is considered appropriate for the RUS to address.

	Grouping	Specific gaps to be addressed
1	London inner suburban services	Peak crowding and forecast growth Off-peak service levels
2	London outer suburban services	Peak crowding and forecast growth
3	Long distance high speed services	Peak crowding and forecast growth Journey times between London, Yorkshire, the North East and Scotland Irregular service intervals Direct services to destinations on and off main ECML Anglo-Scottish service frequency Regional connectivity
4	ECML north service pattern	Irregular service intervals Stopping patterns at smaller stations Increase in local services in Scotland Funder's aspirations
5	South and West Yorkshire services	Peak crowding into Leeds (services via Wakefield Westgate) Links between regional centres Funder's aspirations Sheffield/Doncaster – London flows
6	Tees Valley services	Peak crowding into MiddlesbroughSchemes remitted from North East RPA
7	Tyneside local services	Peak crowding into Newcastle Schemes remitted from North East RPA
8	Network flexibility	Interaction between baseline capacity, options and any infrastructure enhancement schemes. Ability of the system to recover from perturbations Balance of engineering and operations access Capability of diversionary routes and degraded main line operation
9	Freight RUS specific gaps	Capacity Port of Tyne – Tursdale Jn (Freight RUS Gap 12) Capacity Hare Park Jn – South Kirkby Jn (Freight RUS Gap A) Capacity Joan Croft Jn – Hambleton Jn (Freight RUS Gap B) Capacity Peterborough Crescent Jn – Doncaster Loversall Carr Jn (Freight RUS Gap C) W9/W10/W12 gauge aspirations Elimination of Class 92 OHLE restrictions 775m train operations
10	Station gaps	Congestion relief at King's Cross Congestion relief at Finsbury Park Congestion relief at Peterborough Car parking and interchange with other transport modes Access to ECML from area around M25

6.4 Option definition and analysis

A number of general solutions are potentially relevant to all RUSs. The options considered to respond to the above are therefore drawn from the following "tool kit":

6.4.1 Generic Solution 1: Optimising timetables

Options for amending timetables can potentially yield additional capacity (for both freight and passenger services) without infrastructure enhancement.

6.4.2 Generic Solution 2: Train lengthening

These options potentially provide additional capacity relatively quickly, although they may require infrastructure works such as platform lengthening, track layout changes and additional stabling. In certain circumstances it may be possible to utilise selective door opening (SDO) at "difficult" or lightly used stations to reduce the infrastructure cost, though this is not always possible or desirable.

Train lengthening options can also apply to freight trains, though this will often require increasing loop lengths, with 775m being the target on many freight arteries. Gauge enhancement on routes where well wagons are used for high gauge intermodal traffic allows better use of existing train length as a large proportion of the length of well wagons cannot be used for the load.

6.4.3 Generic Solution 3: Train configurations

These options are based on achieving an appropriate balance between seated and standing capacity (for short distance journeys) or first and standard class accommodation and catering facilities (for long distance services). They can be a relatively simple way of providing additional capacity, particularly when new vehicles are being introduced.

6.4.4 Generic Solution 4: Routeing alternatives

Changing the routeing of a train can free up capacity on the original route. However, in many cases this will result in an increased journey time for the diverted train. This option only works where diversionary routes have sufficient capacity and capability.

6.4.5 Generic Solution 5: Infrastructure works

The provision of additional tracks, signalling, platforms, improved junctions or other infrastructure (including loops, enhanced gauge and route availability) may be an appropriate means of accommodating growth or dealing with an existing constraint.

6.4.6 Generic Solution 6: Engineering access

This option is based on optimising engineering access to ensure that there is an appropriate balance between asset management policies (including safety) and the impact of engineering work on train services. Whilst there are standard industry processes for such issues, there may be specific issues of strategic relevance that need considering through a RUS. This is particularly likely if additional services are proposed in the late evening or at a weekend. Increased levels of access for freight trains at night can assist with growth.

6.4.7 Generic Solution 7: Demand management

These options consider opportunities to influence demand where there is peak crowding but spare capacity exists in the shoulder peaks.

6.4.8 Assumptions underlying option generation

It should be noted that the option generation process is intended to identify the overall service level that is required and any supporting changes to infrastructure, rolling stock or operational methods. It is not intended to prejudge path allocation between operators or potential operators. This would be subject to established standard industry processes.

6.4.9 Assessment of options

A number of the options proposed in the RUS have been assessed using output from various models. Options which examine increasing LDHS services on ECML were modelled using PLANET Strategic. Options relating to London & South East services have drawn on analysis produced by TfL using Railplan. The majority of non-London options or performance options were modelled using outputs from MOIRA except for train lengthening options which were based on bespoke modelling of TOC loading data where available. These models are described in Section 5.2.2.

Each assessed option has followed DfT guidance including the application of recommended standard rail industry values to estimate associated costs and benefits. TfL's assessments are based on Railplan and the outputs of these have been converted, as far as possible, to meet with DfT business case requirements. Additionally, for options in Scotland, assessment has been carried out using STAG principles as far as practical (STAG requires the consideration of transport solutions from all modes to resolve identified problems, but the RUS process is not remitted to consider non-rail options).

Each assessment is presented on a stand alone basis unless described otherwise. For example, dependent options may require another option to be implemented first; or strategic options seek to combine various individual options together as part of an overall strategy. Much work was done to establish the feasibility of implementing options where timetabling and performance were considered critical to the option. In these cases the costs of additional infrastructure required to mitigate any estimated performance impact has been included particularly if re-timetabling was not a possible solution.

A number of assumptions have been made when evaluating the options presented:

- Options which involve timetabling solutions have been appraised over 10 years.
- Options which involve additional rolling stock have been appraised over 30 years.
- Options which require additional infrastructure have been appraised over 60 years.
- A number of start years have been assumed depending on the type of option. These range between 2008 and 2013.
- The replacement costs of any life expired assets, particularly applicable to 60 year appraisals, has not been included in the costs.
- Cost estimates include conversion to market prices and an adjustment to reflect optimism bias.
- Non-user benefits and an estimate for other Government impacts (such as the effect on fuel duty collected by the Exchequer) has been included except for options modelled using Railplan.
- Revenue transfer between TOC and the Government has been included where it is considered to have a significant impact on resulting benefit cost ratios.
- A simplified DfT BCR is calculated as follows:

$$\frac{\text{(User benefits + Non-user benefits)}}{\text{(Capital costs + Operating costs + Other govt impacts – Revenue)}}$$

6.5 Gap 1 - London inner suburban services

6.5.1 Summary of options responding to gap 1

The following options have been considered in response to the gap. These options have been tested to identify whether it is possible to deliver the following improvements:

- a reduction in crowding during the weekday commuter peak periods, particularly on the Hertford Loop
- an improvement in off-peak service levels.

Summary of options responding to Gap 1 (London inner suburban services)		
Option	**Description**	**Specific gap to be addressed**
1.1	Extension of all inner suburban peak services to six-car	Peak crowding and forecast growth
1.2	Run additional peak services on Hertford Loop to Moorgate	Peak crowding and forecast growth
1.3	Increase off peak inner suburban service to 4tph Monday to Saturday	Off-peak service levels
1.4	Increase inner suburban service to 4tph Sundays	Off-peak service levels
1.5	Run trains to/from Moorgate after 22:00 on weekdays and at weekends	Off-peak service levels
1.6	Reconfigure inner suburban rolling stock layouts	Peak crowding and forecast growth

6.5.2 Assessment of Option 1.1

Extension of all inner suburban peak services to six-car	
Concept	Previous sections have identified peak crowding and forecast growth on these services. A small number of shoulder peak trains on the Hertford/Welwyn Garden City routes are currently operated by a 3-car 313 or a 4-car 317. Under this option these services would be extended to 6-car. The option assumes use of four 313s currently in operation on the North London Line, since new rolling stock for that route is currently under construction.
Operational analysis	There is likely to be a slightly beneficial operational impact due to a reduction in station dwell times as crowding is eased.
Infrastructure required	None.
Passenger impact	This option would reduce existing crowding in the shoulder peak and is likely to facilitate some peak spreading, but it will not be sufficient to meet projected passenger growth on its own.
Freight impact	None.
Contribution to 2014 HLOS outputs	If implemented before 2014, this option would contribute to the three hour peak capacity target for Moorgate but would have minimal impact on the high peak hour target.

Financial and economic analysis	Appraisal of this option has shown it to have a good business case as shown in the table below.	
	30-year appraisal	**£million**
	Costs (Present Value)	
	Investment Cost	0.0
	Operating Cost	14.5
	Revenue	-7.2
	Other Government Impacts	2.1
	Total costs	**9.4**
	Benefits (Present Value)	
	Rail users benefits	23.4
	Non users benefits	2.3
	Total quantified benefits	**25.7**
	NPV	**16.3**
	Quantified BCR	**2.7**
	Note: All figures are presented in 2002 market prices.	
Dependencies with other options	None.	
Conclusion	It is recommended that this option is progressed as soon as the rolling stock becomes available.	

6.5.3 Assessment of Option 1.2

Run additional peak services on Hertford Loop to Moorgate	
Concept	Previous sections have identified peak crowding and forecast growth on inner suburban services, particularly from the Hertford Loop. At present 6-7tph operate on this route in the peak. The specific option tested has been for 3tph additional in the high peak (2tph in the shoulder peak).
Operational analysis	This option has potential to cause an adverse impact on performance for all service groups due to increased utilisation of the network between Alexandra Palace and Finsbury Park and a very high utilisation of capacity at Moorgate requiring a reduction in turn-around times. This impact would be partially mitigated by the infrastructure enhancements that are required to deliver the option.
Infrastructure required	There would be significant levels of infrastructure investment required to deliver this option, including conversion of the Up Goods line between Alexandra Palace and Finsbury Park for use by passenger trains, and additional signals to achieve four-minute headways on the Moorgate Branch. Power supply work in the inner London area would be necessary, but the cost of this is included within the Thameslink Programme.
Passenger impact	This option would provide a significant increase in capacity on Hertford Loop services which will contribute to a reduction in crowding.
Freight impact	Minimal, as freight trains do not run on this route section at peak times. There might be a small negative effect off-peak and contra-peak due to conversion of the Up Goods line for use by passenger trains.

Contribution to 2014 HLOS outputs	If implemented before 2014, this option would deliver the peak capacity increase to Moorgate specified in the 2007 DfT HLOS.
Financial and economic analysis	The RUS Draft for Consultation included a quantified socio-economic appraisal for this option with a BCR of 1.3. Further development work on the option revised both the anticipated costs for the infrastructure required and the value of the benefits. Analysis also revealed that infrastructure added to the scope would bring benefits to other train services that were not a part of the original appraisal. This relationship is explained more fully and quantified in Section 6.15.
Dependencies with other options	None.
Conclusion	This option would require significant infrastructure investment, which would generate benefits outside the definition of gap 1; this solution is therefore examined further in Section 6.15.

6.5.4 Assessment of Option 1.3

Increase inner suburban off peak service to 4tph Monday to Saturday	
Concept	This option is based on the Mayor of London's aspiration for all services within the London boundary to operate at 4tph frequency all day. At present off peak services operate at 3tph Monday – Friday daytime and 2tph evenings and most Saturdays. A minimum 4tph service would operate all stations to Welwyn Garden City and Hertford North between 0600 – 0030 Monday to Friday and 0730 – 0030 on Saturdays. In the descriptions below the following sub-options have been used: ■ Option 1.3a refers to Monday – Friday inter-peak ■ Option 1.3b refers to Monday – Friday evenings ■ Option 1.3c refers to Saturdays.
Operational analysis	This group of options has potential to cause an adverse impact on performance for all service groups due to increased utilisation of the network between Alexandra Palace and Finsbury Park and a reduction in turn-around times at Moorgate. Additional late evening services may also conflict with Rules of the Route maintenance work on the Welwyn route. On Saturdays Option 1.3c has potential to lead to pressures regarding platform capacity at King's Cross (unless combined with implementation of Option 1.5).
Infrastructure required	None assumed, though the implementation of a third Up passenger line between Alexandra Palace and Finsbury Park (as described in Section 6.15) would provide some performance benefit.
Passenger impact	These options would improve off-peak journey opportunities by making trains more frequent.
Freight impact	Minimal impact on freight traffic using either the Hertford Loop or the Welwyn route. On the Hertford line, even if a second passenger train per hour was extended to Stevenage, then there would be capacity for two freight trains per hour.
Contribution to 2014 HLOS outputs	If implemented before 2014, this option would contribute to passenger kilometre growth target for Route 8.

Financial and economic analysis	Appraisal of these options (as shown in the tables below) indicates that they would be financially positive ie. additional revenue generated would cover operating costs. It is not appropriate to calculate a BCR in these circumstances.	
	Option 1.3a (Monday to Friday inter-peak) 10-year appraisal	**£million**
	Costs (Present Value)	
	Investment Cost	0.0
	Operating Cost	5.3
	Revenue	-5.7
	Other Government Impacts	0.0
	Total costs	**-0.4**
	Benefits (Present Value)	
	Rail users benefits	13.1
	Non users benefits	0.0
	Total quantified benefits	**13.1**
	NPV	**13.5**
	Quantified BCR	**N/A**
	Note: All figures are presented in 2002 market prices.	

	Option 1.3b (Monday to Friday evenings) 10-year appraisal	**£million**
	Costs (Present Value)	
	Investment Cost	0.0
	Operating Cost	5.9
	Revenue	-7.5
	Other Government Impacts	0.0
	Total costs	**-1.7**
	Benefits (Present Value)	
	Rail users benefits	5.5
	Non users benefits	0.0
	Total quantified benefits	**5.5**
	NPV	**7.1**
	Quantified BCR	**N/A**
	Note: It was assumed services would run to/from King's Cross after 22:00	
	Option 1.3c (Saturdays) 10-year appraisal	**£million**
	Costs (Present Value)	
	Investment Cost	0.0
	Operating Cost	4.4
	Revenue	-5.1
	Other Government Impacts	0.0
	Total costs	**-0.8**
	Benefits (Present Value)	
	Rail users benefits	8.9
	Non users benefits	0.0
	Total quantified benefits	**8.9**
	NPV	**9.7**
	Quantified BCR	**N/A**
	Note: All figures are presented in 2002 market prices. These appraisals assume that no additional infrastructure is required and do not include any adverse performance effects. Other government impacts/non user benefits have not been calculated but are unlikely to change the recommendation.	
Dependencies with other options	None.	
Conclusion	It is recommended that this option group is developed further, to confirm the revenue and operating costs for different timetable options, and review any conflicts with engineering access requirements. The work should include examining the extension of a second Hertford Loop line service to Stevenage and the provision of a separate bay platform there.	

6.5.5 Assessment of Option 1.4

<table>
<tr><th colspan="4">Increase inner suburban service to 4tph on Sundays</th></tr>
<tr><td>Concept</td><td colspan="3">This option is based on the Mayor of London's aspiration for all services within the London boundary to operate at 4tph frequency all day. At present the normal Sunday service operates at 2tph from King's Cross to both Welwyn Garden City and Hertford North, but this service is reduced and/or replaced by buses on many occasions as a result of engineering work.
The 4tph service would operate all stations to Welwyn Garden City and Hertford North between 09:00 – 23:30 (every 30 minutes between 07:30 and 09:00).</td></tr>
<tr><td rowspan="4">Operational analysis</td><td colspan="3">As described under option 1.3, plus the following:
The need for engineering access on the ECML or the Hertford Loop on most Sundays makes delivery of this option problematic.
The following table shows the number of Sunday track possessions for engineering work in the 2006/07 timetable year:</td></tr>
<tr><td></td><td>ECML (Wood Green Jn - Langley Jn)</td><td>Hertford Loop</td></tr>
<tr><td>Sunday blocks per year</td><td>12</td><td>26</td></tr>
<tr><td colspan="3">It can be seen that the Hertford route is currently required quite frequently on Sundays for LDHS and outer suburban services, so there is very limited capacity available several weeks of the year for running additional stopping services. (Note, however, that Option 8.1 should alleviate this problem.)
An enhanced level of inner suburban service could not operate on the Welwyn route when a two-track railway timetable is in use.</td></tr>
<tr><td>Infrastructure required</td><td colspan="3">None.</td></tr>
<tr><td>Passenger impact</td><td colspan="3">This option would improve journey opportunities on Sundays by making trains more frequent.</td></tr>
<tr><td>Freight impact</td><td colspan="3">Minimal impact on freight traffic using either the Hertford Loop or Welwyn route, as overall service levels would be no greater than for Option 1.3.</td></tr>
<tr><td>Contribution to 2014 HLOS outputs</td><td colspan="3">If implemented before 2014, this option would provide a small contribution to passenger kilometre growth target for Route 8.</td></tr>
</table>

Financial and economic analysis	Appraisal of this option has shown a good economic case as shown below:	
	10-year appraisal	**£million**
	Costs (Present Value)	
	Investment Cost	0.0
	Operating Cost	4.1
	Revenue	-3.1
	Other Government Impacts	0.0
	Total costs	**1.0**
	Benefits (Present Value)	
	Rail users benefits	5.5
	Non users benefits	0.0
	Total quantified benefits	**5.5**
	NPV	**4.5**
	Quantified BCR	**5.5**
	Note: All figures are presented in 2002 market prices. Other government impacts non-users benefits have not been calculated but are unlikely to change the recommendation. This assessment assumed that a viable timetable is operable.	
Dependencies with other options	None.	
Conclusion	It is recommended that this option is not progressed at this stage, as it would not be deliverable for a substantial proportion of the year due to engineering work requirements. However, this is an opportunity for the 7-Day Railway initiative to examine.	

6.5.6 Assessment of Option 1.5

Run trains to/from Moorgate after 22:00 on weekdays and at weekends	
Concept	The Moorgate to Finsbury Park service does not currently operate during the late evening or weekends, services run into King's Cross instead during these times. Option 1.5a is based on serving Moorgate until the close of service on weekdays, providing better services to/from the City of London in the late evening to reflect recent increases in demand to the area. Option 1.5b is based on serving Moorgate at weekends.
Operational analysis	Option 1.5a has negligible operational impact as longer distance services have mostly left King's Cross at the times concerned but does, however, impact on current maintenance access on the Moorgate branch. Option 1.5b potentially has a beneficial operational impact, as it may alleviate platform capacity constraints at King's Cross.
Infrastructure required	None.

<table>
<tr><td>Passenger impact</td><td colspan="2">This option would provide a consistent service to the passenger at all times of the day and week. In addition, the cross-platform interchange at Highbury & Islington (from the Victoria line) would be available at all times.
However, the extensive station facilities available to passengers waiting for trains at King's Cross would not be available.</td></tr>
<tr><td>Freight impact</td><td colspan="2">Slightly positive, since freight trains do not run on the Moorgate branch, and capacity would be eased slightly between King's Cross Incline Junction and Finsbury Park.</td></tr>
<tr><td>Contribution to 2014 HLOS outputs</td><td colspan="2">If implemented before 2014, this option would provide a small contribution to Route 8 passenger kilometre target.</td></tr>
<tr><td>Financial and economic analysis</td><td colspan="2">Appraisal results (for Monday – Friday services after 22:00) are shown in the table below:</td></tr>
<tr><td></td><td>10-year appraisal</td><td>£million</td></tr>
<tr><td></td><td>Costs (Present Value)</td><td></td></tr>
<tr><td></td><td>Investment Cost</td><td>0.0</td></tr>
<tr><td></td><td>Operating Cost</td><td>1.7</td></tr>
<tr><td></td><td>Revenue</td><td>-0.3</td></tr>
<tr><td></td><td>Other Government Impacts</td><td>0.0</td></tr>
<tr><td></td><td>Total costs</td><td>1.4</td></tr>
<tr><td></td><td>Benefits (Present Value)</td><td></td></tr>
<tr><td></td><td>Rail users benefits</td><td>0.5</td></tr>
<tr><td></td><td>Non users benefits</td><td>0.0</td></tr>
<tr><td></td><td>Total quantified benefits</td><td>0.5</td></tr>
<tr><td></td><td>NPV</td><td>-1.0</td></tr>
<tr><td></td><td>Quantified BCR</td><td>0.3</td></tr>
<tr><td></td><td colspan="2">Note: All figures are presented in 2002 market prices. Other government Impacts non-users benefits have not been calculated but are unlikely to change the recommendation.
It can be seen from the above that this option has a poor business case as a stand alone scheme. This is due to the additional staffing costs on the Moorgate branch, which are assumed to be for an additional shift after 22:00.
In addition similar work undertaken by Transport for London shows that there is currently insufficient demand to the City of London at weekends to justify provision of this service on either Saturday or Sunday.</td></tr>
<tr><td>Dependencies with other options</td><td colspan="2">None.</td></tr>
<tr><td>Conclusion</td><td colspan="2">It is recommended that this option is not progressed in isolation at this stage as it does not offer value for money (although on Saturdays it may be required to facilitate other options which increase overall service levels into King's Cross). However, it should be kept under review as to whether it can be delivered more cost effectively, or if the market demand increases.</td></tr>
</table>

6.5.7 Assessment of Option 1.6

Reconfigure inner suburban rolling stock layout	
Concept	Some operators have responded to increasing levels of crowding by reconfiguring the interior layout of their rolling stock. This typically involves increasing the amount of standing space available by reducing the number of seats.
Operational analysis	Increasing the capacity of existing rolling stock can lead to increased dwell times in stations though this can be mitigated by careful design of door areas. However, it is not technically feasable to substantially increase the maximum load of the current rolling stock.
Infrastructure required	None identified.
Passenger impact	This proposal could potentially add between 20 percent and 30 percent capacity, depending on the style of reconfiguration, but would reduce the number of passengers who are able to get a seat on busy services. More passengers would therefore have to stand, and the length of the route over which standing would occur would increase.
Freight impact	None.
Contribution to 2014 HLOS outputs	If implemented before 2014, this option could deliver the Moorgate peak hour capacity targets.
Financial and economic analysis	The current appraisal methodology is not well suited for this option. While some benefit accrues to standing passengers, who will have more room in which to stand, an equal or greater disbenefit is experienced by those who no longer have a seat. Nevertheless, empirical evidence suggests that the relative values placed on sitting and standing by London commuters differ depending on the length of journey. Many people prefer to stand at the front of a train, rather than to sit at the rear, if this saves two or three minutes when exiting the station.
Dependencies with other options	None identified.
Conclusion	It is recommended that this option be considered only when new or additional rolling stock is procured, or existing stock becomes due for refurbishment. It should thus be evaluated when the Class 313 fleet is replaced.

6.5.8 Summary of appraisals responding to gap 1

The following themes emerge from the above analysis of options 1.1 – 1.6:

- Some limited reduction in overcrowding can be delivered in the short term by extending all shoulder peak inner suburban services to six cars. However, this will not be sufficient to meet the predicted growth.
- Limited improvements to off-peak services are possible without additional infrastructure. It should be noted that opening of the Moorgate branch on Saturdays may potentially be required (due to capacity constraints at King's Cross) to facilitate other service frequency increases.
- Additional peak trains could run if additional infrastructure is provided. With the platform length constraints on the tunnel section and the difficulty of modifying current rolling stock to increase capacity per vehicle, this is the only option that can provide sufficient capacity for expected growth by the end of the RUS period. This option would require significant infrastructure investment, which would generate benefits outside the definition of gap 1; this solution is therefore examined further in Section 6.15.

6.6 Gap 2 - London outer suburban services

6.6.1 Summary

The following options have been considered in response to the gap:

Summary of options responding to Gap 2 (London outer suburban services)		
Option	**Description**	**Specific gap to be addressed**
2.1	Use paths of King's Cross - Letchworth/ Royston inner suburban services north of Welwyn Garden City for additional outer suburban peak services	Peak crowding and forecast growth
2.2	Progressive implementation of 12-car outer suburban peak services	Peak crowding and forecast growth

These options have been tested to identify whether it is possible to deliver the following improvements:

- more efficient utilisation of the network over the critical two-track section north of Welwyn Garden City
- a reduction in crowding during the weekday commuter peak periods, particularly on the Cambridge line.

6.6.2 Assessment of Option 2.1

Use paths of King's Cross - Letchworth/Royston inner suburban services north of Welwyn Garden City for additional outer suburban peak services	
Concept	At present, a limited inner suburban peak service operates between King's Cross and Letchworth/Royston. These services use paths over the critical two-track section in the Welwyn North area, but are poorly loaded on this section due to longer journey times to/from London than the faster outer suburban services which are also available. Under this option these services would be curtailed at Welwyn Garden City. This would affect three trains in each of the morning and evening peaks. Meanwhile, previous sections have identified peak crowding and forecast growth on Cambridge line services. Under this option the rolling stock and paths through Welwyn North that would be freed by stopping inner suburban services at Welwyn could be reallocated to additional outer suburban services, which would be more highly loaded as a result.
Operational analysis	This option has the potential to improve performance, due to removing slower services from a critical section of the network. FCC has developed a timetable which aims to maximise the use of these paths to alleviate crowding.
Infrastructure required	Minor power supply enhancements and limited platform lengthening at Cambridge and Royston.
Passenger impact	A small number of journey opportunities between local stations would be removed. Journey opportunities into London would be retained on the faster services. Performance of other services would be expected to improve. This option would deliver a short term reduction in crowding on Cambridge line services. However this option will not be sufficient to meet projected medium term growth on this route on its own.
Freight impact	Minimal, since freight services do not operate in peak hours in the peak direction.
Contribution to 2014 HLOS outputs	This option is likely to be delivered in CP3 and would contribute to the peak capacity target at King's Cross.
Financial and economic analysis	Quantitative economic analysis of this option has not been carried out, though proposals have been developed by FCC (as a franchise commitment) which the DfT are considering. The crowding benefits are likely to mean that the option has a good economic case.
Dependencies with other options	None.
Conclusion	It is recommended that this option is progressed.

6.6.3 Assessment of Option 2.2

Progressive implementation of 12-car outer suburban peak services	
Concept	Previous sections have identified peak crowding and forecast growth on outer suburban services, particularly on the Cambridge line. Implementation of Option 2.1 would only provide limited additional capacity. Platform lengths on the Cambridge and Peterborough lines and power supplies in the London area restrict most services to 8-car.

Operational analysis	12-car services would need to operate into the main train shed at King's Cross, as platforms 9 – 11 cannot accommodate longer than 8-car. This option therefore has potential to impact on the LDHS timetable and may have adverse performance impacts due to fewer outer suburban services being able to use platforms 9 –11. In the morning, there is reasonable capacity for some 12-car arrivals at King's Cross prior to 09:00, before the main peak period for LDHS services commences. However, in the evening, the peak periods for LDHS and commuter services coincide. Therefore the evening is critical to 12-car platform capacity. Some additional capacity at King's Cross could be released by a reduction in the current long turnarounds of outer suburban services (but this could be expected to have some performance disbenefit). Currently, outer suburban services occupy two main train shed platforms throughout the peak, and so prior to completion of the Thameslink Programme, with successive departures from one platform every 20 minutes, six 12-car trains could operate per hour.
Infrastructure required	This option requires a major power supply upgrade in the London area, platform extensions on both the Peterborough and Cambridge lines to enable more 12-car trains to operate. Additional stabling and maintenance facilities will be required at Peterborough and Cambridge, and in the London area. A new island platform at Cambridge will be required, which is already recommended in the Greater Anglia RUS. Services for King's Lynn would split/join at Cambridge. See Chapter 4 for further details of these schemes. The option does not provide any additional physical 12-car platform capacity at King's Cross, though the implementation of the Thameslink Programme would allow the 10 paths per hour created under Option 2.1 to be operated as 12 cars, as most would operate via the Thameslink tunnel section via St Pancras International rather than to/from King's Cross.
Passenger impact	This option would deliver a further reduction in crowding on outer suburban services and meet predicted growth, with a 30 percent capacity increase from December 2015, and up to 50 percent following completion of the Thameslink Programme.
Freight impact	None.
Contribution to 2014 HLOS outputs	If implemented before 2014, this option would provide a significant contribution to the peak capacity targets at King's Cross.
Financial and economic analysis	As the Thameslink Programme is funded, no appraisal has been undertaken.
Dependencies with other options	None.
Conclusion	Due to the capacity constraint created by the two-track section through Welwyn North, the best option for accommodating the forecast passenger growth on outer suburban services is through progressive train lengthening, thereby making best use of track capacity and train crew resources. Much of the infrastructure work required for this will be provided by the Thameslink Programme, but needs to be brought forward to allow train lengthening at the earliest opportunity. The building of the connection to the Thameslink corridor in the Belle Isle area would not need to be brought forward.

6.6.4 Summary of appraisals responding to gap 2

The following themes emerge from the above analysis of options 2.1 – 2.2:

- Some limited reduction in overcrowding can be delivered in the short term (especially on the Cambridge line) by implementing a revised timetable, though this requires some minor infrastructure enhancements.
- Progressive implementation of 12-car outer suburban services requires additional infrastructure, but makes best use of track capacity on the main constraint of the two-track section through Welwyn North. It will deliver a further reduction in overcrowding, and meet likely future growth well into the next decade. Most of the infrastructure required is already funded through the Thameslink Programme, but some of the works need to be brought forward.

6.7 Gap 3 - Long distance high speed services

6.7.1 Summary

The following options have been considered in response to the gap:

Summary of options responding to Gap 3 (Long distance high speed services)

Option	Description	Specific gap to be addressed
3.1	Lengthening of the LDHS train fleet	Peak growth and forecast crowding
3.2	Implementation of a repeating standard hour timetable	Journey times between London, Yorkshire, the North East and Scotland Irregular service intervals Direct services to destinations on and off the main ECML Regional connectivity
3.3	Increase LDHS service at King's Cross to 8tph peak/6tph off peak	Peak growth and forecast crowding Journey times between London, Yorkshire, the North East and Scotland Irregular service intervals Direct services to destinations on and off the main ECML
3.4	Removal of intermediate stops in LDHS services	Journey times between London, Yorkshire, the North East and Scotland
3.5	Increase in linespeed on ECML	Journey times between London, Yorkshire, the North East and Scotland
3.6	Improved services to various destinations on and off main ECML	Direct services to destinations on and off the main ECML

These options have been tested to identify whether it is possible to deliver the following improvements:

- a reduction in crowding on LDHS services, particularly on longer distance services to the North East and Scotland
- a reduction in journey times on LDHS services between London, the north and Scotland
- standardised arrival and departure times for services throughout the day
- a regular service to the smaller stations on the route
- direct services and improved connections to towns and cities not directly on the ECML
- improved provision of freight paths over critical sections of the ECML.

6.7.2 Assessment of Option 3.1

Lengthening of the LDHS train fleet	
Concept	This option investigates inserting carriages into existing train sets to lengthen the current LDHS train fleet and thereby provide more seats per train.
Operational analysis	With additional unpowered vehicles there would be an adverse impact on acceleration and deceleration characteristics. In addition, the existing electric fleet cannot be extended as no suitable vehicles are available. If the longer trains could not be accommodated in all platforms that are currently capable of accommodating LDHS services this would impose a significant operational constraint.
Infrastructure required	Platform lengthening is likely to be required at certain locations. Depot reconfiguration works would be necessary.
Passenger impact	This option would not provide sufficient crowding relief to meet projected peak growth, as one extra coach would provide less than 15 percent extra capacity, significantly less than forecast growth.
Freight impact	None.
Contribution to 2014 HLOS outputs	If implemented before 2014, this option for lengthening LDHS trains could deliver around half of the HLOS target increase in peak capacity at King's Cross but there would be no scope to accommodate further growth in the remainder of the RUS period and beyond.
Financial and economic analysis	No specific assessment has been undertaken.
Dependencies with other options	None.
Conclusion	It is recommended that this option is not progressed, since it would not provide sufficient additional capacity to accommodate growth, and it is not deliverable with the current train fleets. However, it is recommended that opportunities are taken to maximise train lengths on all LDHS peak and shoulder peak train paths into and out of King's Cross, and thereby make best use of track capacity on the ECML and platform capacity at King's Cross. In the medium term, when the Intercity Express Programme (IEP) fleet is introduced, longer formations (as well as longer vehicles) should be considered.

6.7.3 Assessment of Option 3.2

Implementation of a repeating standard hour LDHS timetable	
Concept	The timetable structure on the ECML does not currently follow a regular repeating pattern. Services have a range of different calling patterns and hence varying journey times to their final destination. This option consists of a broadly repeating pattern of train services operating every hour or two hours (albeit with some peak hour differences), within the current quantum of train services.
Operational analysis	Implementation of a repeating standard hour has potential to improve capacity utilisation and timetable robustness. It may also allow a reduction in LDHS turnaround times at King's Cross, potentially freeing up capacity at this key constraint.
Infrastructure required	None identified.
Passenger impact	It has not been possible to develop an acceptable "standard hour" timetable specification based on the existing quantum of train paths that balances longer distance journey times with calling patterns south of Doncaster. This is because there are insufficient trains in the current quantum to provide a sufficient level of service to the smaller stations at the same time as providing for fast journey times between key centres. As a result, some direct journey opportunities would be removed by a repeating standard hour timetable, or longer distance journey times would increase. No crowding relief would be provided.
Freight impact	Standard freight paths will improve timetabling opportunities for freight services across a wide area and may unlock freight capacity especially in the southbound direction which has more conflicting movements. The critical factor on the ECML is the need for two freight paths in each LDHS off-peak hour between Peterborough and Doncaster (including a quantum of 60mph paths) as described in the Freight RUS. Even with a standard hour timetable it is not possible to create one 75mph and one 60mph path per hour on current infrastructure without increasing journey times for all services and worsening performance.
Contribution to 2014 HLOS outputs	Negligible.
Financial and economic analysis	No specific appraisal has been undertaken.
Dependencies with other options	None.
Conclusion	It is recommended that this option is not progressed in isolation (i.e. for the current level of services), since it would provide insufficient capacity to cater for predicted peak passenger growth or freight growth, and is likely to lead either to the removal of some established direct links or increased journey times. In addition, the industry lead times for a major timetable implementation project of this nature are such that an increased level of service would be required by the time that any new timetable could be implemented.

6.7.4 Assessment of Option 3.3

Increase LDHS service at King's Cross to 8tph peak/6tph off peak	
Concept	Previous sections have identified high levels of forecast growth on LDHS services, especially between London and Yorkshire. This will exacerbate existing peak crowding problems into and out of King's Cross. This option considers the impact of an increased service level to 8tph (peak) and 6tph (off-peak).

<table>
<tr><td>Operational analysis</td><td>An increase in the number of LDHS trains every hour is the only way to allow some of the longer distance trains to be accelerated while maintaining the number of calls at intermediate stations. It would allow greater segregation of services into distinct groups to serve key markets:
■ fast services between Scotland, the North East and London, with few stops and competitive overall journey times
■ fast services between Leeds and London
■ regular stopping services serving the smaller stations between Peterborough and Doncaster (Grantham, Newark North Gate and Retford)
■ services to provide links between London and the intermediate stations on the northern half of the route, such as Northallerton, Durham and Darlington
■ services to destinations off the main ECML.
The current level of freight traffic during the main hours of operation of LDHS services (06:00 – 20:00) requires provision of one path per hour in a standard pattern off-peak timetable. Actual path utilisation is typically seven trains each way out of 11 paths available in the off-peak hours. Timetable analysis has shown that there is insufficient capacity on the main line between Peterborough and Doncaster to increase the level of off-peak LDHS service to 6tph and accommodate 1tph for today's level of freight services without worsening freight and passenger journey times and performance.
Additional track capacity between these locations would be necessary to accommodate the increase in LDHS services alongside current freight services, so alternatives were considered alongside the freight outputs required from Option 9.3.
During the LDHS peak period, the critical part of the route is the section between Peterborough and King's Cross (Specifically: the two-track section between Digswell and Woolmer Green; Cambridge Junction at Hitchin; and platform capacity at King's Cross). Infrastructure investment is therefore required to deliver both the peak and the off-peak outputs in this option.</td></tr>
<tr><td>Passenger impact</td><td>See section 6.15.3 assessment of Option C.</td></tr>
<tr><td>Freight impact</td><td>See section 6.15.3 assessment of Option C.</td></tr>
<tr><td>Contribution to 2014 HLOS outputs</td><td>If implemented before 2014, this option would deliver about half the peak capacity increase to King's Cross and potentially all of the ECML Route capacity increase specified in the 2007 DfT HLOS.</td></tr>
<tr><td>Financial and economic analysis</td><td>The following figures are an indication of the significant benefits possible from the quantum increase to 6tph off peak and 8tph peak:
<table><tr><td>30-year analysis</td><td>£million</td></tr><tr><td>Benefits (Present Value)</td><td></td></tr><tr><td>Rail users benefits</td><td>580</td></tr><tr><td>Non users benefits</td><td>60</td></tr><tr><td>Total quantified benefits</td><td>640</td></tr></table>Note: All figures are presented in 2002 market prices
Of course, this figure does not include any of the costs or disbenefits associated with the increase in LDHS services, which in simple terms would appear as a significant negative performance effect, or significant infrastructure investment, or some element of both.</td></tr>
<tr><td>Dependencies with other options</td><td>Passenger growth on this route section will require infrastructure investment, so solutions should be developed in conjunction with the freight outputs identified in Option 9.3 and the network flexibility outputs identified in Option 8.4.</td></tr>
<tr><td>Conclusion</td><td>Solutions should be developed to accommodate both the freight and passenger outputs required from this section of the network.
This process is described in Section 6.15.</td></tr>
</table>

6.7.5 Assessment of Option 3.4

Removal of intermediate stops in LDHS services	
Concept	This option would potentially provide for a reduction in end to end journey times between London, the north and Scotland by reducing calls at intermediate stations on longer distance trains. It is recognised that there is a need to balance the benefits of reducing journey times with a need to provide an appropriate level of calls at intermediate stations and maintain direct journey opportunities. This option is based around the detailed consideration of the various alternative stopping patterns that could be adopted within the current quantum of train service. Each station call adds around five minutes to the end to end journey times.
Operational analysis	Removal of intermediate stops would require a wider timetable recast as the trains would no longer be in their current timetable paths at critical locations where they interact with other services. Calling patterns between Peterborough and Doncaster are particularly significant, since this mainly two-track section has poor facilities for fast services to overtake slower ones or freight.
Infrastructure required	None identified, although at some locations, infrastructure improvement might reduce the impact of station calls, eg. Peterborough and Darlington.
Passenger impact	This option has potential to speed up journeys between London, the North East and Scotland, but would reduce journey opportunities to the smaller stations on the route.
Freight impact	Dependent on calling pattern adopted and how LDHS trains are ‘grouped’.
Contribution to 2014 HLOS outputs	Negligible.
Financial and economic analysis	No specific appraisal work has been carried out.
Dependencies with other options	None.
Conclusion	It is recommended that this option is not progressed within the current quantum, since it would require a significant reduction in services at the smaller stations. In addition, the industry lead times for a major timetable implementation project of this nature are such that an increased level of service would be required by the time that any new timetable could be implemented.

6.7.6 Assessment of Option 3.5

Increase in linespeeds on ECML	
Concept	Increasing linespeeds on the ECML offers an opportunity to reduce LDHS journey times to Scotland and the north. There is a need to identify future speed requirements, plus acceleration and braking characteristics, so as to inform the IEP.
Operational analysis	An increase in linespeed would increase the differential between the fastest and slowest services operating on the route. This would exacerbate several existing capacity constraints, but for the purpose of assessing this option it is assumed not to affect slower existing services on the route.
Infrastructure required	Significant infrastructure investment would be required to enable services to run at 140mph. However speeds between the current 125mph maximum and this figure may be worth considering, as may increasing some lower speed restrictions.
Passenger impact	Reduced journey times would, other factors held equal, stimulate demand and increase crowding.

Freight impact	Freight growth could be adversely affected by the capacity effect of the increased speed differential. Unless combined with other options to increase capacity, this option could threaten the delivery of forecast freight growth.
Contribution to 2014 HLOS outputs	If implemented before 2014, this option would contribute to increased passenger kilometre targets.
Financial and economic analysis	Network Rail's analysis indicates that there would be a large economic benefit from improving linespeeds on the ECML. As an indication the benefits associated with a one minute journey time improvement on various sections of the route have been estimated. From this the associated maximum level of capital expenditure that could be supported to achieve good value for money (a minimum BCR of 2) can be estimated:

Appraisal of:	one-minute journey time reduction
Growth assumption:	4 percent growth p.a. 2006-16, 2 percent p.a. 2017-26
Appraisal period:	60 years
BCR:	2

Route Section	**£m**
Peterborough - Huntington	105
Peterborough - Grantham	95
York - Darlington	55
Doncaster - Adwick	35
Newcastle - Morpeth	20

Note: all figures shown in 2007 factor prices before optimism bias is applied

It should be noted that this appraisal assumes that all passengers travelling over these core sections of route would benefit from the linespeed improvement, regardless of train operator or where they joined the ECML. In practice not all passengers may benefit from journey time improvements, and this will depend on the type of infrastructure option being proposed. For example speed improvements close to a station will only benefit passengers on non-stop services or if the new speed is in excess of 100mph only passengers on LDHS would benefit. The figures shown above are indicative of the overall maximum levels that could be spent if all passengers benefit from the journey time improvement over the described sections. Any proposed infrastructure option must always aim to find the most cost efficient solution to deliver any journey time benefits.

Dependencies with other options	None.
Conclusion	It is recommended that further work is undertaken on this option, in conjunction with improvements to infrastructure capacity and the IEP.

6.7.7 Assessment of Option 3.6

Improved services to various destinations on and off the main ECML	
Concept	There is potentially demand for LDHS services (mainly to London) at stations serving major towns and cities not directly on the ECML. Particular examples of such locations include Hull, Harrogate, Skipton, Bradford, Halifax, Huddersfield, Sunderland, Middlesbrough, Grimsby and Lincoln. These can potentially be served either by direct services or by connections. Some have a limited number of direct services to London at present, whilst others have none. Additionally, there may be demand for a different level of service to some destinations that are located on the main ECML, such as Leeds, York, Newcastle and Edinburgh.

Operational analysis	Any direct services to destinations not on the main ECML would need to fit into the overall quantum of trains in Option 3.3, as would additional services to destinations on the ECML. Where stations are not served directly by LDHS services, development of a standard hour LDHS timetable would enable connections to be improved, as most local services currently operate to a standard hour.
Infrastructure required	No specific enhanced infrastructure requirements have been considered (for diesel services), though some locations covered by this RUS may require platform lengthening and infrastructure enhancement may be necessary on routes to destinations outside the geographic scope of this RUS.
Passenger impact	The options of providing direct services to towns and cities not currently served by trains to/from London and revising service levels to those that do currently have such connections have the potential to deliver passenger benefits. The overall crowding impact of such options would be dependent on the destinations served and calling pattern. The option of improving connections to towns and cities not currently served by trains to/from London also has some potential to deliver passenger benefits.
Freight impact	Potential negative impact, dependent on destination and frequency.
Contribution to 2014 HLOS outputs	If additional train miles were introduced before 2014, this option could contribute to the ECML Route capacity increase specified in the 2007 DfT HLOS.
Financial and economic analysis	No specific appraisals have been carried out by the RUS on this option. It would be possible, where appropriate, to make recommendations following DfT appraisal criteria using standard rail industry models. However these models are considered by many stakeholders to be poor at forecasting demand where direct services to London do not currently exist.
Dependencies with other options	None.
Conclusion	It is recommended that, subject to issues from the above analysis and the preservation of at least the existing frequency on all significant flows, the market will largely decide the ultimate destinations of LDHS services. Any final allocation of paths would be determined through the usual industry processes.

6.7.8 Summary of appraisals responding to Gap 3

The following themes emerge from the above analysis of options 3.1 – 3.6:

- Lengthening of existing LDHS trains would be very difficult to achieve and would not provide sufficient capacity to cope with predicted growth. However it is important that opportunities are sought to maximise the length of all peak services into and out of King's Cross. The IEP programme (referred to in 4.6.1) will determine the optimum future length(s) for LDHS trains, taking into account infrastructure characteristics both on the ECML and elsewhere.

- An increase in train service levels to 8tph (peak) and 6tph (off peak) has potential to alleviate overcrowding, cater for growth, reduce journey times between London, the north and Scotland and provide acceptable stopping patterns at the smaller stations. The scale of potential benefits that are generated by moving to such a timetable is high. However, significant infrastructure investment may be required in order to maintain or improve performance and journey times. This is discussed further in Section 6.15.
- Development of a standard pattern timetable, based on the current LDHS train quantum, would not provide any extra passenger capacity and would remove certain direct journey opportunities. However, a standard pattern timetable repeating every one or two hours would provide a number of benefits when combined with an increased quantum of services.

6.8 Gap 4 - ECML north service pattern

6.8.1 Summary

The following options have been considered in response to the gap:

Summary of options responding to Gap 4 (ECML north service pattern)

Option	Description	Specific gap to be addressed
4.1	York to Newcastle: Improvements to the spread of services	Irregular service intervals Stopping patterns at smaller stations
4.2	Newcastle to Edinburgh: Improvements to the spread of services	Irregular service intervals Stopping patterns at smaller stations
4.3	Newcastle to Edinburgh: Semi fast service	Stopping patterns at smaller stations Increase in local services in Scotland
4.4	Additional Dunbar stops in LDHS services	Stopping patterns at smaller stations Increase in local services in Scotland
4.5	Berwick-upon-Tweed to Edinburgh local service, with new stations at East Linton and Reston	Stopping patterns at smaller stations Increase in local services in Scotland
4.6	Half hourly North Berwick to Edinburgh service	Stopping patterns at smaller stations Increase in local services in Scotland
4.7	New Down platform at Dunbar	Stopping patterns at smaller stations Journey times between London, Yorkshire, the North East and Scotland
4.8	New Dunbar - Edinburgh hourly service	Stopping patterns at smaller stations Increase in local services in Scotland Funder's aspirations

These options have been tested to identify whether it is possible to deliver the following improvements:

- an improved spread of services between York and Edinburgh
- improved local services north of Newcastle
- additional calls at Dunbar.

Options related primarily to Scottish issues have been presented according to Scottish Transport Appraisal Guidance (STAG) criteria.

6.8.2 Assessment of Option 4.1

York to Newcastle: Improvements to timetable spread	
Concept	Services between York, Darlington, Durham and Newcastle are currently operated by a mixture of the following: ■ LDHS services to London ■ Cross country services to the Midlands and beyond (operating alternately via Leeds and Doncaster) ■ Cross-Pennines services to the Manchester area. The above results in a frequent but irregular service pattern, exacerbated by the London services not being in a standard hour pattern. For example, although there are typically 4tph from Newcastle to Durham, there are long gaps of up to 35 minutes between services. The North East RPA recommended that consideration be given to improving the spread of these services, and to provide a 'turn up and go' service between key locations.
Operational analysis	The timing of LDHS services through this area is dependent on issues described under Options 3.2 – 3.6. The timing of cross country services through this area is dependent on national timetable issues, primarily determined by paths available in the Birmingham New Street area. The critical section is the mostly two-track section between Northallerton and Newcastle. Passenger services are often "flighted" through this area. This optimises the use of available capacity and, in particular, provides paths for freight services, but leads to a poorer service for passengers making intermediate journeys. It should be noted though that only a small proportion of journeys in this section are local journeys to such intermediate stations, with only 8 percent of journeys on trains immediately north of York and 20 percent immediately south of Newcastle falling in to this category. A standard hourly pattern for the London services would allow a regular pattern of passenger and freight services on this section. However, to have an even spread of services would require significant infrastructure investment, such as reopening the Leamside route, to provide robust freight paths with reasonable journey times, but the level of benefit would be limited to journeys both joining and alighting at or between York and Newcastle.
Infrastructure required	No specific infrastructure requirements identified at this stage.
Passenger impact	This option would improve services by making trains run at more consistent intervals. As a result it may have some potential to alleviate crowding at peak times.
Freight impact	Regular freight paths would need to be provided. Altering the gaps between passenger services may make this difficult. Routeing of freight traffic via alternative routes might be possible but only for certain flows due to the increase in journey time.
Contribution to 2014 HLOS outputs	Negligible.

Financial and economic analysis	No assessment has been undertaken.
Dependencies with other options	Linked to LDHS Option 3.3 and national timetable issues.
Conclusion	The spread of services will largely be determined by the development of future timetables but it is recommended that opportunities to optimise this spread should be considered within the constraints of the service mix. In particular, opportunities should be examined to reduce the gaps in the service at Durham.

6.8.3 Assessment of Option 4.2

Newcastle to Edinburgh: Improvements to timetable spread	
Concept	Services north of Newcastle are currently operated by a mixture of the following: ■ LDHS services to London ■ Cross country services to the Midlands and beyond (operating via Leeds) ■ a local service to Morpeth (with a very limited service of two trains per day each way extended northwards, forming the only service at Pegswood, Widdrington, Acklington and Chathill stations) ■ an hourly North Berwick to Edinburgh service (half hourly in the peaks and on Saturdays) This results in a service pattern between Newcastle and Edinburgh with some significant gaps. This option seeks to test improving the spread of these services. Particular consideration may be required regarding which services would serve stations such as Alnmouth, Berwick-upon-Tweed and Dunbar, since there is currently no pattern to these calls.
Operational analysis	The two-track section of this route has a mixture of services operating with varying speeds and characteristics. The timing of LDHS services through this area is dependent on issues described under Options 3.2 – 3.5. The timing of cross country services through this area is dependent on national timetable issues, primarily determined by paths available in the Birmingham New Street area.
Infrastructure required	No specific infrastructure requirements identified at this stage
Passenger impact	This option would improve services by making trains run at more consistent intervals.
Freight impact	Regular freight paths need to be included in any standard pattern. Altering the gaps between passenger services could make this difficult.
Contribution to 2014 HLOS outputs	Negligible.
Financial and economic analysis	No assessment has been undertaken.
Dependencies with other options	Linked to LDHS Option 3.3 and national timetable issues.

Conclusion	The spread of services will largely be determined by constraints elsewhere on the network and the development of future timetables, but it is recommended that opportunities to maximise this spread should be considered within the constraints of the service mix (particularly the balance between freight and passenger requirements). In particular, there are two recommendations: 1) The regular interval timetable departures from Newcastle and Edinburgh for 'fast' services should be as close as possible to 30 minutes apart. 2) Regular calls at Berwick-upon-Tweed should be maintained, with other intermediate calls being market driven (including the local commuter peaks). Outside the peaks, there should be no more than two calls between Newcastle and Edinburgh, to maintain the service pattern and journey times.

6.8.4 Assessment of Option 4.3

Newcastle to Edinburgh: Semi-fast service	
Concept	This option has been carried forward from the North East RPA. Introduction of a new two-hourly service between Newcastle and Edinburgh, calling at Morpeth, Alnmouth, Berwick-upon-Tweed and Dunbar was assumed. A variant on this option looked at operating an hourly service to replace the Morpeth and Chathill services and a few of the North Berwick peak services, and calling at two new stations, at Reston and East Linton.
Operational analysis	This potential service has not currently been proven operationally but the service in the variant option would have to be 'looped' somewhere in the Borders as it would need to be overtaken by a LDHS service. Relevant constraints are the mixture of passenger and freight services already operating over this two-track section, and timetabling constraints at Newcastle, Dunbar, and between Drem and Edinburgh.
Infrastructure required	No change assumed for the main option. A new Down platform at Dunbar would be advantageous for both options. The variant option requires new stations to be built at East Linton and Reston, with park-and-ride facilities at Reston.
Passenger impact	This option would improve journey opportunities between Newcastle and intermediate stations to Edinburgh, and allow some journey time reductions for LDHS services if their stopping patterns were adjusted. New stations at Reston and East Linton would create completely new journey opportunities.
Freight impact	Dependent on timetable solution.
Contribution to 2014 HLOS outputs	If implemented before 2014, this option would provide a small contribution to Route 8 passenger kilometres target.

Financial and economic analysis	The following table conforms to Scottish Transport Appraisal Guidance (STAG) criteria:	
	Environment Dedicated and improved frequency encouraging modal shift from less environmentally friendly modes, reducing road noise and pollution.	
	Safety Assists in reducing the risks of road accidents by encouraging modal shift.	
	Economy Three tests have been examined for this option: **(1)** A new two-hourly service pattern between Newcastle and Edinburgh. In this test, calls at Morpeth, Alnmouth and Dunbar (except some in the peak) were removed from LDHS services and journey times on associated Anglo-Scottish services were improved. However, this test resulted in a net financial loss and had a negative impact on rail user benefits. **(2)** An additional two-hourly service comprising a notional 2-car electric multiple unit between Newcastle and Edinburgh on top of the existing LDHS service pattern. **(3)** An additional hourly service using 4-car electric multiple units, integrated with the North Berwick services, between Newcastle and Edinburgh on top of the existing LDHS service pattern, additionally calling at new stations at Reston (with park-and-ride facilities) and East Linton. The results of tests 2 and 3 are shown below:	
	30-year appraisal, based on a 2-car semi-fast service	**£million**
	Costs (Present Value)	
	Investment Cost	0.0
	Operating Cost	31.1
	Revenue	-6.9
	Other Government Impacts	2.1
	Total costs	**26.3**
	Benefits (Present Value)	
	Rail users benefits	22.4
	Non users benefits	3.3
	Total quantified benefits	**25.7**
	NPV	**-0.6**
	Quantified BCR	**1.0**
	Note: All figures are presented in 2002 market prices	
	Sensitivity tests were carried out on the base case (shown above) as follows: (a) increasing the proposed train length from 2-car to 3-car. This resulted in a BCR of 0.7. (b) increasing the number of guards and drivers required to operate the services by 50 percent. This resulted in a BCR of 0.8.	

	60-year appraisal, based on a 4-car stopping service (including two new stations)	**£million**
	Costs (Present Value)	
	Investment Cost	8.9
	Operating Cost	92.2
	Revenue	-26.7
	Other Government Impacts	7.6
	Total costs	**82.0**
	Benefits (Present Value)	
	Rail users benefits	41.7
	Non users benefits	32.1
	Total quantified benefits	**73.8**
	NPV	**-8.2**
	Quantified BCR	**0.9**
	Note: All figures are presented in 2002 market prices	
	Integration Seeks to address North East RPA and Transport Scotland aspirations.	
	Accessibility and social inclusion Additional and more frequent services will enhance connectivity and improve local accessibility to all categories of users.	
Dependencies with other options	The new Down platform at Dunbar, Option 4.7, would probably be required though its costs are not included in the appraisals.	
Conclusion	It is recommended that this option is not progressed in isolation at this stage due to poor value for money of the sub-options as tested. However, elements of it could be considered as part of a package of proposals for east of Edinburgh local services, which could be investigated further by Transport Scotland through the multi-model STAG methodology.	

6.8.5 Assessment of Option 4.4

Additional Dunbar stops in LDHS services	
Concept	Dunbar has a relatively low level of service with some long gaps. This option tests whether there is a case for a significant increase in calls by LDHS London and/or cross country services at Dunbar. Provision of additional calls would be at the expense of increasing end to end journey times.
Operational analysis	All northbound trains calling at Dunbar must cross over the southbound line to use the single platform face. This restricts capacity and is a performance risk. Analysis has identified that the majority of LDHS services in the current timetable could stop at Dunbar with existing infrastructure, should this be justified, however there would be a performance disbenefit. A potential scheme to provide an additional platform at Dunbar is described in Appendix 4 and appraised as Option 4.7. This would remove performance issues associated with northbound calls at this station and would allow a small journey time saving for these services.

Infrastructure required	A new Down platform would allow a greater choice of services to call, reduce the northbound journey time disbenefit, and improve performance. As this would create benefits for existing services, this has been assessed separately as Option 4.7.
Passenger impact	This option would improve journey opportunities for passengers travelling to/from Dunbar. However, journey times for passengers between England and Scotland would be extended by the time taken to call at the station.
Freight impact	Minimal.
Contribution to 2014 HLOS outputs	Negligible.
Financial and economic analysis	Assessment of this option has shown that stopping a significant number of LDHS services at Dunbar would result in overall disbenefits as journey times would be extended.
Dependencies with other options	The new platform recommended as Option 4.7 would enable additional calls to be made without incurring a performance disbenefit.
Conclusion	The work has shown there is no case for a step-change in calls at Dunbar by existing services, but the market will identify where some additional calls could be justified.

6.8.6 Assessment of Option 4.5

Berwick-upon-Tweed to Edinburgh local service, with new stations at East Linton and Reston	
Concept	This option considers the introduction of a new local service between Berwick-upon-Tweed and Edinburgh, with additional stations at Reston (park-and-ride) and East Linton. The option is an aspiration of both Borders and East Lothian Councils.
Operational analysis	In order to make best use of track capacity and to reduce the requirement for additional rolling stock, the analysis assumed that one of the half-hourly North Berwick peak services is diverted to Berwick-upon-Tweed. This would give a half-hourly local service east of Edinburgh all day, although not all stations would be able to have a half-hourly off-peak service due to timetabling constraints, with alternate trains to North Berwick and Berwick-upon-Tweed. Analysis has identified that the main constraints relevant to this potential service are as follows: ■ the mixture of passenger and freight services already operating over this two-track section ■ timetabling constraints at Berwick-upon-Tweed, Dunbar and Edinburgh.
Infrastructure required	Additional stations at Reston (park-and-ride) and East Linton.
Passenger impact	This option would improve journey opportunities between Berwick-upon-Tweed and the busier intermediate stations to Edinburgh, but would reduce the number of peak services serving North Berwick. New journey opportunities would be created by the construction of two new stations.
Freight impact	Dependent on timetable solution.
Contribution to 2014 HLOS outputs	If implemented before 2014, this option would provide a small contribution to passenger kilometres targets.

Financial and economic analysis	The following table conforms to Scottish Transport Appraisal Guidance (STAG) criteria.	
	Environment The improved frequency of services would encourage a modal shift from less environmentally friendly modes, reducing road noise and pollution.	
	Safety The proposal would assist in reducing the risk of road accidents by encouraging a modal shift.	
	Economy Appraisal of this option is presented below. It includes the construction costs of and demand from a new station at East Linton and a park-and-ride station at Reston.	
	60-year appraisal	**£million**
	Costs (Present Value)	
	Investment Cost	9.4
	Operating Cost	78.5
	Revenue	-39.2
	Other Government Impacts	10.0
	Total costs	**58.7**
	Benefits (Present Value)	
	Rail users benefits	39.5
	Non users benefits	16.3
	Total quantified benefits	**55.8**
	NPV	**-2.9**
	Quantified BCR	**1.0**
	Note: All figures are presented in 2002 market prices	
	If no park-and-ride facilities are provided at Reston station then the fall in passenger demand reduces the BCR to 0.7.	
	Integration Seeks to address policy aspirations of both East Lothian and Borders Councils.	
	Accessibility and social inclusion Additional and more frequent services will enhance connectivity and improve local accessibility to all categories of users.	
Dependencies with other options	None.	
Conclusion	See conclusion for Option 4.6.	

6.8.7 Assessment of Option 4.6

North Berwick to Edinburgh half-hourly off-peak weekday service	
Concept	The North Berwick branch has approximately an hourly service off-peak on weekdays at present, but half-hourly in the peaks and on Saturdays. This option seeks to test whether there is a case for enhancing the service to half-hourly in the off-peak.

Operational analysis	Initial work has identified that the main constraints preventing a more regular service pattern on this route are as follows: ■ The non-standard pattern LDHS timetable. ■ Coal train movements between loading points in Scotland and Cockenzie power station.
Infrastructure required	No change assumed.
Passenger impact	This option would improve off-peak journey opportunities between North Berwick and intermediate stations to Edinburgh.
Freight impact	Dependent on timetable solution.
Contribution to 2014 HLOS outputs	If implemented before 2014, this option would provide a small contribution to passenger kilometres targets.
Financial and economic analysis	The following table conforms to Scottish Transport Appraisal Guidance (STAG) criteria:
	Environment Improved half-hourly frequency encouraging modal shift from less environmentally friendly modes, reducing road noise and pollution.
	Safety Assist in reducing the risks of road accidents by encouraging mode shift.
	Economy Appraisal of this option assumes that 4-car electric units, using the North Berwick resource base, would operate the service. The results, shown in the table below, indicates a poor business case for running the proposed additional off-peak service, due to insufficient demand to justify the costs:

10-year appraisal	**£million**
Costs (Present Value)	
Investment Cost	0.0
Operating Cost	6.7
Revenue	-1.2
Other Government Impacts	0.3
Total costs	**5.8**
Benefits (Present Value)	
Rail users benefits	3.6
Non users benefits	0.3
Total quantified benefits	**3.9**
NPV	**-1.9**
Quantified BCR	**0.7**
Note: All figures are presented in 2002 market prices	

	Integration Seeks to address East Lothian Council policy aspirations.
	Accessibility and social inclusion Additional and more frequent services will enhance connectivity and improve local accessibility to all categories of users.
Dependencies with other options	None.

Conclusion	The quantified BCR for this option is 0.7, indicating that every £1 spent generates only 70p in socio-economic benefits. It is unusual to proceed with a scheme that performs this poorly in economic terms, but attention must be paid to the unquantified factors. Such services should be further investigated by the local authorities or Regional Transport Partership concerned, in accordance with their priorities. Due consideration will need to be given to the impact of the service(s) on the ECML as a whole, including Option 4.3. Options 4.5 and 4.8 examine alternative improvements to local services east of Edinburgh. All three options are dependent on the future timetable pattern of LDHS Anglo-Scottish services and freight requirements. It is suggested that a full multi-model appraisal is undertaken before committing funds to this option. It may be possible to identify a stronger economic case for some of the outputs of this option by combining it with some of the other opportunities once the LDHS service pattern is established.

6.8.8 Assessment of Option 4.7

New Down platform at Dunbar	
Concept	Construction of an additional Down (northbound) platform at Dunbar.
Operational analysis	A number of high speed services either call at or pass through Dunbar station. An additional down platform would allow stopping services to be routed more quickly through the area as currently both Up and Down services share the same platform.
Infrastructure required	A new Down platform at Dunbar.
Passenger impact	If this option were implemented, passengers on northbound services calling at Dunbar could arrive one minute earlier at Dunbar or two minutes earlier at Edinburgh. LDHS services would also benefit from an improvement in performance as a result of the additional flexibility provided by the new platform.
Freight impact	This would be minimal.
Contribution to 2014 HLOS outputs	Negligible.
Financial and economic analysis	The following table conforms to Scottish Transport Appraisal Guidance (STAG) criteria:
	Environment Improved operational flexibility will reduce the number of services that will have to slow down and/or wait for platform availability. Hence, reducing waiting time to access a platform will reduce the environmental pollution generated from braking and reaccelerating unnecessarily.
	Safety Increases safety by reducing the risks generated by crossing movements currently being made to access the Up Dunbar platform.
	Economy An economic appraisal of this option is shown below. It is based on the assumption that passengers calling at Dunbar will experience a journey time reduction of one minute, either arriving at Dunbar, or between Dunbar and their final destination. Performance benefits have also been included.

Financial and economic analysis	**60-year appraisal**	**£million**
	Costs (Present Value)	
	Investment Cost	7.4
	Operating Cost	0.0
	Revenue	-4.7
	Other Government Impacts	1.2
	Total costs	**3.9**
	Benefits (Present Value)	
	Rail users benefits	7.5
	Non users benefits	2.4
	Total quantified benefits	**9.8**
	NPV	**5.9**
	Quantified BCR	**2.5**
	Note: All figures are presented in 2002 market prices. A sensitivity test on this option showed that halving passenger growth results in a BCR of 1.5.	
	Integration The construction of an additional platform at Dunbar may support proposals for local services from Edinburgh to Dunbar.	
	Accessibility and social inclusion Access to the second platform at Dunbar would be compliant with the DDA.	
Dependencies with other options	None.	
Conclusion	It is recommended that this option is progressed further as it provides additional flexibility on the ECML, improving journey times and performance in the area. The scheme is considered good value for money.	

6.8.9 Assessment of Option 4.8

Dunbar - Edinburgh hourly service	
Concept	Introduction of a new hourly service between Dunbar and Edinburgh, calling at Longniddry, Prestonpans, Musselburgh (and Drem and Wallyford in the peaks), and also at a new station, East Linton. This replaces some of the half-hourly peak services from North Berwick to Edinburgh, so service levels from Drem westwards would remain unchanged.
Operational analysis	With the current pattern of LDHS services, a substantially revised track layout at Dunbar is required to allow the service to turn back between the two main lines.
Infrastructure required	Construction of a new station at East Linton and a probably a turnback facility at Dunbar.
Passenger impact	This option would improve journey opportunities and frequency of trains between Dunbar and (in the off-peak) intermediate stations to Edinburgh. New rail journey opportunities will also exist from the new station proposed at East Linton.
Freight impact	Dependent on timetable solution.

Contribution to 2014 HLOS outputs	If implemented before 2014, this option would provide a small contribution to passenger kilometres targets.	
Financial and economic analysis	The following table conforms to Scottish Transport Appraisal Guidance (STAG) criteria:	
	Environment Improved frequency of services should encourage a modal shift from less environmentally friendly modes, reducing road noise and pollution.	
	Safety The proposal would assist in reducing the risks of road accidents by encouraging a modal shift.	
	Economy It is assumed that the service will be operated by a 4-car electric unit. The results of an economic appraisal are shown below:	
	60-year appraisal	**£million**
	Costs (Present Value)	
	Investment Cost	4.7
	Operating Cost	34.5
	Revenue	-20.8
	Other Government Impacts	5.3
	Total costs	**23.7**
	Benefits (Present Value)	
	Rail users benefits	28.6
	Non users benefits	8.7
	Total quantified benefits	**37.3**
	NPV	**13.6**
	Quantified BCR	**1.6**
	Note: All figures are presented in 2002 market prices. As a sensitivity test, doubling the number staff assumed necessary to operate this new service has been evaluated. This resulted in a BCR of 1. The appraisal does not include the cost of a new track layout at Dunbar. Unless the future pattern of LDHS services avoided the need for this then the associated costs would cause a significant reduction in the business case.	
	Integration This proposal seeks to address Transport Scotland's aspirations to increase services to stations east of Edinburgh, particularly in the off-peak.	
	Accessibility and social inclusion Additional and more frequent services will enhance connectivity and improve local accessibility to all categories of users.	
Dependencies with other options	Options 3.3 and 4.2 in terms of pattern of LDHS service in the Dunbar area in particular and Option 4.7 might provide a benefit.	
Conclusion	See conclusion for Option 4.6.	

6.8.10 Summary of appraisals responding to gap 4

The following themes emerge from the above analysis of options 4.1 – 4.8:

- The spread of services (London LDHS, cross country and Regional) north of York is largely driven by timetabling constraints on other parts of the network, but opportunities should be sought to improve the spread where this is possible within operational constraints.
- There is insufficient demand to justify provision of additional local services between Newcastle and Edinburgh as tested. Operational constraints would make implementation of this service problematic.
- There is an insufficient business case to justify provision of improved local services between North Berwick/Berwick-upon-Tweed and Edinburgh as tested. Operational constraints may make implementation of these improvements problematic.
- There is a better business case to consider operating an hourly Edinburgh to Dunbar service, including diverting one of the half-hourly North Berwick to Edinburgh peak and Saturday services to Dunbar, and opening a new station at East Linton at which this service can call, but only if future LDHS timetable patterns do not drive the need for a revised layout at Dunbar.
- There may be opportunities to combine elements of LDHS and local service changes over this section (which may require additional infrastructure) that would enable an improved case to be made for an overall package of improvements.
- Additional calls at Dunbar in LDHS services could be timetabled, should there be a market-driven case to do so. An additional northbound platform is potentially useful for any level of calls and, subject to an engineering solution that avoids reduction in the northbound linespeed, there is a business case for this based on current calls.

6.9 Gap 5 - South and West Yorkshire services

6.9.1 Summary

The following options have been considered in response to the gap:

Summary of options responding to Gap 5 (South and West Yorkshire services)

Option	Description	Specific gap to be addressed
5.1	Introduction of a new train service to serve Robin Hood Airport Doncaster Sheffield (RHADS).	Funder's aspirations
5.2	Provide additional capacity on the Sheffield/ Doncaster - Wakefield Westgate - Leeds corridor	Peak crowding into Leeds (services via Wakefield Westgate) Links between regional centres Funder's aspirations
5.3	Extension of Knottingley – Wakefield Kirkgate services into Wakefield Westgate and Leeds	Peak crowding into Leeds (services via Wakefield Westgate) Funder's aspirations
5.4	Improve South Yorkshire links to London via ECML or MML	Sheffield/Doncaster – London flows

These options require testing to identify whether it is possible to deliver the following improvements:

- specific proposals from SYPTE & WYPTE
- a reduction in crowding on peak services into Leeds (via Wakefield Westgate)
- provision of end-to-end services between Leeds and Sheffield via appropriate routes.

6.9.2 Assessment of Option 5.1

Introduction of a new train service to serve Robin Hood Airport Doncaster Sheffield (RHADS)	
Concept	Provision of a new train service between Doncaster and RHADS (on the Doncaster to Lincoln line). The potential new station could be served by a new shuttle service to Doncaster, and/or by just calling there with the relatively infrequent trains already operating on this route to/from Lincoln, or by increasing the level of this existing service. The airport is currently served by a bus service from Doncaster.
Operational analysis	The east side of Doncaster is not currently accessible from the Lincoln route. The west side of Doncaster station is operating close to capacity and any additional services could cause performance problems. Options to link trains serving the airport with services from Doncaster to Scunthorpe or Hull could assist with capacity problems, but also provide easier access to the airport for people in the Hull and Humber Ports City Region.
Infrastructure required	Provision of a new two platform station near the airport. Infrastructure changes may be required to enable trains to reverse here. Any additional services into Doncaster would increase the need for bi-directional signalling between the eastern side of the station and the Lincoln line. This scheme is described in Chapter 4.
Passenger impact	This option would improve access to RHADS.
Freight impact	Potential negative impact of any additional trains in the Doncaster area.
Contribution to 2014 HLOS outputs	If implemented before 2014, this option would provide a small contribution to passenger kilometres targets.
Financial and economic analysis	No analysis has been undertaken.
Dependencies with other options	None.
Conclusion	It is recommended that further consideration of this option is undertaken within the Yorkshire and Humber RUS, which is considering all the train services in the Doncaster area.

6.9.3 Assessment of Option 5.2

Provide additional capacity on the Sheffield/Doncaster – Wakefield Westgate – Leeds corridor	
Concept	Previous sections have highlighted that there is peak period crowding on the ECML corridor from Wakefield Westgate into Leeds. This option would provide increased capacity (more trains, longer trains or changes to stopping patterns) on this corridor. The Wakefield Westgate to Leeds corridor is currently served by a mixture of the following: ■ all stations Sheffield – Rotherham – Moorthorpe – Wakefield Westgate – Leeds services ■ cross country services from south of Sheffield, running fast to Wakefield Westgate, Leeds and beyond. ■ all stations Doncaster – Leeds service ■ LDHS trains from London via Doncaster to Leeds
Operational analysis	Timetable analysis has shown that there is capacity for an hourly Sheffield – Leeds service between Swinton Junction and Leeds but development of a timetable is constrained by the current non-standard pattern of the timetable. This option is subject to a path being available south of Swinton Junction through to Sheffield, which will be examined in the Yorkshire and Humber RUS. The Doncaster to Leeds route is congested, with a mixture of fast and slow services, and the Leeds station area is operating close to capacity. Any additional service on this route would have potential to create performance disbenefit. There is scope to lengthen Sheffield – Moorthorpe – Leeds services by providing additional vehicles, while replacing Class 321 units by Class 333 on the Doncaster local trains would also provide additional capacity. Both of these would require some platform extensions.
Infrastructure required	Some platform extensions to allow longer peak services are required. The scheme to enhance the layout and station facilities at Wakefield Westgate would provide mitigation to performance disbenefits.
Passenger impact	This option has potential to alleviate overcrowding on the ECML route into Leeds by providing additional local capacity. This option also has potential to provide additional Leeds – Sheffield services, which is an option being examined through the Yorkshire and Humber RUS.
Freight impact	Additional passenger services between Hare Park Junction and South Kirkby Junction would worsen the capacity gap identified in the Freight RUS.
Contribution to 2014 HLOS outputs	If implemented before 2014, this option would contribute to the peak growth target at Leeds.
Financial and economic analysis	No analysis has been undertaken.
Dependencies with other options	None.
Conclusion	Increasing capacity on this corridor needs to be examined in the Yorkshire and Humber RUS alongside all other routes into Leeds.

6.9.4 Assessment of Option 5.3

Extension of Knottingley – Wakefield Kirkgate services into Wakefield Westgate and Leeds	
Concept	Previous sections have highlighted that there is peak period crowding on the ECML corridor from Wakefield Westgate into Leeds. This option would provide increased capacity between Wakefield Westgate and Leeds by extending services which currently terminate at Wakefield Kirkgate into Leeds via Wakefield Westgate. This is also a West Yorkshire PTE aspiration.
Operational analysis	The main constraints relevant to this option are at Wakefield Kirkgate (where there is only a single platform available on the Down Goole line) and the single line of Westgate curve (between Wakefield Kirkgate and Wakefield Westgate). Analysis has shown that the above constraints make it impossible to path this option in the current timetable, and a full recast of the timetable would therefore be required. Analysis between Wakefield Westgate and Leeds has shown that there is theoretically capacity available for this option, but that the current pattern of the timetable does not allow a standard path to be found. The Doncaster to Leeds route is congested, with a mixture of fast and slow services, and Leeds station area operating at close to capacity. Any additional service on this route would have potential to create performance disbenefit.
Infrastructure required	No specific infrastructure requirements have been identified at this stage, though the scheme to enhance the layout and station facilities at Wakefield Westgate would provide mitigation to performance disbenefits.
Passenger impact	This option has potential to alleviate overcrowding on the ECML route into Leeds by providing additional local capacity.
Freight impact	Dependent on any timetable solution to the operational issues above.
Contribution to 2014 HLOS outputs	If implemented before 2014, this option would contribute to the peak growth target at Leeds.
Financial and economic analysis	No analysis has been undertaken.
Dependencies with other options	None.
Conclusion	It is recommended that further consideration of this option is undertaken within the Yorkshire and Humber RUS.

6.9.5 Assessment of Option 5.4

Improve South Yorkshire Links to London via ECML or MML	
Concept	Previous sections have highlighted that demand between the Sheffield/ Rotherham/Doncaster area and London can potentially be catered for by either the MML or ECML. This option considers how to determine an appropriate split between the two routes to London in catering for this market.
Operational analysis	Both the ECML and MML routes suffer from congestion. Services from Doncaster to London are generally at least 30 minutes faster than services from Sheffield to London, and are more frequent.
Infrastructure required	Dependent on any solution chosen.

Passenger impact	Dependent on any solution chosen.
Freight impact	Dependent on any solution chosen.
Contribution to 2014 HLOS outputs	If implemented before 2014, this option would provide growth in passenger kilometres on either the ECML or MML.
Financial and economic analysis	No analysis has been undertaken.
Dependencies with other options	None.
Conclusion	As this is a strategic routeing issue of national importance, it is recommended that further consideration of this option is undertaken through the Network RUS.

6.9.6 Summary of appraisals responding to gap 5

The following themes emerge from the above analysis of options 5.1 – 5.4:

- Further work is required by forthcoming RUSs on these issues, primarily in the Yorkshire and Humber RUS where there may need to be increases in local and regional services on the Sheffield to Doncaster and Leeds corridors.

6.10 Gap 6 - Tees Valley services

6.10.1 Summary

The following options have been considered in response to the gap:

Summary of options responding to Gap 6 (Tees Valley services)

Option	Description	Specific gap to be addressed
6.1	Introduction of a new Sunderland – Hartlepool – Stockton – Darlington service	Schemes remitted from North East RPA
6.2	Extension or diversion of trans-Pennine services via the Durham Coast	Schemes remitted from North East RPA
6.3	Improved Tees – Tyne link (via the ECML)	Peak crowding into Newcastle Schemes remitted from North East RPA
6.4	Improved Tees – Tyne link (via the Durham Coast)	Peak crowding into Newcastle Schemes remitted from North East RPA
6.5	New stations on the Durham Coast	Schemes remitted from North East RPA
6.6	Reduction in Tees Valley and Durham Coast journey times by linespeed improvements or amendments to stopping patterns	Schemes remitted from North East RPA
6.7	Separation of Darlington – Bishop Auckland and Darlington – Saltburn services	Schemes remitted from North East RPA
6.8	Increasing peak capacity into Middlesbrough by train lengthening	Peak crowding into Middlesbrough Peak crowding into Middlesbrough

These options have been tested to identify whether it is possible to deliver the following improvements, which have mainly been carried forward from the North East RPA:

- provision of services from the Durham Coast line to the ECML, with various alternatives being considered:
  - **(1)** extending cross-Pennines services currently terminating at Middlesbrough
  - **(2)** diverting cross-Pennines services currently operating via the ECML to Newcastle
  - **(3)** provision of a new service from the Durham Coast to Darlington.
- improvements to journey opportunities between Newcastle and Teesside, via either the ECML or Durham Coast.
- a reduction in crowding on peak services into Middlesbrough
- new stations on the Durham Coast
- reduced journey times on the Tees Valley and Durham Coast lines.

6.10.2 Assessment of Option 6.1

Introduction of a new Sunderland – Hartlepool – Stockton – Darlington service	
Concept	Provision of a new hourly train service Sunderland (or Hartlepool) to Darlington via Stockton. This scheme was highlighted in the North East RPA.
Operational analysis	Analysis has indicated that the main constraint to pathing this potential service is the non-standard timetable pattern of the ECML. A new platform at Darlington (east of the main line) would remove the need for the crossing moves required. Chapter 4 shows a potential infrastructure improvement on the Durham Coast route which would add capacity.
Infrastructure required	No change assumed in the analysis. However, for the Sunderland option a shortened signalling section between Hartlepool and Dawdon will be required, and probably a new turnback facility at Sunderland.
Passenger impact	This option would improve journey opportunities to the Durham coast, with connections to ECML services at Darlington. In addition, the option would increase frequencies on parts of the Durham Coast line to half hourly.
Freight impact	Dependent on timetable solution.
Contribution to 2014 HLOS outputs	Small contribution to passenger kilometre targets.

Financial and economic analysis	Business case work is summarised below:	
	30-year appraisal, based on a Hartlepool - Darlington service (extending to Sunderland gives similar results before any infrastructure costs are added)	**£million**
	Costs (Present Value)	
	Investment Cost	0.0
	Operating Cost	17.6
	Revenue	-2.8
	Other Government Impacts	0.7
	Total costs	**15.6**
	Benefits (Present Value)	
	Rail users benefits	9.7
	Non users benefits	0.9
	Total quantified benefits	**10.6**
	NPV	**-5.0**
	Quantified BCR	**0.7**
	Note: All figures are presented in 2002 market prices	
	The above business case work has shown that there is insufficient demand to justify provision of this service. This conclusion is based on standard rail industry forecasting guidance and models; some stakeholders have expressed concern that these may not accurately reflect demand for new flows of this nature.	
Dependencies with other options	None.	
Conclusion	It is recommended that this option is not progressed at this stage due to poor value for money for the service as tested.	

6.10.3 Assessment of Option 6.2

Extension or diversion of cross-Pennines services via the Durham Coast	
Concept	Cross-Pennines services between Manchester Airport and the North East currently operate to the following general timetable pattern: ■ 1tph to Middlesbrough ■ 1tph to Newcastle via the ECML. This option seeks to provide improved services from the Durham Coast to York and beyond by testing the following: ■ extending the service terminating at Middlesbrough to the Durham coast (Option 6.2a), reversing at Middlesbrough ■ diverting the Newcastle service to run via the Durham Coast line instead of the ECML (Option 6.2b). The concept was highlighted in the North East RPA.
Operational analysis	Dependent on timetable solution. Appendix 4 shows potential infrastructure improvements on the Durham Coast route which would add capacity.

Infrastructure required	No change assumed in the analysis. However, for the Sunderland option a shortened signalling section between Hartlepool and Dawdon will be required, and probably a new turnback facility at Sunderland.	
Passenger impact	Both Options 6.2a and 6.2b would improve journey opportunities to the Durham Coast, with direct services from York and beyond. However, Option 6.2b would remove all direct trains between Newcastle and the Manchester area (via the ECML), leading to increased passenger journey times. In addition, both options would increase frequencies on the Durham Coast line to half hourly.	
Freight impact	Dependent on timetable solution.	
Contribution to 2014 HLOS outputs	Option 6.2a would provide a small contribution to passenger kilometre targets.	
Financial and economic analysis	Business case work for option 6.2a is summarised below:	
	30-year appraisal, based on extending the cross-Pennines service beyond Middlesbrough to Hartlepool (extending to Sunderland gives similar results before infrastructure costs are added)	**£million**
	Costs (Present Value)	
	Investment Cost	0.0
	Operating Cost	15.8
	Revenue	-2.4
	Other Government Impacts	0.7
	Total costs	**14.1**
	Benefits (Present Value)	
	Rail users benefits	8.5
	Non users benefits	0.8
	Total quantified benefits	**9.3**
	NPV	**-4.8**
	Quantified BCR	**0.7**
	Note: All figures are presented in 2002 market prices	
Financial and economic analysis (continued)	The above business case work has shown that there is insufficient demand to justify provision of this service. This conclusion is based on standard rail industry forecasting guidance and models; some stakeholders have expressed concern that these may not accurately reflect demand for new flows of this nature. Option 6.2b has also been considered. The analysis shows that the generalised journey time impact for passengers to Newcastle far outweighs the benefits.	
Dependencies with other options	None.	

Conclusion	It is recommended that Option 6.2a is not progressed at this stage due to poor value for money for the service as tested. It is recommended that Option 6.2b is not progressed due to the significant disbenefits relating to journey opportunities to Newcastle. With the introduction of Grand Central's Sunderland – London services the Durham Coast now has direct services to York. There may be opportunities to provide some infill services on some of the hours when the services do not run using marginal resources including those provided for peak hour train lengthening.

6.10.4 Assessment of Option 6.3

Improved Tees – Tyne link (via the ECML)	
Concept	Provision of a direct train service between Middlesbrough and Newcastle via Stillington and the ECML. This would result in a significant improvement on current journey times (over 75 minutes) between these major centres (to around an hour). This scheme was highlighted in the North East RPA.
Operational analysis	Services would need to operate on the mainly two track section of the ECML between Ferryhill and Newcastle which is already congested and therefore paths are unlikely to be available on many hours. Chapter 4 includes potential infrastructure changes on the Stillington branch. These would assist with this service.
Infrastructure required	Dependent on timetable solution.
Passenger impact	This option would provide significantly improved journey opportunities between the Tees and Tyne conurbations, with fast direct trains via the ECML. This option has some potential to reduce crowding by adding peak capacity into Newcastle.
Freight impact	Dependent on timetable solution.
Contribution to 2014 HLOS outputs	Peak capacity into Newcastle and small contribution to passenger kilometres targets.

Financial and economic analysis	Business case work is summarised below. It does not include any capital costs on the Stillington branch or consideration to improve capacity on the constrained Ferryhill to Newcastle section.	
	30-year appraisal, based on a Newcastle to Middlesbrough service via Stillington and the ECML	**£million**
	Costs (Present Value)	
	Investment Cost	0.0
	Operating Cost	28.3
	Revenue	-8.5
	Other Government Impacts	2.3
	Total costs	**22.2**
	Benefits (Present Value)	
	Rail users benefits	20.5
	Non users benefits	2.7
	Total quantified benefits	**23.2**
	NPV	**1.0**
	Quantified BCR	**1.0**
	Note: All figures are presented in 2002 market prices If it is assumed that there are no additional leasing costs (i.e. that additional units obtained for peak services could be used), the BCR rises to 1.4 over a 30 year appraisal period.	
	The above business case work has shown that there is insufficient demand to justify provision of this service. This conclusion is based on standard rail industry forecasting guidance and models. Some stakeholders have expressed concern that these may not accurately reflect demand for new flows of this nature.	
Dependencies with other options	None.	
Conclusion	It is recommended that this option is not progressed at this stage due to poor value for money for the service as tested.	

6.10.5 Assessment of Option 6.4

Improved Tees – Tyne link (via the Durham Coast)	
Concept	Provision of improvements to the train service between Middlesbrough and Newcastle via the Durham Coast. Services generally operate at hourly intervals at present, with typical journey times as follows: ■ 56 minutes between Middlesbrough and Sunderland ■ 75 minutes between Middlesbrough and Newcastle This option seeks to test running additional services and/or reducing journey times. This scheme was highlighted in the North East RPA.
Operational analysis	Dependent on timetable solution.

Infrastructure required	No change assumed in the analysis. However, Chapter 4 shows a potential minor infrastructure improvement which would add capacity that would be required for this option.	
Passenger impact	The option tested would increase frequencies on the Durham Coast line to half hourly. The additional services would be around 10 minutes quicker than the existing service for end-to-end journeys (based on current infrastructure) as these would not call at all stations.	
Freight impact	Dependent on timetable solution.	
Contribution to 2014 HLOS outputs	Peak capacity into Newcastle and small contribution to passenger kilometres targets.	
Financial and economic analysis	Business case work for additional services is summarised below:	
	30-year appraisal, based on an additional hourly Newcastle to Middlesbrough semi-fast service via the Durham Coast, assuming no infrastructure costs	**£million**
	Costs (Present Value)	
	Investment Cost	0.0
	Operating Cost	27.7
	Revenue	-7.2
	Other Government Impacts	2.0
	Total costs	**22.6**
	Benefits (Present Value)	
	Rail users benefits	20.1
	Non users benefits	2.8
	Total quantified benefits	**22.9**
	NPV	**0.4**
	Quantified BCR	**1.0**
	Note: All figures are presented in 2002 market prices. If it is assumed that there are no additional leasing costs (i.e. that additional units obtained for peak services could be used), the BCR rises to 1.3 over a 10 year appraisal period.	
	It was noted that there is a very low level of demand at certain stations on the Durham Coast route, an example being Seaton Carew. Hence as a separate sub-option, halving the number of calls at this station (based on the current hourly service) has been considered and may theoretically result in a net overall benefit due to reducing journey times for other passengers. The RUS did not consider closure as the benefits were unlikely to outweigh the costs of closure.	
Dependencies with other options	None.	
Conclusion	It is recommended that the option of increasing frequencies is not progressed at this stage due to poor value for money for the service as tested. It is recommended that the service level at lightly used stations on the Durham Coast line is not specified by this RUS, but is left to normal industry processes to determine.	

6.10.6 Assessment of Option 6.5

New stations on the Durham Coast	
Concept	This option seeks to test whether there is a case for up to four new stations on the Durham Coast line (Hart Village, Peterlee, Easington and Ryhope) to serve local developments. This scheme was highlighted in the North East RPA.
Operational analysis	Any new stations would increase the journey times of trains that call at them and so train paths may no longer work either due to conflicts with other services at junctions or turnround times being broken.
Infrastructure required	Construction of new two platform stations at the locations concerned.
Passenger impact	The stations would create new journey opportunities to/from the areas concerned. However, current long end-to-end journey times on the Durham Coast line would be increased further.
Freight impact	None identified.
Contribution to 2014 HLOS outputs	Negligible or negative.
Financial and economic analysis	Appraisal work (based on the high growth scenario described in section 5.5.1) has shown that there is insufficient demand to justify creating a new station at any of the locations identified in the RPA. The analysis has used Census data on travel to work patterns for the local areas concerned and compared these with similar locations on the Durham Coast with rail stations. This has shown that the stations would generate low levels of patronage and calls at them would lead to overall disbenefits due to extending journey times.
Dependencies with other options	None.
Conclusion	It is recommended that this option is not progressed at this stage due to poor value for money. If in future there is evidence of journey to work patterns changing along the Durham Coast, then this gap could be re-examined, prioritising Peterlee. If a developer or other funder wishes to consider providing a station then this should be examined in more detail using localised data and multi-modal analysis.

6.10.7 Assessment of Option 6.6

Reduction in Tees Valley journey times	
Concept	This option seeks to test reducing journey times in the Tees Valley either by reducing calls at lightly used stations or by undertaking infrastructure enhancement works. Train journeys between Darlington and Saltburn typically take around 52 minutes at present, and those from Newcastle to Middlesbrough via the Durham Coast typically take 75 minutes. This scheme was highlighted in the North East RPA.
Operational analysis	None identified.
Infrastructure required	Significant infrastructure investment would be required to increase linespeeds noticeably on the Tees Valley line. However, small scale increases are under investigation as part of planned track, signal and bridge renewals. Meanwhile, the Tees Valley Metro project is intended to deliver journey time improvements through infrastructure and rolling stock solutions.
Passenger impact	Any journey time improvements are likely to be minor.

Freight impact	None identified.
Contribution to 2014 HLOS outputs	Negligible.
Financial and economic analysis	No detailed appraisal of increasing linespeeds on these routes has been undertaken, as the cost and engineering practicality of enhancing the infrastructure has not been identified at this stage. As an indication, the benefits associated with a one minute journey time improvement on the sample route sections described below have been assessed. From this, it is possible to estimate the associated maximum level of capital expenditure that could be supported to achieve good value for money (a BCR of 2). It should be noted that these estimates assume all passengers travelling over the sections of route would benefit from the linespeed improvement, regardless of the train operator or where they joined the route section. In practice not all passengers may benefit from journey time improvements, as this will depend on the type of infrastructure option being proposed.
	Appraisal of: 1-minute journey time reduction Growth assumption: 3.7 percent growth p.a. 2006 – 16, 1.85 percent p.a. 2017 – 26 Appraisal period: 60 years BCR: 2
	Route Section / **£m CAPEX** Middlesbrough - South Bank / 4 Darlington – Dinsdale / 3
	Note: *All figures shown in 2007 factor prices before optimism bias* There is a very low level of demand at certain stations, notably Redcar British Steel and South Bank (though these stations are only served by two and six trains per day each way respectively). Closure of these stations has been assessed and is considered likely to result in net benefits due to reducing journey times for other passengers using the route. However, the associated benefits and disbenefits for either station would be relatively minor and so the RUS is not recommending closure unless significant expenditure becomes due.
Dependencies with other options	None.
Conclusion	It is recommended that the option of increasing linespeeds is considered as renewals become due on these routes or as part of the Tess Valley Metro project.

6.10.8 Assessment of Option 6.7

Separation of Darlington – Bishop Auckland and Darlington – Saltburn services	
Concept	This option seeks to split the current Saltburn – Darlington – Bishop Auckland service into two separate services. This scheme was highlighted in the North East RPA.
Operational analysis	There are no bay platforms at the north end of Darlington, making platforming of a separate Bishop Auckland service problematic.
Infrastructure required	A new north facing bay platform is likely to be required.
Passenger impact	Through journey opportunities across Darlington would be removed. Benefits would only arise if frequencies were increased east of Darlington.
Freight impact	None identified.

Contribution to 2014 HLOS outputs	Negative.
Financial and economic analysis	This scheme would have a very poor business case, due to no major benefits being identified.
Dependencies with other options	None.
Conclusion	It is recommended that this option is not progressed at this stage as no major benefits have been identified and infrastructure enhancement is likely to be required. The proposals of the Tees Valley Metro project relating to services east of Darlington must take the Bishop Auckland service into account.

6.10.9 Assessment of Option 6.8

Increasing peak capacity into Middlesbrough by train lengthening	
Concept	Previous sections have identified that there is peak period crowding on local services into Middlesbrough. The option considered for dealing with this problem was running longer trains.
Specification assessed	This option comprises the provision of vehicles to lengthen selected peak hour trains. Additional vehicles are assumed to be class 170 stock with an average of 66 seats per vehicle. All platforms are long enough to accommodate 3x23m vehicles except British Steel Redcar where Selective Door opening could be used. Extra depot capacity required can be provided within the current facilities at Heaton.
Operational analysis	The analysis of lengthening trains in this area is based on developing a case for adding an additional vehicle. In practice, individual trains would not (and in most cases could not) be lengthened simply by adding a single additional vehicle to the existing formation. The deployment of new rolling stock, and the optimal matching of capacity to demand, would be likely to require cascades of rolling stock between routes. The effect of platform lengths will need to be taken into account in the deployment plan.
Infrastructure required	Depends on rolling stock deployment plan.
Passenger impact	Reducing crowding levels on peak services into Middlesbrough.
Freight impact	None identified.
Contribution to 2014 HLOS outputs	None.
Financial and economic analysis	A combined appraisal for Options 6.8 and 7.1 is shown in Option 7.1.
Dependencies with other options	None.
Conclusion	It is recommended that nine additional vehicles are included in the DfT Rolling Stock Plan for the Newcastle and Middlesbrough peaks. The Tees Valley Metro project is planning to increase the frequency of services between Darlington and Saltburn, hence overlapping with this proposal.

6.10.10 Summary of appraisals responding to gap 6

The following themes emerge from the above analysis of options 6.1 – 6.8:

- there is insufficient demand to justify provision of a new service between the Durham Coast and Darlington
- there is insufficient demand to justify cross-Pennines services operating via the Durham Coast, either by extending services that currently terminate at Middlesbrough, or by diverting services that currently operate via the ECML
- there is insufficient demand to justify provision of an improved Tyne – Tees link via either the EMCL or the Durham Coast.
- there is insufficient demand to justify provision of additional stations on the Durham Coast route though third party funded station schemes would be worth examining
- there are insufficient benefits to justify separating out Darlington – Bishop Auckland and Darlington – Saltburn services
- small scale linespeed improvements on the Tees Valley line could potentially be delivered as track, structures and signalling on the route become due for renewal and opportunities should be examined as part of the Tees Valley Metro project
- peak crowding and growth into Middlesbrough could be addressed by the lengthening of some existing services

6.11 Gap 7 - Tyneside local services

6.11.1 Summary

The options in the table below have been considered in response to the gap.

Note also that Options 6.3 and 6.4 in the previous section are relevant to 7.1 as they would provide additional services into Newcastle.

Summary of options responding to Gap 7 (Tyneside local services)

Option	Description	Specific gap to be addressed
7.1	Increasing peak capacity into Newcastle by train lengthening	Peak crowding into Newcastle
7.2	Reduction in Tyne Valley line journey times by linespeed improvements or amendments to stopping patterns	Schemes remitted from North East RPA

6.11.2 Assessment of Option 7.1

Increasing peak capacity into Newcastle by train lengthening	
Concept	Previous sections have identified that there is significant peak period crowding on local services into Newcastle. The option considered for dealing with this problem was running longer trains.
Specification assessed	This option comprises the provision of vehicles to lengthen selected peak hour trains. Additional vehicles are assumed to be class 170 stock with an average of 66 seats per vehicle. All platforms are long enough to accommodate 3x23m vehicles. Extra depot capacity can be provided within the current facilities at Heaton.
Operational analysis	The analysis of lengthening trains in this area is based on developing a case for adding an additional vehicle. In practice, individual trains would not (and in most cases could not) be lengthened simply by adding a single additional vehicle to the existing formation. The deployment of additional rolling stock, and the optimal matching of capacity to demand, would be likely to require cascades of rolling stock between routes. The effect of existing platform lengths will need to be taken into account in the deployment plan.
Infrastructure required	Depends on the rolling stock deployment plan.
Passenger impact	Reducing crowding levels on peak services into Newcastle.
Freight impact	None identified.
Contribution to 2014 HLOS outputs	Peak capacity into Newcastle.

<table>
<tr><td>Financial and economic analysis</td><td>The economic analysis below relates to the lengthening of services in to both Middlesbrough and Newcastle (Options 6.8 & 7.1). This combined option gives a BCR of 2.7. This analysis takes into account:
the benefits to users, principally from reduced crowding but also from improved quality of rolling stock
revenues from the release of suppressed demand, as crowding is reduced
non-user benefits, principally from road decongestion arising from the transfer of some journeys from road to rail.
Crowding has been modelled on an individual train basis and does not take into account the fact that passengers may switch trains. If a train does not need all of its capacity of an additional vehicle, the spare capacity is assumed to have no benefit. In practice, passengers may choose to switch trains to take advantage of the additional space, which would help to strengthen the case for lengthening trains.
Based on individual train lengthening, an economic and financial analysis shows that approximately seven to nine additional vehicles are required. The business case for nine additional vehicles is shown below.
<table><tr><td>30-year appraisal</td><td>£million</td></tr><tr><td>Costs (Present Value)</td><td></td></tr><tr><td>Investment Cost</td><td>0.0</td></tr><tr><td>Operating Cost</td><td>20.5</td></tr><tr><td>Revenue</td><td>-8.8</td></tr><tr><td>Other Government Impacts</td><td>1.8</td></tr><tr><td>Total costs</td><td>13.5</td></tr><tr><td>Benefits (Present Value)</td><td></td></tr><tr><td>Rail users benefits</td><td>15.8</td></tr><tr><td>Non users benefits</td><td>20.0</td></tr><tr><td>Total quantified benefits</td><td>35.8</td></tr><tr><td>NPV</td><td>22.4</td></tr><tr><td>Quantified BCR</td><td>2.7</td></tr><tr><td colspan="2">Note: All figures are presented in 2002 market prices.</td></tr></table>The business case above assumes that the extent of road congestion in the North East is slightly higher during the morning peak three hours than the standard congestion bands would suggest. This assumption is supported by evidence provided by NEXUS, which shows high volumes of morning peak traffic, particularly on the A1(M) approaching Newcastle. If standard average values for road congestion bands are assumed, this would indicate seven additional vehicles would be required in total, with an overall BCR of 2.9.</td></tr>
<tr><td>Dependencies with other options</td><td>None.</td></tr>
<tr><td>Conclusion</td><td>It is recommended that nine additional vehicles are included in the DfT Rolling Stock Plan for the Newcastle and Middlesbrough peaks.</td></tr>
</table>

6.11.3 Assessment of Option 7.2

Reduction in Tyne Valley line journey times	
Concept	This option seeks to test reducing journey times in the Tyne Valley by reducing calls at lightly used stations or by undertaking infrastructure enhancement works. Train journeys between Newcastle and Carlisle typically take around 1 hour 26 minutes at present. This scheme was highlighted in the North East RPA.
Operational analysis	None identified.
Infrastructure required	Major infrastructure investment would be required to significantly reduce journey times on the Tyne Valley line. However, Appendix 4 shows some potential minor infrastructure improvements which could add capacity and provide a small improvement to journey times.
Passenger impact	Any journey time improvements are likely to be minor.
Freight impact	None identified provided the speed improvements do not increase the speed differential between freight and passenger trains.
Contribution to 2014 HLOS outputs	Negligible.
Financial and economic analysis	No detailed appraisal of increasing linespeeds has been carried out at present. As an indication, the benefits associated with a one-minute journey time improvement on the selected route sections described below have been estimated. From this, it is possible to estimate the maximum associated level of capital expenditure that could be supported to achieve good value for money (a BCR of 2). It should be noted that these estimates assume that all passengers travelling over the sections of route would benefit from the linespeed improvement, regardless of train operator or where they joined the route section. In practice not all passengers may benefit from journey time improvements, as this will depend on the type of infrastructure option being proposed.
	Appraisal of: One-minute journey time reduction Growth assumption: 3.7 percent growth p.a. 2006 – 16, 1.85 percent p.a. 2017 – 26 Appraisal period: 60 years BCR = 2
	Route Section / **£m** Newcastle – Dunston / 4 Hexham – Corbridge / 3 Haydon Bridge – Hexham / 1
	Note all figures shown in 2007 factor prices before optimism bias There is a very low level of demand at certain stations, notably Dunston and Blaydon. Closure of these stations has been assessed and is considered likely to result in net benefits due to reducing journey times for other passengers. However, the associated benefits and disbenefits for either station would be relatively minor and so the RUS is not recommending closure unless significant expenditure becomes due.
Dependencies with other options	None.
Conclusion	It is recommended that the option of increasing linespeeds is considered as renewals become due on this route.

6.11.4 Summary of appraisals responding to gap 7

The following themes emerge from the above analysis of options 7.1 – 7.2:

- small scale linespeed improvements on the Tyne Valley line could potentially be delivered through the signalling scheme described in Appendix 4
- peak crowding and growth into Newcastle could be addressed by the lengthening of some existing services

6.12 Gap 8 - Network flexibility

The issues covered by this gap grouping comprise a number of distinct elements, as described in the specific gaps below. However, as there is often a considerable overlap in the solutions that may be adopted to meet these gaps, the consideration of possible responses has been outlined on a geographic basis. The issues facing particular sections of the ECML, and the possible methods of dealing with them, have been designated as gaps 8.1 to 8.11, and are discussed in Sections 6.12.5 to 6.12.15 below.

6.12.1 Interaction between baseline capacity, options and any infrastructure enhancement schemes

In previous sections it has been highlighted that there are several significant capacity bottlenecks on the ECML. The ability of the existing infrastructure to accommodate additional services at many of these locations is very limited.

The two most critical “high level” constraints are as follows:

- during peak hours – there is limited capacity for additional LDHS and commuter services over the intensively used railway south of Peterborough
- during off peak hours – there is limited capacity for additional LDHS and freight services over the mostly two track section between Peterborough and Doncaster.

Options responding to gaps 1-3 and freight growth would all involve additional services operating over the above sections and many require infrastructure enhancement prior to their implementation.

A number of infrastructure schemes with potential to increase ECML capacity, by removing or alleviating existing bottlenecks, are described in Appendix 4. These infrastructure schemes are “enabling options”, potentially required to facilitate the implementation or optimisation of the “primary” options described up to this point. Many of the primary options have potential to interact with other primary options in some way. For similar reasons, many of the potential infrastructure schemes would provide capacity which could be useable by several of the options shown. This makes it problematic to attribute the costs associated with many of the potential infrastructure schemes to specific options. Some of them provide a capacity benefit for one option and a performance or journey time benefit for another.

Further timetable development and performance modelling work will be required to confirm which of the primarily performance focussed infrastructure enhancement schemes needs to be implemented and the detailed scope of all schemes.

6.12.2 Ability of the system to recover from perturbations

Any specific options responding to this gap would be based on consideration of how best to ensure continuing performance improvements. At this stage this is particularly relevant to timetable options described elsewhere. The RUS seeks to reduce reactionary delay by ensuring that timetables are robust and that there is some headroom in the level of infrastructure utilisation.

6.12.3 Balance of engineering and operations access

Any specific options responding to this gap would be based on consideration of how best to ensure that there is an optimum level of

engineering access, using appropriate asset maintenance and renewal policies, balanced with aspirations for providing increased train operations. The aim is to balance the need for engineering work with the disruption that it causes. This is being examined by industry partners in the 7-Day Railway workstream.

6.12.4 Capability of diversionary routes
The availability of adequate diversionary routes helps to mitigate all three of the previous gaps. The ability to use a variety of routes to move traffic between different points allows:

- existing capacity constraints to be alleviated through the permanent routing of some services elsewhere
- increased ability to recover from perturbation, through the routing of some services away from points experiencing temporary delays or congestion
- greater opportunities for maintaining service levels during engineering access.

Improving linespeeds, signalling arrangements, loading gauge and route availability on diversionary routes enhances the flexibility of the network and hence its ability to cope with all these issues. Accordingly, the options available for upgrading diversionary routes form a considerable portion of the geographically based discussion of network flexibility in Sections 6.12.5 to 6.12.15 below. Apart from Option 8.1, these generally identify issues and opportunities for the 7-Day Railway workstream.

In the longer term, many of these options are also relevant to the potential benefit offered by the IEP described in 4.6.1, since this may enable more effective use of some diversionary routes without requiring their electrification.

Analysis of the capability of the ECML by route sections

Gap	Description
8.1	Capability of Wood Green Junction to Langley Junction
8.2	Capability of Langley Junction to Hitchin Cambridge Junction (and other four-track sections where lines are paired by direction and are without any diversionary routes)
8.3	Capability of Hitchin Cambridge Junction – Peterborough
8.4	Capability of Werrington Junction to Newark (and on to Doncaster)
8.5	Capability of Newark to Doncaster Decoy Junctions
8.6	Capability of Marshgate Junction to Colton Junction
8.7	Capability of Marshgate Junction to Leeds
8.8	Capability of Northallerton to Ferryhill
8.9	Capability of Ferryhill to Newcastle
8.10	Capability of Newcastle to Edinburgh
8.11	Use of ECML by traffic normally using other routes

6.12.5 Analysis of gap 8.1

Capability of Wood Green Junction to Langley Junction	
Existing constraints on main line	The main constraint on the ECML between Wood Green Junction and Langley Junction is the two-track section between Digswell and Woolmer Green, but other issues are the four span OHLE, bridges carrying all four tracks, and the pairing of Down lines and Up lines together.
Potential alternative routes	The Hertford Loop is a relatively good diversionary route, as it is electrified, but it is short of capacity north of Gordon Hill. However, when the Hertford Loop is unavailable, the main line via Welwyn is not capable of accomodating W9 Freight traffic.
Analysis	Any improvement to the capability and capacity of the Hertford Loop would significantly help when the main ECML route via Welwyn is closed. At present, when the ECML via Welwyn is closed, crowding occurs on passenger services, due to the limited current capacity of the Hertford Loop for LDHS, outer suburban and inner suburban services. The predicted growth will exacerbate this. Meanwhile, freight services must share the limited current capacity of the Hertford Loop with passenger services. Analysis has indicated that the Hertford Loop enhancements (described in Chapter 4) would allow the following services to operate via Hertford: ■ the current Saturday and Sunday level of LDHS services (on the Welwyn route) ■ all Saturday outer suburban services to Peterborough and Cambridge, with some services calling at Watton-at-Stone, Hertford North, Bayford, Cuffley and Crews Hill. ■ 2tph all stations inner suburban service, terminating at Gordon Hill. ■ Increased levels of LDHS services could be operated with a reduced level of outer suburban services. ■ One freight train each way per hour. The infrastructure required for these improvements comprises: ■ Signalling improvements, to give 4-minute headways north of Gordon Hill. ■ Provision of enhanced turnback facilities at Gordon Hill or Hertford North. ■ Additional S&C at Stevenage South to provide improved access to/from the ECML. Analysis has been undertaken from both a timetable/performance and economic perspective on the combined effect of these enhancements. The economic appraisal shown below has examined improving the capacity of the Hertford Loop as a diversionary route during planned possessions. The current engineering practice is to close the main line via Welwyn between north of Alexandra Palace and Knebworth for eight consecutive weekends per year, whilst maintenance and other works are undertaken. This significantly reduces the number of inner suburban, outer suburban and LDHS services that can be provided during this time. Increasing demand for weekend travel implies that it would be necessary to increase the number of services that can be provided at such times, and this would require increased capacity on the Hertford Loop. Two timetable options have been considered, based on the current levels of service when diversions occur: ■ Option 8.1a: Increasing only inner and outer suburban services; and ■ Option 8.1b: Increasing LDHS services as well. These options have been appraised, assuming that the planned diversions will last for eight consecutive weekends per year:

Option 8.1a: Increasing FCC inner and outer services (60-year appraisal)	£million
Costs (Present Value)	
Investment Cost	37.2
Operating Cost	0.0
Revenue	-20.6
Other Government Impacts	5.3
Total costs	**21.9**
Benefits (Present Value)	
Rail users benefits	56.7
Non users benefits	25.9
Total quantified benefits	**82.6**
NPV	**60.7**
Quantified BCR	**3.8**
Option 8.1b: Increasing LDHS services (60 year appraisal)	**£million**
Costs (Present Value)	
Investment Cost	37.2
Operating Cost	0.0
Revenue	-53.2
Other Government Impacts	13.6
Total costs	**-2.5**
Benefits (Present Value)	
Rail users benefits	65.2
Non users benefits	64.1
Total quantified benefits	**129.2**
NPV	**131.7**
Quantified BCR	**Financially positive**

Note: All figures are presented in 2002 market prices.

Sensitivity tests show that if planned possessions are reduced to four consecutive weekends per year, then the BCRs for Options 8.1a and 8.1b falls to 1.4 and 3.7 respectively.

It should be noted that this option has additional benefits which have not been included in the appraisals shown above, due mainly to the availability of data. For example, the diversionary route would be able to carry an increased level of services during times of perturbation (ie. unplanned diversions) on the main line between Alexandra Palace and Langley Junction. Increasing the number of services also helps to reduce the impact on overall passenger journey times and the level of TOC refunds that might have to be made. The infrastructure is likely to provide additional everyday operational flexibility which could result in improved performance levels for inner services on the Hertford Loop.

	How future engineering access on the main line will be planned has not yet been established. These assumptions are based on current practices. However, the need for an improved diversionary route between Alexandra Palace and Knebworth will undoubtedly become more critical as the 7-Day Railway initiative proceeds. Please also note that any infrastructure necessary to deliver the frequency enhancements on the Hertford Loop described in Options 1.2 and 1.3 is likely to be beneficial to this option.
Conclusion and/or recommendation	It is recommended that this option is developed further, including (as a sub option for the Stevenage South scheme) a new Down bay platform at Stevenage, to allow termination of current Letchworth inner suburban services at Stevenage.

6.12.6 Analysis of gap 8.2

Capability of Langley Junction to Hitchin Cambridge Junction (and other four-track sections where lines are paired by direction and are without any diversionary routes)	
Existing constraints on main line	Where lines are paired by direction, the absence of bi-directional signalling constrains the possible use of single line working.
Conclusion and/or recommendation	When signalling renewals are due, consider bi-directional signalling over the Fast Lines and, where necessary, powered Fast Line to Fast Line crossovers, so that 'single line working' can be introduced easily over either the Down pair or Up pair with trains running 'wrong' line on the Fast Line.

6.12.7 Analysis of gap 8.3

Capability of Hitchin Cambridge Junction – Peterborough	
Existing constraints on main line	The main constraint on this section of the ECML is the two/three-track section between Huntingdon and Peterborough, but other issues are the headspan OHLE, bridges carrying all four tracks, and the pairing of Down lines and Up lines together. The most constrained section of the main route is the two and three-track section between Huntington and Fletton.
Potential alternative routes	The diversionary route (which runs from Peterborough to Ely and Cambridge, rejoining the ECML at Hitchin) is of limited use for most passenger services at present (though a few services use it occasionally) as it is not electrified between Ely and Peterborough. It is about 27 miles longer than the direct route, and thus produces significantly longer journey times to London than via the ECML. It is only cleared to W8 gauge and thus is constrained as a diversionary route for freight traffic. The Ely to Peterborough line has limited capacity.
Analysis	No specific infrastructure requirements have been identified to enable the route via Cambridge to be used for the diversion of diesel powered services, but additional track capacity would be needed for all but a few diverted services. Use of this diversionary route would reduce the need for providing bus replacements for passenger services south of Peterborough when the main ECML is closed. It should be noted that Gauge enhancement of the Ely to Peterborough section to W10 is planned as part of the committed scheme described in Section 4.4.

Conclusion and/or recommendation	It is recommended that an option for this gap is developed further, as part of a wider project considering: 1) Potential further capacity increments on the Felixstowe to Nuneaton cross country route 2) The 7-Day Railway workstream, including examining the enhancement of the main line against enhancing the capability of the diversionary route. 3) The IEP programme When signalling renewals on the main line are due, or other enhancements in the area, bi-directional signalling over the two-track section across Stilton Fen should be considered, as should any necessary powered crossovers, so that 'single line working' can be introduced easily.

6.12.8 Analysis of gap 8.4

Capability of Werrington Junction to Newark (and on to Doncaster)	
Existing constraints on main line	The main constraint on this section of the ECML is the two-track section between Stoke Summit and Newark, but other issues are the four span OHLE south of Stoke, bridges carrying all four tracks, and the pairing of Down lines and Up line together.
Potential alternative routes	The diversionary route via Spalding and Lincoln is not electrified and has low linespeeds, so is of limited use as a diversionary route for most passenger services at present. Journey times for any services using this route are significantly longer than the main ECML, principally due to the lower linespeeds. The diversionary route via Spalding is also 10 miles longer than the direct route along the main line. The route is currently only W8 gauge.
Analysis	Although capacity would still be well below daytime requirements, bi-directional signalling on the two-track sections of the ECML would improve capacity during times of perturbation and assist with planned engineering work. Development work has been undertaken previously on the enhancements required to upgrade the GN/GE Joint Line (which runs from Peterborough to Doncaster via Spalding, Lincoln and Gainsborough Lea Road) to W9 & W10 gauge, and increase linespeeds to 75mph. These include track, signalling and civil engineering works. These works are recommended for Options 3.3 and 9.3. There are opportunities to increase passenger linespeeds to 90mph or 100mph. Use of this diversionary route would reduce the need for replacement buses when sections of the ECML between Peterborough and Doncaster are closed. As the Joint Line is currently only cleared to W8 gauge, and has significantly longer journey times than the main line, the works described above would also significantly improve its freight capacity. The business case for these proposals has been incorporated in that for Options 3.3 and 9.3 combined, which is shown in paragraph 6.15. It should also be noted that trains procured as part of the IEP (see 4.3.1) may potentially be able to use these routes.
Conclusion and/or recommendation	Further opportunities to provide increased diversionary capability should be examined as part of the GN/GE Joint Line upgrade. When signalling renewals are due, bi-directional signalling over the two-track sections should be considered, as should any necessary powered crossovers, so that 'single line working' can be introduced easily. The 7-Day Railway workstream should examine the opportunities the above offers.

6.12.9 Analysis of gap 8.5

Capability of Newark to Doncaster Decoy Junctions	
Existing constraints on main line	The principal constraint on this section of the ECML is that it is a two-track railway.
Potential alternative routes	The diversionary route (which runs from Newark to Doncaster via Swinderby and Gainsborough, avoiding Lincoln by using the chord from Boultham Junction to Pyewipe Junction) is currently used by occasional services. It is 15 miles longer than the direct route on the ECML, is only cleared to W7 gauge, and is not electrified. Due to lower linespeeds, journey times are significantly longer than via the ECML. However, gauge enhancement to W10 for the route via Swinderby and Gainsborough is planned as part of the committed scheme described in Section 4.3. Freight operators have requested that this work should also provide W9 gauge, and this is under investigation.
Analysis	Although capacity would still be well below daytime requirements, bi-directional signalling on the two-track sections of the ECML would improve capacity during times of perturbation and assist with planned engineering work. Development work has been undertaken previously on the enhancements required to upgrade the diversionary route via Swinderby and Gainsborough to W9 & W10 gauge, and increase linespeeds to 75mph. These include track, signalling and civil engineering works. Use of this diversionary route for passenger traffic would reduce the need for replacement buses when sections of the ECML between Newark and Doncaster are closed. Meanwhile, the gauge enhancement work will increase the capacity of this route for the diversion of freight. Enhancement of the Lincoln to Doncaster section is proposed as part of Options 3.3 and 9.3, and the business case for upgrading the diversionary route is linked to these options. It should also be noted that trains procured as part of the IEP (see 4.3.1) may potentially be able to use these routes.
Conclusion and/or recommendation	The RUS recommends the more comprehensive upgrade of the Werrington Junction – Spalding – Lincoln – Gainsborough route, but opportunities to enhance the Newark – Lincoln section for diversions should still be examined. When signalling renewals are due, bi-directional signalling over the two-track sections should be considered, as should any necessary powered crossovers, so that 'single line working' can be introduced easily. The 7-Day Railway workstream should examine the opportunities for the above.

6.12.10 Analysis of gap 8.6

Capability of Marshgate Junction to Colton Junction	
Existing constraints on main line	The principal constraint on this section of the ECML is that it is a two-track railway.
Potential alternative routes	None of the potential diversionary routes are electrified throughout, and all are gauge W8 or less, so they are of limited use for either passenger or freight (though a few services use them on occasions). The route via Knottingley and Church Fenton is about 1 mile longer than the main line between Shaftholme Junction and Colton Junction, and the routes via Gascoigne Wood and Selby are also slightly longer than the main line. However, they are all considerably shorter than the alternative diversionary route via Wakefield and Leeds, which is 23 miles longer than the ECML.
Analysis	No specific infrastructure requirements have been identified to enable these routes to be used more widely for the diversion of diesel powered services. Use of these diversionary routes would potentially allow London – north east England trains and cross country services to run when the main ECML between Doncaster and York is closed. Upgrading any of these routes to W10 or W9 would also enhance network flexibility for freight in this area. It should be noted that if trains procured as part of the IEP (see 4.3.1) have both diesel and electric traction capability they would be able to use the diversionary routes.
Conclusion and/or recommendation	It is recommended that the opportunities and requirements for using the diversionary routes are examined by the 7-Day Railway workstream, taking into account possible infill electrification east of Leeds, the IEP programme, and the potential that the Northern W10 project could include W9 and W10 clearance of some or all of the diversionary routes. When signalling renewals are due, bi-directional signalling over the two-track sections of the main line should be considered, as should any necessary powered crossovers, so that 'single line working' can be introduced easily.

6.12.11 Analysis of gap 8.7

Capability of Marshgate Junction to Whitehall Junction	
Existing constraints on main line	The principal constraint on this section of the ECML is that it is a two-track railway.
Potential alternative routes	The route via Hambleton Junction is not electrified, so is of limited use as a diversionary route for most passenger services at present. It is about seven miles longer than the route via Wakefield Westgate. Meanwhile, the alternative diversionary route via Calder Bridge and Normanton is about three miles longer than the direct route, and is also not electrified. Neither diversionary route serves Wakefield Westgate, and both routes are only cleared to W8 gauge. Some Leeds to London services are diverted this way on occasions.

Analysis	Use of these diversionary routes would potentially allow trains between London and Leeds to run when the normal route between Doncaster and Leeds is closed. No specific infrastructure requirements have been identified to enable the diversionary routes to be used for the diversion of diesel powered services, though capacity is constrained east of Leeds. A potential scheme for electrification of the route via Hambleton Junction and Micklefield is shown in Chapter 4. This would allow the diversion of electrically hauled services between Leeds and London. Some stakeholders have suggested that use of this route during normal operations would enable a more efficient London to Leeds service to operate. Services using the Hambleton Junction route towards Leeds could run onwards to form a service to Bradford or back to London via Wakefield, without the need for a reversal. This may assist in timetable development options. It should also be noted that if trains procured as part of the IEP (see 4.3.1) have both diesel and electric traction capability they would be able to use both of the diversionary routes.
Conclusion and/or recommendation	It is recommended that the opportunities and requirements for using this diversionary route are examined by the 7-Day Railway workstream, taking into account possible infill electrification east of Leeds, the IEP programme, and the potential that the Northern W10 project could include W9 and W10 clearance of the diversionary routes. When signalling renewals are due, bi-directional signalling over the two-track Doncaster to Leeds route should be considered, as should any necessary powered crossovers, so that 'single line working' can be introduced easily.

6.12.12 Analysis of gap 8.8

Capability of Northallerton to Ferryhill	
Existing constraints on main line	The principal constraint on this section of the ECML is that it is a two-track railway.
Potential alternative routes	There is a diversionary route between Northallerton and Ferryhill via Eaglescliffe and the Stillington branch, but it is not electrified so is of limited use as a diversionary route for passenger services at present. This route is constrained by some long signalling sections, and poor linespeeds between Norton Junctions and Ferryhill. It is also only cleared to W8 gauge.
Analysis	Use of this diversionary route would potentially allow London – Newcastle/ Scotland trains and cross country services to run when the normal route via Darlington is closed. A scheme to reduce signalling headways on the Stillington branch is shown in Appendix 4. It should be noted that if trains procured as part of the IEP (see 4.3.1) have both diesel and electric traction capability they would be able to use the diversionary route.
Conclusion and/or recommendation	It is recommended that opportunities and requirements for using this diversionary route are examined by the 7-Day Railway workstream, taking into account proposals to improve headways and line speeds between Norton Junctions and Ferryhill, the IEP programme, and that the potential Northern W10 and Teesport projects could include W9 and W10 clearance.

6.12.13 Analysis of gap 8.9

Capability of Ferryhill to Newcastle	
Existing constraints on main line	The principal constraint on this section of the ECML is that it is a two-track railway.
Potential alternative routes	The diversionary route from Northallerton to Newcastle via the Durham Coast is not electrified (other than at the north end for Tyne & Wear metro services, which is 1500V DC and so not compatible with ECML electric trains) so is of limited use as a diversionary route for passenger services at present. The route is also constrained by some long signalling sections and low linespeeds, plus Tyne & Wear Metro services using the Newcastle end of the route. The route is also significantly less attractive than the ECML for freight operators, as it is only cleared to W6 gauge, is significantly slower than the ECML, has limited capacity, limited length capability, and has some weak bridges that restrict Route Availability. Another diversionary route could be created by the reinstatement of the Leamside Line (which runs from Ferryhill on the ECML to Pelaw Junction on the Durham Coast Line).
Analysis	Use of the diversionary route via the Durham Coast would potentially allow London – Newcastle/ Scotland trains and cross country trains to run when the normal route via Durham is closed. A scheme to reduce signalling headways on the Durham Coast line is described in Chapter 4. It should also be noted that if trains procured as part of the IEP (see 4.3.1) have both diesel and electric traction capability they would be able to use this route. The usefulness of the Durham Coast Line for freight is restricted by the absence of a direct connection to Port of Tyne from the Sunderland direction, though this would be resolved by the reinstatement of Boldon East curve (as described in Appendix 4). The reinstatement of the former Leamside Line would require major capital expenditure, and it is very unlikely that this could be justified with network flexibility benefits alone.
Conclusion and/or recommendation	It is recommended that opportunities and requirements for using this diversionary route are examined by the 7-Day Railway workstream, taking into account planned headway improvements between Hartlepool and Dawdon, and the IEP programme. It should also confirm the level of benefits that could contribute to the Leamside reinstatement costs.

6.12.14 Analysis of gap 8.10

Capability of Newcastle to Edinburgh	
Existing constraints on main line	The main constraint on this section of the ECML is that it is a two-track railway.
Potential alternative routes	Although used quite often during engineering works, the diversionary route via Carlisle is much longer and doubles journey times, is not electrified, and is only W8 in part.
Analysis	There are no options for significantly improving network flexibility north of Newcastle that would not involve major infrastructure works.
Conclusion and/or recommendation	It is recommended that the 7-Day Railway workstream examines enhancing those sections of the ECML in Scotland without bi-directional signalling (only Grantshouse to Innerwick is currently bi-directional) against the alternative of developing the capability of the diversionary route.

6.12.15 Analysis of gap 8.11

Use of ECML by traffic normally using other routes	
Existing constraints on the network	There are several routes broadly parallel to the ECML for which the ECML could be used as a diversionary route, including: ■ The Settle – Carlisle Line, from which traffic to/from Scotland could be diverted on to the ECML ■ The West Coast Main Line, from which traffic to/from Scotland could be diverted on to the ECML (including Caledonian Sleeper services) ■ The Durham Coast Line ■ The Felixstowe – Peterborough route, from which freight traffic to/from the east coast ports could be diverted via the Great Eastern Main Line, North London Line and the southern end of the ECML
Analysis	No specific infrastructure requirements have been identified at this stage, though the southern end of the ECML is not W10 cleared, which constrains the ability to move 9' 6" containers in the last example above. Diversion of east coast ports traffic via the southern end of the ECML and North London Line would thus not be possible for W10 gauge traffic without gauge clearance works or the use of 'specialist' wagons. Similarly, the capability of lines connecting these parallel routes to the ECML will have to be considered.
Conclusion and/or recommendation	It is recommended that this option is developed further by the Network RUS and the other RUSs for the routes concerned.

6.12.16 Summary of analyses responding to gap 8

From the above analysis of options 8.1 – 8.11, it is clear that further work is required on a strategy for diversionary routes, both on the ECML and nationally.

At present there are limited opportunities for diversion of passenger services when the ECML is closed, since the majority of the main long distance train fleet can only operate on electrified routes.

The introduction of IEP trains on the ECML could potentially allow increased diversionary route options to be developed, depending on the number of dual-traction sets procured.

6.12.17 The contribution of proposed infrastructure schemes to network flexibility and performance

In addition to the schemes described above that are principally intended to improve network flexibility, a number of the other proposed infrastructure schemes would deliver enhanced flexibility as a secondary benefit. Furthermore, many of the schemes listed in Appendix 4 would also deliver some level of performance benefit through reducing reactionary delay. For some schemes, the primary driver of benefits is improved performance for current services, whilst others are primarily driven by capacity improvements, but do also deliver some level of performance benefits or network flexibility.

The following table identifies the primary (P) and secondary (S) drivers of the principal schemes:

Key drivers of infrastructure schemes in the ECML RUS

	Drivers					
Proposed infrastructure work	**Passenger growth**	**Freight growth**	**Performance improvement**	**Passenger journey times**	**Safety**	**Network flexibility**
Major power supply: ECML South (Thameslink programme)	P	S	S			
Moorgate branch additional signalling	P		S			
Alexandra Palace - Finsbury Park 3rd passenger Up line	S		S	P		S
Finsbury Park - Alexandra Palace Down Slow 2 to serve Harringay & Hornsey	P		S			S
Outer suburban platform lengthening to 12 cars (8 at Meldreth, Shepreth and Foxton) mostly within Thameslink programme scope	P					S
Hertford Loop capacity upgrade	S	S	S			P
Hitchin grade separation	S	S	P	S	S	S
Peterborough station capacity enhancements (inc. additional 12-car stabling - Thameslink programme)	P		S	S		S
Cambridge additional island platform and additional 12-car stabling	P					S
Upgrade of GN/GE Joint Line	P	P	S	S		S
ECML Level Crossing closure programme	P	P	S		S	
Doncaster station capacity and service improvements	P	P	S			S
Shaftholme Junction remodelling	S	P	S			S
Holgate 4th line and associated enhancements	S	S	P	S		S
Boldon East Curve reinstatement		P				S
IEP introduction works	P		S	S		S
W9/W10 gauge works as identified through TIF and other development work		P				S

6.13 Gap 9 - Freight RUS specific issues and freight capability

The gaps identified in the Freight RUS were listed in Section 5.6.6. The following options are under consideration in response to these gaps and other current freight issues:

The enhancement of passing loops at Hemsworth (considered in Freight RUS Gap A, Hare Park Junction to South Kirkby Junction) has been passed to the Yorkshire and Humber RUS as this route is a key artery for local and regional services in the Yorkshire and Humber Region running to and from routes that will be covered by that RUS.

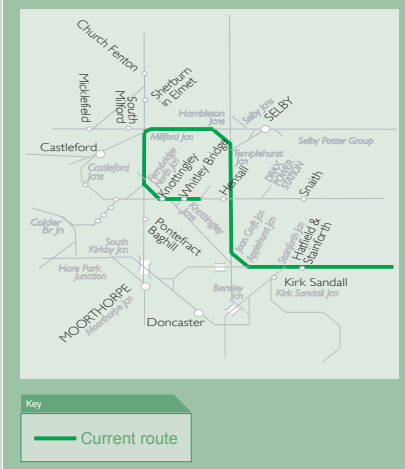
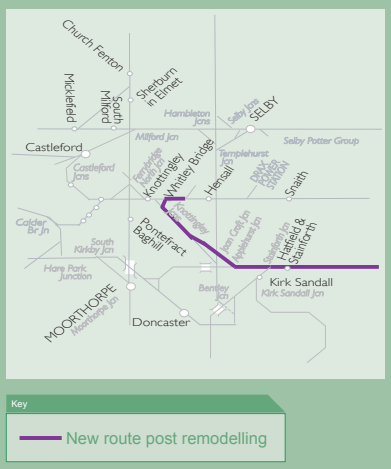
Summary of options responding to Freight RUS gaps and freight capability issues

Option	Description	Specific gap to be addressed
9.1	Reinstatement of Boldon East Curve	Port of Tyne – Tursdale Junction (Gap 9A /Freight RUS 12)
9.2	Construction of a remodelled junction at Shaftholme	Joan Croft Junction – Hambleton Junction (Gap 9B/Freight RUS B)
9.3	Provision of two freight paths per hour between Peterborough and Doncaster (including a quantum of class 6 as described in the Freight RUS)	Peterborough Crescent Jn – Doncaster Loversall Carr Junction (Gap 9C/Freight RUS C)
9.4	The upgrading of certain route sections to W9, W10 and W12 gauge	W9, W10 and W12 gauge aspirations on core freight arteries
9.5	Upgrade of electrical power supplies	Restrictions on the use of Class 92 locomotives
9.6	Increased capability for 775m trains	Increased capability to operate 775m freight trains on core freight arteries

6.13.1 Assessment of Option 9.1 (Freight RUS gap 12)

Reinstatement of Boldon East Curve	
Concept	Reinstatement of Boldon East Curve.
Operational analysis	This option would enable freight traffic between Port of Tyne and ECML south to be routed via the Durham Coast line, avoiding the congested section of the ECML between Newcastle and Northallerton.
Infrastructure required	Reinstatement of Boldon East Curve. This scheme is described in Appendix 4.
Passenger impact	None identified.
Freight impact	As above.
Contribution to 2014 HLOS outputs	None.
Financial and economic analysis	Appraisal of this scheme was published in the Freight RUS.
Dependencies with other options	None.
Conclusion	The scheme to reinstate Boldon East Curve was recommended by the Freight RUS and is supported here for implementation.

6.13.2 Assessment of Option 9.2 (Freight RUS gap B)

Construction of a remodelled junction at Shaftholme	
Concept	Construction of a grade separated or remodelled at-grade junction at Shaftholme.
Operational analysis	Both options would enable freight traffic between Immingham and Eggborough/Drax/Ferrybridge power stations to be routed via Askern, avoiding the need to run 14 miles on the busy ECML, and shortening the end-to-end journey time as well. The grade separated junction would also eliminate crossing moves across the ECML.  
Infrastructure required	Construction of a grade separated junction or remodelled at-grade junction at Shaftholme. This scheme is described in Appendix 4.
Passenger impact	Improved performance and increased capacity.

<table>
<tr><td>Freight impact</td><td colspan="2">As above, plus improved performance, reduced journey times and increased capacity for other freight services on the ECML.</td></tr>
<tr><td>Contribution to 2014 HLOS outputs</td><td colspan="2">Performance improvement.</td></tr>
<tr><td>Financial and economic analysis</td><td colspan="2">The appraised option is full segregation of the freight services from the LDHS passenger services on the ECML. The economic and financial appraisal of this option (undertaken for a P-TIF submission) produced the following results:</td></tr>
<tr><td></td><td>60-year appraisal</td><td>£million</td></tr>
<tr><td></td><td>Costs to government (Present Value)</td><td></td></tr>
<tr><td></td><td>Grant/subsidy</td><td>48.7</td></tr>
<tr><td></td><td>Indirect taxation impact</td><td>3.3</td></tr>
<tr><td></td><td>Revenue transfer from TOC to Government</td><td>-16.6</td></tr>
<tr><td></td><td>Network rail operating and renewals saving transfer</td><td>-5.2</td></tr>
<tr><td></td><td>Total costs</td><td>30.2</td></tr>
<tr><td></td><td>Benefits (Present Value)</td><td></td></tr>
<tr><td></td><td>Rail users benefits</td><td>11.5</td></tr>
<tr><td></td><td>Non users benefits</td><td>33.2</td></tr>
<tr><td></td><td>TOC & FOC benefits</td><td>63.1</td></tr>
<tr><td></td><td>Total quantified benefits</td><td>107.8</td></tr>
<tr><td></td><td>NPV</td><td>77.6</td></tr>
<tr><td></td><td>Quantified BCR</td><td>3.6</td></tr>
<tr><td></td><td colspan="2">Note: All figures are presented in 2002 market prices.
The appraisal format used here is different to the other similar forms presented in the RUS as it uses the P-TIF appraisal methodology.</td></tr>
<tr><td>Dependencies with other options</td><td colspan="2">This proposal will assist with capacity and performance for any additional LDHS services to York and the North East, or to Leeds via Hambleton Junction, and for any additional freight services to/from the North East and Scotland</td></tr>
<tr><td>Conclusion</td><td colspan="2">It is recommended that this option is developed further. It may be subject to a TIF submission.</td></tr>
</table>

6.13.3 Assessment of Option 9.3 (Freight RUS gap C)

Provision of two freight paths per hour between Peterborough and Doncaster	
Concept	The Freight RUS identified a gap between forecast freight growth on this section of the route and the capacity currently available, driven by the speed differential between freight and passenger services on the two-track section of the route and by crossing movements at Peterborough. This option seeks to deliver forecast freight growth between Peterborough and Doncaster.
Operational analysis	The current level of freight traffic during the main hours of operation of LDHS services (06:00 – 20:00) requires provision of one path per hour in a standard pattern off-peak timetable. The Freight RUS is predicting over 15 additional trains each way, principally driven by gauge enhancement between Felixstowe and Bathside Bay and various terminals in Yorkshire. Assuming an even spread over the day and night, this drives the need for the RUS to find capacity for two paths per off-peak hour in a standard pattern timetable between Peterborough and Doncaster (this quantum needs to include provision of some 60mph paths). Additional track capacity between these locations would be necessary to accommodate the increase in freight services alongside current LDHS passenger services, so alternatives were considered alongside the passenger outputs required from Option 3.3.
Passenger impact	See section 6.15.3 assessment of Option C.
Freight impact	See section 6.15.3 assessment of Option C.
Contribution to 2014 HLOS outputs	None.
Financial and economic analysis	Each return intermodal freight path between Felixstowe and West Yorkshire could generate of the order of £20 million in non-user benefits over 60 years. However, as additional capacity is required between Ipswich and Peterborough to deliver the increase in freight paths, only part of this benefit can be attributed to the GN/GE Joint Line upgrade.
Dependencies with other options	Freight growth on this route section will require infrastructure investment, so solutions should be developed in conjunction with the passenger outputs identified in Option 3.3 and the network flexibility outputs required in Option 8.4.
Conclusion	Solutions should be developed to accommodate both the freight and passenger outputs required from this section of the network. This process is described in Section 6.15.

6.13.4 Assesment of Option 9.4

The upgrading of certain route sections to W9, W10 and W12 gauge	
Location of gap	The Freight RUS includes an aspiration that the following route sections be upgraded to W10 clearance: ■ Canonbury to Peterborough ■ Templehirst Junction to Portobello Junction ■ Northallerton to Teesport Meanwhile, the Freight RUS also requests that any development work on the following route sections consider a further upgrading to W12 clearance: ■ Canonbury to Portobello Junction (via Peterborough) ■ Doncaster to Hare Park Junction ■ Newcastle to Carlisle ■ Northallerton to Teesport
Issue to be addressed	The Freight RUS includes a number of aspirations that certain route sections be upgraded to W10 or W12 clearance, as described above. Freight Operators would also like those routes above that are not already cleared to be capable of taking W9 traffic.
Recommendation	A programme of feasibility work has been developed (as described at the end of Appendix 4) which will develop gauge clearance proposals for these routes.

6.13.5 Assesment of Option 9.5

Upgrade of electrical power supplies	
Location of gap	All electrified route sections.
Issue to be addressed	Consideration should be given to eliminating all restrictions on the use of Class 92s due to OHLE power supply issues.
Recommendation	Power supply along the route will be re-assessed over the next few years for the introduction of IEP trains. This assessment should consider all other potential electric traction requirements.

6.13.6 Assesment of Option 9.6

Increased capability for 775m trains	
Location of gap	Core intermodel freight arteries.
Issue to be addressed	There is an aspiration to be able to operate 775m freight trains along more of the route.
Recommendation	It is recommended that this is considered during the development of renewals and enhancements where it can be delivered most efficiently.

6.13.7 Summary of appraisals responding to Gap 9

From the above analysis of Options/Gaps 9.1 – 9.6, there are a number of infrastructure schemes required to facilitate freight growth and development work is underway examining gauge clearance issues on aspirational routes for W9, W10 and W12.

6.14 Gap 10 - Station capacity

Congestion at stations was described in section 3.6.2. The following options have been considered in response to the gap between station capacity and requirements that will develop as passenger numbers grow:

	Location of gap	Issue	Option to address gap
10.1	King's Cross station	There is significant passenger congestion in the station concourse and interface to the underground. Growth predicted on LDHS and outer suburban services will increase this problem.	There is a committed scheme to redevelop King's Cross station which will provide additional pedestrian capacity.
10.2	Finsbury Park station	There is significant passenger congestion, particularly in the subway and interface to the underground. Growth predicted on outer and inner suburban services will increase this problem.	Resolving this issue would require complex engineering works. Various options are under consideration. The reinstatement of the disused Up platform as part of the Finsbury Park to Alexandra Palace third Up line proposal should form part of the solution.
10.3	Peterborough station	The overbridge between platforms can suffer from significant congestion. Growth predicted on LDHS services will increase this problem.	Providing additional pedestrian capacity through a potential station redevelopment scheme is under consideration. This will include track works.
10.4	Car parking capacity at specific stations	There are particular problems at: 1) A number of FCC stations (especially Royston and Hatfield). 2) Stevenage: The station car park is normally full, but adjacent car parks are underused. 3) Sunderland: There is no car parking, but it may be possible to use a nearby station with sufficient parking as an alternative parkway station.	See Section 6.14.2 below.
10.5	Transport interchange issues at specific stations	There are no major problems identified at current levels of demand, but some measures are foreseen in the coming years.	See Section 6.14.3 below.
10.6	Proposed M25/ ECML Parkway Station	This proposal for a new station has been under consideration since 1996, and is supported by some stakeholders.	See the detailed option description below. A full multi-modal study would be necessary before progressing this proposal.

6.14.1 Assessment of Option 10.7

Construction of a parkway station at the intersection of the M25 and the ECML	
Concept	A new station would be constructed at the intersection of the ECML and the M25, i.e. between Potters Bar and Hadley Wood. A large car park and link road to the M25 would be constructed so that it could be used as a parkway station, with the intended market principally comprising passengers who wish to travel from the south east to the north and Scotland.
Operational analysis	The operational impact of the station would depend on the option chosen. It has been suggested that the station could be constructed around the current four-track layout in the area, with relatively little in the way of rail infrastructure works required. However, when the proposal was originally developed in 1999 – 2000, it was envisaged that route would be widened to six-track around the station. There would be considerable differences between the timetabling and performance impacts of these options.
Infrastructure required	This is dependent upon the option chosen. However, infrastructure that would be required may include: ■ station and associated facilities ■ car park (capacity 2000+) ■ link road to the M25 ■ additional S&C and signalling ■ widening to six-track around the station, with related E&P work ■ significant civil engineering works to remove parts of either the Potters Bar or Hadley Wood tunnels ■ retaining works to the embankments adjacent to the track.
Passenger impact	Though this would depend to some extent on the station option chosen and the timetables developed, there could be a significant increase in journey opportunities and ease of access to the network for a large potential market. Conversely there would be some abstraction of current business at Stevenage and King's Cross.
Freight impact	This would depend on the station option chosen and the timetables developed.
Contribution to 2014 HLOS outputs	Unlikely to be implemented in CP4.
Financial and economic analysis	A full multi-modal analysis would be required to appraise this proposal to understand the effects on the trunk road network in particular.
Dependencies with other options	This proposal would be affected by all the other proposals relating to the suburban and LDHS service patterns between Stevenage and Alexandra Palace.
Conclusion	As a full multi-modal analysis has not been undertaken, the RUS is unable to support the proposal at the present time.

6.14.2 Car parking issues

Several car parks are being very heavily used at suburban stations at the south end of the ECML. In particular, car parks at the following stations are being used at 95 percent capacity or higher: Gordon Hill, Hatfield, Hertford North, Huntingdon, Palmers Green, Potters Bar, Royston, & St. Neots. As First Capital Connect has a franchise commitment to provide 600 additional spaces, Network Rail are currently progressing schemes at Royston, St. Neots and Huntingdon.

The new franchisee for the East Coast has yet to submit detailed proposals regarding car parking at their stations, but Network Rail has examined options for improvements at Newcastle, Darlington, York, Retford and Newark. Meanwhile, Peterborough City Council are examining plans for an additional 1000 spaces of car parking there, and the better utilisation of existing nearby car parks is being considered as a means of dealing with the lack of spaces at Stevenage.

Grand Central has expressed concern that there is no car parking at Sunderland. They have suggested using the nearby station at the Stadium of Light as an alternative, as there is sufficient parking to allow this to be used as a parkway station. Additionally, Grand Central would like to see Eaglescliffe developed as a parkway station, as extension of the existing car park would be relatively straightforward here. The Tees Valley Metro project may also increase usage of this station.

6.14.3 Interchange issues

Whilst many of the stations within the RUS area are adequate to meet future demand, at certain locations it is clear that action will be required to accommodate future demand.

- King's Cross is currently the subject of a major scheme funded by DfT to improve interchange with LUL services. On completion in 2010 this will provide a new northern ticket hall linked to King's Cross main line station and St Pancras International and step-free access from the street and mainline international and domestic services to all LUL lines. Associated with this, Network Rail is currently working on the provision of a new western concourse which will greatly increase the space available to passengers compared with the existing facility. The present southern concourse will then be redeveloped creating a new open piazza area at the front of the main train shed.
- Finsbury Park will require work associated with the proposed increase in inner suburban services and reinstatement of an additional platform. This will focus on improving access between the platforms and the subway and to LUL services.
- Highbury & Islington is expected to see substantially increased passenger volumes from 2011 resulting from completion of the East London Line extension. The parts of the station owned by Network Rail are currently considered to be adequate although some work to the LUL areas may be required.

6.15 Combining the options

Many of the recommended options have been developed into discrete interventions and so may be implemented independently of other options. However, some larger interventions are inter-related because the train service or infrastructure changes required by one, overlap with those required by another. This section explains how the elements of Options 1.2, 3.3 and 9.4 were considered together to develop the strategy that was proposed in the RUS Draft for Consultation and is now set out in revised form in Chapter 8 of this document.

One enhancement to the infrastructure is common to the delivery of inner suburban services in option 1.2 and LDHS services in Option 3.3: the conversion for passenger use of a third line in the Up direction (currently the Up Goods) between Alexandra Palace and Finsbury Park, including provision of platforms on this line at each station. This change would permit trains from the Hertford Loop to Moorgate to be segregated from King's Cross services. This scheme is good value for money even without any other changes, because it would allow some shortening of journey times on services to King's Cross, and it would improve performance on this critical section of the route. An appraisal for this change on its own is set out below.

6.15.1 Assessment of Option A

Option A: Alexandra Palace - Finsbury Park: Additional third Up Line		
Concept	The conversion of the Up goods line between Alexandra Palace and Finsbury Park to a third Up passenger line would allow a reduction in journey times for LDHS and outer suburban services passing through this section of the ECML.	
Operational analysis	An additional Up passenger line between Alexandra Palace and Finsbury Park (including the reinstatement of the disused Up platform at Finsbury Park) would allow additional operational flexibility. This option improves current performance and reduces journey times for some LDHS and outer suburban services.	
Infrastructure required	• Re-instatement of the disused Up platform at Finsbury Park and associated station accessibility improvements • Conversion of the Up Goods line between Alexandra Palace and Finsbury Park for use by passenger trains • Additional platforms at Alexandra Palace, Hornsey and Harringay • Revised access to Bounds Green depot	
Passenger impact	This option would allow some journey times between London and the north/Scotland to be reduced by up to three minutes. Performance would also improve.	
Freight impact	This should be minimal, as freight trains do not run on this route section at peak times. There might be a small negative effect in the off-peak and contra-peak due to conversion of the Up Goods line to passenger status.	
Financial and economic analysis	This option brings about both journey time and performance benefits. These have been combined in the economic business case shown below, which is based on the assumption that only half of the benefits generated by the improved LDHS and outer suburban journey times can be achieved, and only half of the benefits from the improvement in performance can be realised. In practice, it may be possible to achieve a higher level of benefit from one element or the other.	
	60-year appraisal	**£million**
	Costs (Present Value)	
	Investment Cost	45.1
	Operating Cost	0.0
	Revenue	-26.7
	Other Government Impacts	6.1
	Total costs	**24.6**
	Benefits (Present Value)	
	Rail users benefits	34.1
	Non users benefits	17.4
	Total quantified benefits	**51.6**
	NPV	**27.0**
	Quantified BCR	**2.1**
	Note: All figures are presented in 2002 market prices.	
Conclusion	This infrastructure change can be recommended for inclusion in the strategy even without any train service changes, as long as care is taken over the balance between journey time reductions and performance benefits.	

This infrastructure was identified as a requirement for the additional inner suburban services proposed in Option 1.2. An incremental appraisal has now been undertaken, to understand whether there is a case for making the changes proposed in Option 1.2 after the Alexandra Palace – Finsbury Park scheme has been introduced as appraised above. This incremental appraisal is set out below.

6.15.2 Assessment of Option B

Option B: Run additional peak services on Hertford Loop to Moorgate	
Concept	This option considers the impact of using the additional infrastructure provided in Option A to operate additional peak services between Hertford North and Moorgate.
Operational analysis	Additional peak inner suburban services to Moorgate cannot be accommodated unless signal sections are shortened in the tunnels on the Moorgate branch to deliver four-minute headways. Performance would worsen significantly compared with the current service, although this would be mitigated to some extent by the additional infrastructure provided under Option A and could be further mitigated by measures such as enhancing infrastructure asset reliability on the branch, careful timetabling of contra-peak services, and introducing improved rolling stock when the current Class 313s are replaced.
Infrastructure required	• Additional signals to achieve four-minute headways on the Moorgate branch • Power supply work in the inner London area would be necessary, but the cost of this is included within the Thameslink Programme so it has been excluded from this appraisal.
Passenger impact	The performance impact noted in the 'operational analysis' section was modelled and indicated some reduction in the improvement delivered by Option A on outer suburban and LDHS services, and worse performance for inner suburban services. However, passengers' perception of the reduction in performance may not be as significant as the value appraised in this case, given the increase in frequency which essentially provides a 'turn up and go' service during the high peak. Even taking the standard appraisal value of the reduction in performance, this is more than offset by the benefits of the additional capacity provided.
Freight impact	This should be minimal, as freight trains do not run on this route section at peak times.
Contribution to 2014 HLOS outputs	If implemented before 2014, this option would deliver the peak capacity increase to Moorgate specified in the 2007 DfT HLOS.

Financial and economic analysis	The appraisal shown below combines the costs and benefits of increasing inner suburban capacity and the predicted worsening of performance.	
	30-year appraisal	**£million**
	Costs (Present Value)	
	Investment Cost	9.5
	Operating Cost	62.2
	Revenue	-25.9
	Other Government Impacts	4.9
	Total costs	**50.6**
	Benefits (Present Value)	
	Rail users benefits	101.1
	Non users benefits	1.5
	Total quantified benefits	**102.7**
	NPV	**52.0**
	Quantified BCR	**2.0**
	Note: All figures are presented in 2002 market prices.	
Conclusion	It is recommended that this option is included in the strategy, with consideration of appropriate mitigations for the anticipated reduction in performance on inner suburban services.	

The infrastructure improvement appraised on its own in Option A above is also identified as a contributor to the peak period service outputs for LDHS services in Option 3.3. As described in the assessment of Option 3.3 and 9.3, neither of the increased outputs required by 2014 (passenger trains to meet forecast growth and contribute to HLOS targets; extra freight trains to meet Freight RUS growth forecasts) is deliverable with acceptable performance on the current infrastructure on the critical Peterborough – Doncaster section of the route. Alternatives for delivering extra capacity on this section are considered in the 'infrastructure required' section of the assessment below.

6.15.3 Assessment of Option C

Option C: Increase LDHS service at King's Cross to 8tph peak/6tph off peak, and increase freight capacity in line with Freight RUS forecasts	
Concept	This option considers ways to provide the combination of outputs required by Option 3.3 (to meet the LDHS passenger growth identified in Gap 3) and Option 9.3 (to meet freight growth identified in Freight RUS Gap C).
Operational analysis	A standard pattern timetable repeating every one or two hours would deliver the outputs required if it contained six LDHS paths and two freight paths in each direction in each off-peak hour and eight LDHS paths in each peak hour. It is assumed that no freight services (in the peak direction) would operate when the peak level of LDHS services runs. The quantum provided by two freight paths between Peterborough and Doncaster in each direction every off-peak hour would cater for existing services (including both 75mph and 60mph trains) and the growth forecast in the Freight RUS. During the LDHS off peak, the critical part of the route is the two-track section between Stoke Junction (north of Peterborough) and Loversall Carr Junction (south of Doncaster). Timetable development work over this section, using a number of different specifications for a sample off-peak hour, has indicated that 6tph LDHS services and 2tph 75mph freight paths can theoretically be accommodated but with poor journey times for some freight and passenger services. Performance modelling of sample timetables has shown that there would be a significant performance disbenefit over this two-track section. Even with only one 75mph freight path per hour, there is still a significant impact on the reliability of passenger and freight services. No daytime 60mph paths for freight would be available. During the LDHS peak period, the critical part of the route is the section between King's Cross and Peterborough (specifically: the two-track section between Digswell and Woolmer Green; Cambridge Junction at Hitchin; and platform capacity at King's Cross). Infrastructure investment is therefore required to deliver both the peak and the off-peak outputs (in terms of paths, reliability and journey times) in this option. Enhancements to rolling stock could contribute to optimising the timetable south of Hitchin to avoid very costly infrastructure enhancement on the Digswell to Woolmer Green section: ■ introduction of rolling stock with improved acceleration on the inner suburban services when the Class 313s are replaced ■ replacing the Class 317s (which operate some of the outer suburban services) with units whose characteristics are at least as good as the Class 365s used on the remaining outer suburban services In addition, south of York the use of LDHS rolling stock with a maximum speed of less than 125mph should be avoided as far as possible to minimise the speed differential between the various LDHS services.

Infrastructure required	Alternatives were considered for provision of the outputs required over the critical section in the off peak: ■ enhancements to the freight loops or providing additional loops ■ (partial) four-tracking of the ECML ■ significantly upgrading the Peterborough – Lincoln – Doncaster route for freight traffic, such that freight operators could reasonably use that route instead ■ running additional freight services via the Midland Main Line, to relieve this critical section of the ECML Consideration was given to the question of which of these options would be the most cost-effective means of creating sufficient extra capacity. Analysis of the costs of recent comparable projects suggested that four-tracking and the extension of freight loops would cost in the range of £20-25 million per route mile. Hence for comparison purposes, using a spot cost of £20 million per route mile, four-tracking of as much of the ECML as possible would cost about £1 billion. This would deliver a level of benefits similar to upgrading the GN/GE Joint Line, but would cost over four times as much, since the comparable estimate for the Joint Line upgrade is £225 million (spot cost). Four-tracking a lesser proportion of the ECML or just extending loops would of course be less expensive, but would deliver a much lower level of benefits. Meanwhile, the option of four-tracking the ECML as far north as Newark, and then upgrading the diversionary route from Newark to Doncaster via Swinderby and Gainsborough, was estimated to cost over £400 million and is 5 miles longer than the route via the Joint Line. This would deliver a level of benefits slightly less than the Joint Line upgrade, but at nearly twice the price, so it is not as good value either. None of these options provides the benefit that the Joint Line upgrade delivers of creating an entirely separate diversionary route for the ECML for 75 miles of its length. The fourth option, of using the Midland Main Line (via Oakham, Syston Junction, Toton and Chesterfield) also provides some of this benefit, and though not a viable passenger diversionary route for the ECML, if suitably enhanced it could be an acceptable route for freight traffic between Peterborough and South and West Yorkshire. However, journey times via this route to Doncaster, the North East, Scotland, and the Humber area could be significantly longer than via the current route or the Joint Line, and it is unlikely that delivery of sufficient capacity and capability on this route would be feasible before 2014. Development of this route beyond that date to supplement the additional capacity on the Joint Line (Section 8.6.7) will be considered in greater depth in the East Midlands and Yorkshire and Humber RUSs. On the basis of current cost estimates and deliverability timescales, the upgrade of the GN/GE Joint Line via Spalding, Lincoln and Gainsborough is recommended for short to medium-term freight and passenger growth. The appraisal therefore includes the cost of the following infrastructure changes, which are definitely required to deliver the outputs: ■ Upgrading the route from Peterborough to Doncaster via Spalding, Sleaford, Lincoln and Gainsborough, to accommodate 2tph freight services as well as the current passenger and freight services, with an end-to-end journey time comparable with freight paths on the route via Grantham, Newark and Retford ■ Upgrading or removal of level crossings where required by the increased train service frequency

<table>
<tr><td></td><td>The appraisal also includes the cost of the following infrastructure changes, which are considered to be required to deliver the outputs although further analysis may prove that the cost of the scheme is greater than the performance and journey time benefits they bring:
■ Conversion for passenger use of a third line in the Up direction (currently the Up Goods) between Alexandra Palace and Finsbury Park, including provision of platforms on this line at each station
■ Platforms on the third passenger line in the Down direction (Down Slow 2) between Finsbury Park and Alexandra Palace
■ Grade separation of Cambridge Junction at Hitchin
■ A contribution to the remodelling scheme at Peterborough
■ Changes at Doncaster to reduce the number of conflicting movements.</td></tr>
<tr><td>Passenger impact</td><td>Crowding would be reduced significantly but additional demand would also be generated by providing additional capacity.
The volume of passenger traffic on LDHS services is sensitive to fares levels. The following table indicates a forecast of passenger growth to 2016 for the base and with implementation of this option, for various fare scenarios. The changes per annum have been assumed to apply to all fares; current Government policy is to increase regulated fares by an average of RPI+1% each year but unregulated fares are a matter for individual train operators.
<table><tr><th></th><th>RPI +1%</th><th>RPI +2%</th><th>RPI +3%</th><th>RPI +4%</th></tr><tr><td>Base</td><td>40%</td><td>23%</td><td>12%</td><td>2%</td></tr><tr><td>Option 3.3</td><td>54%</td><td>33%</td><td>21%</td><td>11%</td></tr></table>These figures demonstrate that without additional services, there would be a need to manage crowding by increasing fares at times of high demand.</td></tr>
<tr><td>Freight impact</td><td>This option would provide the Freight RUS path requirements without adversely affecting daytime freight journey times, as services running via Lincoln would not need to be looped for passenger services to pass. However, existing freight services would need to travel 10 miles further than via the main line, which would affect mileage-related operating costs.
Standard freight paths would improve timetabling opportunities for freight services across a wide area and might unlock greater end-to-end capacity on long-distance flows.
Significant capacity would be created because in addition to the 2tph in the standard pattern off-peak timetable, more paths would be available in both directions at peak times, and overnight, there would be much greater network availability between Peterborough and Doncaster.
The upgrade of the GN/GE Joint Line would enable the provision of additional night-time freight paths if closures or part-closures for engineering work were limited to only one of the two routes at a time.</td></tr>
</table>

Contribution to 2014 HLOS outputs	If implemented before 2014, this option would deliver about half the peak capacity increase to King's Cross and potentially all of the ECML Route capacity increase specified in the 2007 DfT HLOS.	
Financial and economic analysis	For the purpose of this appraisal it was assumed that any additional passenger services are operated by a franchised operator, ie. that any operating costs and fare revenues generated are visible in the appraisal and that most net revenue would (in the long run) accrue to the public sector. This assumption is not intended to prejudge the allocation of capacity between franchised and open access operators which will be determined through normal industry processes.	
	60-year appraisal	**£million**
	Costs (Present Value)	
	Investment Cost	580
	Operating Cost	727
	Revenue	-940
	Other Government Impacts	239
	Total costs	**606**
	Benefits (Present Value)	
	Rail users benefits	1,166
	Non users benefits	578
	Total quantified benefits	**1,744**
	NPV	**1,138**
	Quantified BCR	**2.9**
	Note: All figures are presented in 2002 market prices.	
Conclusion	It is recommended that this option is included in the strategy.	

It is clear that the proposed increases in passenger and freight services generate very large benefits and are likely to be able to support the infrastructure works required to achieve a satisfactory balance of capacity and performance. Therefore, it is recommended that Option C is included in the strategy, with further analysis to establish the scope, performance impact, incremental business case, timing and prioritisation of the various infrastructure changes that have been identified.

7. Consultation process and overview

7.1 The draft for consultation

This section outlines the key outputs that have informed the development of this strategy.

The East Coast Main Line RUS Draft for Consultation was published in June 2007, along with a press release announcing its publication. The document outlined a number of gaps between the present capability of the rail routes throughout the East Coast and North East (in terms of capacity and performance), and the predicted demand for both freight and passenger traffic up to 2016. A set of options was proposed for bridging those gaps.

The Draft for Consultation was distributed to a wide range of stakeholders and a period of twelve weeks was given to allow stakeholders to respond. The consultation period ended on 21st September 2007.

During the consultation period, stakeholders were invited, either collectively or individually, to briefing sessions at which specific issues were discussed.

7.2 Consultation responses

A total of 87 consultation responses were received and these are broken down as follows:

Train operators	10
Government and Local Authorities	39
Businesses	4
User Groups	25
MPs	2
Members of the public	7

Copies of the various responses can be found on the Network Rail web site at www.networkrail.co.uk.

7.3 Key themes in the consultation responses

The responses which Network Rail received were varied and, in many cases, comprehensive. Therefore, only the key and recurring themes are summarised below:

7.3.1 Positive Reaction

General reaction from most respondents was positive, particularly welcoming the fact that the ECML was now the subject of detailed study against a background in recent years of the primary focus being on the West Coast Main Line and the West Coast Route Modernisation. Responses were generally supportive of the gaps identified, the options proposed for recommendations, the overall direction of the RUS, and the work being done.

7.3.2 Appraisals

Many respondents felt that the Draft for Consultation did not provide sufficient completed option appraisals for a full analysis to be done. Since publication, Network Rail has carried out extensive work on all of the outstanding options and is able to demonstrate that the forecast demand can be met out to 2016 with the measures that are being recommended.

7.3.3 Performance

It was suggested that there should be a better understanding of primary delay on the route and possibly compare it with other routes. The RUS has not examined this as there are other industry processes that look at primary delay.

It was noted that some current planning headways differ significantly from signalling headways when compared with other areas of the network. On one hand this provides some performance resilience but does have

capacity implications. Any proposed changes to planning headways would need to be examined through the industry Rules of the Route process.

7.3.4 North East

Concerns were raised by stakeholders in the North East that there are signs of more emphasis being put on the southern end of the route whilst there does not appear to be a strategy for the North East. There is a perception that the issues in the north are not being addressed because the level of spend is lower than in the south.

However, the strategy provides for dealing with commuter growth, particularly into Newcastle, just as it does for London. The difference is that significant infrastructure enhancement is required in the south in order to run longer or additional trains where the volume of rail users is much higher. It also aims to assist the economic development of the North East by enhancing long distance high speed (LDHS) services such that journey times between the North East and London are improved, additional capacity is provided and the service interval becomes more regular.

7.3.5 Scotland

It was felt that the present rail share of the London – Scotland market compared with air was sub-optimal and it was important that when LDHS timetable changes were made at the southern end of the route the opportunity was not missed to reduce the number of station stops in Anglo-Scottish services, leading to more attractive overall journey times for long distance passengers. However, this would need to be balanced with returning some key direct Scottish flows such as to/from Peterborough.

7.3.6 RPA

Respondents were disappointed that most North East options related to possible interventions in the DfT's North East RPA and were not being recommended by the RUS. The RPA had specifically asked that these were examined by the RUS and these were all examined using the DfT's appraisal criteria, the results of which are in Chapters 4 and 8. There were no other passenger focussed RUS gaps in the area, other than North East commuter growth, so the RUS did not consider other options.

7.3.7 Growth

Concern was expressed that in some areas growth was occurring at a more rapid rate than industry models were forecasting and that if the trend continues the actions proposed in the RUS might not be sufficient.

The RUS had already recognised this issue and for the North East, the high growth assumptions have been used for the appraisals as these are consistent with observed historic trends.

7.3.8 Capability

Whilst in Chapter 3 of the Draft for Consultation it was noted that some signalling and track layouts in the North East constrain capacity, few of the options appear to address any of these issues. The RUS has already identified some enhancements and Network Rail would normally review other opportunities when renewals become due.

7.3.9 Freight

There is no mention in the consultation document of increasing Route Availability (RA) or electrical power supplies for freight and a lack of information on upgrading and/or opening additional diversionary routes in terms of gauge and RA. In particular, the Tyne Valley route should be considered for W9 and W10 gauge to allow diversion of European and deep sea container traffic from the East and West Coast Main Lines.

Timetabling solutions must recognise the existence of freight terminals on the ECML and the need to ensure reasonable access opportunities, including during the daytime. Options involving permanent diversion of daytime freight off the ECML to the 'GN/GE Joint Line' or the Midland Main Line must recognise the necessity of fully adequate infrastructure as a pre-requisite and an agreement reached on the effects of the additional mileage.

The RUS has now examined freight capability on the main arteries and diversionary routes and has recognised the issues around diversion of daytime services.

7.3.10 Network Flexibility

Very little was mentioned in the consultation document regarding bi-directional signalling for use during times of perturbation and W10 gauge diversionary routes.

Another area that was highlighted was the effect the Government's White Paper 'Delivering a Sustainable Railway' would have in terms of Intercity Express Programme and how this will affect capacity within the RUS timescales.

This document covers these issues in more detail and recommends a number of issues that the 7-Day Railway initiative needs to examine as well as some direct infrastructure enhancement recommendations.

7.3.11 Depot and Stabling

Some of the options in the Draft for Consultation required lengthening services or increasing the number of trains. Some respondents wanted to see a clear strategy for improving stabling facilities, including whether the current facilities are able to cater for the additional units, and if not, what options are preferred. These issues have been addressed.

7.3.12 Station strategy

Consultation responses expressed concern that there was no clear strategy in the RUS for access to stations and that as there is currently believed to be insufficient car parking along the route, this should have been addressed in the RUS, there being a feeling that it had not been expressed as comprehensively as in other RUSs. This document has covered these issues mainly by identifying that other industry workstreams are addressing many of them.

7.4 Responses outside the RUS scope

Several responses called for the RUS to consider the construction of new or re-opening of former stations and lines. Whilst these points were welcomed, the scope of the RUS dictates that such options should only be considered where they address a gap that was identified through the RUS process. There is also little mention about how to improve patronage at the low footfall stations along the route. This is something that the relevant Train Operators would examine opportunies for.

Responses which propose options considered to be outside the RUS remit will be passed to railway specifiers and funders for their consideration.

8. Strategy

8.1 Introduction

The routes in the East Coast Main Line and North East areas are generally already very well used by both passenger and freight traffic. The most acute issues on the ECML are accommodating the growth in passenger and freight traffic and a number of performance issues. The Strategy therefore seeks to address the question of meeting growth progressively over time, whilst improving on current levels of performance.

The RUS process has considered the current and future freight and passenger markets and assessed the future growth in each. It has then sought to accommodate this growth effectively and efficiently, in accordance with the route utilisation objective specified in Licence Condition 7. The measures proposed range from lengthening services to provision of additional infrastructure.

The RUS has considered Regional Planning Assessment options and has looked at other potentially fundable stakeholder aspirations, particularly those of the Department for Transport, Passenger Transport Executives, Transport for London, Transport Scotland, local authorities and regional bodies. In the course of this investigation, options were developed, tested, sifted and modified until feasible solutions were identified with acceptable performance and meeting value for money criteria, which were consistent with anticipated funding and acceptable to all key stakeholders.

8.2 Principles

8.2.1 Dealing with growth

The general principle adopted throughout the RUS has been to consider simpler and lower cost interventions before turning to more complex and expensive solutions. In the first instance optimising use of existing infrastructure has been examined. Timetabling solutions have always been sought as preferable to infrastructure works, subject to there being no unacceptable performance impact. The next step has been to consider the progressive lengthening of trains where heavy demand exists to the maximum practical size and only then to look towards infrastructure enhancement. Again the range of options is considered in order, from simpler schemes such as platform extensions, through more far-reaching measures such as signalling and power supply upgrades, or capability works for heavier/longer freight trains, to more comprehensive investment in the whole of a line of route.

Looking to the longer term, account has been taken of the opportunity presented by the introduction of new trains to assume improved seating capacity per train through the design specification for the Intercity Express Programme (IEP), the new vehicles for the Thameslink Programme and the possibility towards the end of the period covered by the RUS of the renewal of the London inner suburban fleet.

8.2.2 Performance

Issues affecting performance on the ECML are complex, given its length and the wide range of services operating over it, with many of the services originating from places well outside the route. It is clear that major factors are the mix of services with varying speed and stopping patterns, the large number of complex junctions and crossings, mostly on the level, with conflicting train movements and the very limited extent of electrified diversionary routes. These factors become critical when trains are running out of

sequence due to an incident and the strategy seeks to address this issue.

8.2.3 Access to stations

Access to the network was also highlighted as a gap in the RUS. A range of measures are proposed to improve access to the railway and work is already in hand to extend car parks at a number of stations where parking is already at or close to capacity. There will be a continuing need to work with train operators, local authorities and other stakeholders to maximise access opportunities both within the Network Rail property portfolio and beyond it.

8.2.4 Rolling stock

DfT published its Rolling Stock Plan on 30 January 2008. The Plan sets out how rolling stock will be used to deliver increased capacity and hence contribute to the capacity outputs required over the period covered by the 2007 HLOS (2009 – 2014) and beyond. The DfT and train operators have been involved in the ECML RUS throughout its development, so it has been possible to ensure that the strategy set out in this chapter takes account of the key provisions of the Rolling Stock Plan. The fleet replacements represented by IEP for long distance high speed (LDHS) services and the Thameslink Programme (for outer suburban services) will both contribute significantly to this strategy, but their impact will be felt mainly after 2014.

Further benefits might be achieved by replacement of the Class 317 fleet with rolling stock whose characteristics are at least as good as Class 365s which would minimise journey time differentials between outer suburban and LDHS services and thereby optimise the timetable. Similarly, replacement of the Class 313 fleet would give an opportunity to procure or deploy rolling stock with characteristics that optimise between the needs for rapid acceleration/deceleration, maximum carrying capacity and quick access/egress to minimise station dwell times.

8.2.5 Depots and stabling

A strategic solution to provision of adequate rolling stock facilities is a network wide issue and will be considered as part of the Network RUS. So far as London area suburban services are concerned, provision of additional depot accommodation will be a key feature of the Thameslink Programme with the substantial expansion of the fleet size envisaged.

The number of vehicles required to deal with growth in the North East is relatively small and is expected to be accommodated within Northern Rail's existing facilities. There may be a need for some expansion in the Yorkshire and Humber area and this will be dealt with in the RUS for that area.

Until IEP roll-out commences it is considered LDHS vehicles can largely be handled within existing facilities. The IEP Programme will consider in depth the depot facilities required to allow successful implementation and as the Programme is still in its early stages, it is not possible as yet to indicate the likely implications.

8.2.6 Power supplies

With much of the network within the RUS area electrified at 25kv (and 750v third rail Drayton Park – Moorgate), traction power supply is potentially critical to service developments such as the operation of more frequent and longer trains - especially on the Moorgate branch where only electric traction can be used. A number of interventions have

been identified which will address the more immediate issues posed by growth, notably the progressive implementation of the upgrade works south of Peterborough and Cambridge that are required for the Thameslink Programme.

Looking further to the future, potential for service development within the limits of the existing power supply infrastructure is dependent on the exact timetable, train formations and classes of traction that will be used. Considerable spare capacity is expected to continue to be available off-peak, but there may be constraints at times of maximum demand. Traction units which draw heavily on power – Class 92, for example – have been subject to restrictions which are progressively being removed. In the longer term, much will depend on the power consumption characteristics of IEP vehicles, details of which will not become known until later in the year when the procurement process has reached a more advanced stage.

By the end of 2008, it is expected that all electrified routes within the RUS area will have been made receptive to regenerative braking, allowing the environmental and financial benefits of regeneration to be exploited by future new build and re-engineered rolling stock.

8.2.7 Engineering access

The ECML is used by fast passenger services and high passenger and freight tonnages – it is consequently in the top category for the specification and scheduling of maintenance inspections and work. The RUS recommendations to run additional services are therefore not expected to drive a need for additional maintenance access. By contrast, the recommended upgrade of the GN/GE Joint Line will lead to a significant increase in tonnage on that route, requiring additional maintenance. But the creation of two practical double-track routes between Peterborough and Doncaster will allow a step-change improvement in passenger and freight capacity, with near-constant availability of the route for through services, while allowing appropriate engineering access. This is indicative of the benefits that can be delivered by the '7-Day Railway' initiative, where consideration of local conditions and constraints drives targeted investment to improve the flexibility and availability of the network.

Similarly, the recommendation to upgrade the Hertford Loop will deliver better capacity in normal use and much greater flexibility when the ECML via Welwyn is closed.

8.3 Developing the strategy

The RUS seeks to attain the effective and efficient use and development of railway capacity, commensurate with funding and other constraints. It is important to differentiate between:

- Measures which contribute to the objective and which are financially neutral or beneficial
- Measures which contribute to the objective; which have a net financial cost but are value for money when their socio-economic benefits are considered; and which are necessary to meet gaps identified through RUS analysis
- Measures which contribute to the objective which have a net financial cost but are the result of specific requests from railway funders.

One measure included in the strategy has a financial case for implementation: the proposal to invest in the capability of the Hertford Loop to allow more trains to run when the main line via Welwyn is closed is clearly financially beneficial on the appraisal assumption of closures for eight weekends each year.

Although some options were investigated as the result of requests from railway funders, after discussions of the assessments, none has been included in the strategy, therefore all of the other measures that are recommended offer value for money using standard appraisal criteria and fall into the second of the three categories identified above.

8.4 Short-term strategy 2008 – 2009 (Control Period 3)

The most acute issue on the ECML is accommodating the forecast growth in both passenger and freight traffic, although a number of performance issues are also apparent. Significant additional capacity cannot be delivered in this timescale, although development work will continue on a number of proposed Control Period Four (CP4) initiatives.

Small scale power supply improvements will be made to facilitate additional London suburban services, to address peak crowding on the Cambridge route with enhanced switching arrangements in the Alexandra Palace area and enhanced booster transformers between Hitchin and Cambridge. Platforms will be lengthened at Cambridge and Royston. These additional services are those proposed by First Capital Connect in their Cambridge Capacity Study.

8.5 Medium-term strategy 2009 – 2014 (Control Period 4)

8.5.1 Background

In July 2007, High Level Output Specifications (HLOSs) were published for England and Wales, and for Scotland. The HLOSs set out the improvements in the safety, reliability and capacity of the railway system which the Secretary of State for Transport and Scottish Ministers want to secure during the period 2009 – 2014.

Network Rail's Strategic Business Plan identifies the schemes required to meet these outputs: the Plan produced in October 2007 aligned with the emerging conclusions of the ECML RUS Draft for Consultation and the revision to the Plan to be published in April 2008 will incorporate the final conclusions of this RUS.

The strategy in the medium term consists of measures to increase capacity for peak passenger services into London and other urban centres, to increase and improve long distance passenger services throughout the day and to provide capacity for freight growth. In addition, work will commence on the development of measures expected to be required in later years. The England & Wales HLOS makes special mention of the Thameslink Programme, for which funding has been identified. Thameslink Key Output 2, which connects the ECML to the cross-London tunnels, will not be complete until 2015, but enabling works will be carried out during the preceding years. This RUS identifies elements of the Thameslink Programme, particularly improvements to the power supply, platform extensions at outer suburban stations, and additional stabling and maintenance facilities, as being critical to the delivery of the required outputs during the years 2009 – 2014.

The strategy for CP4 is set out below.

8.5.2 London inner suburban

Inner suburban peak services that are currently three cars long will increasingly be run at full six-car length. This requires work to upgrade the power supply. (CP4-3 in Figure 46)

Additional six-car morning and evening peak inner suburban services will be operated to/from Moorgate with priority given to the Hertford North route. This will require a significant range of infrastructure enhancements. (CP4-4 in Figure 46)

Additional inner suburban services will be run between the peaks, at evenings and weekends to move towards an all-day frequency of 4tph on the Hertford and Welwyn routes. (CP4-5 in Figure 46)

Inner suburban services on the Hertford Loop will be less disrupted by diversions when there is engineering work or other disruption on the route via Welwyn, because of improvements to the capability of the route via Hertford North. (CP4-2 in Figure 46)

8.5.3 London outer suburban

Outer suburban peak services that are currently eight cars long will increasingly be run at full 12-car length. This requires works to upgrade the power supply, provide additional

stabling and maintenance facilities, and lengthen platforms at a number of stations. Much of this work is within the scope of the Thameslink Programme, but is likely to be needed before the Programme currently plans to deliver it. Network Rail will work with DfT to prioritise those items that are within the scope of the Programme and to develop schemes to deliver the other enhancements that are required to deliver HLOS outputs for 2014. (CP4-1 in Figure 46)

Outer suburban services will be less disrupted by engineering work or other disruption on the route via Welwyn, through improvements to the capability of the diversionary route for this section via Hertford North. (CP4-2 in Figure 46)

8.5.4 Long distance passenger services to/from London

Additional LDHS services will run to and from King's Cross in the peak (up to 8tph) and off-peak (6tph) in a standard hour or two-hour repeating timetable.[1] This is best delivered as a combined approach that also caters for medium-term freight growth through investment in infrastructure capacity between Peterborough and Doncaster. Services will be less disrupted by engineering work or other disruption on the route via Grantham, because of improvements to the capability of the main diversionary route. Infrastructure enhancements will also be required south of Peterborough to enable the peak level of service to operate reliably. This approach will meet expected growth, while creating the potential to improve connectivity, make best use of capacity and reduce long-distance journey times. (CP4-6 in Figure 46)

Long distance passenger services will be less disrupted by engineering work or other disruption on the route via Welwyn, through improvements to the capability of the main diversionary route for this section via Hertford North. (CP4-2 in Figure 46)

Pre-series IEP trains are expected to be introduced on some services. (CP4-7 in Figure 46)

8.5.5 Non-London long distance passenger services

The CrossCountry franchise is committed to deliver additional capacity, and capacity on cross-Pennines services is being addressed in the Yorkshire and Humber RUS.

8.5.6 Regional passenger services

Trains will be lengthened in the North East to provide increased capacity on the busiest peak trains to/from Newcastle and Middlesbrough. (CP4-8 in Figure 46)

8.5.7 Freight (south of Doncaster)

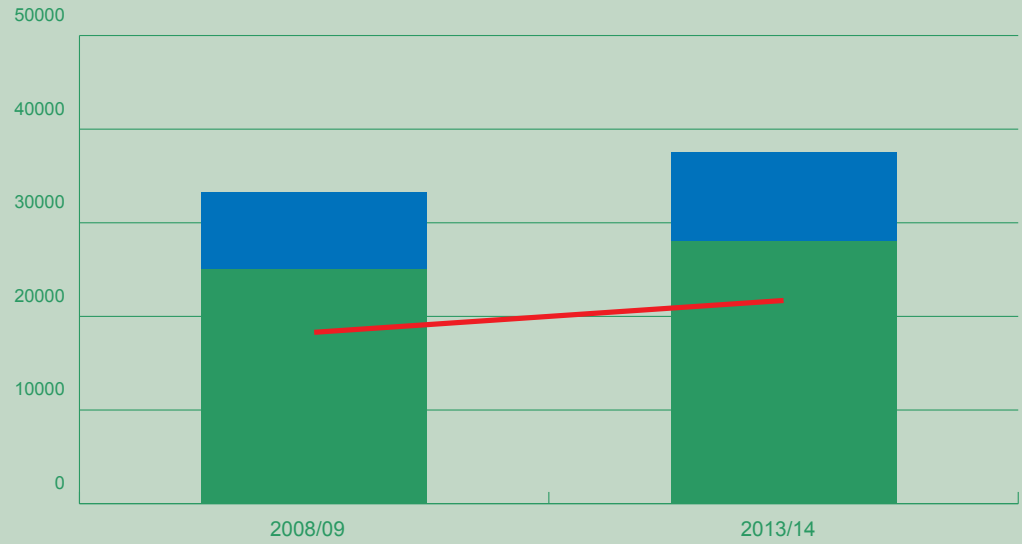
Additional freight paths will be provided to support the level of demand forecast in the Freight RUS. This is best delivered by a combined approach that also caters for medium-term passenger growth through investment in infrastructure capacity between Peterborough and Doncaster. Services will be less disrupted by engineering work because of the availability of a parellel route for this section of the ECML. This approach will not only meet expected growth as forecast in the Freight RUS, but provide capacity for much more traffic in future years, potentially including paths for trains between East Anglia and the north at peak times because their route will have minimal conflict with the peak passenger flows. (CP4-9 in Figure 46)

8.5.8 Freight (north of Doncaster)

Continued freight growth will be enabled by the provision of additional capacity at constrained locations identified in the Freight RUS: reinstatement of Boldon East curve (to relieve the section between Port of Tyne and Tursdale Junction); modification of Shaftholme and Joan Croft Junctions (to remove the need for freight services crossing the ECML to use the section of the route north of Joan Croft Junction); and

1 South of Doncaster the repeating pattern will be off-peak only to allow the calling patterns of peak services to be optimised

Figure 45 – King's Cross: AM peak demand and capacity



works to improve progressively the capability of freight routes as funds can be identified. (CP4-10 in Figure 46)

8.5.9 Delivering the outputs

This strategy will deliver the HLOS outputs for DfT and Transport Scotland in 2014. As an example, Figure 45 shows the effect of the strategy interventions on peak capacity at King's Cross against the passenger numbers required by the HLOS: it can be seen that the average load factor across the morning peak (07:00 – 09:59) can be expected to remain approximately as now.

The changes advocated by this strategy before 2014 will require a significant range of enabling infrastructure work. These comprise:

A. New power feeder station in inner London and upgrade of power supplies at Potters Bar. This will allow increased 12-car outer suburban operation and growth in other electric services, including the Intercity Express Programme (IEP).

B. Additional signals to reduce headways on the Moorgate branch.

C. Conversion of the Up Goods line between Alexandra Palace and Finsbury Park to passenger use including an additional platform at each station. This will improve performance, reduce pathing time, allow additional Finsbury Park calls and allow additional inner suburban services.

D. Platforms on the third passenger line in the Down direction (Down Slow 2) between Finsbury Park and Alexandra Palace. This will allow additional services to operate without an unacceptable impact on journey times or performance.

E. Hertford Loop resignalling, with improved turnback facilities and additional crossovers at Stevenage. This will allow an increased level of service when trains need to be diverted via Hertford North when the main line (with its two-track section in the Welwyn North area) is blocked by engineering works or an incident.

F. Grade separation at Hitchin Cambridge Junction. This will improve journey times and reduce adverse performance impact and junction safety risk.

G. Longer platforms at outer suburban stations and additional stabling and maintenance facilities. This will provide for increasing 12-car operation on peak services.

H. Layout enhancements at Cambridge. An additional island platform will allow increased outer suburban 12-car operation (also recommended in the Greater Anglia RUS).

I. Layout enhancements at Peterborough. An additional island platform will separate East Anglia services from Down LDHS services, potentially speeding up journey times for trains that call at Peterborough; stabling will be increased for outer suburban 12-car operation, and increased capability and capacity will accommodate growth in freight traffic.

J. Peterborough - Doncaster capacity increase through enhancing the parallel 'GN/GE Joint Line' route via Spalding and Lincoln. This is the most effective way of delivering the LDHS and freight growth required within this timescale. The capability delivered on this route will affect which traffic can reasonably use it rather than the main line via Grantham. The capability specification appraised provided a loading gauge and speed upgrade suitable for the fastest freight trains, but did not, for example, include electrification.

K. Capacity and service enhancement at Doncaster station to reduce conflicting movements in the event of increased LDHS and freight services. This will be developed within the Yorkshire and Humber RUS alongside analysis of the needs of local services.

L. Shaftholme/Joan Croft Junction reconfiguration or grade separation. This will deliver freight (and potential LDHS) growth, performance and improved Immingham to Aire Valley coal train journey times plus environmental benefits.

M. Additional (fourth) line at Holgate Junction south of York station and other enhancements in the station area. This will significantly reduce conflicting movements, with consequent performance and capacity benefits.

N. Programme of level crossing enhancements or closures. This will allow an increase in LDHS and freight paths.

O. Loading gauge enhancement to W9/W10 or W12 on priority routes, building on committed schemes.

P. Re-instatement of East Curve at Boldon. This will allow freight trains to/from the Port of Tyne to use the Durham Coast line via Sunderland as an alternative to the ECML south of Newcastle.

Q. Infrastructure works associated with the introduction of IEP trains.

Some of these changes are essential to delivery of one or more outputs, including the improvement in the overall reliability of franchised passenger services as required by the HLOSs. Figure 46 shows the complex interdependencies between each infrastructure element and each element of the strategy during CP4.

Delivery of the strategy for the route during CP4 will require analysis of the value of the different inputs and outputs to understand better the relationships shown, and to produce a robust staged implementation plan. Some of the inputs might be redefined or eliminated after further development work, but this is considered unlikely because many of the key dependencies are already clear.

Delivery of a completely restructured timetable to realise all the benefits of the investments in capacity will depend upon renegotiation of some existing track access contracts.

Figure 46

Key:

	Contributes to delivery of the strategy element
	Not required to deliver the strategy element
	Within the list of enhancements for which funding is to be sought through the Periodic Review
	Not within the list of enhancements for which funding is to be sought through the Periodic Review

*Some schemes are candidates for Periodic Review funding as part of the Strategic Freight Network

		CP4-1	CP4-2	CP4-3	CP4-4	CP4-5	CP4-6	CP4-7	CP4-8	CP4-9	CP4-10
		Longer outer suburban peak trains	Less disruption when Welwyn route is closed	Longer inner suburban peak trains	Additional inner suburban peak trains	Additional inner suburban off-peak trains	Additional LDHS trains	New LDHS trains (IEP)	Longer North East peak trains	Additional freight paths south of Doncaster	Additional freight paths north of Doncaster
A	New power feeder station in inner London and upgrade of power supply at Potters Bar										
B	Additional signals on the Moorgate branch										
C	Conversion of the Up Goods line between Alexandra Palace and Finsbury Park for passenger use including additional platforms										
D	Platforms on the third passenger line in the Down direction (Down Slow 2) between Finsbury Park and Alexandra Palace										
E	Hertford Loop resignalling, with layout enhancements at Stevenage										
F	Grade separation of Hitchin Cambridge Junction										
G	Longer platforms at outer suburban stations and additional stabling and maintenance facilities										
H	Layout enhancements at Cambridge										
I	Layout enhancements at Peterborough										
J	Capacity enhancement between Peterborough and Doncaster via Spalding and Lincoln										
K	Capacity and service enhancement at Doncaster										
L	Layout enhancement at Shaftholme & Joan Croft Junctions north of Doncaster										
M	Additional (fourth) line at Holgate Junction south of York station										
N	Programme of level crossing enhancements or closures										
O*	Loading gauge enhancement to W9/W10 or W12 on priority routes										
P	Re-instatement of East Curve at Boldon										
Q	Infrastructure works associated with the introduction of IEP trains										

8.6 Contingent projects

8.6.1 Thameslink Programme

The Secretary of State for Transport has given financial approval for the Thameslink Programme, upgrading the Thameslink line and extending its service pattern. The benefits will be delivered in two increments. The first involves the provision of the capability for 12-car operations at a frequency of 16 trains per hour through the core London section and via the Midland Main Line towards Bedford by December 2011. The second increment, which involves the connection of the Great Northern services into the route and operation of 12-car trains on the Peterborough and Cambridge routes, is planned to be delivered by December 2015. The overall Programme involves £3.55 billion of infrastructure works which will be undertaken by Network Rail, as well as the acquisition of new trains and the revision of relevant franchises. The Programme has completed its passage through the Parliamentary planning process; the necessary infrastructure works are included in the Government's CP4 HLOS and Network Rail's Strategic Business Plan.

The effect of the second increment will be substantial in linking ECML outer suburban services directly to the City of London as well as a wide range of destinations further south, including East Croydon and Gatwick Airport. It will also offer improved east-west connections by means of the new Crossrail interchange at Farringdon. The strategy in this RUS to extend outer suburban peak train lengths is intentionally compatible with the proposals contained in the Thameslink Programme, though some of the schemes in the programme will be required earlier and some additional enhancements will be necessary to deal with forecast peak hour demand.

8.6.2 Crossrail

Like Thameslink, Crossrail aims to create major improvements in journey opportunities across central London by linking Maidenhead and Heathrow in the west with Shenfield and Abbey Wood in the east. It will include new stations at key city locations such as Bond Street, Farringdon and Canary Wharf. The Prime Minister announced a £16 billion funding package for the project in October 2007. A Bill is currently progressing through Parliament with construction expected to begin in 2010 and the first trains are expected to run in 2017. Whilst there is minimal physical impact by Crossrail on the lines covered by this RUS, there will be benefit to passengers using ECML Thameslink services through improved east/west connectivity via Farringdon.

8.6.3 Intercity Express Programme

The Intercity Express Programme sponsored by DfT has commenced development and whilst it is currently in its early stages it is clear that it will be a significant element in the long-term development of the ECML. Network Rail will support IEP with a range of infrastructure works to accommodate operation of the new trains, and National Express East Coast is committed to operation of the pre-series trains. The DfT has invited bids from pre-qualified bidders by May 2008 for delivery of IEP vehicles, with a view to contract award in April 2009. The ECML is firmly included within the scope and there is a priced option also for inclusion of King's Cross – Cambridge – King's Lynn.

9. A longer term scenario

9.1 Background

This RUS primarily examines the period to 2016, for which the rail industry's preferred strategy is set out in the previous chapter. It is increasingly becoming necessary to prepare plans for the next decade in the context of possible longer term requirements; a point reinforced by the 2007 Government White Paper 'Delivering a Sustainable Railway.'

The White Paper anticipates continuing growth in passenger and freight traffic and suggests that there could be an overall doubling of traffic over the next 30 years. Against this background, the RUS has considered as a scenario what this level of growth would mean for the ECML and North East routes. It has looked at capacity provision foreseen in 2016, 10 years from the RUS base year of 2006, and what might be provided 30 years on in 2036.

The scenario is not a forecast. Such a doubling of traffic may or may not happen depending on a variety of circumstances. Long distance high speed train operators on the route have expressed a view that such a growth will occur much sooner than 2036. This scenario has been developed specifically because of its link to the White Paper.

For the purposes of this assessment it is assumed that a doubling of passenger journeys occurs in proportion to existing rail travel patterns across all markets. This reflects that all market segments have been experiencing significant growth over the last few years.

It is assumed that the majority of freight growth will be on intermodal flows driven by the expansion of east coast ports. Therefore there would be more than a doubling of freight path requirements on those arteries connecting the ports, the Channel Tunnel and regional distribution points. Supply of fuel to the electricity supply industry does not follow a simple trend and is even less predictable than other commodities in the long term (Section 5.7.1) – so volumes broadly similar to current have been assumed. When aggregated with future growth in other bulk traffics and existing flows of all commodities, this would then equate to a doubling of freight. Indeed even over a 10-year horizon, the Freight RUS already anticipates a doubling of freight paths on many routes that form such arteries. It is also assumed that such arteries would be cleared for W9 and W10 loading gauge or possibly W12.

The next sections look at the implications of the above in terms of changes to services, taking into account the shorter term recommendations in the RUS. The high-level train path requirements are then considered in aggregate over the various key sections.

9.2 Train services

9.2.1 London inner suburban

As ever, it is the commuter peaks where growth will put the most pressure on services. The RUS base is 11 Inner Suburban services in the morning high-peak hour formed of six-car trains, ie. 66 vehicles (there are only 10 trains in the evening high-peak hour). In the short-term the RUS recommends three additional six-car trains, the absolute limit of track and platform capacity on the Moorgate branch being 15 trains per hour. A doubling of the capacity requirement equates to 132 vehicles of which 84 would be provided by the proposed 14 x six-car trains to Moorgate.

However, with the present Class 313s being 40 years old by the middle of the next decade,

their replacement will be due and this could offer the opportunity to provide higher capacity stock. Assuming that this could provide a 10 percent increase in capacity then the shortfall in additional vehicles is around 28, equivalent to about five additional six-car trains. These additional trains would not be able to operate to Moorgate as increasing capacity at Moorgate itself would be extremely expensive. Capacity freed up in the suburban platforms at King's Cross could be used to accommodate the additional services south of Finsbury Park or there may be limited opportunities for inter-working with North London Line or East London Line services via Canonbury to destinations in east London.

9.2.2 London outer suburban

Again, it is the morning and evening peaks where growth will put the most pressure on services. The RUS base is 10 outer suburban services in the high peak hour formed mostly of eight-car trains, making 80 vehicles in total. In the short-term the RUS recommends progressive lengthening of these to 12 cars as growth occurs. From December 2015 eight 12-car tph could operate via the Thameslink corridor and, with two other 12 car tph still running to/from King's Cross, this gives a 50 percent increase in capacity in 2016. A further increase of four 12-car trains to/from King's Cross in each peak hour would mean 168 vehicles could be operating per peak hour north of King's Cross by 2036, giving a 110 percent increase in capacity. The combination of six tph to/from King's Cross and eight to/from the Thameslink route would still release four train paths per hour to/from King's Cross station itself compared with today.

Alternatively, the longer distance flows from Peterborough and Cambridge/King's Lynn to King's Cross might be handled by IEP trains, providing additional train and route capacity through an increase in individual train capacity, better harmonisation of train speeds on the route, improved performance and product quality. This is an option within the current Invitation to Tender for the IEP trains.
As a consequence it would be the inner suburban services that would form the core of the Thameslink timetable on the route.

9.2.3 Long distance services to/from London

It is currently anticipated that the IEP will deliver around a 70 percent increase in capacity on 'franchised services' over that available in the 2006 base. This is achieved by an increase in seats compared with a Mark IV set and the additional service per hour recommended in the RUS for the short term. The shortfall for a doubling of capacity would be provided by two extra trains each way per hour which would allow a further segregation of the market following that recommended for the short term in the RUS.

Although the market will decide the ultimate destinations of the services, for the purposes of the 2036 analysis the following off-peak pattern is assumed:

2 London – Scotland: limited stop

1 London – Newcastle: semi-fast

2 London – Leeds: limited stop

3 London – medium distance destinations: semi-fast/stopping services, serving destinations such as those considered in Option 3.6 (Section 6.7.7).

Additional less frequent passenger services to other locations may operate where appropriate timetable space permits or as part of the fourth group. In the peak periods the service would increase to 10tph, with every train between King's Cross and Peterborough being capable of carrying the maximum passenger load practicable, so that scarce network capacity at these times is efficiently utilised.

Figure 47 examines possible capacity in terms of seats per hour for London services on various sections of the route

Figure 47

Capacity		2006	2016	2036
King's Cross - Doncaster	Peak	6tph x 540 seats = 3240 seats / hr	6tph x 640 seats + 2tph x 600 seats = 5040 seats / hr (+56%)	8tph x 640 seats + 2tph x 600 seats = 6320 seats / hr (+95%)
	Off-peak	4tph x 540 seats + 1tph x 200 seats = 2360 seats / hr	4tph x 640 seats + 1tph x 370 seats + 1tph x 300 seats = 3230 seats / hr (+37%)	5tph x 640 seats + 2tph x 370 seats + 1tph x 300 seats = 4240 seats / hr (+80%)
Yorkshire	Peak	3tph x 540 seats = 1620 seats / hr	3tph x 640 seats = 1920 seats / hr (+19%)	4tph x 640 seats = 2560 seats / hr (+58%)
	Off-peak	2tph x 540 seats = 1080 seats / hr	2tph x 640 seats = 1280 seats / hr (+19%)	2tph x 640 seats + 1tph x 370 seats = 1650 seats / hr (+53%)
North East	Peak	3tph x 540 seats = 1620 seats / hr	2tph x 640 seats + 1tph x 600 seats = 1880 seats / hr (+16%)	3tph x 640 seats + 1tph x 600 seats = 2520 seats / hr (+56%)
	Off-peak	2tph x 540 seats = 1080 seats / hr	2tph x 640 seats = 1280 seats / hr (+19%)	3tph x 640 seats = 1920 seats / hr (+78%)
Edinburgh	Average	1.5tph x 540 seats = 810 seats / hr	1.5tph x 640 seats = 960 seats / hr (+19%)	2tph x 640 seats = 1280 seats / hr (+58%)

Overall this approach would almost double capacity to/from King's Cross and would provide 53 percent to 78 percent increase north of Doncaster which is sufficient to accommodate a doubling of demand within a reasonable load factor.

The interaction of the various north-south routes is an important factor in assessing future traffic levels and it has been assumed that growth from markets that currently use the Midland Main Line will be accommodated on that route or elsewhere without using the ECML.

Incremental improvement of ECML line speed and removal or easing of specific restrictions is likely to be possible and could deliver useful journey time reductions. However, a step change in journey times, to become equivalent (for a given distance) to those provided by Eurostar and some mainland European railways, is not likely to be possible without major reconstruction or provision of a new line.

9.2.4 Non-London long distance services

Pro-rata increases in capacity of current CrossCountry and TPE franchise services could be achieved by lengthening with no additional trains running on the ECML. The current Invitation to Tender for IEP trains includes an option for longer bi-mode trains for cross-country Plymouth – Edinburgh services and in the longer term it might be viable to deploy similar IEP bi-mode trains on the cross-Pennines Newcastle services, releasing line capacity and accelerating the services through 125mph operation.

9.2.5 Regional passenger services

The strategy is to implement some selective strengthening of peak services by 2016 with further strengthening by 2036. No additional services appear to be necessary to accommodate a doubling of demand though there may be some opportunities to make use of the additional peak hour rolling stock and spare network capacity to provide a few increased service frequencies.

9.2.6 Freight (south of Doncaster)

Growth to 2036 is assumed to be quadrupling of intermodal flows and less significant change to other flows against the base (2006) provision of 1 path per hour (pph) off-peak. The strategy for the period to 2016 is to provide 2pph between Peterborough and Doncaster via the GN/GE Joint Line, although some traffic for destinations in South or West Yorkshire might use the northern half of the Midland Main Line, and some might continue to use the Main Line via Newark. The strategy for 2036 is to increase the freight capacity available between Peterborough and South or West Yorkshire to 4pph, using a combination of the GN/GE Joint Line and the Midland Main Line.

If, in this timescale, a significant volume of traffic remains associated with East Anglian terminals, then Peterborough and the flat junction at Werrington (although improvements are proposed to both before 2014) could become the critical capacity constraint for that traffic. This whole area could be avoided and a more direct route provided by re-opening of the March – Spalding line, with partial deviation from the original alignment. Alternatively, Werrington Junction could be grade-separated. The medium-term improvements within the upgrade of the GN/GE Joint Line (section 8.5.9) will be designed to provide for this if required later.

By 2036 2pph would need to be provided between Peterborough and London. In some situations, particularly if the March – Spalding line is re-opened, additional freight capacity might best be provided via the West Anglia Main Line towards London. This would have to be assessed against the ECML and Midland Main Line alternatives, with particular attention to how growth in all markets is developing on the additional capacity proposed before 2014 by this RUS on the Hertford Loop, and by the Greater Anglia RUS in the Lea Valley.

9.2.7 Freight (north of Doncaster)

No significant change is proposed for 2016, as the passenger service frequency is not increased (except possibly between Doncaster and Hambleton South Junction or York) and only Doncaster – Colton Jn was identified as a gap from the Freight RUS requiring resolution in the ECML RUS. The Shaftholme Jn proposal (Section 8.5.9) would deal with these issues.

By 2036, the unpredictability of traffic patterns becomes a real difficulty, particularly for ESI flows (see Section 5.7.1), though with gauge clearance to W10 or larger north of Doncaster intermodal growth is likely to be significant. Between Colton Junction and Northallerton the route is four-track so capacity is not expected to be a problem except perhaps at Skelton Bridge Junction where remodelling might be necessary. Running additional passenger services north of Northallerton by 2036 would probably require enhancement and increased use of the parallel route via Eaglescliffe, Stockton and Ferryhill; and reinstatement of the Leamside route (Ferryhill – Washington – Pelaw Junction) might be beneficial to provide sufficient overall capacity between Ferryhill and Newcastle. Both routes would need to allow intermodal freights to run at 75mph and have the necessary gauge clearance.

9.3 Key infrastructure constraints

King's Cross platform capacity

Assuming the present platform configuration plus Platform Y, the proposed service level in 2036 would give the evening peak platform utilisation shown in Figure 48.

Figure 48

Origin	Trains per peak hour	Turnround (minutes)	Reoccupation (minutes)	Total (mins / hour)
Scotland	2	40	7	94
Newcastle	2	30	7	74
Yorkshire and medium distance	6	25	7	192
GN Outer	6	15	6	126
Total				**486**
Utilisation of Platforms Y - 8				90%
GN Inner	5	10	5	75
Utilisation of Platforms 9 - 11				42%

Some services would be formed by rolling stock from stabling points and therefore turnrounds for these would be less. Although the turnrounds for longer distance services are significantly shorter than current practice at King's Cross, they are more in line with practice at other London termini.

As can be seen, the level of occupation of the long platforms would be extremely high, whereas the shorter platforms would be under-utilised.

Line capacity King's Cross - Hitchin

The peak hour timetable for 2016 requires that Fast Line/Slow Line weaves are avoided so that Fast Line utilisation can be maximised. Therefore the main limit on capacity will be the two-track section between Digswell Jn and Woolmer Green Jn. Assuming that ERTMS is implemented and gives a reduction in planning headway from three minutes to two minutes, it appears possible to accommodate the desired level of service over the current track layouts as shown in Figure 49:

Figure 49

Peak Services	2006	2016	2036
Longer distance	6	8	10
Outer suburban	10	10	14
Total	16	18	24
Planning headway	3 mins	3 mins	2 mins
Capacity utilisation	80%	90%	80%

Clearly the 2036 level of service will require four-tracking if a two minute planning headway cannot be achieved. On the four-track sections two minute headways would be needed on the Fast Line and acceleration characteristics of long distance and outer suburban rolling stock would have to be similar.

With careful planning, this approach would deliver sufficient capacity to accommodate anticipated growth. However, the capacity utilisation level on the southern part of the ECML would be very high and the service would be 'fragile' in the sense that any minor incident would rapidly cause major disruption. Further enhancements (yet to be identified) are likely to be necessary to ensure that performance delivery would meet the expectations of government, passengers and freight forwarders at that time.

9.4 Infrastructure investment priorities

If the demand growth in all markets were to materialise in the way identified in this scenario, then the following significant changes to the network are likely to be required to support the train service outputs described above.

Priorities for 2014 - 2019 (Control Period 5)
Completion of the Thameslink Programme. This will connect the southern ECML to the cross-London tunnels.

Changes to the track and platform layout at King's Cross at the time of the planned signalling renewal. This will accommodate the increasing proportion of long train formations and improve the ability to handle parallel arrivals and departures.

Increased capacity between Huntingdon and Peterborough, possibly including an improved turnback facility at Huntingdon. This will provide flexibility to improve the pattern of peak services.

Upgrading the alternative route from Peterborough to South and West Yorkshire via the northern half of the Midland Main Line. This will provide capacity for freight growth and diversionary use.

Upgrading the Eaglescliffe – Stockton – Ferryhill route. This will provide capacity for freight growth and diversionary use.

Gradual deployment of ERTMS as the route's signalling is renewed, starting in the south. This will bring potential benefits in linespeed, capacity and performance.

Possible requirements after 2019:
Four-tracking between Digswell and Woolmer Green if two-minute headways are not deliverable through ERTMS.

Re-instatement of the direct route between March and Spalding. This would allow freight from East Anglia (particularly Felixstowe and Harwich) to parts of Yorkshire, the North East and Scotland to bypass Peterborough. This might be required before 2019 if patterns of growth make Peterborough a capacity constraint.

Re-instatement of the Leamside route (Ferryhill – Washington – Pelaw Junction). This would provide additional capacity south of Newcastle.

Lengthened platforms throughout the route and expansion of depots and stabling facilities to accommodate longer trains. The IEP specification includes the ability to lengthen these trains to approximately 312m length and, despite the high cost of achieving this platform length at certain locations, it might still be the most viable option to accommodate continuing growth.

9.5 Alternative growth scenarios

The demand forecasts used in this RUS represent the growth projections derived from the housing, population and employment forecasts contained in the DfT's latest (Version 5) TEMPRO model. Longer term demand forecasts are very uncertain and extremely sensitive to economic conditions. Stakeholders generally agree that growth is unlikely to be lower than the forecast though there are a number of sensitivities which may drive rail passenger numbers higher and the rate of increase over the last couple of years has been well above the average projected forward (including the impact of the passenger capacity that is proposed).

The RUS strategy of increasing LDHS services to 6tph off-peak and 8tph in the peak and providing longer outer suburban and increased frequency inner suburban services is expected to cater adequately for forecast growth in passenger demand to the end of the RUS period in 2016. In the longer term, increasing train capacity by the use of IEP and increasing network capacity by roll-out of ERTMS might create the potential to deliver a doubling of capacity against the 2006 base. Similarly, the proposed interventions would deliver the level of growth forecast in the Freight RUS by 2014, and considerably more.

In the event that passenger or freight growth does not meet the RUS forecasts, then clearly it would be possible to delay or abandon interventions where appropriate, provided that decisions are made in time to avoid major expenditure commitments.

The Government's 2007 White Paper suggests a general doubling of both passenger and freight traffic nationally over a 30-year period; however it is recognised there may be wide variations on individual routes or parts of routes according to local circumstances.

Trends since 1996 in respect of Intercity East Coast demand indicate a doubling of volume by 2024 when projected forward, whilst the underlying assumptions to the current franchise suggest a doubling being achieved by 2019. The events of the past 10 years have not been entirely favourable to passenger growth on the route, given the significant impact of major incidents such as the Hatfield derailment and its aftermath coupled with more aggressive marketing by internal airlines aimed at the longer journeys. Looking to the future, it is reasonable to consider the possibility that given a lesser impact from incidents, a continuing improvement in performance and a levelling-off of airline expansion – of which there are currently increasing signs – growth will occur at a more rapid rate than during the recent past.

Additionally, it must be recognised that current levels of crowding on some outer suburban services necessitate additional passenger capacity already and assuming the continuation of the present policy of regulated fares for peak period commuting it is difficult to foresee any significant lessening of the upward trend.

Some consideration must, therefore, be given to the scenario where by around 2020 all available paths have been taken up and train length and seating capacity have reached their effective maximum following full deployment of IEP, Thameslink rolling stock and new inner suburban multiple units. The long-term strategy outlined earlier assumes that a further capacity increase would arise from provision of more train paths by deployment of ERTMS. However, at present, the development of ERTMS and planning for its application to the ECML are at an early stage and it is not possible to be certain that the benefits expected will be sufficient to alleviate known

pinch-points such as the Welwyn viaduct, whilst the earliest date for deployment on the ECML is 2015. Therefore it would be prudent to consider whether any alternative strategies might be available to provide additional capacity if rapid growth continues and ERTMS is delayed or delivers reduced benefits.

Whilst there will undoubtedly be some options to contain LDHS growth by the application of increasingly sophisticated yield and demand management techniques coupled with some real price increases in unregulated fares, these techniques are likely to be less effective in managing growth in peak commuting demand. Therefore, additional route capacity will be required at some point in the 2020s or 2030s and if this is not provided by ERTMS, it might be possible to implement further major infrastructure schemes such as four-tracking in the Welwyn area. However, opportunities are limited and costs would be high, so it appears that the ultimate capacity of the ECML in its present form would have been reached.

In these circumstances there is little doubt the strategy for handling demand in the longer term must look to the opportunities offered by the wider rail network. These could include, for example, making use of any remaining capacity for growth on the Midland Main Line and the West Coast Main Line, or construction of some completely new sections of railway which could be unconstrained by traditional limitations on maximum speed, loading gauge and other output characteristics. These issues go well beyond the scope of the current RUS and it is intended that they will be addressed more fully in the Network RUS.

10. Next steps

10.1 Introduction

This RUS will become established sixty days after publication unless the Office of Rail Regulation (ORR) issues a notice of objection within this period.

The recommendations of a RUS form an input to decisions made by industry funders and suppliers on, for example, franchise specifications, investment plans and the Governments' HLOSs.

10.2 Network Rail Route Plans

The Route Plans for Network Rail Strategic Routes 8 (East Coast Main Line) and 9 (North East Routes) together include all the routes covered by this RUS. The Route Plans were published alongside the Strategic Business Plan (SBP) in November 2007, and are updated regularly. They list all significant planned investment on the route, including scheduled renewals as well as committed and aspirational enhancements. Those published in March 2007 cite some improvements included in the RUS; the next edition (April 2008) will incorporate the RUS conclusions as well as the SBP recommendations.

10.3 Access Charges Review

The ORR review of Network Rail's funding requirements and access charges for the period 2009 – 2014 will conclude in 2008. This RUS has informed Network Rail's input to the review and this is discussed below.

10.4 High Level Output Specification (HLOS)

In July 2007, the Department for Transport and Transport Scotland issued their HLOSs to define the outputs they wish to buy from the rail network during the next Control Period, i.e. 2009 – 2014. These HLOSs, and an accompanying Statement of Funds Available, will be used by ORR to set the funding requirements of Network Rail over that period, taking into account other obligations and funders' reasonable requirements. Network Rail has prepared the Strategic Business Plan (SBP) in conjunction with industry stakeholders to present the industry's response to the HLOSs. The recommendations of this RUS, where they fall within the 2009 – 2014 period, are part of the rail industry's recommendations incorporated within the SBP for funding via the Access Charges Review.

10.5 Ongoing access to the network

This RUS will also help to inform the allocation of capacity on the network through application of the normal Network Code processes.

10.6 Review

Network Rail is obliged to maintain a RUS once it is established. This requires a review using the same principles and methods used to develop the RUS:

- when circumstances have changed;
- when so directed by ORR; or
- when (for whatever reason) the

Appendices

Appendix 1 Freight terminals

The following table highlights the freight terminals located in the RUS area and typical current usage:

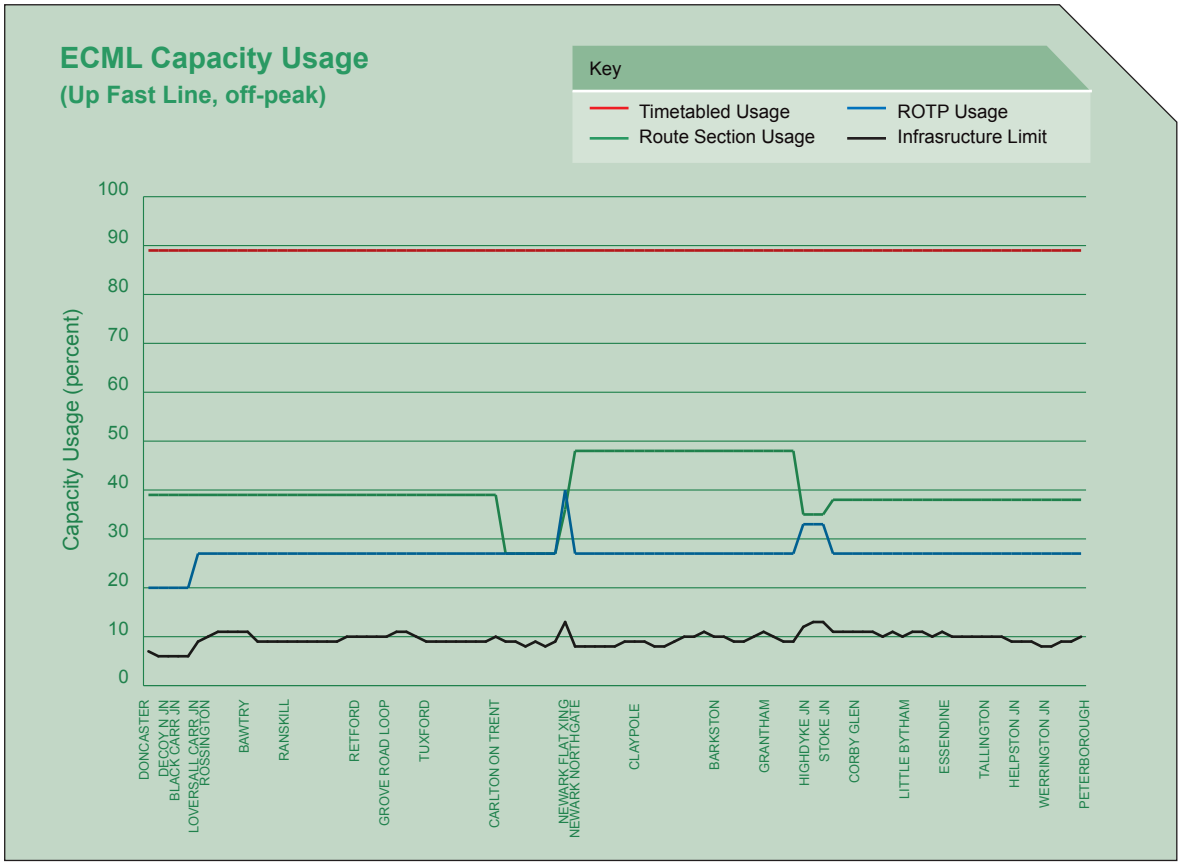
Location	Commodities	Origin / Destinations	Volume
Ferme Park Sdgs	LU Infrastructure Traffic	Acton/Willesden	10-20 pw
Langley Lafarge	Aggregates	Mountsorrel	2 pw
Hitchin Up Yard	Metals & Aggregates	Sheerness/Cardiff/Peak Forest	5 pw
Biggleswade Plasmor	Construction	Heck Plasmor	3 pw
Peterborough Crescent Shops	Test Trains	Various	1 pw
Peterborough	Infrastructure Traffic	Various	12-15 pw
Peterborough West Yard	Construction	Various	5 pw
Tallington Tarmac	Infrastructure Traffic	Whitemoor	5 pw
Doncaster Europort	Containers	Felixstowe, Thamesport	10 pw
Doncaster Royal Mail	N/A	N/A	Nil
Doncaster Wood Yard	Infrastructure Traffic	Various	25 pw
Doncaster Wabtec Rail Works	Railway Rolling Stock	Various	15 pw
Heck Plasmor	Construction	Biggleswade/Bow	6 pw
Stockton Thomson	Metals	Cardiff, Aldwarke, Thornaby, Tees, Tyne Dock	2 pw
Thrislington Quarry	Industrial Minerals	South Wales	5 pw
Middlesbrough Yard	Potash & Metals	Thornaby & Boulby	50 pw
Tees Port	Potash/Metals/ Containers	Boulby, Lackenby, Thornaby, Trafford Park	45 pw
Redcar Coal Term	Coal	Aire Valley Power Stations	25 pw
Redcar Ore Terminal	Metals & Aggregates	Hardendale & Rylstone	10 pw
Lackenby Steel Works	Metals	Llanwern, Margam, Scunthorpe & Dalzell	10 pw
Wilton Coal Handling Plant	Coal	Killoch & Wilton	Nil
Wilton Intermodal Term	Containers	Leeds, Ipswich & Felixstowe	10 pw

Skinningrove Corus	Metals	Tees Yard	20 pw
Boulby Potash	Potash	Middlesbrough Goods Yard, Tees Dock & Grangetown	55 pw
Port Clarence	Petrochemical	Westerleigh and Bedworth	3 pw
Hartlepool South Works	Metals	Leith/Georgemas Junction	2 pw
Hartlepool Power Station	Nuclear	Sellafield	varies
Seaham/Ryhope Grange	Cement	Earles Hope Sdgs/Oxwellmains	5 pw
Port of Tyne	Automotive/Coal	South West and Channel Tunnel/Aire & Trent Power Stations	50 pw
Jarrow Shell	Petroleum	Lindsey and Humber Oil Refineries	15 pw
Low Fell Royal Mail	N/A	N/A	Nil
Battleship Wharf	Coal	Aire Valley Power Stations	17 pw
North Blyth Alcan	Alumina/Bauxite	Lynemouth Alcan (Alumina)/Western Scotland	18 pw
Lynemouth Alcan	Alumina/Metals	North Blyth Alcan/South Wales	18 pw
Butterwell Opencast	Coal	Aire Valley Power Stations & Lynemouth	15 pw
Tweedmouth Sidings EWS	Weedsprayer	ECML	ad-hoc
Torness Power Station	Nuclear	Carlisle Kingmoor DRS	varies
Oxwellmains Cement Works	Cement	Glasgow, Aberdeen, Inverness & Carlisle	10 pw
Dunbar Rail Terminal	Waste Products	Powderhall	5 pw
Cockenzie power station	Coal	Leith, Chalmerston, Killoch, Hunterston	varies

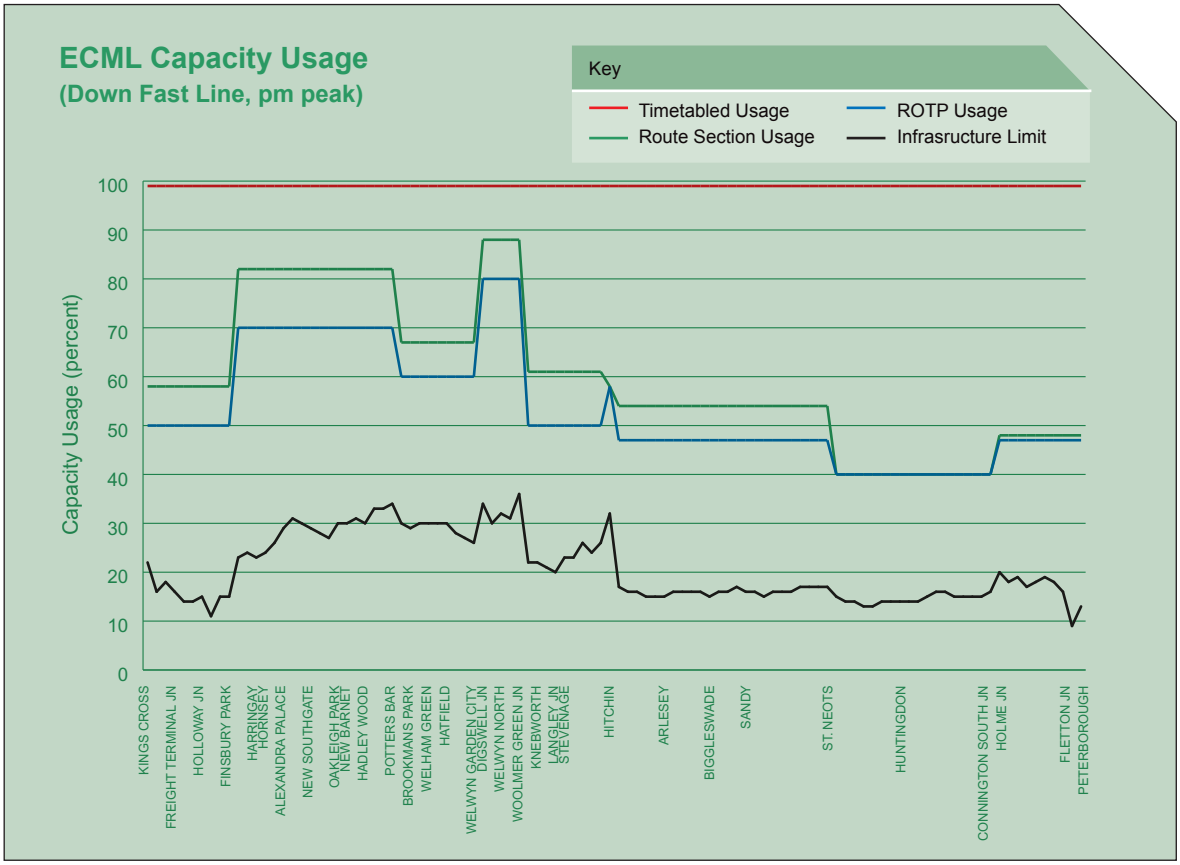
Appendix 2 - ECML Capacity Analysis

The colour coded lines in the chart show:

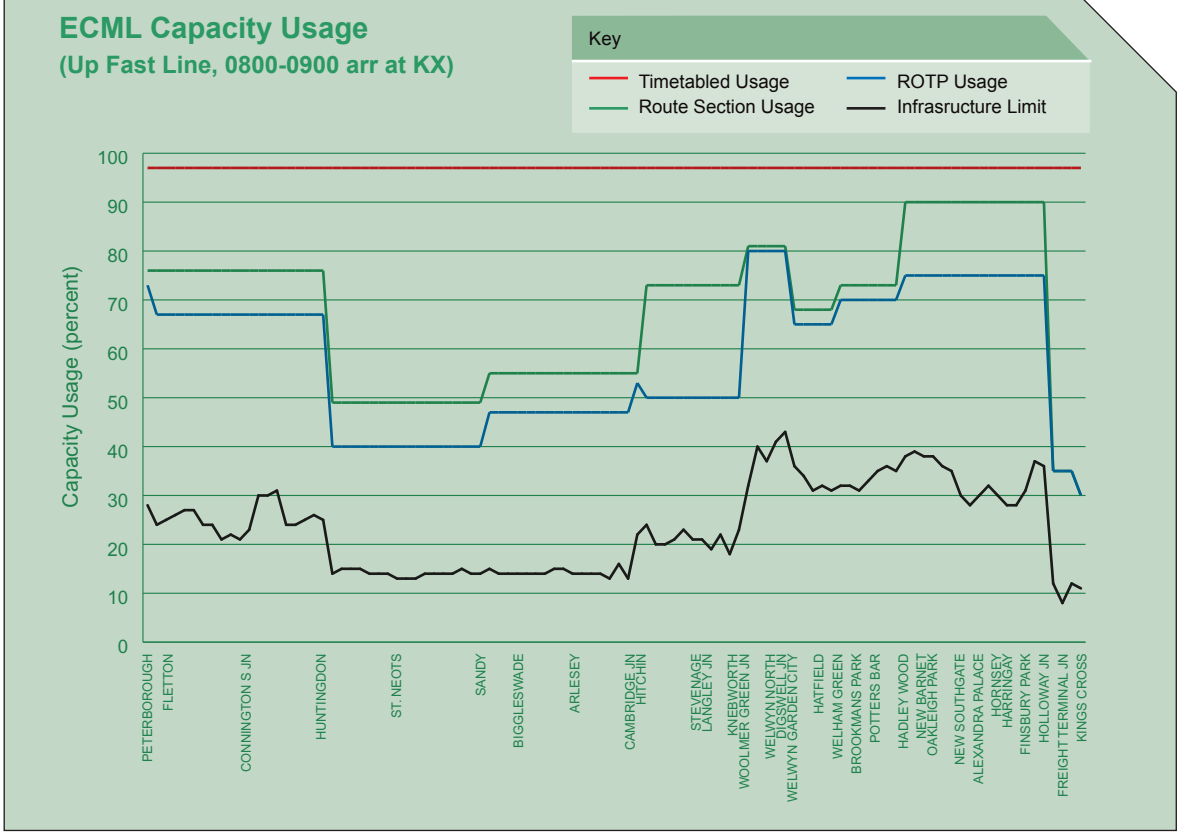
- Timetable Usage – the capacity used by the timetable over the whole route.
- Route Section Usage – the capacity used by the timetabled mix of trains over the a route section with a constant number of trains
- Rules of the Plan (ROTP) Usage – the capacity required to run the timetabled number of trains at the minimum planning headway and specified junction margins
- Infrastructure Limit – the absolute theoretical minimum capacity consumption if timetabled trains could run at signalling headway.



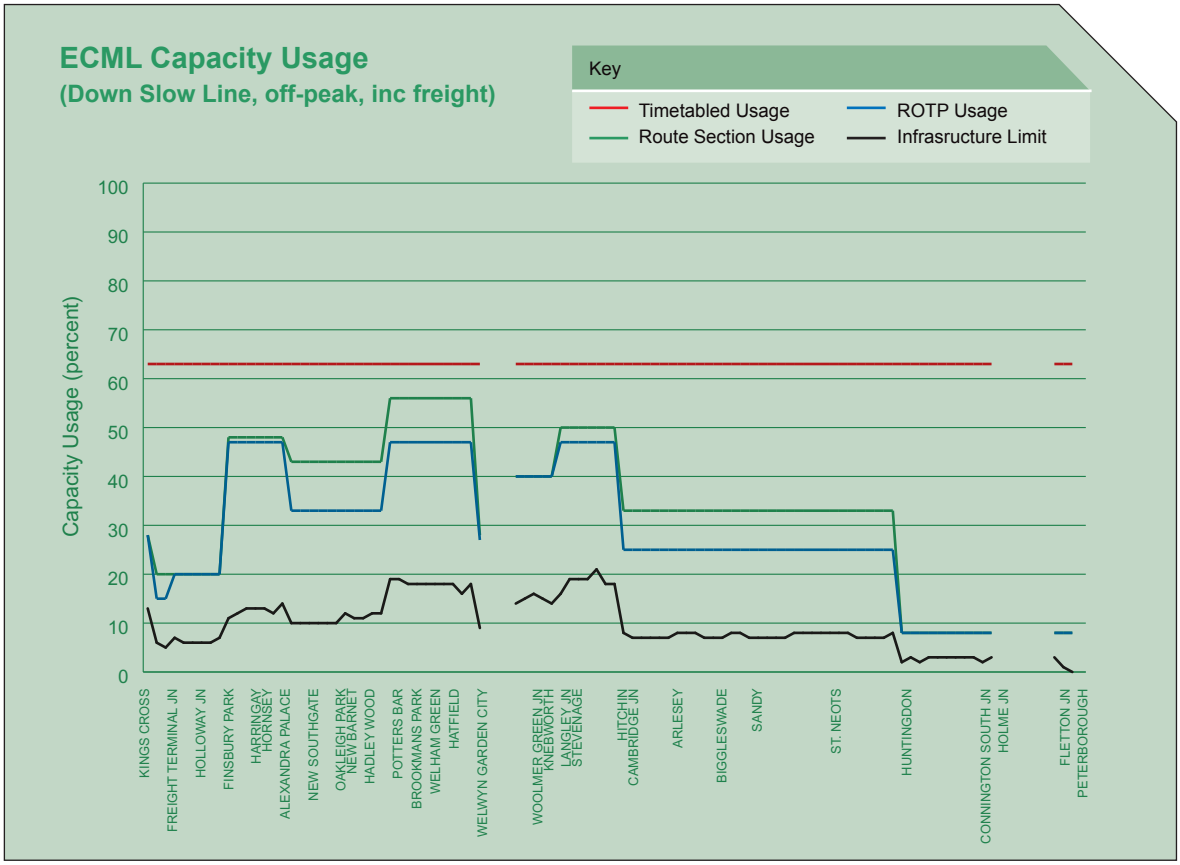
ECML Capacity Usage
(Down Fast Line, pm peak)



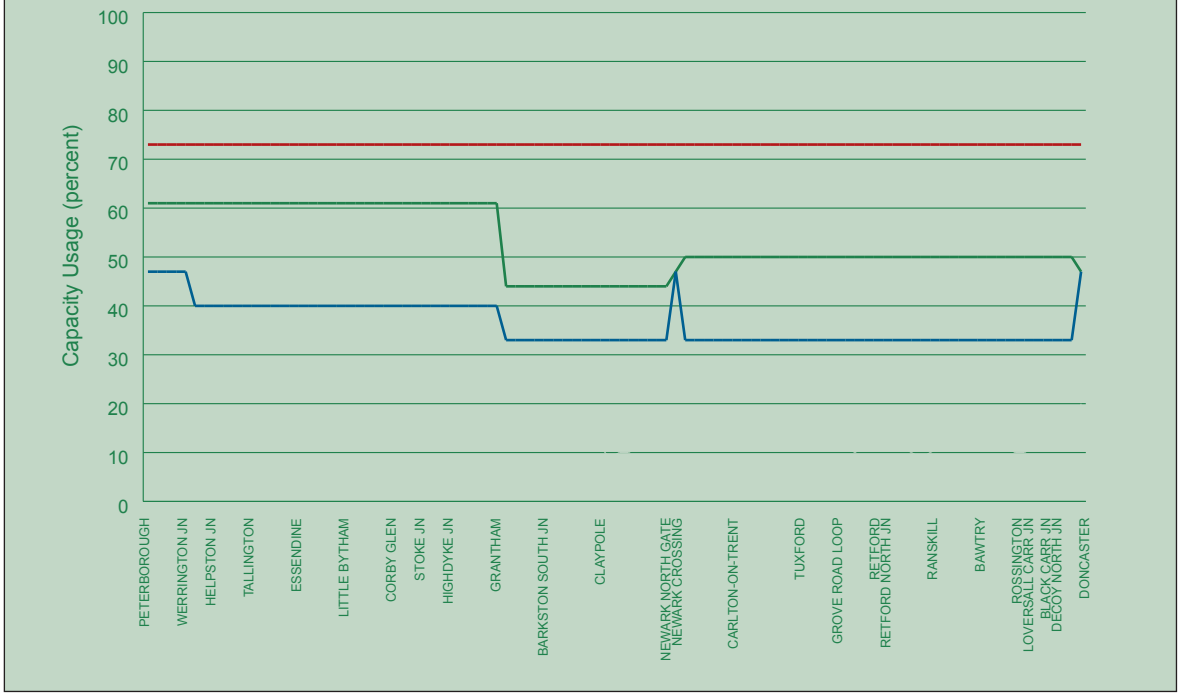
ECML Capacity Usage
(Up Fast Line, 0800-0900 arr at KX)



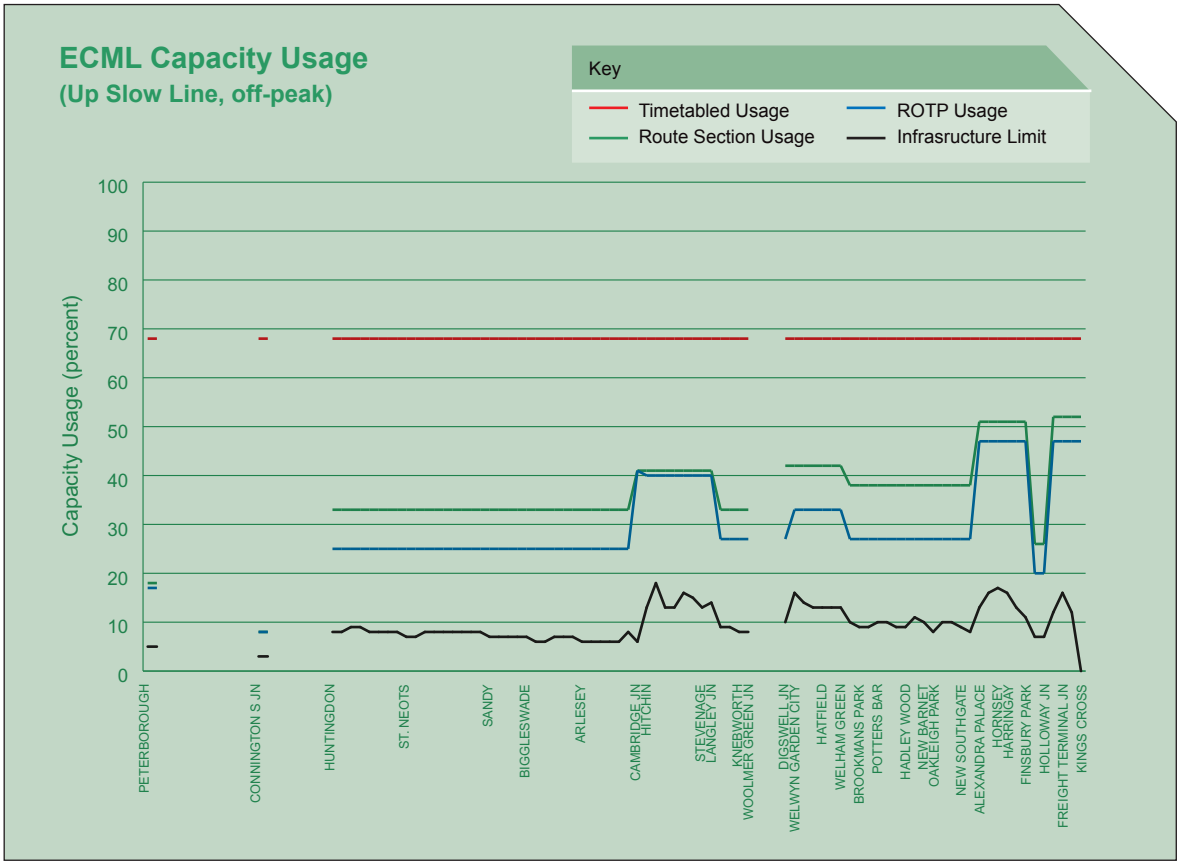
ECML Capacity Usage
(Down Slow Line, off-peak, inc freight)



ECML Capacity Usage
(Down Fast Line, off-peak)



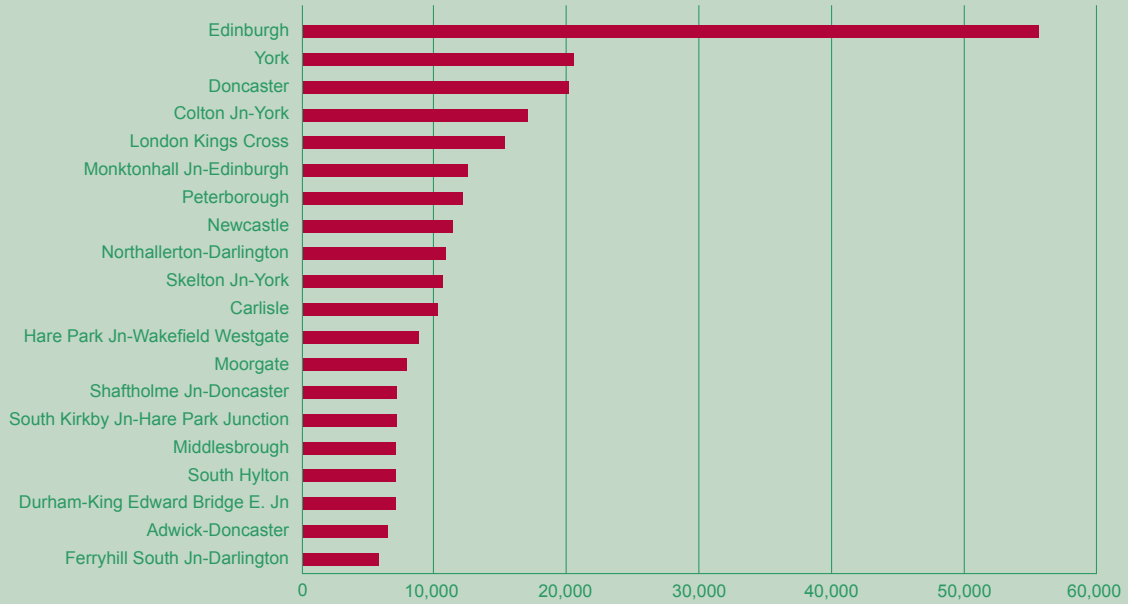
ECML Capacity Usage
(Up Slow Line, off-peak)



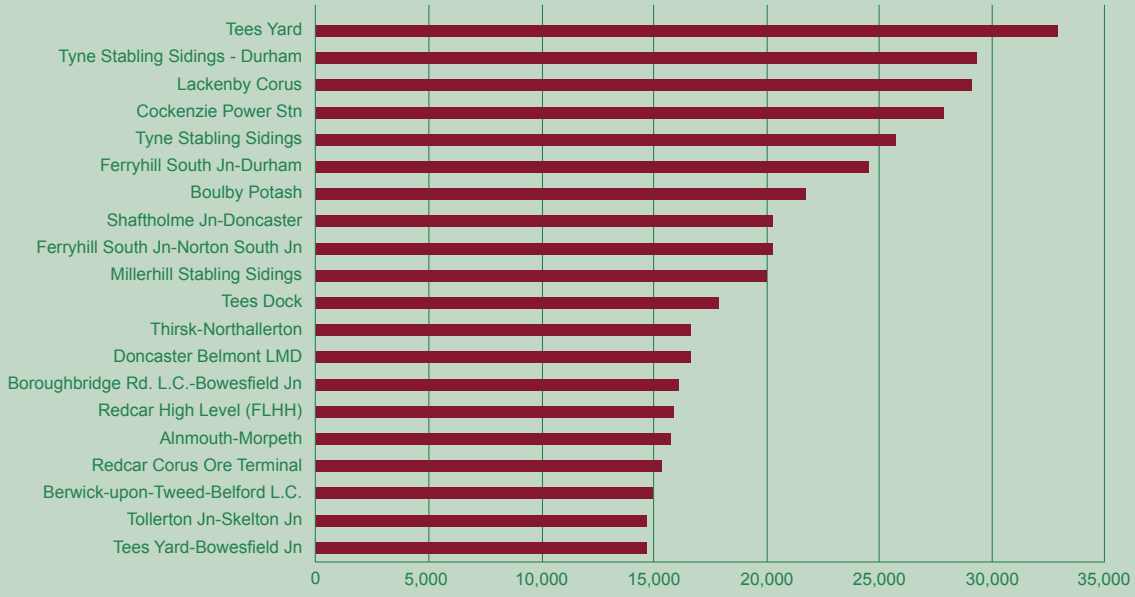
Appendix 3 - ECML Performance Analysis

Reactionary and total Network Rail delay by location for train and freight operators between 1st April 2005 and 31st March 2007.

Reactionary Delay Minutes to Passenger Operators (ECML + NE Strategic Routes)

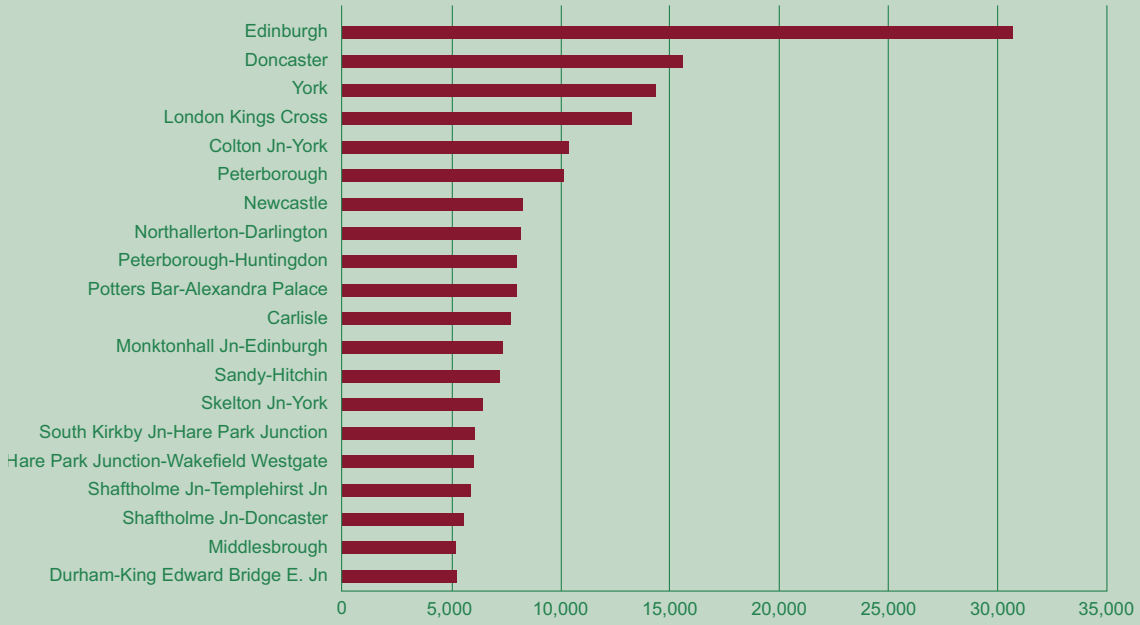


Reactionary Delay Minutes to Freight Operators (ECML + NE Strategic Routes)

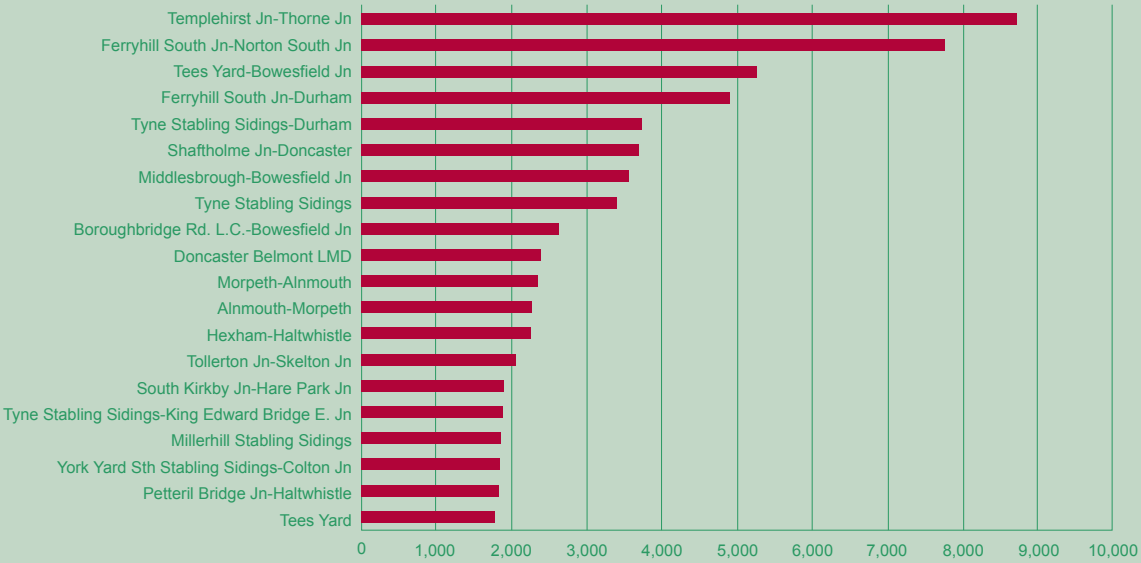


ECML (North to South) Reactionary Delay Minutes to Passenger Trains

Total NR Delay Minutes to Passenger Operators (Top 20 Locations ECML + NE Strategic Routes)



Total NR Delay Minutes to Freight Operators (Top 20 Locations ECML + NE Strategic Routes)



Appendix 4: Other possible infrastructure enhancements

This appendix lists schemes that are being developed for possible implementation from 2009.

Route 8 - London King's Cross to Peterborough (incl)

Project Description	Output change	Possible completion
Fletton Junction – to provide a higher speed turnout between the Up Slow and the Up Fast line	Improved capacity and performance	2009/10
Huntingdon North crossover – to provide a higher speed turnout between the Up Fast and Up Slow line	Improved capacity and performance	2009/10
Alexandra Palace to Finsbury Park 3rd Up Line project – additional southbound platforms between Alexandra Palace, and Finsbury Park and conversion of goods line Alexandra Palace to Finsbury Park to passenger status	Improved capacity and performance and increased interchange at Finsbury Park	2011/12
Platform lengthening at Welwyn Garden City, Welwyn North, Knebworth, Letchworth, Baldock, Ashwell and Royston	Improved capacity through train lengthening	2011/12
Hertford Loop capacity enhancements – provision of improved signalling headways north of Gordon Hill, passing loops or enhanced turn-back facilities at Gordon Hill and additional S&C at Stevenage to provide improved access to/from the ECML, to enable more frequent trains to operate	Improved capacity and performance	2011/12
New platform on the western side of Peterborough station, additional southbound platform, enhanced freight loops and improvement to Nene sidings	Improved capacity, performance and additional stabling for outer suburban services	2013
Hitchin Grade Separated Junction – revised layout at Hitchin Cambridge junction taking the Down Cambridge Lines over the ECML	Improved capacity and journey times, safety and performance	2013/14
Level Crossing closures/ enhancements	Improved capacity	Ongoing
Additional signals on Moorgate branch	Increased capacity	TBA

Route 8 - Peterborough (excl) to Edinburgh (excl)

Project Description	Output change	Possible completion
Grantham banner repeater signal - to provide a new banner repeater signal on the Down line	Improved performance	2009/10
Platform lengthening Doncaster to Leeds	Improved capacity	2010
York Holgate Junction 4th line – new line from Holgate Junction to Platform 11 at York station and to improve restrictive signalling arrangements	Improved capacity and performance	2010
Wakefield Westgate station – to relocate main platforms, create new platform loops and relocate station buildings and footbridge. This scheme will improve station facilities and allow better regulation of services	Improved capacity and performance and enhanced customer facilities	2010/11
York to Northallerton slow lines linespeed increase	Improved capacity and journey times	2010/11
Doncaster to Loversall Carr Junction revised operational layout – additional signalled route	Improved capacity, performance and engineering access and reduced freight journey times	2012
Shaftholme and Joan Croft Junction remodelling	Improved capacity and performance. Also reduces coal train journey times	2014
Dunbar additional platform	Improved performance and capacity	2011
Level Crossing closures/ enhancements	Improved capacity	Ongoing

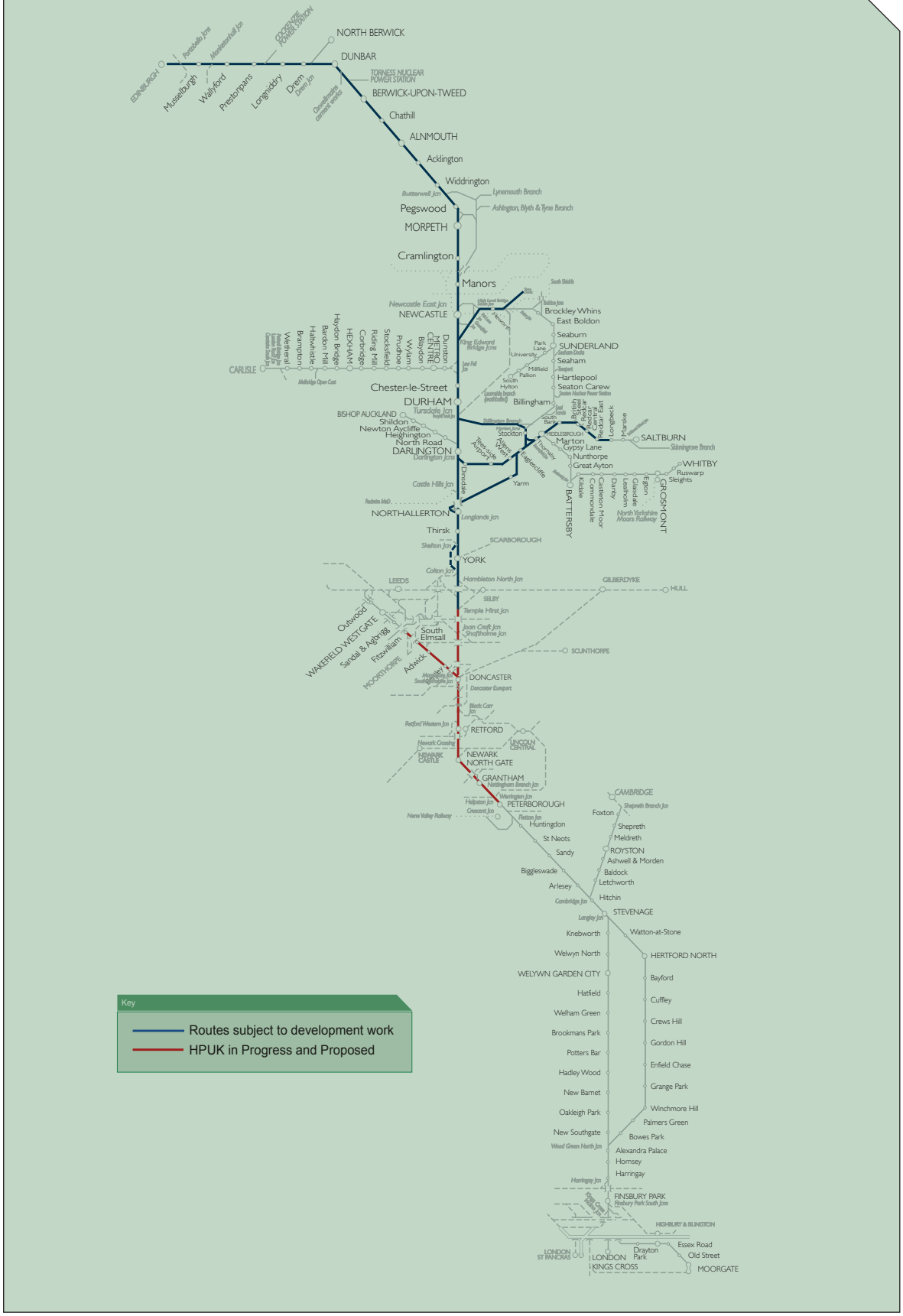
Route 9

Project Description	Output change	Possible completion
Bowesfield Jn to Tees Bridge - Linespeed improvement through track re-alignment as part of Tees Bridge works and S&C renewals	Improved performance and journey times	2009/10
Durham Coast re-signalling enhancement element	Shorten signal block section between Hartlepool and Dawdon	2009/10
Northallerton to Eaglescliffe linespeed increases	Improve journey times	2009/10
Haltwhistle to Low Row linespeed increase	Improved journey times and reduce planning headways	2010/11
Restoration of Boldon East Curve to bring freight directly onto the Durham Coast Line hence avoiding the congested area between King Edward Bridge Junction and Ferryhill	Improved capacity and performance	2011
Stillington Branch – shorten block section and increase linespeeds	Route capacity, improved performance and journey times	2011/12

Since the publication of the consultation document, DfT has announced progression of a number of rail-based Transport Innovation Fund (TIF) schemes, which are described in section 4.4. The RUS has taken the outputs of these schemes into consideration. Further schemes are being developed with a view to possible TIF funding in the future, including some in routes 8 and 9.

Network Rail is currently developing proposals for achieving gauge enhancement to W10 gauge as a “base case” with W9 and W12 incremental overlays on a number of priority routes. This will give clarity on scope and cost for gauge enhancement works on a route by route basis. Currently there is no identified funding for development beyond GRIP Stage 3 although prioritisation based on industry consultation and need may enable the subsequent development of funding proposals on a route by route basis. The map overleaf shows the routes within the RUS area that are being considered through this process.

W10 Upgrading



Glossary

Term	Meaning
AC	Alternating Current
ATOC	Association of Train Operating Companies
BCR	Benefit-Cost Ratio
Capacity	The number of trains that can be run over a given section of route or the number of passengers/volume of freight that a specific train type is designed to carry
CP	Control period
CUI	Capacity Utilisation Index
DC	Direct Current
DfT	Department for Transport
Down	Where referred to as a direction ie. Down direction, Down peak, Down line, Down train, this generally but not always refers to the direction that leads away from London
DRS	Direct Rail Services
Dwell time	The time a train is stationary at a station
ECML	East Coast Main Line
ERTMS	European Rail Traffic Management System
EWS	English Welsh and Scottish Railway
FCC	First Capital Connect
FLHH	Freightliner Heavy Haul
FOC	Freight Operating Company
FTA	Freight Transport Association
GBRf	First GB Railfreight
GDP	Gross Domestic Product
GNER	Great Northern Eastern Railway
GRIP	Guide to Railway Investment Projects
Headway	The minimum interval possible between trains on a particular section of track
HLOS	High Level Output Specification
HPUK	Hutchison Ports UK (the port operator at Felixstowe)
HST	High Speed Train
IECC	Integrated Electronic Control Centre
IEP	Intercity Express Programme, the name given to the project to replace the HST fleet
Jn	Junction
JPIP	Joint Performance Improvement Plans
Junction margin	The minimum interval possible between trains operating over the same junction in conflicting directions
L&SE	London & South East
LATS	London Area Travel Survey
LC	Level Crossing
LDHS	Long Distance High Speed
LENNON	An industry database recording ticket sales

Term	Meaning
LMD	Light Maintenance Depot
Loading Gauge	Maximum dimensions to which a vehicle can be built or loaded without being at risk of striking a lineside structure
LUL	London Underground Limited
MML	Midland Main Line
MOIRA	A passenger demand forecasting model
Network	The network of which Network Rail Infrastructure Ltd is the operator pursuant to its network licence
N/A	Not applicable
NEXUS	Tyne and Wear PTE
NPV	Net Present Value
NSIP	National Stations Improvement Programme
ORR	Office of Rail Regulation
PDFH	Passenger Demand Forecasting Handbook. An industry document that summarises the effects of service quality, fares and external factors on rail demand
PIXC	Passengers In Excess of Capacity. Passengers In Excess of Capacity only applies to weekday commuter trains arriving in London between 07:00 and 09:59 and those departing between 16:00 and 18:59. Capacity is deemed to be the number of standard class seats on the train for journeys of more than 20 minutes; for journeys of 20 minutes or less, an allowance for standing room is also made. The allowance for standing varies with the type of rolling stock but is typically approximately 35 percent of the number of seats. The PIXC measure for a Train Operating Company (TOC) as a whole is derived from the number of passengers travelling in excess of capacity on all services divided by the total number of people travelling, expressed as a percentage. PIXC counts are carried out once a year, on a typical weekday during the autumn. The DfT has set limits on the level of acceptable PIXC at 4.5 percent on one peak (morning or afternoon) and three percent across both peaks. The DfT monitors the level of PIXC across peaks (both individually and combined).
PLANET	A demand forecasting model
Possession	Where part of the infrastructure is closed to services to carry out maintenance, renewal or enhancement works
pph	Paths per hour
PPM	Public Performance Measure
PPP	Public Private Partnership (on the London Underground system)
PSB	Power Signal Box
PTE	Passenger Transport Executive
PV	Present Value
RA	Route availability - a system to determine which types of locomotive and rolling stock may travel over a route, normally governed by the strength of underline bridges in relation to axle loads and speed
Railsys	A computer model used for timetable modelling
RFG	Railfreight Group
RFOA	Railfreight Operators Association
RHADS	Robin Hood Airport – Doncaster – Sheffield
RPA	Regional Planning Assessment for the Railways, produced by the Department for Transport
RPI	Retail Price Index

Term	Meaning
RSS	Regional Spacial Strategy
ROTP	Rules Of The Plan
RUS	Route Utilisation Strategy
S&C	Switches and Crossings
SDO	Selective Door Opening, used where the whole of the train does not fit onto a station platform
Seated Load factor	The amount of seats occupied on a train service expressed as a percentage of total seats available
SMG	Stakeholder Management Group
STAG	Scottish Transport Appraisal Guidance
SRA	(former) Strategic Rail Authority
SYPTE	South Yorkshire PTE
TEU	Twenty-foot Equivalent Unit
TfL	Transport for London
TIF	Transport Innovation Fund
TOC	Train Operating Company
TPE	First Keolis Transpennine Express
tpd	trains per day
tph	trains per hour
tpw	trains per week
Train path	A slot in a timetable for running an individual train
Up	Where referred to as a direction ie. Up direction, Up peak, Up line, Up train, this is generally but not always refers to the direction that leads towards London
VXC	Virgin Cross Country
WCML	West Coast Main Line
WSG	Wider Stakeholder Group
WTT	Working Timetable
WYPTE	West Yorkshire PTE

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