# Wessex Route Study

*August 2015*


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# Foreword



We are delighted to present this Wessex Route Study, which sets out the strategic vision for the future of this vital part of the rail network over the next 30 years.

Each weekday this railway carries more than 50,000 people in the high peak hour alone into central London, with many thousands more accessing key interchange points and travelling between regional centres on the Route. Even before future growth is considered, some services on the route are already carrying significant numbers of passengers in excess of realistic capacity. Standing is commonplace from Woking and Basingstoke, with passengers standing from as far away as Winchester on fast services to London Waterloo.

Significant volumes of freight traffic are conveyed on the route, with the majority of movements focused on the busy corridor between the Port of Southampton and the Route boundary north of Basingstoke (on the Basingstoke to Reading line).

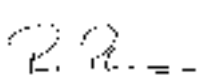
Improvements to the network are already in hand to accommodate passenger and freight growth in Control Period 5 (2014 to 2019). But in future years, even more will have to be done if this railway is to play its part in securing economic growth and serving peak commuter demand into London.

The Route Study has developed options to deliver against the key challenges, subject to value for money, deliverability and affordability. Options are set out against a long-term planning horizon to 2043, allowing sets of long-term interventions to be presented alongside and consistent with a prioritised set of options for Control Period 6 (2019 – 2024).

The dominant issue is the need to provide sufficient capacity in the peak periods, specifically to and from London. The study has focused on developing options that can contribute to improving performance as well as meeting the capacity challenge on the route. Alongside this, the study has also considered the growing challenge of accommodating peak passenger volumes at stations, with a view to setting priorities and options for investment in CP6.

This Route Study is published in August 2015. The options presented will help to inform the Initial Industry Plan to be submitted in Autumn 2016.

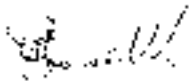
Network Rail has led the production of this Route Study on behalf of the Industry and as such it has been developed collaboratively with industry partners and wider stakeholders including passenger and freight operators, the Department for Transport, Transport for London, Local Authorities and Local Enterprise Partnerships. We thank them all for their contribution.



Paul Plummer

Group Strategy Director

Network Rail



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# Executive Summary




## 0.1 Introduction

0.1.1 Network Rail is producing a programme of geographic **Route Studies**, in conjunction with rail industry partners and other stakeholders. This programme runs alongside development of Network-wide **Route Utilisation Strategies**. These review national issues such as stations, depots, rolling stock and electrification.

0.1.2 This Wessex Route Study investigates what capacity and capability will be required from the railway network in Control Period 6 (2019-2024), and beyond up to 2043. It seeks to accommodate the conditional outputs articulated in the **Long-Term Planning Process (LTPP) Market Studies**, whilst maintaining operational performance, and at a cost acceptable to funders and stakeholders.

0.1.3 The Route Study identifies "choices for funders" which will inform the Initial Industry Plan (IIP) for CP6 in September 2016 and ultimately feed into the Department for Transport's (DfT) High Level Output Specification for CP6.

0.1.4 This Route Study has been developed as a result of considerable analysis and close collaboration between Network Rail, the Department for Transport, Transport for London and the passenger and freight operators on the route. The Office of Rail Regulation has acted as an observer. Productive meetings with Local Enterprise Partnerships and local authorities have also been held.

0.1.5 The study is also unique in that it has jointly been produced with the Wessex Alliance. This alliance between South West Trains and Network Rail was formed in 2012 and has operated, maintained and renewed the railway in Wessex under one joint management team.

## 0.2 Scope

0.2.1 The scope of the Route Study covers the South West Main Line and connecting routes to the Hampshire and Dorset Coast and the dense inner and outer suburban network of radial routes in south west London, Surrey and Berkshire. **Figure 0.1** sets out the Study area.

0.2.2 The area covered by the Route Study contains some of the most densely trafficked routes in the country, **Figure 0.2** helps to put this point into context, comparing traffic levels on the Waterloo approaches, the busiest part of the route to a sample of other key nodes and termini in the country.

0.2.3 The route currently provides for a wide range of passenger flows. Commuter traffic from the Main Lines, Windsor Lines and inner suburban network sees over 50,000 passengers arrive into London in a single typical high-peak hour alone.

0.2.4 As well as the dense London commuter operation, the Wessex Route supports high levels of passenger traffic to/from the many other important regional centres on the route such as Bournemouth, Southampton, Portsmouth, Guildford and Basingstoke. Off-peak business and leisure travel has shown continued growth in recent years.

0.2.5 Although principally a radial route with most services operating to or from London, it also accommodates key inter-regional passenger services on connecting routes:

- From Southampton / Portsmouth to Brighton / Gatwick Airport
- From Reading / Guildford to Gatwick Airport
- From Bournemouth / Southampton to the Midlands and the North
- From Portsmouth / Southampton to Bristol and South Wales
- From Weymouth to Bristol

0.2.5 Significant volumes of freight traffic are conveyed on the route, though the majority of movements are focused on the busy corridor between the Port of Southampton and destinations in the Midlands and the North via Basingstoke and Reading. This traffic is predominantly deep sea containers to / from the Port, but significant volumes of automotive and aggregates traffic are also transported on this and connecting routes.

## Figure 0.1 Geographic scope area of the Wessex Route Study

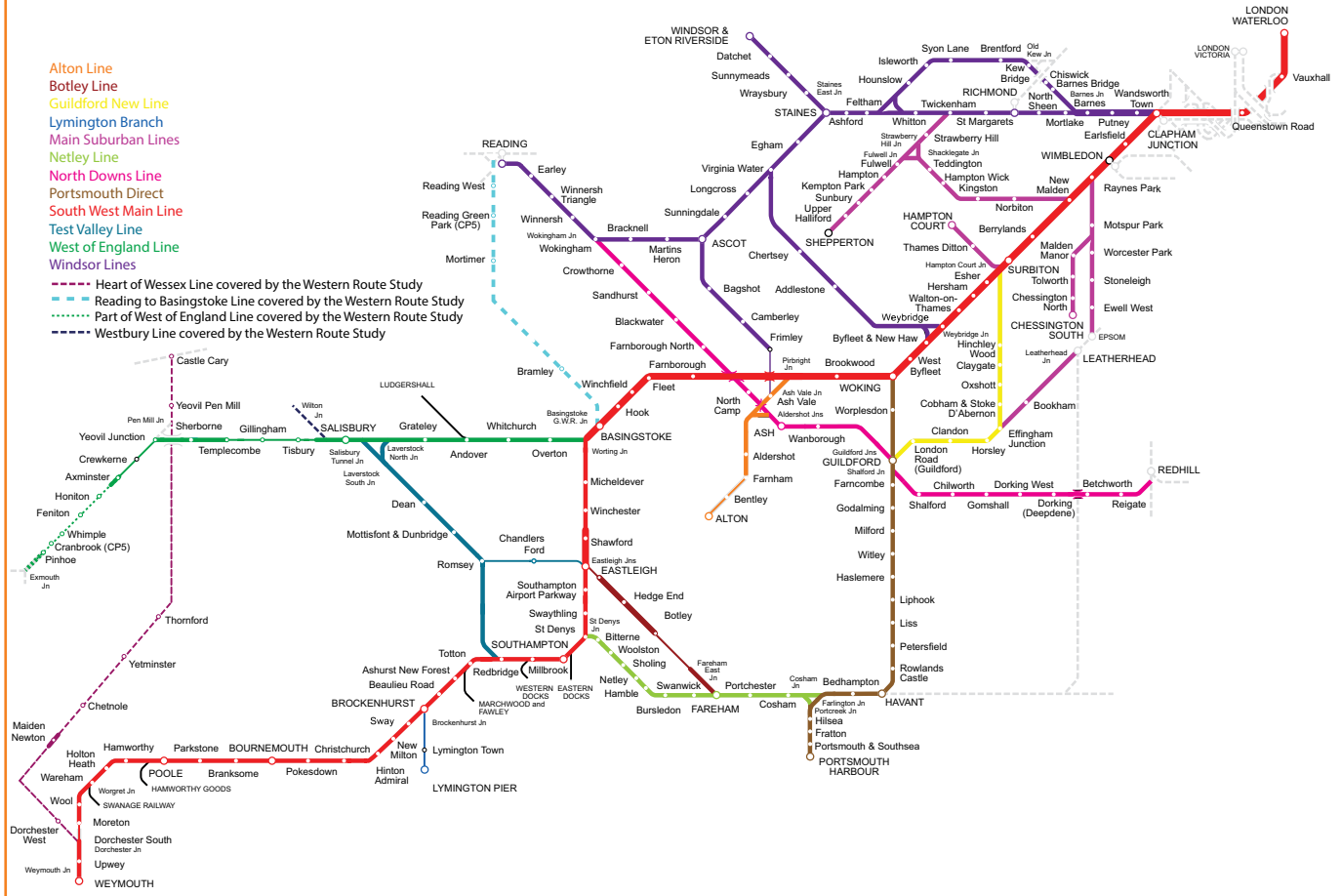
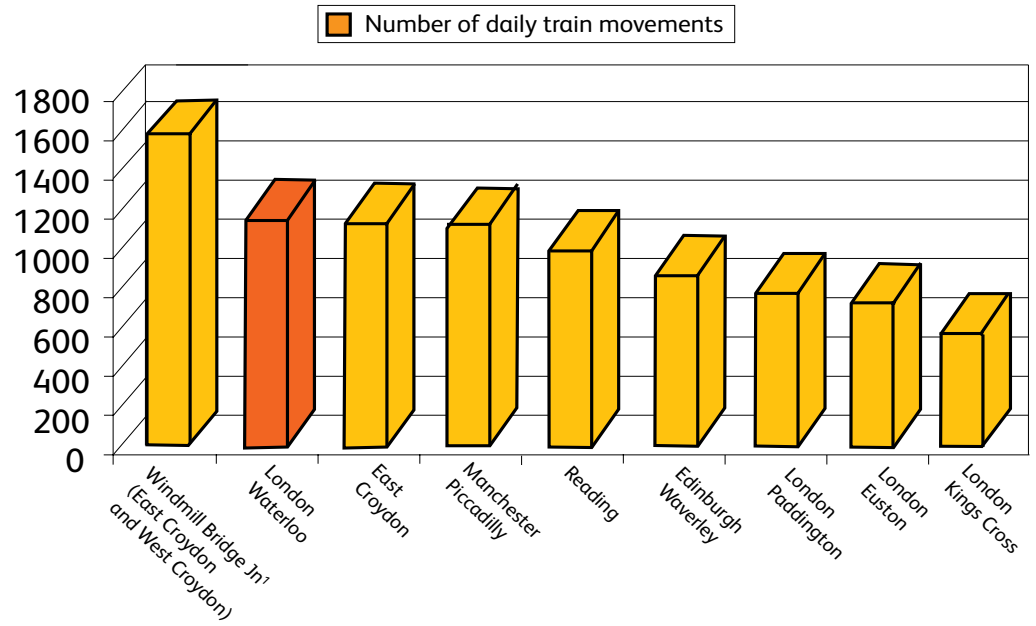


**Figure 0.2 Daily train movements. Waterloo approaches / A national comparison**




## 0.3 Baseline

0.3.1 The period from 1 April 2014 to 31 March 2019 is Network Rail's current Control Period 5 (CP5). All commitments to 2019 which are contained in the **CP5 Delivery Plan** have been included as part of the Route Study baseline. Key enhancement schemes that fall into this category are described further in **Chapter 3**.

0.3.2 Within these baseline enhancements there are some significant improvements to some areas of route capacity, which have been developed by South West Trains and Network Rail. The key components are:

- Works at Waterloo to allow all Main Suburban peak trains (those operating from Epsom, Hampton Court, Shepperton, Guildford (via Cobham), Kingston to London) to run at 10-car instead of current 8-car lengths
- Works at Waterloo fully to reopen Waterloo International Terminal (WIT) for use by Windsor Line services, releasing extra platforming capacity for this service group and in turn some main line services
- Works at Queenstown Road to increase capacity on the Windsor lines and ease the movement of empty Main Line stock out of Waterloo
- Works to improve 'on station' capacity for passengers at Waterloo, Vauxhall and a number of other suburban stations
- Additional rolling stock to strengthen Main Line trains from Woking and further out that currently do not operate at their potential maximum length
- Works to allow Windsor line services from Reading to operate at 10 rather than 8-car length.

0.3.3 Completion of these schemes will see significant capacity added to Main Suburban services to complement the additional capacity already being provided in the peaks by the current roll-out of 10-car train lengthening on most high-peak Windsor Lines services into London Waterloo.

0.3.4 It is recognised that the 2019 baseline used for the Wessex Route Study has the potential to change, following the review of the Control Period 5 enhancement programme announced by the Secretary of State.

0.3.5 As the options within the study represent a longer term view over the context of the next 30 years, the implications of any baseline revision are likely to be limited to the timing of the implementation of these options rather than their scope. We are therefore publishing this strategy noting that some of the baseline assumptions could change. Should any influences significantly alter the outputs of, and options identified within, the strategy, we will review and update accordingly as part of the ongoing process to maintain the validity of the strategy.

## 0.4 Conditional Outputs

0.4.1 The starting point for this Route Study is the **Market Studies** published in October 2013, and established by the Office of Rail Regulation in December 2013. The **Market Studies** forecast demand for passenger and freight traffic, and propose service level 'Conditional Outputs' for the industry to meet subject to feasibility, affordability and value for money.

0.4.2 Detailed demand analysis has been undertaken to ascertain expected growth over the next 10 and 30 years. The analysis identifies where supply and demand is mismatched over 10 and 30 year time horizons, and thus where train lengthening or more train services might be required in peak periods.

0.4.3 The key Conditional Outputs for this Route Study include:

- The level of rail capacity required to meet peak Main Line passenger demand into London
- The level of rail capacity required to meet peak Main Suburban and Windsor Lines passenger demand into London
- The level of rail capacity needed to accommodate predicted freight demand
- The level of rail connectivity between large towns and cities across the route (for example, the frequency of train services, journey times, and the provision of direct journeys which do not require an interchange)

## 0.5 Choices for funders in Control Period 6 (2019-2024) and beyond

0.5.1 The key choices identified and in some cases appraised as part of the Wessex Route Study are summarised below with a more detailed account in **Chapter 5**.

0.5.2 In some cases there may be further work required to identify additional benefits in order to demonstrate a sufficiently strong economic return.

0.5.3 In all cases, where support exists from funders to progress a particular option, Network Rail will need to complete further engineering feasibility to ensure sufficiently detailed costings, output definitions and delivery plans can be submitted as part of the Business Plan for CP6. All costings published in this Study must be regarded as a high level guide only at this stage and are subject to change.

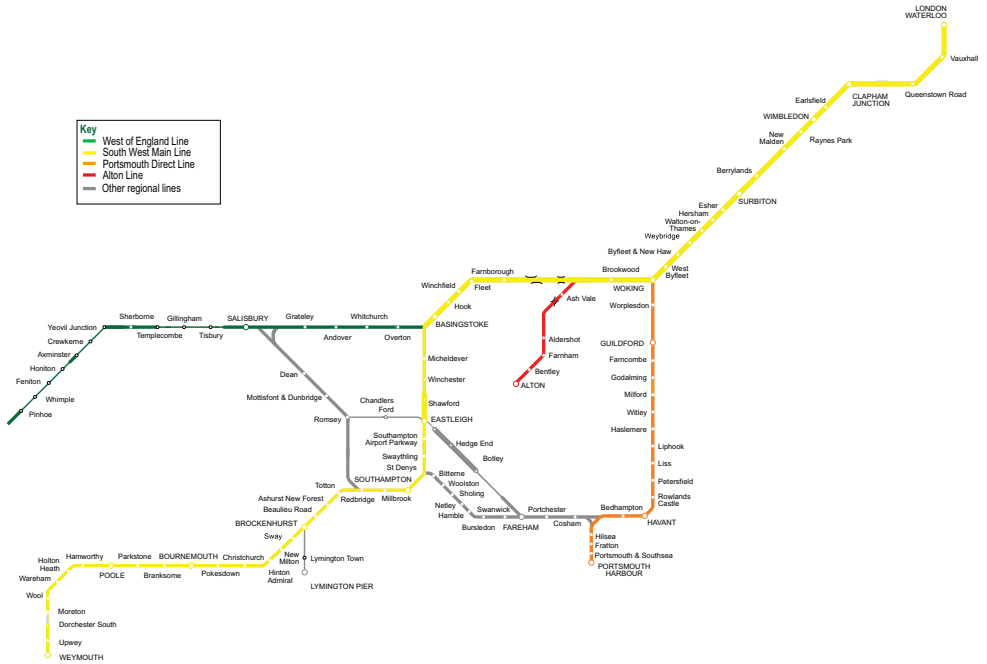
## 0.6 Peak Capacity: Main Line services to / from Waterloo

0.6.1 This group of services comprises most trains operating on the fast lines inwards of Surbiton. **Figure 3** sets out the relevant routes that have services that fall into this category.

0.6.2 For this service group the **London and South East Market Study** anticipates growth of 40 per cent by 2043. It is critical to note that even before growth is considered approximately 20% additional capacity is required to deal with existing over crowding on these services. Standing is commonplace from Woking and Basingstoke.

0.6.3 Passengers are also standing from as far away as Winchester on fast services to London Waterloo, a journey of over

**Figure 0.3 Main Line service groups**




one hour, although seats are available on slower services from this station.

0.6.4 The Route Study's assessment, therefore, is that an additional 60 per cent capacity is required in the high peak hour to meet the 2043 capacity conditional output for Main Line long distance services. This equates to 13 (10-11 Main Line and 2-3 Outer Suburban) additional paths in the high peak hour, assuming the majority of trains are configured with 3+2 seating.

0.6.5 Of particular note for this service group is the fact that the density of operation on the single Up (London bound) Fast Line inwards of Surbiton during the peak is higher than on any other single stretch of main line in the UK. The significant growth in passenger numbers alongside the constraint on network capacity means even the smallest delay can quickly be transferred to other services. This brings its own challenges in terms of maintaining performance and particularly avoiding knock on delays as a result of minor incidents. The capacity to add further services without significant improvements to signalling and other infrastructure is extremely limited.

## Post-CP6 Options

0.6.6 For the longer term, meeting the capacity challenge on the Main Line involves two distinct challenges: those in the inner area (inwards of Surbiton) and those in the outer area (country end of Surbiton outwards).

0.6.7 This distinction highlights the differing nature of the challenge. In the 'inner area', Main Line services in the peak operate on a single fast line in both directions between Surbiton and Clapham Junction. In the peak there are no capacity reducing station stops between Surbiton and London Waterloo, or flat junctions causing conflicting moves – so the challenge on this section is simply that the railway has reached its maximum capacity based on current signalling capability and the number of tracks.

0.6.8 Against this background, the route study identifies three high-level options for the long term in the inner area, each based on large scale changes to infrastructure and or signalling systems– but with the same complementary interventions to junctions and stations required in the outer area regardless of the inner area solution. This would require extension of the Up Main Relief towards Clapham Junction, together with one or more of the following options:

A 5th track Surbiton to Clapham Junction

B Crossrail 2

C European Train Control Systems (ETCS) and Automatic Train Operation (ATO) deployment on the Main Lines.

0.6.9 Only Option B (Crossrail 2, which involves some use of freed up slow line capacity and slow line platforms at Waterloo) looks to have the potential to get close to the long term target train numbers to cope with growth.

0.6.10 Option C (accelerating the introduction of ETCS/ATO) looks on initial analysis to have a significant positive impact on capacity in the inner area and could be a much better value-for-money solution than the infrastructure changes needed for Option A. Coupled with Option B, it could provide the necessary capacity up to 2043.

0.6.11 In the 'outer area' the challenges are different. Several flat junctions reduce capacity, and station stops at Woking, together with different calling patterns of services, reduce the maximum theoretical throughput of trains. Options identified here include:

- Woking Junction grade separation
- Woking additional through platform
- Guildford additional platforms
- Basingstoke GW Junction grade separation
- Southampton Central additional platforms

0.6.12 **Table 0.1** below sets out these options. At this stage train paths released estimates are indicative only.

**Table 0.1 Options for long term delivery of Main Line paths**

| Choices / Interventions | Option A | Option B | Option C |
|---|---|---|---|
| Woking Grade Separation and Woking New Platform | | | |
| Basingstoke Grade Separation | | | |
| ETCS/ ATO Woking and inwards | | | |
| Crossrail 2 (including 6th track option) | | | |
| 5th track between Surbiton and Clapham Junction | | | |
| Guildford Additional Platforms | | | |
| Southampton Central Additional Platforms | | | |
| Total Main Line Paths Per Hour * | 30-34 | 32-36 | 30-34 |

* Total figures include the Main Suburban services which utilise the Fast Line.

0.6.13 The requirement for 2043 is the provision 37 Main Line paths per hour. The options included in Table 0.1 do not fully meet this requirement. Analysis has shown that combining 'inner area' solution could provide around 60 paths per hour by 2043 on both the Fast and Slow Lines and would therefore fully meet the morning peak capacity Conditional Outputs.

## CP6 Priorities

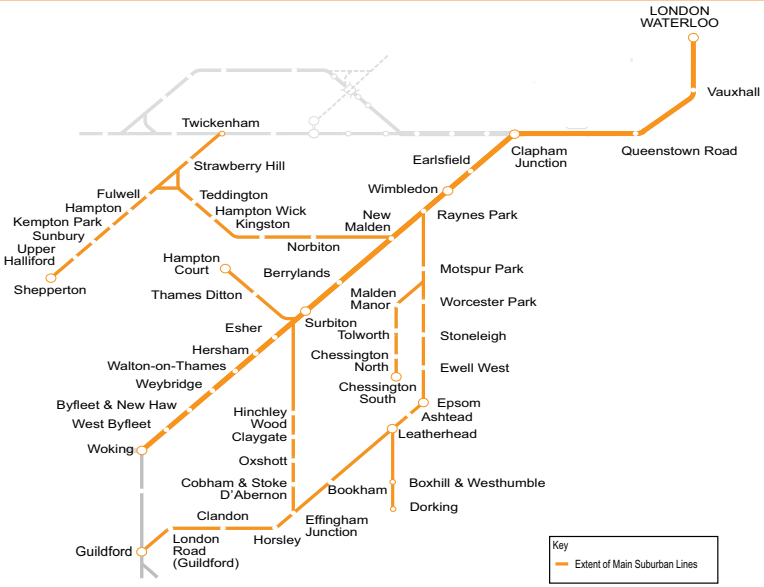
0.6.14 Given the above context, the route study has identified CP6 priorities on the basis of those interventions that would be commonly required regardless of the interventions chosen in the inner area in the longer term. Of themselves they offer some incremental capacity benefit supporting up to 28tph operations on the Main Line. These are the works between Clapham Junction and Waterloo, grade separation and additional platform at Woking, and, depending on where the additional trains were to originate from, the grade separation at Basingstoke.

0.6.15 The interventions at Guildford and Southampton could be delivered in CP6 although their full benefit would only be realised once an inner area solution was completed.

0.6.16 The Route Study has also examined three other options which could potentially provide additional capacity on the Main Lines in CP6. These are:

- Double-deck trains. Whilst the full analysis of this option has not been concluded, initial results would suggest that this is very unlikely to offer value-for-money.
- Homogenised rolling stock. It is suggested that some extra capacity could be achieved if the current diesel fleet used primarily on West of England services were to be replaced with stock with the same performance characteristics as the electric fleet. Analysis suggests that this may not be enough to generate any additional paths, but could offer a performance benefit.
- Greater use of the Slow Lines from Surbiton inwards. If some of the trains which currently switch from the Slow Line to the Fast Line at Surbiton were instead to remain on the Slow Line, then their paths could be used by longer distance services. Analysis suggests that this could potentially release two paths in the high-peak hour. However, the disbenefits would be a) longer journey times to London Waterloo for those whose trains remain on the Slow Line, and b) a performance risk with two additional

**Figure 0.4 Main suburban services to / from Waterloo**



trains per hour using the Slow Line.

## 0.7 Main Suburban services to / from Waterloo

0.7.1 This group of services comprises all trains on the Main Suburban lines as shown in **Figure 0.4**.

### Peak Main Suburban Capacity

0.7.2 The Route Study predicts 40 per cent growth on these services by 2043. The Study sets out how crowding levels are likely to pan out over the long term, concluding that the move from 8 to 10-car operation in CP5 will provide sufficient capacity until the late 2020s, at which point a further intervention is required. The options set out are:

- Train lengthening to 12-car operation
- Crossrail 2

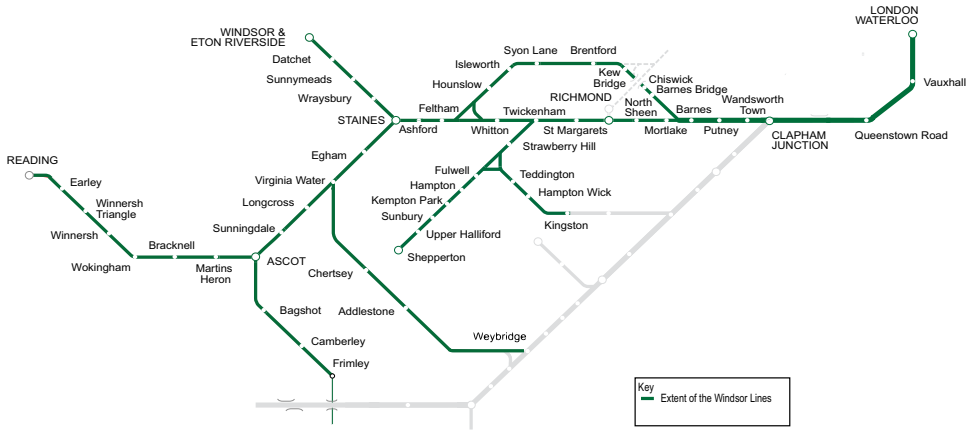
0.7.3 12-car train lengthening is feasible but would require major works at many key locations on the suburban routes. Crossrail 2 would be likely to deliver a more significant step change in capacity, but a number of major changes to the infrastructure would also be required, including possibly some significant works at level crossings.

### Suburban connectivity

0.7.4 The Study tests a number of options around improving connectivity between suburban locations locally and between suburban locations and London.

0.7.5 The Study concludes there could be some minor improvements in off peak connectivity, through minor frequency improvements – possibly at the cost of journey times to/from London. In the longer term, Crossrail 2 is identified as the strongest option for improved connectivity offering both the possibility of peak and off peak frequency improvements on some of the suburban branches and a large set of new and faster journey

**Figure 0.5 Peak capacity: Windsor Line services**



opportunities between parts of the suburban area and central London.

## 0.8 Windsor Line services to / from Waterloo

0.8.1 This group of services comprises all trains on the Windsor Lines as shown in **Figure 0.5**.

0.8.2 The Route Study predicts 37 per cent growth on these services by 2043.

0.8.3 The Study sets out how crowding levels are likely to pan out over the long term, concluding that the move from eight to 10-car operation to be delivered in CP5 will provide sufficient capacity until the late 2020s / early 2030s at which point a further intervention is required on the Richmond route. The options set out are twofold, first a move to a 20 trains per hour timetable in the high peak, followed by a move to 12-car operation.

## 0.9 Other key options and conclusions

### North Downs Line (inter regional Reading – Guildford – Gatwick Airport route)

0.9.1 The Study identifies a range of options for this route including:

- A move to a 3tph timetable to allow for two fast trains per hour to / from Gatwick Airport. This option would be aided by additional platforms and layout changes at Guildford station (an option also recommended for the long term Main Line growth – see **Section 0.6** above)
- Opportunities to raise some linespeeds and reduce headways on the route
- Significant journey time improvements of up to 10 minutes could be achieved through electrification

### Regional services and Freight between Southampton / Bournemouth and the Midlands / North

0.9.2 Options to provide additional paths on the Southampton – Winchester – Basingstoke – Reading route for regional passenger and freight traffic are set out

- An option for a major extension to Wallers Ash loop to provide a section of four-track railway between Wallers Ash and Micheldever
- Basingstoke grade separation as listed above in **Section 0.6** is also required to free up a further hourly freight path between the Midlands and Southampton
- Additional platforms at Southampton as identified in **Section 0.6** would also aid through freight movements through the station area in the off-peak and support the operation of additional regional services in the long term.

### Electrification

0.9.3 The Route Study highlights the need to develop options for electrification of the Basingstoke – Andover – Laverstock / Salisbury – Southampton route. This is in the context of potential plans for an AC electrified 'Electric Spine' for freight between Basingstoke and Southampton. The Study highlights the importance of considering the Andover route as part of this plan, owing both to its critical diversionary role and also potential passenger benefits of electrification to Salisbury

0.9.4 The study includes options for electrification of the North Downs Line. This would support both journey time improvements and the release of diesel rolling stock.

0.9.5 The study sets out options for infrastructure improvement on the West of England Line that would support journey time improvements should electrification take place. Options that support use of the route for diversions for from the Western route are also set out.

### Station Pedestrian Capacity

0.9.6 The Route Study has investigated locations where it is considered that pedestrian flow will become a concern in coming years.

0.9.7 Analysis has shown that in CP6 interventions will be required especially at Clapham Junction.

## 0.10 Acknowledgements and Next Steps

0.10.1 This Route Study has been developed through a process of wide industry collaboration, and the Route Study team wishes to acknowledge the considerable assistance provided by industry stakeholders and others in the development of this document.

0.10.2 The outputs from this Route Study will be used to develop proposals for the Initial Industry Plan, due to be submitted to Government in September 2016.

# 01 Introduction



## 1.1 Background

1.1.1 Since the late 1990s the national rail network has enjoyed a period of unprecedented growth. More passengers are using the network than ever before and the increase in the amount of goods transported by rail is considerable. The Department of Transport (DfT) recognises that the provision of attractive rail services is a significant driver of economic growth and this recognition is demonstrated by Governments' continuing desire to invest significantly in the provision of railway services, most recently through Network Rail's **Control Period 5 (CP5, 2014 – 2019) Delivery Plan** which will see the introduction of a fully 10-car capable suburban network on the Wessex Route.

1.1.2 The **Market Studies** which form part of the overall **Long Term Planning Process** (LTPP), and which were published in 2013, suggest that demand for rail services is going to continue to grow strongly across all sectors. The studies also articulate the economic and demographic factors that continue to work in rail's favour before suggesting a number of service level conditional outputs that will deliver the DfT's strategic goals of:

- Encouraging economic growth
- Reducing environmental impact
- Improving the quality of life for communities and individuals.

1.1.3 It is against this background that the railway industry, working collaboratively, has developed this Route Study to present the case for further investment in the network for Control Period 6 (CP6, 2019 – 2024) and beyond to 2043.

## 1.2 The Long Term Planning Process

1.2.1 The LTPP was endorsed in April 2012 by the then Office of Rail Regulation (ORR - renamed the Office of Rail and Road in April 2015) to meet the requirements of Network Rail's network licence to use and develop the network so that it is consistent with funding that is, or is likely to become, available.

1.2.2 The LTPP is designed to enable the railway industry to take account, and advantage, of long term strategic investment being made in Great Britain's rail network. The planning horizon for the LTPP is 30 years and it is intended to adapt to potential structural changes in the economy and the approach to social and environmental responsibility, so that the rail industry can respond to change over the long-term life of the assets used to operate the rail network.

1.2.3 The LTPP will be an iterative process in which future planning cycles will enable an updated view to be taken of the changing context and requirements of the industry and economy. A key objective of the LTPP is to understand the longer term strategy whilst creating a prioritised view of requirements for the next Control Period (in this case CP6). In this planning cycle the prioritisation of requirements for CP6 will commence with the submission of the Initial Industry Plan (IIP) in September 2016. Future iterations of the LTPP will evolve, identifying requirements for future Control Periods as part of this on-going process.

1.2.4 The LTPP consists of a number of different elements, which, when taken together, seek to define the future capability of the rail network. These elements are:

- **Market Studies**, which forecast future rail demand, and develop conditional outputs for future rail services, based on stakeholders' views of how rail services can support delivery of the market's strategic goals
- **Route Studies**, which will develop options for future services and for development of the rail network, based on the conditional outputs and demand forecasts from the market studies, and assess those options against funders' appraisal criteria in each of Network Rail's devolved Routes
- Cross-boundary analysis, which will consider options for services that run across multiple routes to make consistent assumptions in respect of these services.

## 1.3 Market Studies

1.3.1 In October 2013, Network Rail published four **Market Studies**: **Long Distance passenger**, **London and South East passenger**, **Regional Urban passenger** and **Freight**. All four have

been established by the ORR and are available on the Network Rail website, Long Term Planning Process.

1.3.2 The three passenger Market Studies have clear connections to the three 'sectors' in which passenger train services are often divided. It is important to emphasise that each Market Study considers a particular market, rather than a particular set of train services. The passenger Market Studies have three key outputs:

- Identification of the long term strategic goals which define the successful provision of rail services to each of the three passenger market sectors. These are based on the aspirations of current and likely future industry funders
- Demand forecasts for the sector, over a 10 and 30-year planning horizon. Scenarios are used to reflect key uncertainties, where appropriate
- Conditional Outputs for the sector. The Conditional Outputs are aspired levels of service (in terms of, for example, frequency, journey time and/or passenger capacity on key flows in the sector). The Conditional Outputs reflect stakeholder views of how rail can support delivery of their strategic goals, and opportunities created by planned investments, as well as reflecting current service levels and forecast future demand. The aim of the Market Studies is to provide demand forecasts, and Conditional Outputs, that are consistent across the Route Studies.

1.3.3 For freight the Conditional Outputs are to meet the forecast level of freight set out in the Freight Market Study in 2023 and 2043. The Freight Market Study produced demand forecasts over a 10 and 30 year planning horizon, with preferred routeing of services and the implied requirements in terms of network capacity and capability. Further details on freight growth nationally, and within the Wessex Route, are included within **Chapter 4**.

1.3.4 Conditional Outputs should be viewed as aspirations for the future rather than recommended investment decisions. It is also important to state that the conditional outputs are dependent on affordability, fundability, and a value for money business case. Equally the conditional outputs will need to be deliverable technologically, operationally and physically.

## 1.4 Route Studies

1.4.1 Building upon the Market Studies, the Route Studies develop and assess a series of choices that aim to meet the conditional outputs that were previously identified. The first step in developing these choices is to determine whether the conditional outputs can be accommodated on the existing rail network with enhancements that have already been committed for delivery.

1.4.2 Once this is determined it is important to assess the potential for train service options that would not require any infrastructure interventions. It is only when these two preliminary steps have been taken that the Route Study considers infrastructure based choices.

1.4.3 As previously stated the choices identified within this route study are intended to inform the development of proposals to consider within rail industry funding discussions for CP6. Equally, other potential rail industry funders, for instance Local Authorities or Local Enterprise Partnerships, may wish to consider the information this Route Study contains, when taking forward their own plans and proposals which may impact upon the rail network.

1.4.4 The Route Study takes account of a number of rail industry priorities and initiatives. These are:

### Safety

1.4.5 Network Rail set out its vision for safety in its 'Transforming Safety & Wellbeing' vision and strategy through to 2024. Many of the choices for funders set out in this document are at an early stage of development and safety will be considered in depth as proposals are developed. It should be noted, however, that choices that involve proposals such as those to remove junction conflicts, eliminate level crossing movements or ease the flow of passengers at stations will improve the safe operation of trains for both passengers and freight.

### Performance

1.4.6 The performance objectives for the rail industry in CP6 are not yet known. However, it has been assumed for the purposes of this Route Study that performance will continue to be an important consideration and trade-off when determining what choices will ultimately be taken forward to meet the identified conditional outputs.

### Resilience

1.4.7 The resilience of the rail network has become an increasingly important strategic consideration. This is particularly the case in light of the winter storms of 2014 where lines were blocked or washed away causing significant delays and a number of line closures, not least at Dawlish on the Great Western Main Line south west of Exeter which resulted in the closure of the line to Plymouth, Paignton and Cornwall for eight weeks.

1.4.8 As part of this Route Study the rail industry has considered the outputs from work on resilience that Network Rail has undertaken. Each Network Rail Route has developed a **Weather Resilience and Climate Change Adaptation Plan (WRCCA)**. For the Wessex Route the WRCCA was published at the end of September 2014. This document has set out a management plan for weather resilience and climate change supported by an evaluation of the resilience of rail infrastructure to historical weather events and an awareness of potential impacts from regional climate change projections.

### The Digital Railway

1.4.9 The Digital Railway is an industry-wide programme designed to benefit Great Britain's economy by accelerating the digital enablement of the railway.

1.4.10 The programme sets out to build the industry business case to accelerate the digital-enablement of the railway in several key areas, including infrastructure, train operation, capacity allocation, ticketing and stations.

1.4.11 The output of the programme will be a business case to Government, presented through the Initial Industry Plan in September 2016. For the purpose of the Wessex Route Study, only infrastructure assumptions on changes to signalling have been examined where the digital railway could help achieve conditional outputs.

### Interoperability

1.4.12 **The Railways (Interoperability) Regulations 2011** and associated **Technical Specifications for Interoperability (TSI)** apply to the entire UK rail network with the exception of the exclusions defined on the DfT web-site.

1.4.13 European and UK legislation defining objectives for Interoperability and the Trans European Transport Network (TEN-T) have been taken into account in the development of this Route Study.

1.4.14 For works being carried out on the UK component of the TEN-T network, European Union funding support is available for qualifying projects. Network Rail will work with the DfT to ensure that the UK takes maximum benefit from this opportunity.

### Declarations of congested infrastructure

1.4.15 When Network Rail receives more requests for train paths to be included in the Working Timetable than can be accommodated on a section of line, the section of line concerned should be declared as 'Congested Infrastructure' under paragraph 23 of **The Railways Infrastructure (Access and Management) Regulations 2005**.

1.4.16 If infrastructure is declared as congested Network Rail will undertake and publish capacity analysis within six months under paragraph 23 of the regulations. Then Network Rail will also undertake a capacity enhancement study and publish that within a further six months under paragraph 24 of the regulations.

### Accessibility and diversity

1.4.17 Network Rail's vision is to provide world-class facilities and services to everyone who uses the network. For the passenger interface this is particularly around stations where Network Rail seeks to make all stations:

- Safe
- Accessible and inclusive
- Efficient in the way we use natural resources and manage waste
- Focussed on the needs of all Network Rail customers
- Staffed by a competent, high quality team

1.4.18 Travelling by train should be as easy as possible for everyone who uses the railway network, irrespective of their age, disability, race, religion or belief, sex, or sexual orientation. This brings Network Rail in line with the **Public Sector Equality Duty (PSED)**.

1.4.19 Network Rail receives specific funding for accessibility at stations through the Access for All (AfA) fund and will continue to design infrastructure that meets all accessibility legislation.

## 1.5 Cross-Boundary Analysis

1.5.1 Services that run across more than one Route Study area are considered in a separate cross-boundary workstream but form an integral part of the overall strategy for each route. This specific workstream has developed and assessed options for cross-boundary services (passenger and freight).

1.5.2 The output from the cross boundary analysis is a set of common assumptions that Route Studies should adopt regarding these services. Assumptions include the frequency and calling pattern of passenger services and the frequency and operating characteristics (e.g. gauge, speed, tonnage) of freight services.

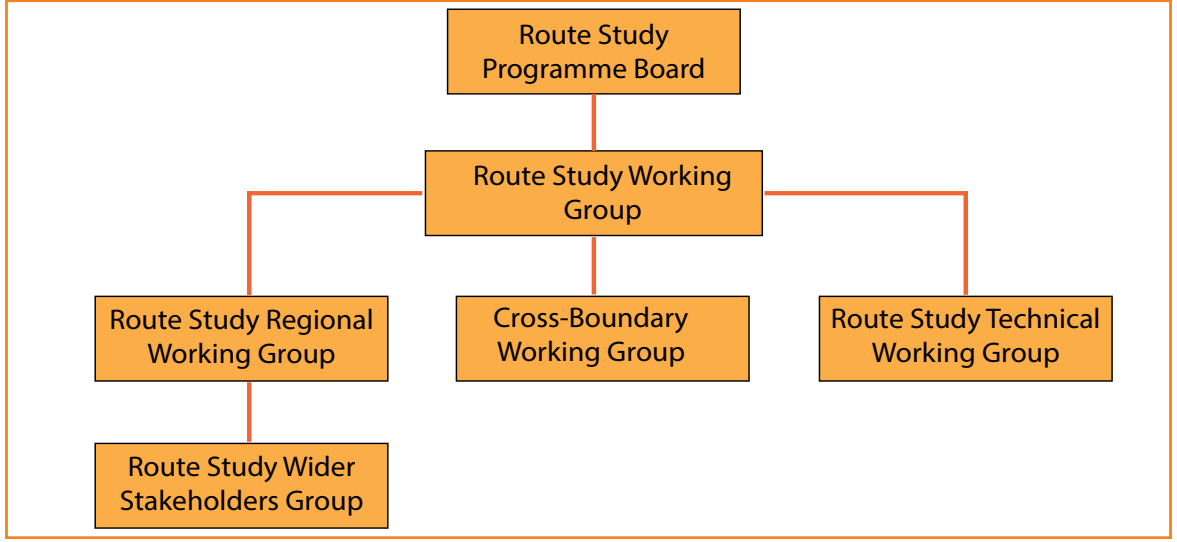
## 1.6 LTPP Governance Arrangements

1.6.1 The LTPP is designed to be as inclusive as possible with contributions encouraged both from the rail industry and wider stakeholders. Overall governance responsibility for the process lies with the Rail Industry Planning Group (RIPG) whose membership comprises:

- Department for Transport (DfT)
- Freight Operating Companies (FOCs)
- London Travel Watch
- Network Rail
- Office of Rail and Road (ORR)
- Passenger Focus
- Passenger Transport Executive Group (PTEG)
- Rail Delivery Group
- Rail Freight Group
- Rail Freight Operators Association
- Railway Industry Association
- Rolling Stock Leasing Companies
- Train Operating Companies (TOCs)
- Transport for London (TfL)
- Transport Scotland
- Welsh Government

1.6.2 RIPG meets bi-monthly and provides strategic direction and endorsement of the constituent publications of the LTPP process.

Figure 1.1 Wessex Route Study Governance Structure




## 1.7 Route Study Governance Arrangements

1.7.1 A three-tier structure for rail industry and wider stakeholder dialogue was established to oversee and help produce this Route Study.

1.7.2 A Programme Board, chaired by the Alliance Managing Director for Wessex with senior level representation from passenger and freight train operating companies, Rail Delivery Group, TfL, DfT and the ORR provided a high-level review function and a forum to resolve any significant issues which the Working Group remitted to the board for decision.

1.7.3 A Working Group, chaired by Network Rail, with a mandate to discuss the study on behalf of the rail industry. The Working Group determined how the conditional outputs from the Market Studies could be accommodated, including identification of service specifications and options with the aim of developing choices for CP6 and to 2043.

1.7.4 The working group comprised representatives from the current Operating Companies (both passenger and freight) who operate on the route, Rail Delivery Group, DfT, TfL, Network Rail, and the ORR as an observer.

1.7.5 A Regional Working Group, chaired by Network Rail, provided location specific oversight as well as an opportunity for collaboration outside the rail industry. The Regional group membership comprised Local Authorities, Local Enterprise Partnerships, Department for Transport, Airports and Freight stakeholders on the route.

1.7.6 Network Rail has managed the development of the work through an internal Technical Working Group to deliver the information necessary to support the deliberations of the Working Group, augmented as appropriate by discussions with rail industry stakeholders.

1.7.7 Wider stakeholders on the route, such as user groups, were consulted during the consultation process to ensure that specific local considerations were addressed or noted.

1.7.8 **Figure 1.1** shows the Governance Arrangements in diagrammatic form.

## 1.8 Document Structure

1.8.1 The remainder of this document is structured as follows:

- **Chapter 2: Consultation Responses** – provides an overview of the responses received during the consultation process, setting out the key themes and how they have or have not been incorporated into the Route Study
- **Chapter 3: Baseline** – includes planned changes to infrastructure and services on the Wessex Route that are anticipated for delivery by the end of CP5
- **Chapter 4: Conditional Outputs** – identifies the established Conditional Outputs from the **Market Studies** relevant to the Wessex Route Study
- **Chapter 5: Accommodating the Conditional Outputs** – identifies and details the choices for funders to meet the conditional outputs as set out in **Chapter 4**. This forms the full strategy for the Wessex Route and incorporates the priorities for CP6 as well as the choices to 2043. Account is taken of capacity, connectivity and cross-boundary conditional outputs
- **Chapter 6: Summary** – provides a succinct overview of the priorities for CP6 and strategy to 2043 for the Wessex Route
- **Appendix A** – sets out the details of the business case work carried out for the Wessex Route Study
- **Appendix B** – quick reference tables for suggested CP6 choices

1.8.2 This document has been published on behalf of the rail industry exclusively on Network Rail's website.

# 02 Consultation Responses



## 2.1 Introduction

2.1.1 The Wessex Route Study (Draft for Consultation) was published on 21 November 2014. A 90-day formal consultation period ensued which ended on 18 February 2015.

2.1.2 A total of 234 responses were received from individuals and organisations, broken down as follows:

- Private Individuals 130
- Local Authorities/Umbrella Organisations 48
- Interest and User Groups 27
- Elected Representatives (MPs/Councillors etc) 9
- Businesses 8
- Local Enterprise Partnerships 4
- Train Operating Companies 3
- Freight Operating Companies 2
- Educational and Professional Institutions 2
- Office of Rail Regulation[1] 1

2.1.3 The responses were well considered, and in many cases comprehensive. As a result, it is difficult to provide an individual précis of each submission. Instead, some of the key and recurring themes are summarised below.

## 2.2 General Comments

2.2.1 By and large, consultees were supportive of the options identified by the study as a means of catering for future growth and improved connectivity.

2.2.2 Several respondents considered that the document focussed too sharply on commuting into London at the expense of other parts of the Wessex route. It is, of course, the case that meeting predicted demand into London Waterloo is the biggest strategic challenge facing the route. However, we remain open and willing to discuss with funders how to achieve desired outputs at other locations on the route.

2.2.3 There was significant support for Crossrail 2 from a wide range of stakeholders, acknowledging the potential it has to release some Main Line capacity.

2.2.4 Similarly, many respondents were supportive of the benefits that would be brought by electrification of the North Downs Line, and of the West of England line at least as far west as Salisbury (including the Test Valley route to Southampton).

2.2.5 A few people expressed concern that the proposed timescales for improvements were too far into the future, and that Network Rail should aim to deliver projects more quickly. Conversely, others suggested that the industry should not concern itself with the future at all, and should instead concentrate on making today's service perform consistently well.

## 2.3 Demand Data

2.3.1 Several consultees expressed the view that future passenger demand projections may be underestimated. Local Authorities in particular were concerned that planned or proposed housing and employment growth in their areas may not have been fully captured by the modelling. Our passenger demand forecasts use centrally developed projections of population and employment and many of the proposals we put forward are to deal with commuting capacity into Central London that is largely driven by central London employment growth rather than population. This approach allows us to develop plans that are in line with Central Government policy. Using local forecasts of housing and population would bias our investment towards those areas with the most ambitious aspirations, rather than where investment is most required.

2.3.2 Similarly a number of freight stakeholders felt that predicted freight demand may also be understated. The forecasts used in this Route Study are, however, those agreed by the industry for the **Freight Market Study**, and as subsequently adjusted (particularly in respect of aggregates traffic). Construction of HS2 may well result in increases in aggregates traffic across parts of the route.

[1] Renamed Office of Rail and Road in April 2015

2.3.3 Some people questioned whether our baseline passenger data accurately reflected reality. Averaging loadings across an hour masks the crowding situation on individual trains. Nevertheless, the Route Study does have data on individual trains, and the proposed solutions would still be applicable in any event.

2.3.4 Using an allowance of 4 people per $m^2$ of floorspace to determine capacity for standing passengers was questioned, especially since train operators on other routes work to standards which are less dense. Some felt that this could lead to interventions being delayed beyond the point at which they are needed. There is, of course, a trade-off between density of passenger loadings and other solutions such as more or longer trains, or even disincentivising peak-time travel.

2.3.5 The point was also made that, quite apart from exogenous growth, capacity improvements may in themselves unlock currently suppressed demand. This in turn could mean that the proposed interventions may prove to be insufficient.

## 2.4 Railfreight

2.4.1 Much of the discussion about railfreight centred on the intermodal route to and from Southampton Docks via Basingstoke and Reading.

2.4.2 A number of respondents emphasised that it was important to consider the entire corridor from Southampton to the West Midlands (and beyond) as a whole. Improvements for freight traffic within the Wessex Route may prove fruitless if, for example, capacity constraints further north cannot be readily overcome. This would have implications on both the scope and the timing of interventions.

2.4.3 Questions were raised about the resilience of the route between Basingstoke and Reading, and about clearing the gauge to W10/W12 on the diversionary route from Basingstoke via Woking, Chertsey, Staines and Kew. The latter was proposed for funding in CP5 (2014-19) from the Strategic Freight Network fund, but the fund's steering group did not consider it a priority.

2.4.4 Several stakeholders wanted almost all freight to/from Southampton via Basingstoke to be routed via Romsey and Andover in order to free up capacity for passenger services on the route via Winchester. The freight operators, however, were unanimously opposed to such a solution; not only would it impact adversely on operating costs (the route via Andover is over 20 miles longer) but would effectively remove diversionary capability.

2.4.5 Freight operators also made the point that it is not always appropriate to spread demand equally across the day (in terms of paths required per hour), as this can ignore their customers' needs (such as terminal opening hours, for example). This issue is closely connected to what the path utilisation rate is for the various types of flow.

## 2.5 Cross-Boundary Passenger Services

2.5.1 There was widespread support for proposals to increase frequencies and generalised journey times on the North Downs Line between Reading and Gatwick Airport.

2.5.2 Elsewhere, however, some people expressed concern that there was insufficient attention given to how journey times on existing services might be improved. Some of the suggested frequency improvements, of course, would improve generalised journey times on those corridors.

2.5.3 Proposals to deliver connectivity to both Heathrow Airport and HS2 at Old Oak Common were broadly welcomed. As far as HS2 is concerned, there was a view that for passengers travelling to Birmingham from Basingstoke (or south thereof) the existing direct service (especially if supplemented with an additional service) may actually prove more attractive than travelling via Old Oak Common.

2.5.4 Connectivity to Southampton Airport was raised by several respondents, especially from the east. There are a number of constraints involved, which were highlighted in the **London and South-East Route Utilisation Strategy** published in 2011.

## 2.6 Rolling Stock

2.6.1 One of the most contentious issues for consultees,

understandably, was the assumption that rolling stock with 3+2 seating should be used for calculating future capacity requirements (i.e. all main line trains were assumed to be formed of 12-car Class 450 Desiros). Many people felt that such stock was not appropriate for longer-distance journeys. Had the assumption been that the proportion of rolling stock with 3+2 seating remains roughly the same as today, then this would require up to three additional Main Line longer distance paths in the high peak hour by 2043, beyond the 30 or so assumed in the draft for consultation..

2.6.2 Double-deck trains prompted a mixed response. Some felt they might offer a solution, whilst others were sceptical about the claimed benefits and thought them unlikely to offer value-for-money.

2.6.3 At present, the different rolling stock types used on services into London Waterloo have different operating characteristics, especially in terms of acceleration and top speeds. It is suggested that homogenising the rolling stock could yield up to two additional paths per hour on the main fast lines. To achieve this would involve replacing the Class 158/159 diesel trains with either more modern diesel units, or (if electrification were extended at least as far as Salisbury) with electric units.

## 2.7 New or Re-opened Infrastructure

2.7.1 Several local residents called for the reinstatement of passenger services along the Fawley Branch at least as far as Hythe, with one being strongly opposed. However, no new evidence was adduced to suggest that the conclusions of recent studies (which suggested that the business case was not robust) should be reviewed.

2.7.2 Similarly a number of people in and around Camberley suggested that the Sturt Lane Chord (which used to connect the Ascot to Aldershot line with the South West Main Line to the east of Farnborough) should be reinstated as a means of improving journey times to Waterloo from the Frimley and Camberley areas. A more cost-effective solution, however, may be to improve connection times with Waterloo-bound trains at Ash Vale.

2.7.3 The freight branch from Andover to Ludgershall was cited as being a potential candidate for reinstatement of passenger services, as were the disused railways from Christchurch to Ringwood, Axminster to Lyme Regis, Seaton Junction to Seaton, and Sidmouth Junction (now Feniton) to Sidmouth. Some respondents also suggested that a west-to-south chord should be installed at Yeovil Junction to enable, inter alia, Bristol-Weymouth services to call at the Junction station as well as at Pen Mill. Funders have not suggested that these proposals would be a priority, however.

2.7.4 Two responses mentioned the Windsor Link Railway proposal to construct a link between the two railways which serve the town. Again, though, funders have not indicated that this should be a priority.

2.7.5 New stations were proposed at Merrow and at Park Barn (both near Guildford), and on the West of England line at Porton, Wilton, and Chard Junction. Readers may be interested in the document '**Investment in Stations: A Guide for Promoters and Developers**'.

## 2.8 Customer Service Issues

2.8.1 A number of respondents raised some customer service issues, which have been forwarded to the appropriate organisations. These included:

- Provision of Wi-Fi on all trains
- Facilities for bicycles, both at stations and on trains
- Improved information provision, especially during disruption
- The lacklustre condition of some rolling stock
- Issues specific to individual stations such as full accessibility, the provision of shelters and seating, and similar concerns

## 2.9 Publication of Responses

2.9.1 Except where respondents have specifically requested otherwise, all responses to the consultation are being published on Network Rail's website.

2.9.2 To comply with the requirements of the **Data Protection Act**, Network Rail holds (where supplied) the name, email, telephone, organisation and postal address information of respondents for the purpose of strategic route planning. This includes the development of the Initial Industry Plan, **Long Term Planning Process** including **Market**, **Route** and **Route Utilisation Study** projects, as well as ongoing Route Planning purposes. This information will not be used for any other purpose by Network Rail.

# 03 Baseline



## 3.1 Introduction

3.1.1 This chapter sets out the geographic scope of the area covered by the Wessex Route Study as well as the baseline characteristics of the route at the end of Control Period 5 (CP5), which runs from 2014 to 2019. The baseline therefore includes all schemes committed for delivery by the end of CP5 and any planned changes to the timetable or rolling stock allocation within that timeframe. It should be noted that schemes that are subject to the Enhancements Cost Adjustment Mechanism process (ECAM) may alter the current assumed baseline.

3.1.2 Longer term projects that are currently being developed, but not necessarily committed, are acknowledged in this chapter. As well as proposed schemes such as HS2, the introduction of the European Train Control System (ETCS) and European Rail Traffic Management System (ERTMS), large scale renewals are also identified.

3.1.3 It is recognised that the 2019 baseline used for the Wessex Route Study has the potential to change, following the review of the Control Period 5 enhancement programme announced by the Secretary of State.

3.1.4 As the options within the study represent a longer term view over the context of the next 30 years, the implications of any baseline revision are likely to be limited to the timing of the implementation of these options rather than their scope. We are therefore publishing this strategy noting that some of the baseline assumptions could change. Should any influences significantly alter the outputs of, and options identified within, the strategy, we will review and update accordingly as part of the ongoing process to maintain the validity of the strategy.

## 3.2 Geographic Scope

3.2.1 The geographic scope of this Route Study is illustrated in **Figure 3.1**. This scope area includes all lines contained within Strategic Route C as detailed in the **Route Specification: Wessex** published on the Network Rail website.

3.2.2 Specific lines in the scope area can be categorised as main line; suburban; freight only; or local/ regional routes dependent on the type of service that operates on the line.

3.2.3 Lines classified as main line are:

- The South West Main Line (SWML) between London Waterloo and Weymouth via Basingstoke and Southampton Central (excluding the slow lines between Waterloo and Woking)
- The West of England Line between Basingstoke (Worting Junction) and Exeter via Salisbury
- The Portsmouth Direct Line between Woking Junction and Portsmouth Harbour via Guildford
- The Alton Line between Pirbright Junction and Alton
- The line between Hilsea and Eastleigh via Fareham and Botley

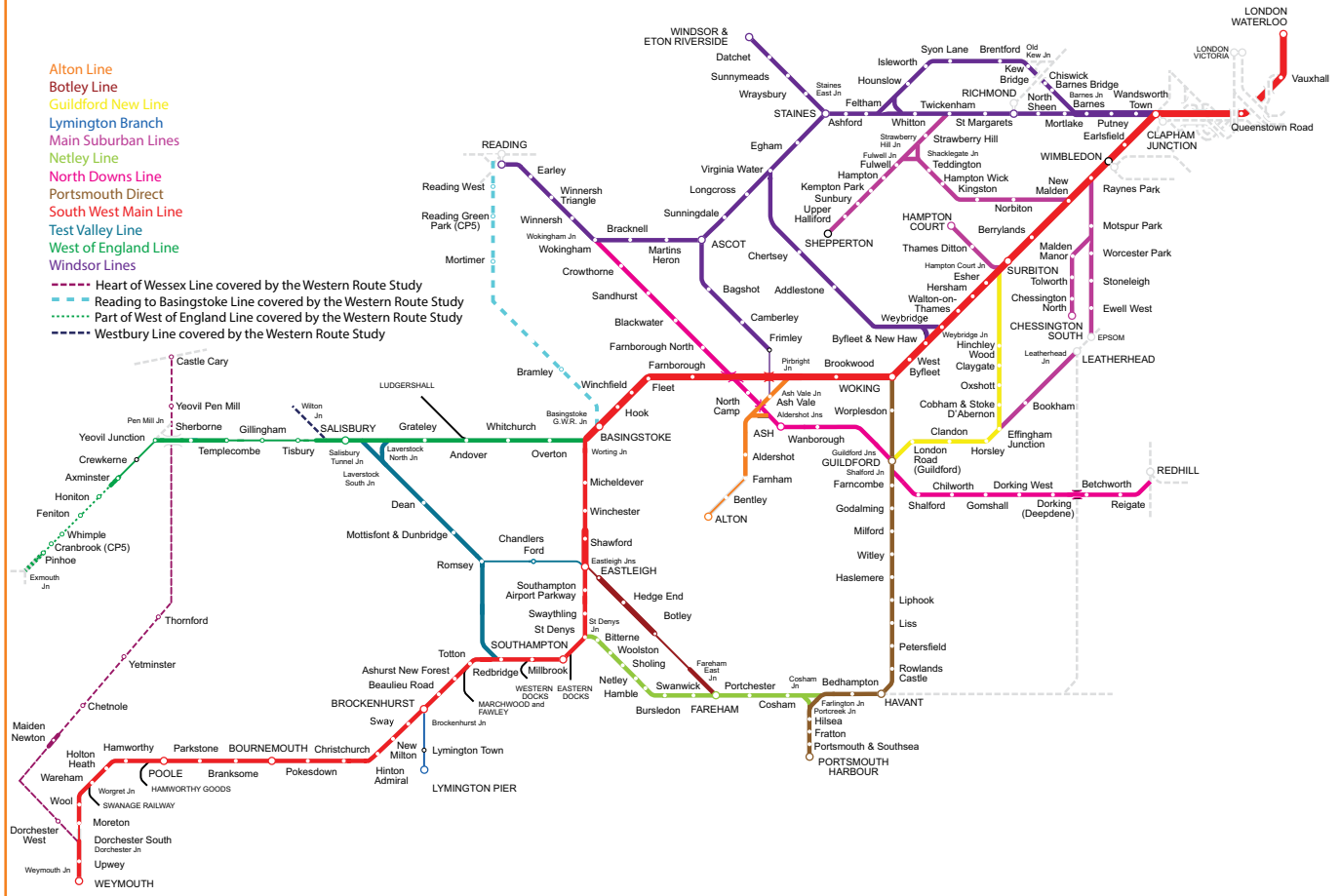
3.2.4 Lines classified as suburban are:

- The Windsor Lines between London Waterloo and Ash Vale via Camberley, Reading, Shepperton via Twickenham, Weybridge via Chertsey, Strawberry Hill via Richmond, and Windsor and Eton Riverside via either Hounslow or Richmond
- Main Suburban lines between London Waterloo and Chessington South, Epsom, Dorking, Guildford via Cobham & Stoke D'Abernon, Hampton Court, Shepperton via Kingston and the Slow Lines to Woking

3.2.5 Lines classified as local/ regional are:

- The Lymington Branch between Brockenhurst and Lymington Pier
- The Netley Line between Fareham and St Denys
- The North Downs Line between Wokingham and Redhill via Guildford
- The Test Valley lines between Salisbury and Eastleigh via Chandler's Ford, and Redbridge via Romsey
- Heart of Wessex Line between Dorchester West and Castle Cary

## Figure 3.1 Geographic scope area of the Wessex Route Study




3.2.6 Lines classified as freight lines are:

- Fawley branch
- Hamworthy Goods Line
- Ludgershall branch
- Southampton Eastern Docks
- Southampton Western Docks

3.2.7 The Island Line, on the Isle of Wight, has not been included in this study as it is not a regulated part of the railway.

## 3.3 Route Characteristics and the CP5 Delivery Plan

3.3.1 The characteristics of the route in terms of specifics such as gauge, axle-weights, line speeds and traction power are detailed in the **Route Specification: Wessex**, published on the Network Rail website.

3.3.2 The baseline of this study is defined as today's railway, as specified in the **Route Specification: Wessex**, plus the infrastructure that is committed for delivery in CP5, through Network Rail's CP5 Delivery Plan.

3.3.3 Details of the CP5 schemes included in the baseline of the Wessex Route Study are presented below. Further details of the schemes specified in the **High Level Output Specification** (HLOS) and renewals volumes are available in Network Rail's **CP5 Delivery Plan**, which can be accessed via the Network Rail website.

### Network Operating Strategy

3.3.4 The Network Operating Strategy (NOS) is the strategy currently being implemented by Network Rail, across the national rail network, to migrate operational control of signalling into modern Rail Operating Centres (ROCs). The NOS will also facilitate the deployment of modern signalling control systems. This offers significant opportunities to reduce annual operating costs and deliver an improved, more efficient railway.

3.3.5 In addition the NOS will incorporate traffic management decision support tools to facilitate real-time planning, prediction and conflict resolution. Through utilisation of these tools controllers will be able to optimise the use of existing infrastructure without impacting on performance thereby improving efficient control of the network.

3.3.6 The Wessex ROC is located at Basingstoke and was opened in early 2015, with signalling control migrations planned from CP5. **Figure 3.2** details the areas of re-control associated with the NOS.

3.3.7 The Network Rail/ South West Trains Alliance is currently reviewing the programme for these re-control schemes to take advantage of potential efficiencies with other works. It should therefore be noted that the above programme of works is subject to change.

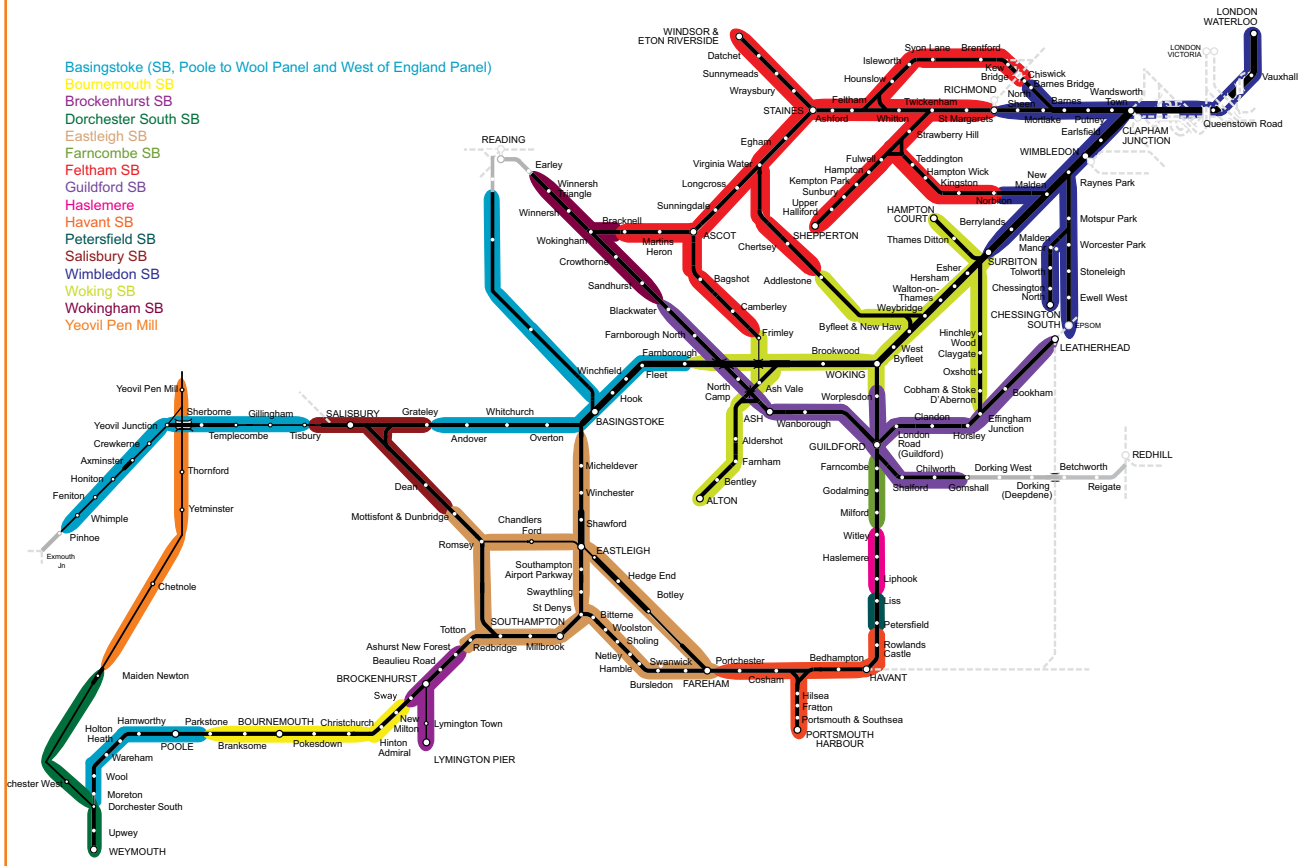
### 10-car South West Suburban Railway

3.3.8 The Wessex suburban network will be fully 10-car capable by the end of CP5, including both Windsor Line and Main Suburban networks. This capability builds on work begun in Control Period 4 (CP4) which involved extending platforms and upgrading the power supply on the Windsor Lines. The remaining works required to provide full 10-car capability on the Windsor Lines will be provided by the Reading, Ascot to London Waterloo project (see later in this section).

3.3.9 Work at Main Suburban stations to facilitate the operation of 10-car services was instigated in CP4 and has been completed in early CP5. This work involved extending platforms across the suburban network.

3.3.10 Before a full 10-car service can be operated on the suburban network the outputs of the Wessex Capacity Programme (see later in this section) will need to be realised. This programme will reinstate the platforms in the former Waterloo International Terminal (WIT) for domestic use and extend London Waterloo Platforms 1 – 4 to accommodate lengthened services.

## Figure 3.2 Network Operating Strategy



### Reading, Ascot to London Waterloo Train Lengthening

3.3.11 Both the **South West Main Line RUS** (published March 2006) and the **London & SE RUS** (published July 2011) recommended that to meet the capacity gap on the Windsor Lines the route between Reading, Ascot and London Waterloo should be 10-car capable thus enabling the operation of longer trains.

3.3.12 In line with these recommendations a scheme to enable 10-car capability has been specified in the **CP5 Delivery Plan**. The scope area of this scheme can be seen highlighted in **Figure 3.3**. This scheme is scheduled to deliver 10-car capability in CP5 and is aligned with proposed rolling stock plans and other specified schemes aimed at delivering the capability for 10-car operation on the whole suburban network.

3.3.13 The scheme will provide infrastructure and operational interventions to allow the use of 10-car trains on the route between Reading, Ascot and London Waterloo as well as for services originating on the line through Camberley. These interventions will include physical works to extend platforms and any associated changes to other assets. In the case of stations, within the scope area, that are lightly used or where platform extensions would be impracticable the project will seek to utilise Automatic Selective Door Opening (ASDO).

### Wessex Traction Power Supply Upgrade

3.3.14 The provision of 10-car capability between Reading, Ascot and London Waterloo, as detailed previously, will necessitate additional traction power on this route. In addition to the main route between Reading and London Waterloo, this project will address works to permit the operation of 10-car trains between Ash Vale and Ascot.

3.3.15 To deliver 10-car capability a number of packages of work have been identified:

- High Voltage (HV) Feeders Aldershot area
- Virginia Water to Reading upgrade works
- Isleworth/ Bedfont upgrade works

3.3.16 These work packages are in addition to the power supply upgrade works and future strategy identified as part of the South London High Voltage (HV) Power Upgrade.

### Feltham Re-signalling

3.3.17 Feltham Re-signalling is a renewals driven scheme to replace life-expired signalling equipment in the Feltham signalling area. It will also deliver the re-control of the Feltham and Wokingham signalling areas to the new Rail Operating Centre (ROC) in Basingstoke.

3.3.18 A large scale re-signalling scheme such as this provides a once in 35-year (the lifespan of signalling assets) opportunity for the efficient delivery of infrastructure enhancements.

3.3.19 Enhancements being considered as part of the scheme include:

- Enhanced capability at Twickenham
- Turnback signal at Fulwell
- Turnback facility at Feltham
- Turnback facility at Kew Bridge
- Turnback facility at Virginia Water
- Turnback facility at Bracknell

3.3.20 It should be noted that re-signalling schemes of this size are developed and delivered over more than one control period and it is for this reason that the list of enhancements detailed above is yet to be finalised and funding agreed.

3.3.21 Through this project there is an opportunity to deliver passive provision for potential future 12-car operation where it is efficient and appropriate to do so.

3.3.22 In addition to these proposed enhancements the scheme will address the closure of level crossings, where it is efficient to do so, and improved level crossing operation through the introduction of technical solutions such as MCB-OD (Manually Controlled Barrier with Obstacle Detection) crossing technology.

**Figure 3.3 Proximity of CP5 Windsor Line schemes**

3.3.23 **Figure 3.3** highlights the relationship between the Feltham Re-signalling and Reading 10-car schemes. Due to this overlap there are opportunities to provide delivery integration to manage costs, disruption and track access more efficiently.

### Wessex Capacity Programme

3.3.24 This CP5 project focuses on the delivery of additional capacity into London Waterloo. The planned infrastructure changes have been developed alongside a supporting Stagecoach South Western Trains (SSWT) rolling stock plan.

3.3.25 In CP5 the scheme will provide infrastructure to support:

- 10-car main suburban services
- Up to 20 trains per hour (tph) Windsor Line services in the busiest hour
- The potential provision of additional main line services in the busiest hour
- Additional station pedestrian capacity where required

3.3.26 In Control Period 4 (CP4) Platform 20 at Waterloo International Terminal (WIT) was reinstated, facilitating additional peak hour Windsor Line services. Within CP5 the Wessex Capacity Programme will fully reopen all remaining platforms at Waterloo International, (platforms 21 – 24), and remodel the tracks from Clapham Junction serving Waterloo International. The project re-opens Platform 1 at Queenstown Road and permits the segregation of the Windsor Line and Main Line service flows on the approach to London Waterloo to provide additional capacity. In addition to the works between Clapham Junction and Waterloo, an additional turnback facility is being provided at Hounslow to create capability for 20tph on the Windsor Lines.

3.3.27 Within Waterloo Station itself Platforms 1 – 4 will be extended to allow the operation of 10-car Main Suburban services to align with the 10-car South West Suburban Railway project (see previously in this section). The existing track layout serving platforms 1 – 8 will be remodelled to accommodate this within the existing land boundary.

3.3.28 Pedestrian congestion has been identified at a number of stations, most notably Vauxhall, Clapham Junction, Wimbledon, and Surbiton.

3.3.29 Improvements to reduce or manage station congestion are being developed for delivery within CP5. It is currently envisaged that these works will include an additional footbridge at Wimbledon to ease platform and staircase congestion, subway and bridge works at Clapham Junction, and general congestion relief works at other identified stations. The project will also deliver improved access and interchange solutions between WIT and Waterloo Station.

3.3.30 To support potential additional mainline services the scheme will develop a solution for grade-separation at Woking Junction and infrastructure changes between Clapham Junction and London Waterloo. Solutions to constraints at these locations will provide an incremental step towards meeting the capacity gap on the Wessex route. The delivery of grade separation at Woking Junction will form part of the choices for funders stated for CP6, see **Chapter 5**.

3.3.31 As well as physical infrastructure interventions, working with the operator the project will support the development of Connected Driver Advisory System (C-DAS) and Traffic Management solutions to assist in reliably providing up to two additional Main Line services per hour into Waterloo.

### South London High Voltage (HV) Power Upgrade

3.3.32 Power upgrades are often required when a capacity enhancement project is delivered in order to provide the traction power to operate additional services. In CP5, across the south London area (South East and Wessex routes), there are several changes to services including frequency, length and rolling stock type that will necessitate additional traction power.

3.3.33 Specifically for the Wessex route the project identified a package of work at Wimbledon to upgrade the grid point. This package will look at providing resilient traction power that is sufficient for all capacity enhancements through CP5 and CP6 as well as later control periods where it is efficient and value for money to do so. It is also proposed that the Wimbledon grid site should be

linked to the New Cross grid site to enable more efficient resilience measures to be provided should either grid site not be able to provide power.

### Electric Spine

3.3.34 Subject to a review of projects to be delivered in CP5, a rolling programme of electrification will create an 'Electric Spine' for a high capacity passenger and freight electric corridor running from Southampton Docks through Basingstoke, Oxford, Leamington Spa, Coventry and Nuneaton to the West Midlands, the North West, North East and Scotland. In addition, the programme will provide connectivity via the East West Rail link from Oxford to Milton Keynes for the West Coast Main Line (WCML) to the North and Scotland, and to Bedford for the Midland Main Line to the East Midlands and South Yorkshire.

3.3.35 The Department for Transport's (DfT) key driver for the programme is to improve regional and national connectivity and links to ports and airports for both passengers and freight in support of economic development. A key element of this is increasing the amount of the network to be electrified to create a 'critical mass' that facilitates the operation of electric, rather than diesel trains.

3.3.36 To this end, the DfT have said that they would like to create an electrified network which:

- Improves rail industry efficiency and value for money
- Improves connectivity by reducing journey times, increasing train carrying capacity and creating new through journey opportunities
- Improves connectivity to the ports thereby making rail freight more competitive
- Reduces the environmental footprint of rail

3.3.37 The current working assumption for Wessex is the delivery of electrification between Southcote Junction and Basingstoke during CP5, as outlined in the **CP5 Delivery Plan**. The development of conversion from DC to AC electrification between Basingstoke and Southampton Docks, possibly including the Andover diversionary route, is currently assumed for delivery in CP6.

### Freight Train Lengthening

3.3.38 The **Freight Route Utilisation Strategy** (Freight RUS) published in March 2007 identified the corridor from Southampton Central to the West Midlands and WCML as having a gap in freight capacity. The **Freight RUS** stated that this gap was as a consequence of the forecast growth in intermodal traffic.

3.3.39 The line from the Southampton area, that forms part of the SWML, is designated as one of the core lines of the Strategic Freight Network. The line was gauge-cleared for W10 in Control Period 4 (CP4) to allow for the more efficient conveyance of intermodal traffic along the route.

3.3.40 To further enhance the network for freight traffic the Freight Train Lengthening project was instigated. This project will facilitate the operation of freight trains of up to 775 metres in length from the Port of Southampton to the West Midlands and WCML.

3.3.41 Having the capability for freight trains of 775 metres will increase the capacity of existing trains by around 20 per cent, making more efficient use of existing train paths to cater for growth and reducing the unit cost of container haulage by rail.

3.3.42 The project will deliver the following interventions, by the end of CP5:

- Wallers Ash – extended Up and Down loops (commissioned)
- Eastleigh – extension of the Up Slow line (commissioned)
- Southampton Maritime – extended reception sidings
- Southampton Western Docks – extended Down docks branch

### Southampton Eastern Docks

3.3.43 Growing demand from both UK automotive manufacturers and automotive logistics providers for an efficient rail freight service to Southampton Eastern Docks has led to a requirement for longer freight train capability into the docks.

3.3.44 To provide the ability to run longer trains into and out of the Eastern Docks at Southampton this scheme addresses the lack of adequate standage for Up direction, outbound, freight trains leaving the docks with a length up to 685 metres.

3.3.45 To deliver this capability in CP5 a new signal section has been constructed to enable trains that are 685 metres in length to be held at the signal whilst keeping clear of Chapel Road Level Crossing. Previously a train of 685 metres would sit across the level crossing blocking road traffic. For this reason automotive freight had to leave the docks as two shorter trains that reformed at Eastleigh Yard.

3.3.46 Providing this improved capability resulted in more efficient train operation and a reduction in freight train and associated light engine movements between Eastleigh and Southampton Eastern Docks. Subsequently this also means additional services can be operated out of Southampton Eastern Docks owing to a reduction in train paths needed for current services.

3.3.47 This scheme was delivered in early 2015.

### Andover Freight Diversionary Route

3.3.48 In CP4 W10 gauge enhancement works were delivered on the line between Southampton Central and Basingstoke via Winchester, and forward on to the West Coast Main Line (WCML). This facilitated the operation of intermodal freight trains that could carry 9ft 6in containers on standard wagons.

3.3.49 In addition to the work on the SWML the diversionary route via Romsey and Andover has been enhanced to W12 gauge. These works were completed in early CP5.

## 3.4 Service Characteristics – the service in Control Period 6 (CP6)

3.4.1 During CP5, the schemes described previously will facilitate the introduction of additional and longer passenger and freight services through enhancement of the capability and capacity of the route. This service specification can be split between Fast Line, Windsor Line, Slow Line and freight services.

### Passenger services: Main Fast Line into London Waterloo

3.4.2 In general it is Main Line services which travel on the Main Fast Lines into and out of London Waterloo during the high peak hour. However, there are some Main Suburban services that also utilise the Main Fast Lines. These are the Guildford via Cobham and Woking stopping services which use the Fast Lines to provide fast services from Surbiton, although this is not fully mirrored in the reverse direction in the evening peak.

3.4.3 There are several constraints on the Fast Lines that inhibit an increased level of service in CP5. These include flat junctions, track capacity and platform capacity. Large scale investment, over a number of Control Periods, is required to address these capacity constraints in an affordable and value-for-money way as there is no one intervention that is capable of addressing the capacity gap on the Fast Lines in CP5 or beyond. It is therefore necessary that incremental steps are taken to achieve a full solution.

3.4.4 For the purposes of this Route Study it is assumed that none of the CP5 interventions associated with the Wessex Capacity Programme (including re-opening of WIT) will provide an increase in Fast Line capacity within the CP5 timeframe. They should, however, enable a more robust service to be operated and should be viewed as providing a base on which further investment will build to meet growth to 2043.

3.4.5 In terms of the high peak hour there are 24tph arriving at London using the Fast Line, as shown in **Table 3.1**. This can be broken down further into 17 Main Line services and 7 Main Suburban services.

3.4.6 There are specific periods of 60 minutes within the three hour peak where 25tph use the Fast Line into London Waterloo from at least as far out as Wimbledon.

3.4.7 Evidence suggests that increasing services above these levels on current infrastructure is likely to affect performance adversely (without mitigating measures).

**Table 3.1 Baseline service specification on the Fast Line into London Waterloo**

| WTT Departure Time | Origin | WTT Arrival Time at Waterloo | Platform at Waterloo | Joins Fast Line at... | Service Group |
|---|---|---|---|---|---|
| 0706 | Basingstoke | 0804 | 13 | Woking East Jn | Main Line |
| 0651 | Southampton Airport Parkway | 0806 | 12 | Worting Jn | Main Line |
| 0710 | Haslemere | 0809 | 10 | Woking Jn | Main Line |
| 0716 | Guildford via Cobham | 0811 | 14 | Berrylands | Main Suburban |
| 0550 | Yeovil Junction | 0812 | 7 | Worting Jn | Main Line |
| 0604 | Bournemouth (joins with Poole train) | 0814 | 11 | Worting Jn | Main Line |
| 0732 | Woking | 0817 | 15 | New Malden | Main Suburban |
| 0714 | Alton | 0820 | 13 | Woking Jn | Main Line |
| 0642 | Hilsea | 0822 | 8 | Woking Jn | Main Line |
| 0746 | West Byfleet | 0824 | 9 | Berrylands | Main Suburban |
| 0724 | Basingstoke | 0827 | 14 | Hampton Court Jn | Main Line |
| 0642 | Portsmouth Harbour via Cobham | 0830 | 10 | Hampton Court Jn | Main Line |
| 0623 | Portsmouth Harbour via Eastleigh | 0832 | 12 | Worting Jn | Main Line |
| 0747 | Woking | 0834 | 15 | Berrylands | Main Suburban |
| 0643 | Southampton Central | 0837 | 13 | Worting Jn | Main Line |
| 0711 | Havant | 0839 | 8 | Woking Jn | Main Line |
| 0510 | Exeter St Davids | 0844 | 11 | Worting Jn | Main Line |
| 0802 | Woking | 0844 | 14 | Berrylands | Main Suburban |
| 0634 | Bournemouth (joins with Weymouth train) | 0848 | 12 | Worting Jn | Main Line |
| 0744 | Alton | 0850 | 9 | Woking East Jn | Main Line |
| 0713 | Portsmouth Harbour | 0853 | 10 | Woking Jn | Main Line |
| 0752 | Basingstoke | 0857 | 6 | Woking East Jn | Main Line |
| 0739 | Farnham | 0857 | 8 | Berrylands | Main Suburban |
| 0807 | Guildford via Cobham | 0859 | 14 | Berrylands | Main Suburban |

3.4.8 All Main Line routes are electrified using a 3rd rail 750V DC system, apart from the West of England line between Basingstoke (Worting Junction) and Exeter which is operated by diesel traction. On these electrified routes the network is capable of accommodating trains to a maximum length of 12-car (assuming 20 metre vehicles) or 10-car (if 23 metre vehicles are provided), although west of Poole there are restrictions on the number of powered coaches that can run to Weymouth owing to power supply capacity. The practical maximum length of trains on the West of

England line as far as Salisbury is assumed to be 10-car (23 metre vehicles).

### Passenger services: Main Slow Line into London Waterloo

3.4.9 CP5 will see the completion of work to enable the operation of 10-car Main Suburban services into London Waterloo through the extension of Platforms 1 – 4. These services predominantly utilise the Slow Lines into and out of London Waterloo. As previously stated some Main Suburban services (seven in the high peak hour) use the Fast Line to access London Waterloo, see **Table 3.1**.

3.4.10 Provision of 10-car capability will provide the capacity required in CP5 to meet the current Main Suburban capacity gap and should be sufficient through to the end of CP6. Therefore there is no proposed increase in the number of services in CP5, above the 18 trains per hour that are currently accommodated into London Waterloo in the high peak hour as shown in **Table 3.2**. Including the seven services using the Fast Line there are 25 Main Suburban services into London Waterloo in the high peak hour.

3.4.11 There is one specific hour where the number of trains exceeds the 18tph in the high peak hour. This is between 08:02 and 09:01 when 19 trains arrive at London Waterloo using the Main Slow Line.

**Table 3.2 Baseline service specification on the Slow Line into London Waterloo**

| WTT Departure Time | Origin | WTT Arrival Time at Waterloo | Platform at Waterloo | Service Group |
|---|---|---|---|---|
| 0723 | Hampton Court | 0802 | 1 | Main Suburban |
| 0710 | Shepperton via Kingston | 0804 | 4 | Main Suburban |
| 0706 | Guildford via Cobham | 0809 | 5 | Main Suburban |
| 0658 | Guildford via Leatherhead | 0811 | 2 | Main Suburban |
| 0739 | Chessington South | 0815 | 1 | Main Suburban |
| 0703 | London Waterloo via Twickenham/ Kingston | 0819 | 4 | Main Suburban |
| 0731 | Dorking | 0822 | 3 | Main Suburban |
| 0737 | Twickenham via Kingston | 0825 | 2 | Main Suburban |
| 0752 | Epsom | 0828 | 5 | Main Suburban |
| 0753 | Hampton Court | 0831 | 1 | Main Suburban |
| 0740 | Shepperton via Kingston | 0834 | 4 | Main Suburban |
| 0736 | Guildford via Cobham | 0838 | 3 | Main Suburban |
| 0746 | Effingham Junction via Leatherhead | 0841 | 2 | Main Suburban |
| 0809 | Chessington South | 0845 | 1 | Main Suburban |
| 0733 | London Waterloo via Twickenham/ Kingston | 0849 | 4 | Main Suburban |
| 0801 | Dorking | 0852 | 3 | Main Suburban |
| 0807 | Twickenham via Kingston | 0855 | 2 | Main Suburban |
| 0822 | Epsom | 0859 | 5 | Main Suburban |

3.4.12 All Main Suburban routes are electrified using a 3rd rail 750V DC system.

### Passenger services: Windsor Lines

3.4.13 Through the re-instatement of Waterloo International Terminal Platform 20 in CP4 the Windsor Lines currently have capacity for 16 trains per hour although currently in the high peak hour there are only 15tph. This will increase to 16tph in December 2015 with the introduction of an additional service from Reading.

3..4.14 Capability for a further four trains per hour will be provided for in CP5 through the full re-opening of Waterloo International Terminal and the segregation of the main line and Windsor Line flows at Queenstown Road. Segregation of these flows allows Empty Coaching Stock (ECS) to run into Clapham Yard from London Waterloo without impacting on Windsor Line capacity. This will fix the capacity of the line at 20tph although it is currently envisaged that only 18tph will operate at the end of CP5, through an additional two services from Hounslow via the Hounslow Loop as shown in **Table 3.3**. All Windsor Line services included in this baseline will be assumed to be operated using 10-car trains.

**Table 3.3 Baseline service specification on the Windsor Lines into London Waterloo**

| WTT Departure Time | Origin | WTT Arrival Time at Waterloo | Platform at Waterloo | Windsor Line at Carlisle Lane Jn… | Service Group |
|---|---|---|---|---|---|
| 0700 | Shepperton via Twickenham | 0802 | 16 | Up Windsor | Windsor Lines |
| 0642 | Reading | 0804 | 18 | Windsor Reversible | Windsor Lines |
| 0645 | London Waterloo via Twickenham/ Brentford | 0809 | 17 | Up Windsor | Windsor Lines |
| 0653 | Reading | 0814 | TBC | TBC | Windsor Lines |
| 0657 | London Waterloo via Kingston/ Twickenham | 0816 | 19 | Up Windsor | Windsor Lines |
| 0723 | Windsor & Eton Riverside | 0819 | 16 | Up Windsor | Windsor Lines |
| 0702 | Weybridge via Brentford | 0826 | 17 | Up Windsor | Windsor Lines |
| 0700 | Aldershot via Ascot | 0827 | 18 | Windsor Reversible | Windsor Lines |
| 0730 | Shepperton via Twickenham | 0832 | 16 | Up Windsor | Windsor Lines |
| 0712 | Reading | 0836 | 19 | Windsor Reversible | Windsor Lines |
| 0715 | London Waterloo via Twickenham/ Brentford | 0841 | 18 | Up Windsor | Windsor Lines |
| 0724 | Reading | 0844 | 17 | Up Windsor | Windsor Lines |
| 0727 | London Waterloo via Kingston/ Twickenham | 0847 | 16 | Up Windsor | Windsor Lines |
| 0753 | Windsor & Eton Riverside | 0849 | 15 | Up Windsor | Windsor Lines |
| 0733 | Weybridge via Brentford | 0856 | 18 | Up Windsor | Windsor Lines |
| 0730 | Aldershot via Ascot | 0858 | 19 | Up Windsor | Windsor Lines |
| TBC | Hounslow* | TBC | TBC | TBC | Windsor Lines |
| TBC | Hounslow | TBC | TBC | TBC | Windsor Lines |

* An additional 2tph originating in Hounslow may be operated by CP5-end making the total 20tph in the high peak hour.

3.4.15 The key constraint of level crossing down-time on the route via Richmond prevents any additional services being routed this way without further invention. Therefore for this Route Study it is assumed that the further additional two trains per hour, to utilise the full capability of 20 trains per hour in the busiest hour, would be routed via the Hounslow Loop and not via Richmond.

3.4.16 All Windsor Line routes are electrified using a 3rd rail 750V DC system. On these electrified routes the network at the end of CP5 will be capable of accommodating trains to a maximum length of 10-car (assuming 20 metre vehicles).

### Freight services: All Wessex lines

3.4.17 Enabling rail freight to expand and thrive is a key responsibility of the rail industry, and will contribute towards rail playing its part in supporting economic recovery and long term sustainable growth.

3.4.18 Accepted freight forecasts for the rail industry are those developed as part of the Strategic Freight Network (SFN) by freight operators, Network Rail and other industry stakeholders.

3.4.19 Forecasts were developed for 2019 and in summary show substantial growth in intermodal freight from ports, a gradual decline in coal traffic as coal forms a smaller part of the UK's power generation mix, and modest growth in other commodities such as aggregates for the construction industry.

3.4.20 As shown in **Figure 3.4** there are significant freight flows across the Wessex route. The area around Southampton is a key centre from which freight flows radiate with terminals at Southampton Western and Eastern Docks, Southampton Maritime Terminal and Millbrook Freightliner Terminal. As previously noted intermodal freight flows will see considerable growth and it is the SWML route between Southampton and Basingstoke which will accommodate the majority of this growth.

3.4.21 Also important for intermodal flows is the diversionary route via Laverstock Junction and Andover that allows freight movements to continue should the SWML be unavailable. This is now cleared for W12 traffic flows. W8-cleared traffic flows utilise routes from Southampton via Salisbury and Westbury as well as via Woking, Chertsey and Kew East Junction.

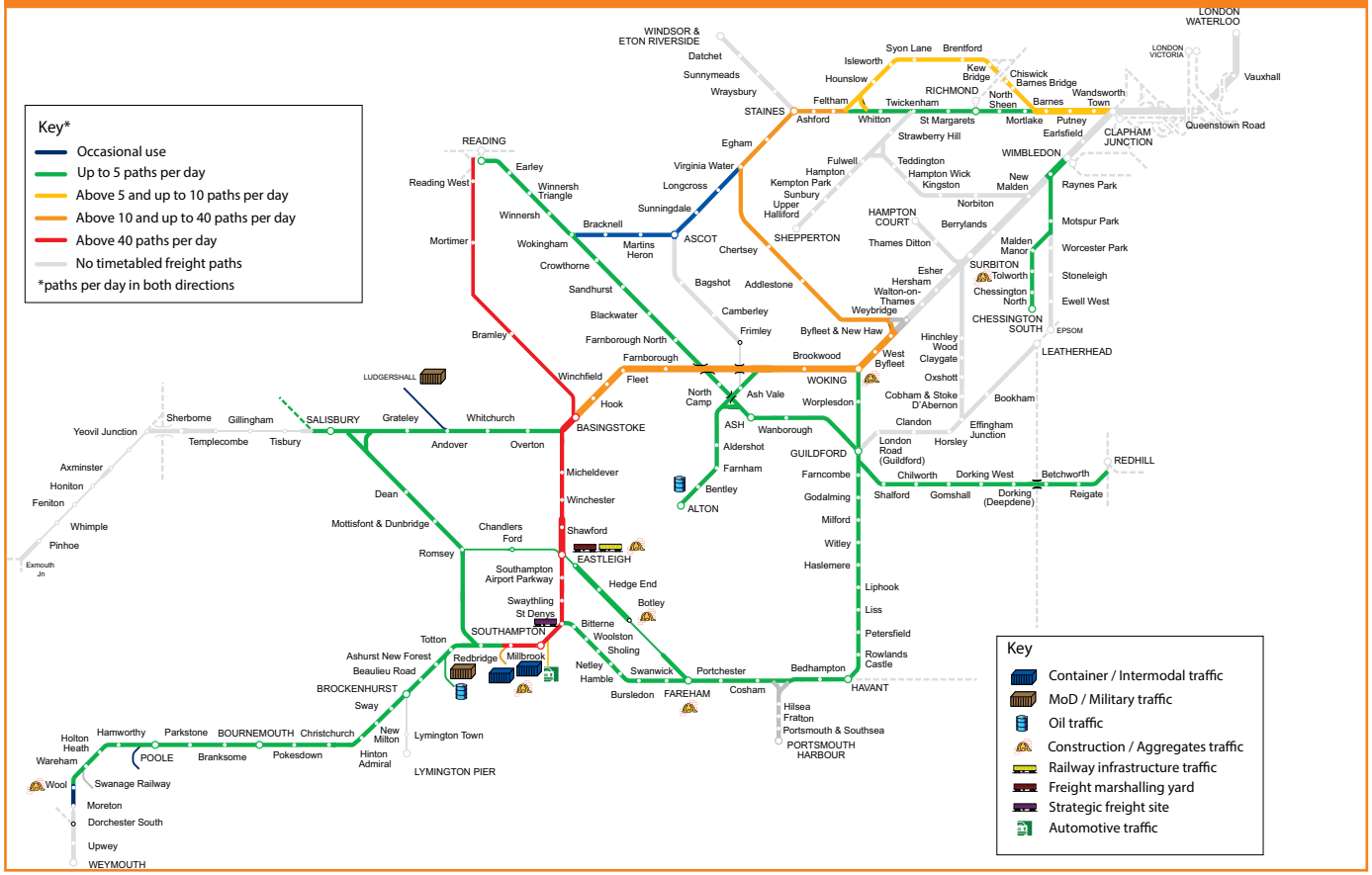
3.4.22 There are significant automotive freight flows between Halewood / Castle Bromwich / Morris Cowley and Southampton Eastern Docks. The main routeing of these flows is via Reading, Basingstoke and the SWML but some services are routed via Westbury and Salisbury.

3.4.23 From Southampton Western Docks there is intermodal traffic to the East Midlands, Yorkshire and the North West; car traffic to Garston and occasionally Scotland; and containerised gypsum traffic to Robertsbridge in Kent.

3.4.24 Another key market for freight on the Wessex route is the transportation of aggregates. Flows from the Mendip quarries transport aggregates to sites at Eastleigh, Botley, Fareham, Tolworth and Woking. Sand is transported from Wool to various locations including Neasden. Aggregate flows can be influenced by large scale construction schemes such as new airport runways, road building and railway schemes. There are several large scale infrastructure works across the transport sector that could increase the demand for aggregates transported by rail including additional runways at Heathrow or Gatwick Airports, High Speed 2 (HS2) and planned works on the M3 and other motorways in the geographic scope of this Route Study.

3.4.25 Petroleum flows operate to/from the oil refinery at Fawley, including traffic from the oil terminal at Holybourne (off the Alton Line). Ministry of Defence (MoD) traffic passes through the route to terminals at Marchwood, Ludgershall and Warminster. There is also considerable rail infrastructure activity on the route to sites such as Eastleigh Yard.

**Figure 3.4 Key freight routes and terminals on the Wessex route**




## 3.5 Route Characteristics – housing growth on the Wessex route

3.5.1 Many Local Authority areas covered by the Wessex route are predicting an increase in housing growth over the period covered by this Route Study. Understanding where this growth is expected provides a useful input to future investment decisions. **Figures 3.5 to 3.11** detail the housing growth expected in Boroughs/ Districts/ Unitary Authorities that are covered by the Wessex Route. The housing growth figures used in **Figures 3.5 to 3.11** have been agreed at County/ Borough/ District/ Unitary Authority level for inclusion in this Route Study.

3.5.2 A number of Local Authorities are currently undertaking a Strategic Housing Market Assessment (SHMA), either individually in conjunction with adjoining authorities, or do not have an agreed and finalised Local Plan. An agreed Local Plan will provide a more accurate assessment of need within their Housing Market Areas.

Data is also subject to further assessments related to land supply constraints, such as Green Belt and Open Space, and infrastructure capacity. Specifically for South Hampshire, **Partnership for Urban South Hampshire (PUSH)** is working to agree housing need within the area that is likely to show a higher requirement than stated here.

3.5.3 Therefore it should be assumed that the data presented in **Figures 3.5 to 3.11** is subject to change and represents the known position at time of publication. For specific, up-to-date information on housing growth please see individual Local Authority websites.

3.5.4 A map has not been produced for the London Boroughs covered by the Wessex Route. The strategy for housing growth within London is co-ordinated and set by the Greater London Authority. **Housing in London: The evidence base for the Mayor's Housing Strategy** states that around 49,000 new homes are required every year in London over the next two decades (from 2014), due to rapid population growth and the existing backlog of need across the capital. For specific, up-to-date information on housing growth please see individual London Borough websites.

**Figure 3.5 Predicted housing growth in Somerset (data provided and verified by South Somerset District Council)**

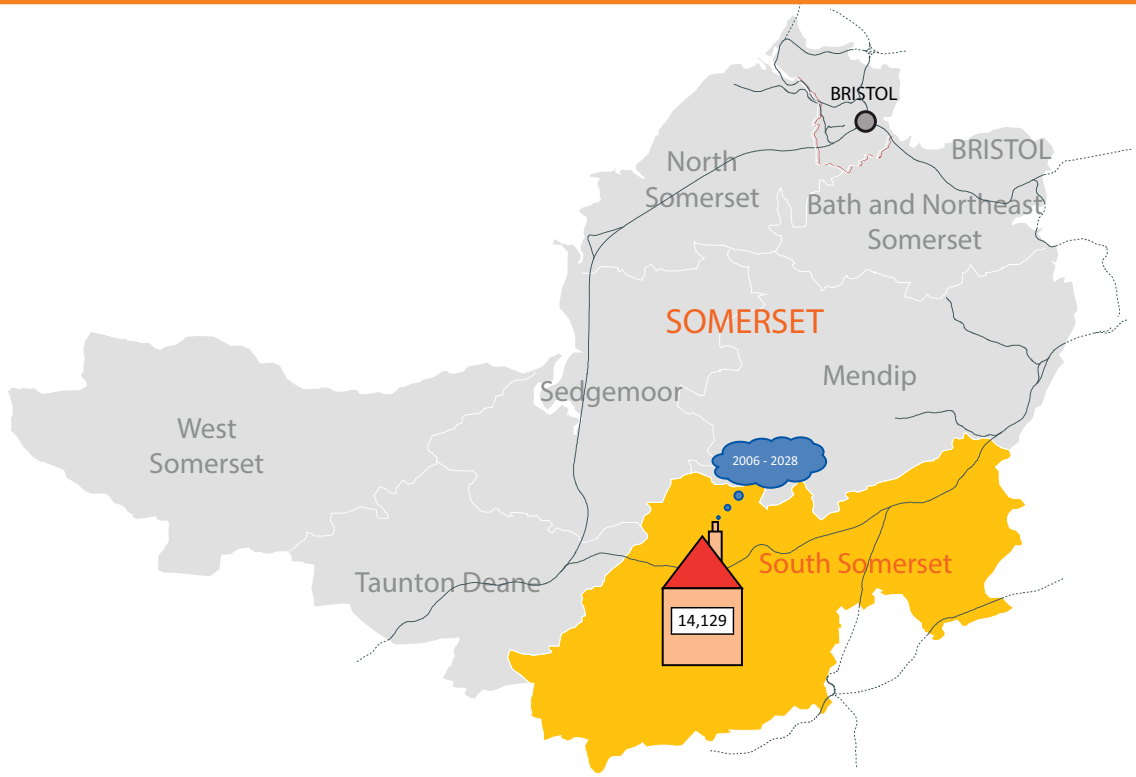


**Figure 3.6 Predicted housing growth in Wiltshire (data provided and verified by Wiltshire County Council)**

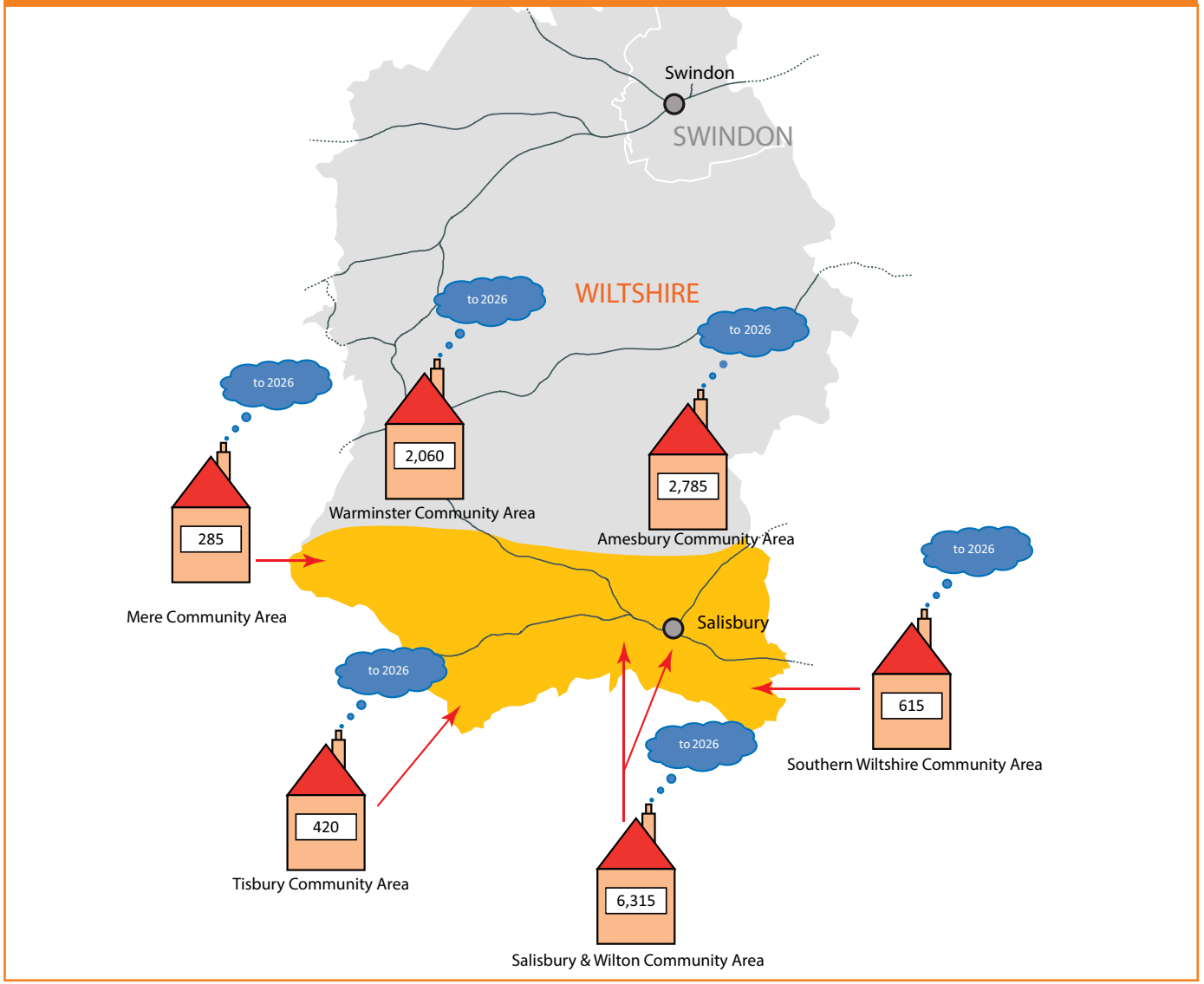


Figure 3.7 Predicted housing growth in Dorset (data provided by Dorset County Council and verified by District and Unitary Authorities)

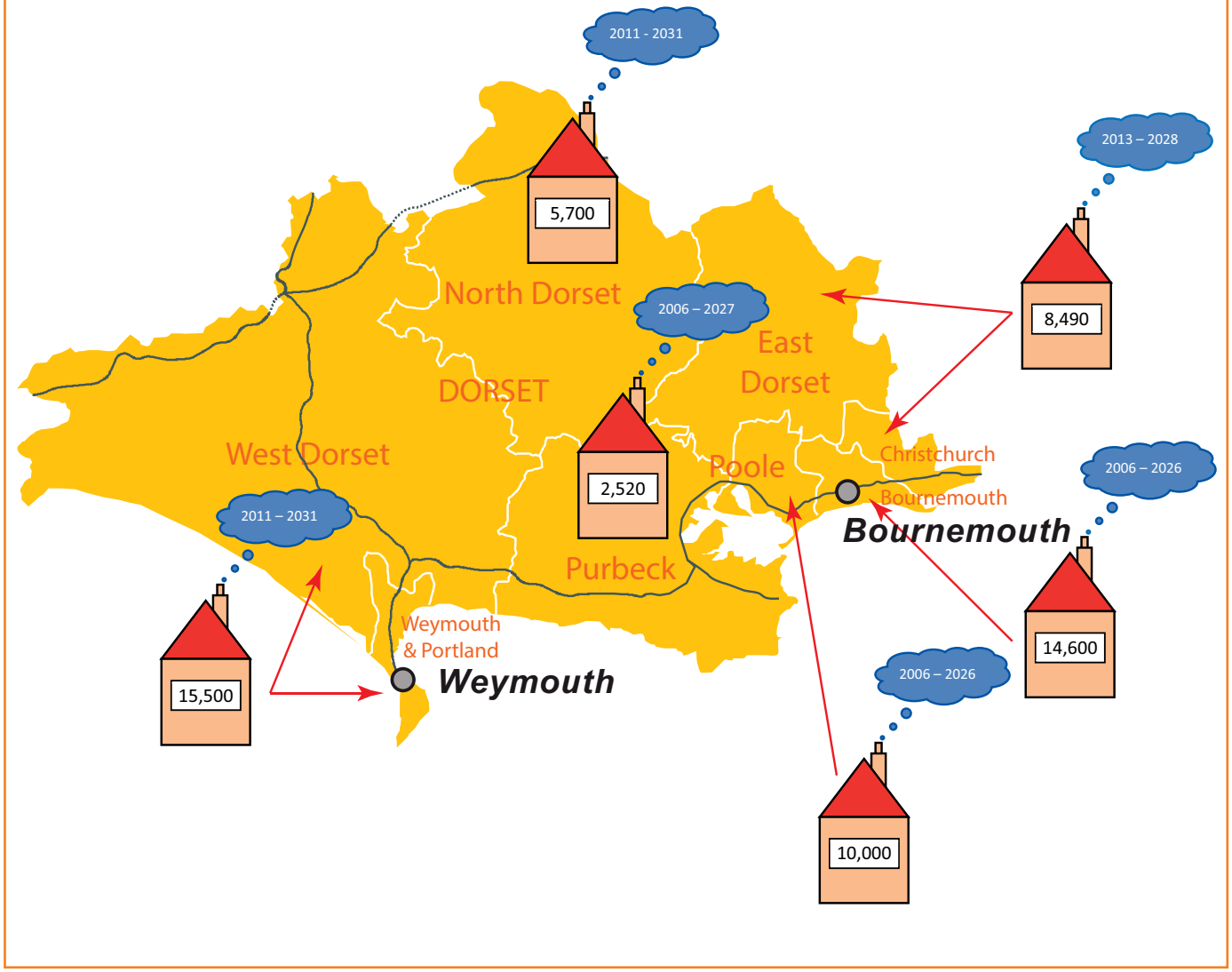
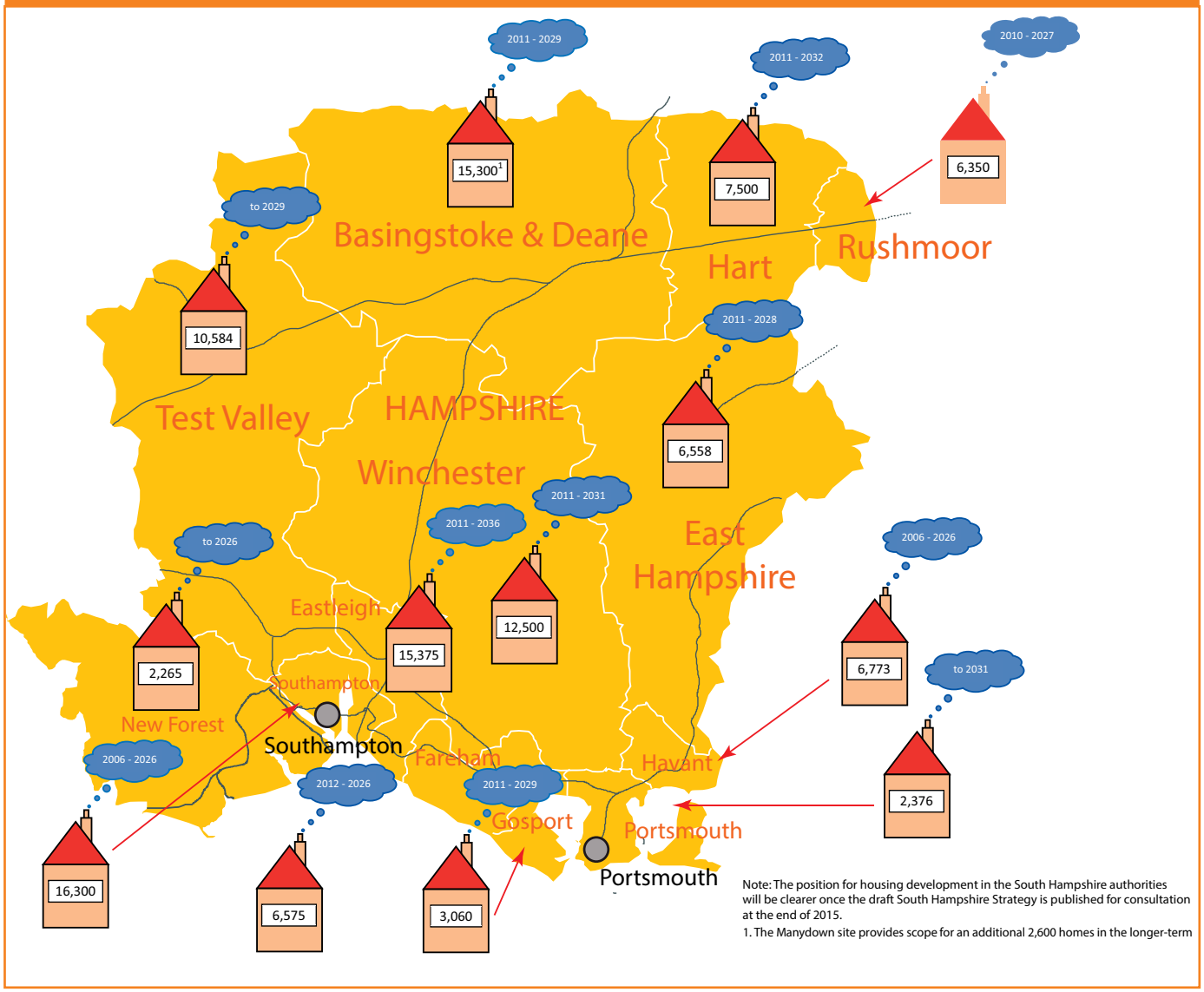


**Figure 3.8 Predicted housing growth in Hampshire (data provided and verified by Borough, District and Unitary Authorities)**




Note: The position for housing development in the South Hampshire authorities will be clearer once the draft South Hampshire Strategy is published for consultation at the end of 2015.

1. The Manydown site provides scope for an additional 2,600 homes in the longer-term

Figure 3.9 Predicted housing growth in Devon (data provided and verified by Exeter City Council)

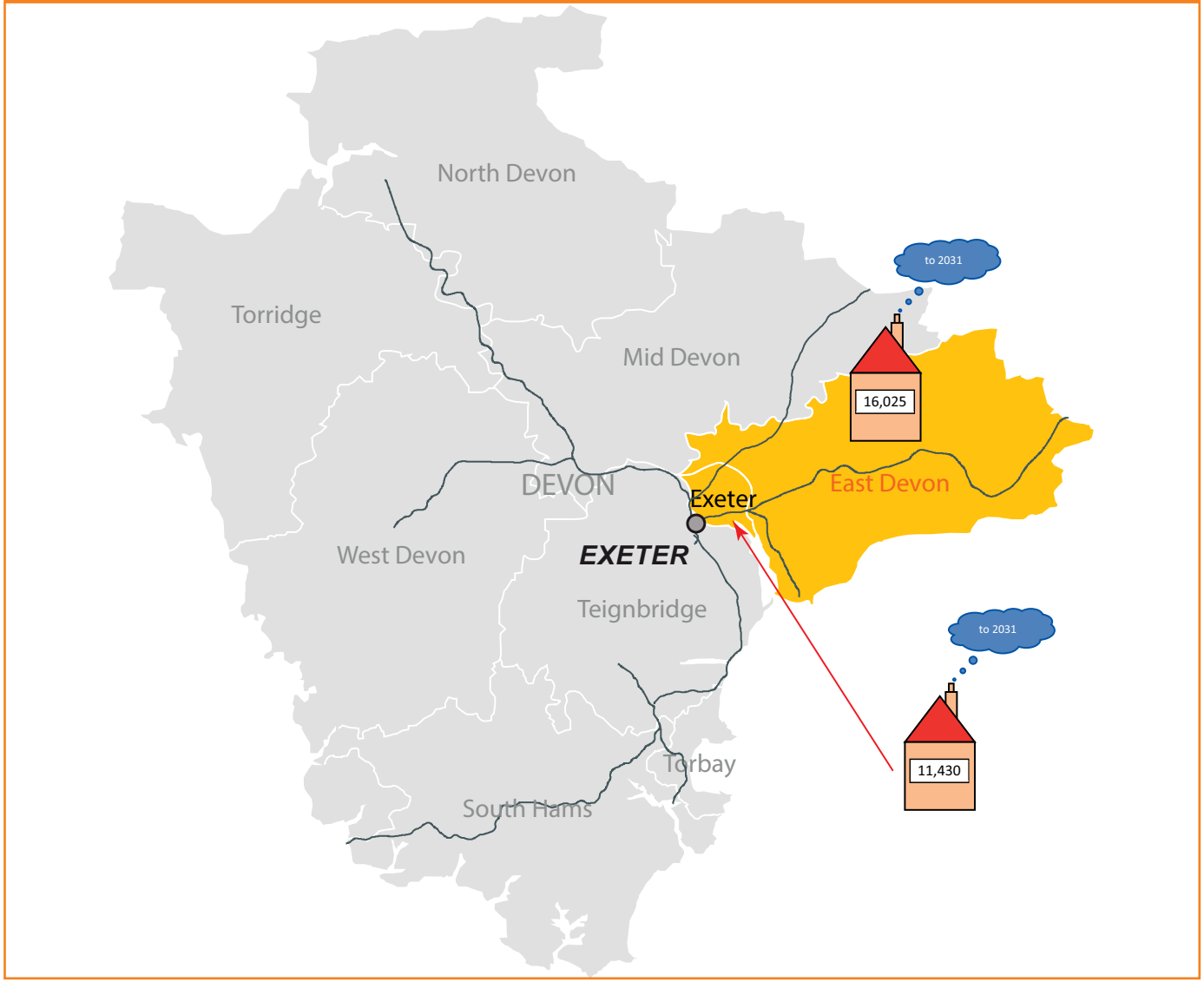


**Figure 3.10 Predicted housing growth in Surrey (data provided by Surrey County Council and verified by the Boroughs)**

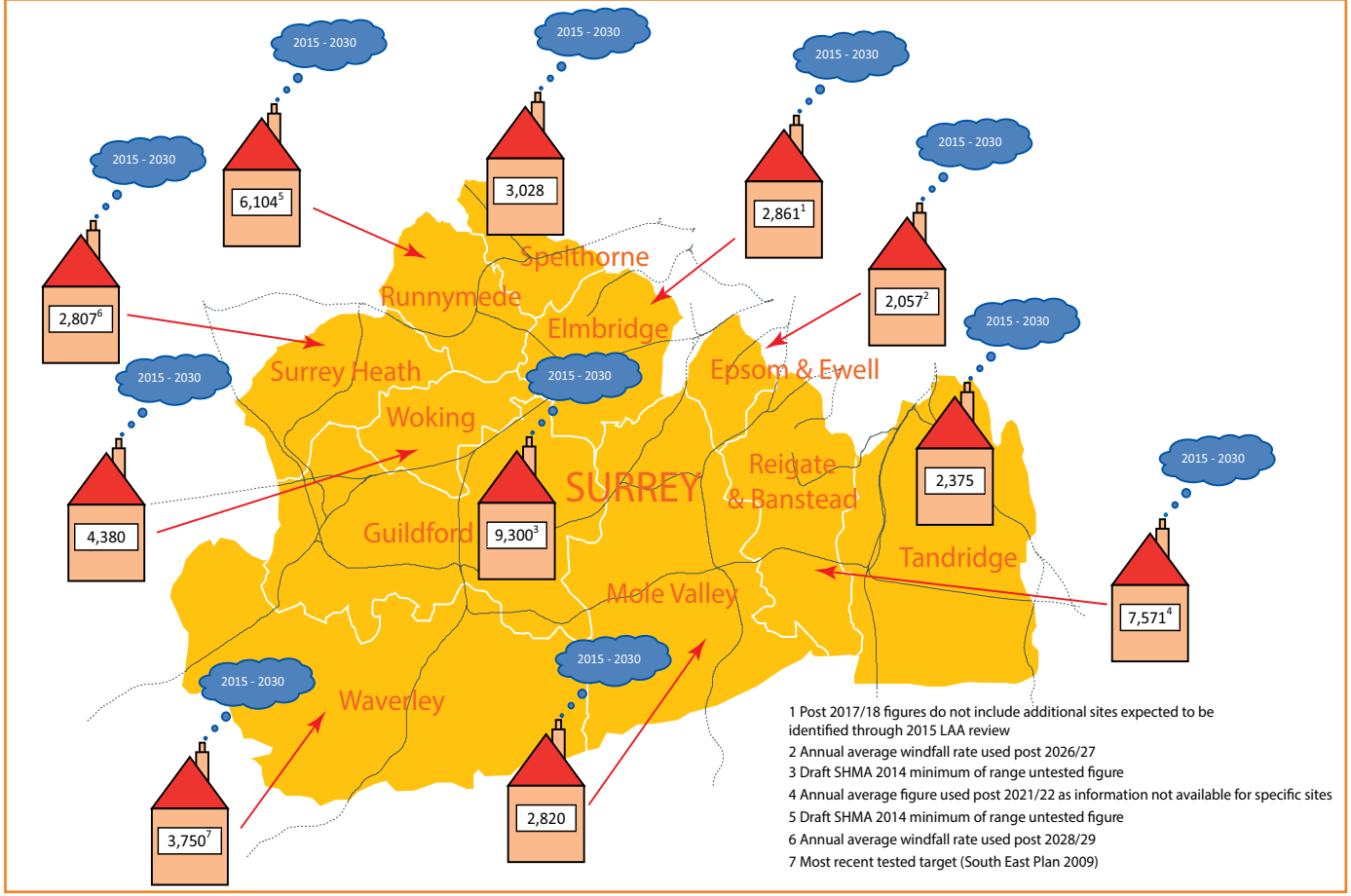
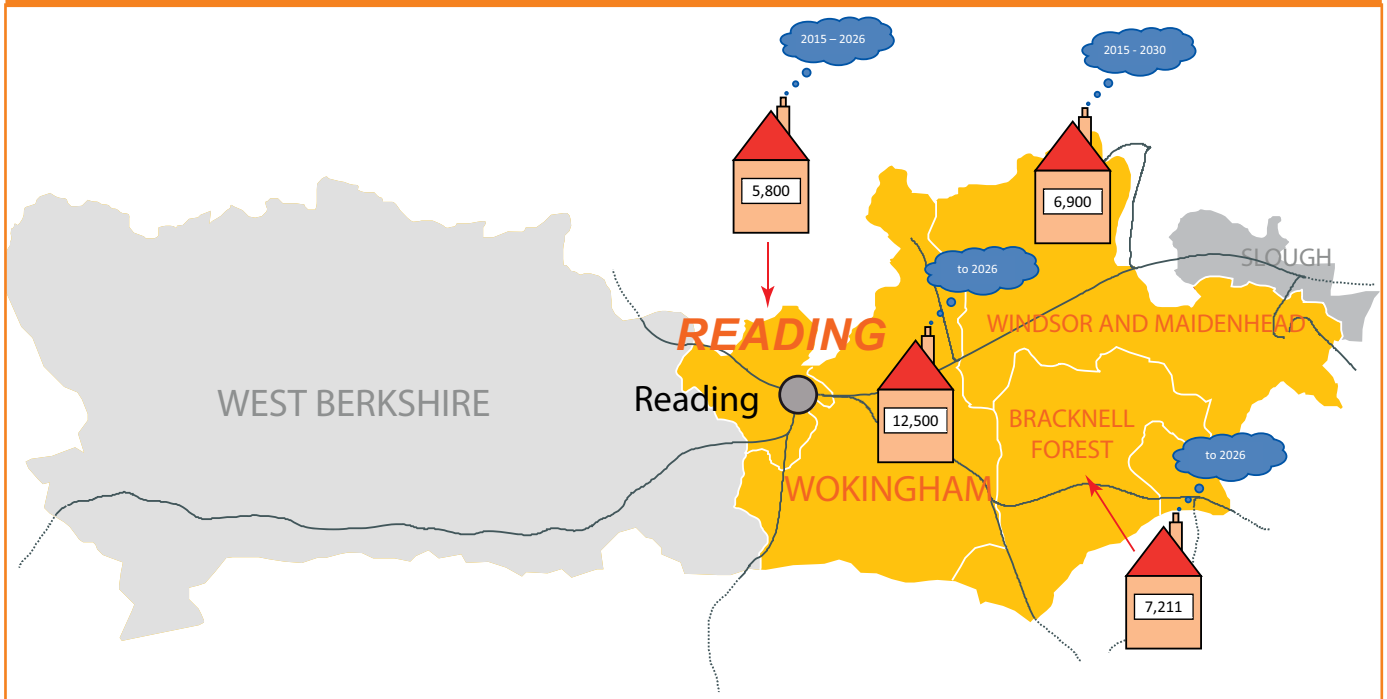


**Figure 3.11 Predicted housing growth in Berkshire (data provided and verified by Borough and Unitary Authorities)**




## 3.6 Route Characteristics – the longer term to 2043

3.6.1 There are a number of complex schemes that are already in development that are within the longer term planning horizon of 2043. These schemes are taken into account in the baseline position as it is envisaged that they will, in some form, be delivered within the timeframe of this route study.

### High Speed Two (HS2)

3.6.2 High Speed Two (HS2) is the proposed high speed line that will run from London Euston to Birmingham via a new station at Old Oak Common, in Phase 1, and on to Manchester and Leeds, in Phase 2. It is proposed that HS2 Phase 1 will be operational by 2026. It is therefore conceivable that demand for connectivity from the Wessex route to HS2 will grow as the project progresses. This study will therefore take account of potential future requirements for links from both the SWML and the suburban network. The **South-East Route: Sussex Area Route Study** has assessed the impact of a potential interchange with HS2 via the West London Line (WLL) at Old Oak Common. If implemented this would increase the number of passengers interchanging at Clapham Junction from both the Sussex and Wessex Route.

### Southern Rail Access to Heathrow

3.6.3 The DfT has remitted Network Rail to develop a study into the potential benefit of access to Heathrow Airport from the Wessex route, otherwise known as 'Southern Rail Access to Heathrow'. No options have been developed at this early stage from the Southern Access Study. However, as the Route Study is being developed in parallel both studies will take account of each other.

### Crossrail 2

3.6.4 Proposals have been put forward and a route safeguarded for a potential Crossrail 2 scheme that would connect the south west of London with the north east of London. This is looked at in more detail as a 'choice for funders' in this route study. The current passenger congestion problems at Clapham Junction and the potential for Crossrail 2 to be taken forward have influenced the requirement for a master plan for Clapham Junction Station. This master plan examines potential development options for both passenger capacity and the operational track layout.

# 04 Conditional Outputs



## 4.1 Interpreting the Conditional Outputs

4.1.1 The suite of Market Studies established during 2013 identified a number of conditional outputs through consultation with the rail industry, funders, local authorities and other interested parties. These conditional outputs are aligned to a number of strategic goals for the transport sector:

- Supporting and stimulating sustainable economic growth
- Reducing the impact of travel and transport on the environment
- Improving the quality of life for communities and individuals

4.1.2 Conditional outputs describe the level of service that the rail industry seeks to deliver over the longer term, and cover (amongst other things):

- The level of rail capacity required to accommodate increasing demand from passenger and freight users
- The level of rail connectivity linking towns and cities across Great Britain (for example, the frequency of train services, journey times, and the provision of direct journeys which do not require an interchange)

4.1.3 These outputs are 'conditional' on being deliverable in a way that represents value for money and is affordable to funders. This means that it is important that the solution to meet a conditional output is not only technically the right solution but also one that is realistic in terms of value and affordability.

4.1.4 All conditional outputs considered by the Wessex Route Study are identified by a unique conditional output reference number and are further explained in the following sections of this document.

## 4.2 Providing sufficient capacity for rail passengers

### Conditional outputs from the Market Studies

4.2.1 The London and South East Market Study identified a conditional output to provide sufficient capacity for rail passengers travelling into central London during morning peak hours, taking into account anticipated growth in the market.

**Table 4.1 Anticipated percentage increase in the number of rail passengers travelling to central London during peak hours (2011 to 2043)**

| | |
|---|---|
| Windsor Line services | 37% |
| Main Suburban services | 40% |
| Main Line long distance services | 40% |

Source: London and South East Market Study, Network Rail, October 2013

4.2.2 For the purposes of the Wessex Route Study the weekday high-peak hour is defined as passenger rail services arriving at London Waterloo between 0800 and 0859. This broadly corresponds to the busiest period, see **Chapter 3**. When assessing the current level of service on which to overlay the growth identified in **Table 4.1** the Working Timetable (WTT) was used as the base data. It should be noted that the arrival time at London Waterloo will differ slightly from that shown in the public timetable.

4.2.3 The morning peak period at London Waterloo is typically more intense than the evening peak period, with a greater number of passengers travelling during the busiest hour. This means that a greater level of on-train capacity is required during the morning peak than in the evening peak. Therefore for this Route Study it is assumed that the strategy developed to accommodate demand during the morning peak will also be sufficient for the evening peak. However, it is important when taking an option forward that the evening peak is fully considered to identify constraints that may need addressing. In respect to pedestrian capacity at stations an assessment is made during both the morning and evening peak periods.

4.2.4 Commuter markets in London and the South East are typically determined by the size of the peak market into central London. The level of commuting into central London generally defines the level of capacity required for the whole Route. As in the example above of the evening peak, further consideration will need to be made to identify specific constraints that affect local commuting requirements. Network Rail would welcome the opportunity to work with local stakeholders on specific issues not addressed fully in this Route Study. Commuter rail services within

the Exeter area are considered by the **Western Route Study**.

4.2.5 **Table 4.2** sets out the identified conditional outputs for peak capacity both to 2043 in the longer term and Control Period 6 (CP6) in the shorter term.

**Table 4.2 Conditional outputs**

| Conditional Output Reference | Conditional output |
|---|---|
| CO1 | To provide sufficient capacity for passengers travelling into central London during peak hours, taking into account anticipated growth over the period to 2043 – Windsor Line services |
| CO2 | To provide sufficient capacity for passengers travelling into central London during peak hours, taking into account anticipated growth over the period to 2043 – Main Suburban services |
| CO3 | To provide sufficient capacity for passengers travelling into central London during peak hours, taking into account anticipated growth over the period to 2043 – Main Line long distance services |
| CO4 | Consistent with the longer term strategy identified to meet CO1, to provide sufficient capacity for passengers travelling into central London during peak hours, taking into account anticipated growth to the end of Control Period 6 (2024) – Windsor Line services |
| CO5 | Consistent with the longer term strategy identified to meet CO2, to provide sufficient capacity for passengers travelling into central London during peak hours, taking into account anticipated growth to the end of Control Period 6 (2024) – Main Suburban services |
| CO6 | Consistent with the longer term strategy identified to meet CO3, to provide sufficient capacity for passengers travelling into central London during peak hours, taking into account anticipated growth to the end of Control Period 6 (2024) – Main Line long distance services |

## Interpretation of conditional outputs CO1 to CO6

### Windsor Line services

4.2.6 As described in **Chapter 2** there are currently 15 train services arriving at London Waterloo during the high-peak hour operating over the Windsor Lines. For the purposes of understanding existing capacity all of these services are assumed to operate using 8-car rolling stock, providing a total of 120 passenger vehicle arrivals during the high-peak. The capacity provided by these services is summarised in **Table 4.3**. It should be noted that since the existing picture was defined, South West Trains have commenced deployment of 10-car trains on the Windsor Lines. The extra capacity provided by these 10-car services is not reflected in **Table 4.3**, but this capacity has been taken into account in the future strategy.

4.2.7 When defining the capacity provided by Windsor Line services the number of seats, plus a further allowance for standing passengers making short trips is accounted for. A short trip is typically defined by funders as a journey of up to 20 minutes.

4.2.8 Capacity for standing passengers on Wessex suburban services is currently calculated assuming a minimum of 0.25m$^2$ of floor space per standing passenger (which is equivalent to a maximum of four passengers per m$^2$). The internal layout of suburban rolling stock has been specifically designed for this level of capacity.

4.2.9 For most train operators the standing capacity is based upon 0.45m$^2$ of floor space per standing passenger, although other crowding standards are used, including 0.35m$^2$ of floor space per standing passenger on some Southeastern and London Overground services.

**Table 4.3 Existing high-peak Windsor Line capacity into London Waterloo**

| Route | Number of train services | Passenger vehicles per train | Total passenger vehicles | Average capacity per passenger vehicle* | Total capacity |
|---|---|---|---|---|---|
| via Richmond | 11 | 8 | 88 | 117[1] (16 vehicles)<br>129[2] (40 vehicles)<br>154[3] (32 vehicles) | 11,950 |
| via Hounslow | 4 | 8 | 32 | 117[1] | 3,750 |
| Total | 15 | - | 120 | - | 15,700 |

[1] 8-car Class 450 rolling stock with 540 Standard seats (arranged as 3+2 seating) plus standing capacity for 392 passengers based upon 0.25m2 of floor space per standing passenger.

[2] 8-car Class 458 rolling stock with 522 Standard seats (arranged as 3+2 seating), 46 First seats, plus standing capacity for 462 passengers based upon 0.25m2 of floor space per standing passenger. Includes First Class accommodation.

[3] 8-car Class 455 rolling stock with 472 Standard seats (arranged as 2+2 seating) plus standing capacity for 760 passengers based upon 0.25m2 of floor space per standing passenger. No First Class accommodation provided.

*10-car Class 458s, which will be operating many services on the Windsor lines within the next 12 to 18 months, will have 540 seats and a total capacity for 1,394 passengers. No First Class accommodation provided.

*10-car Class 455/456 rolling stock with 590 Standard seats (arranged as 2+2 seating) plus standing capacity for 852 passengers based upon 0.25m2 of floor space per standing passenger. No First Class accommodation provided.

4.2.10 Over 13,000 passengers currently use Windsor Line services to access London during the high-peak hour, measured at the busiest point on the route approaching Clapham Junction station. The number of passengers is forecast to increase to over 17,500 by 2043, principally as a result of higher levels of employment anticipated within central London.

4.2.11 Whilst the number of passengers currently using Windsor Line services during the high-peak is less than the total capacity for planning purposes (as shown in **Table 4.3**), passengers' perception of the route is one of being crowded. This is best illustrated by the **National Rail Passenger Survey** which reports that only one-third of passengers who use Windsor Line services during peak hours rate the attribute "Sufficient room for all the passengers to sit / stand" as being either satisfactory or good (see **Table 4.4**). This is below the average for the London and South East rail sector as a whole. It can therefore be assumed that two-thirds of peak passengers are less than satisfied with the level of capacity currently provided, a figure which is likely to be even greater during the high-peak hour.

4.2.14 Many of the train services observed to leave passengers behind are loaded (on average) to a standing density below the current planning standard of four standing passengers per square metre of floor space. In part, this is because passengers do not always distribute evenly throughout the entire length of a train, as a result some passengers are unable to board the busier front of the train in the morning peak (which is closer to the main concourse at London Waterloo), whilst spare capacity is available towards the rear of the train. Encouraging passengers to board trains more evenly could help to accommodate further growth.

| Table 4.4 Proportion of passengers satisfied with capacity provided on Windsor Line services | | |
|---|---|---|
| Route | % of passengers saying satisfied or good - (AM & PM) peak passengers | % of passengers saying satisfied or good - all passengers (peak and off-peak) |
| South West Trains – London[1] | 34% | 60% |
| South West Trains – Reading / Windsor[2] | 29% | 65% |
| London and South East sector | 42% | 64% |
| National Rail | - | 66% |

Source: National Rail Passenger Survey 2013 (Passenger Focus, Spring & Autumn 2013 waves combined)

[1] Journeys starting from stations between Clapham Junction and London Waterloo (inclusive). This includes passengers using Windsor and Main Suburban services, and as a result is not entirely specific to Windsor line services.

[2] Journeys starting from stations on the routes to Reading & Windsor, west of and including Wandsworth Town.

4.2.14 Many of the train services observed to leave passengers behind are loaded (on average) to a standing density below the current planning standard of four standing passengers per square metre of floor space. In part, this is because passengers do not always distribute evenly throughout the entire length of a train, as a result some passengers are unable to board the busier front of the train in the morning peak (which is closer to the main concourse at London Waterloo), whilst spare capacity is available towards the rear of the train. Encouraging passengers to board trains more evenly could help to accommodate further growth.

4.2.15 In total, the proportion of passengers unable to board busy trains, or who prefer to wait for a later train, is relatively small, less than two per cent of all high-peak Windsor Line passengers. See **Table 4.5**.

4.2.16 Some passengers on high-peak Windsor Line services also have to stand for a period of time in excess of the 20 minute guideline. **Figure 4.1** highlights the train services where this currently occurs. Whilst some standing passengers may be able to obtain a seat before central London owing to the churn of passengers on and off trains at intermediate stations, many have to stand at least as far as Clapham Junction, if not all the way to London Waterloo.

4.2.17 On services via Hounslow, passengers are typically having to stand from Chiswick (29 minutes from London Waterloo), and sometimes from as far as Isleworth (40 minutes from London Waterloo). On services via Richmond, standing is commonplace from Whitton (30 minutes from London Waterloo), whilst on some services passengers are standing from as far as Staines (42 minutes from London Waterloo).

4.2.18 As described in **Chapter 3**, Network Rail and South West Trains are currently investing in the capability of the network and additional rolling stock to provide extra high-peak capacity in CP5. As a result, the overall amount of high-peak capacity into central London from the Windsor Lines is planned to increase by approximately 50 per cent by 2019. Capacity via Hounslow will increase by a greater proportion, approximately 90 per cent; whilst capacity via the Richmond route will increase by approximately 35 per cent (see **Table 4.6**).

4.2.19 The extra capacity which is planned for the route via Hounslow by 2019 should be sufficient to meet the 2043 and 2023 conditional outputs for capacity on that route (Conditional Outputs CO1 and CO4 respectively (see **Table 4.2**).

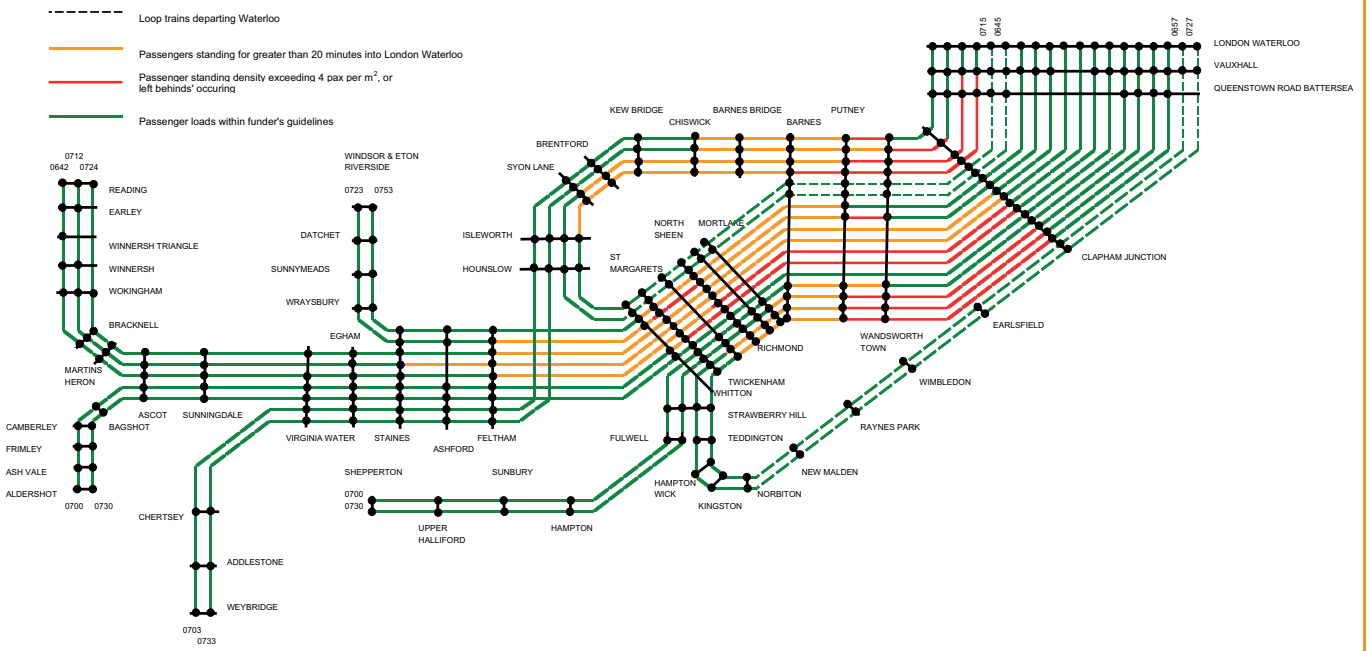
4.2.20 Should it be the case that the assumed level of capacity is not sufficient then **Chapter 5** describes how further capacity, over and above that planned for 2019, could be achieved.

**Table 4.5 Passengers observed not boarding busy trains**

| Station | Number of high-peak services leaving passengers behind | Approximate number of passengers left behind by high-peak services |
|---|---|---|
| Putney | 7 | 90 |
| Richmond | 2 | 20 |
| Twickenham | 2 | 10 |
| Wandsworth Town | 5 | 60 |
| Total | 10 | 180 |

Source: Network Rail observations, Spring 2014. No observations were taken at Clapham Junction station (where left behinds are also known to occur)

**Figure 4.1 Passenger loads on high-peak Windsor Line services (2013/14) (Source: South West Trains automated passenger count data and Network Rail observations)**



4.2.21 For the route via Richmond, the assessment is that an additional 24 vehicles, over and above the extra capacity already planned for 2019, is required in the high-peak hour to meet the 2043 conditional output for capacity (Conditional Output CO1, see **Table 4.2**). However, based upon the industry's existing rolling stock and infrastructure plans, as well as the anticipated rate of growth in the market, this extra capacity is not currently considered a priority for CP6.

4.2.22 At the end of CP5 a further assessment is proposed to re-assess the impact of running all Windsor Line services at 10-car length, see **Table 4.7**. This will clarify the capacity gap and further inform the strategy and the timescales of any interventions.

**Table 4.6 Approximate additional high-peak capacity planned for the Windsor Lines by 2019**

| Route | Current high-peak services | 2019 high-peak services | Approximate increase in capacity by 2019 |
|---|---|---|---|
| via Richmond | 11 x 8-car | 12 x 10-car | 36% |
| via Hounslow | 4 x 8-car | 6 x 10-car | 88% |
| Total | 15 x 8-car | 18 x 10-car | 50% |

**Table 4.7 Assessment of passenger capacity conditional outputs on Windsor Line services**

| Conditional output reference | Description | Assessment of capacity required |
|---|---|---|
| CO1 | To provide sufficient capacity for passengers travelling into central London during peak hours, taking into account anticipated growth over the period to 2043 – Windsor Line services | **Via Hounslow**<br>The capacity already planned for 2019 will be sufficient to meet this conditional output<br><br>**Via Richmond**<br>Additional 24 passenger vehicles during the high-peak hour. Route to be reassessed during at the end of CP5 to determine timing of next intervention |
| CO4 | Consistent with the longer term strategy identified to meet CO1, to provide sufficient capacity for passengers travelling into central London during peak hours, taking into account anticipated growth to the end of Control Period 6 (2024) – Windsor Line services | **Via Hounslow Loop**<br>The capacity already planned for 2019 will be sufficient to meet this conditional output<br><br>**Via Richmond**<br>The capacity already planned for 2019 will be sufficient to meet this conditional output |

## Main Suburban services

4.2.23 As described in **Chapter 3** there are currently 25 train services arriving at London Waterloo during the high-peak hour within the Main Suburban service group. 18 of these are timetabled to operate over the Main Slow Line via Wimbledon, whilst the remaining seven are timetabled to operate over the Main Fast Line via Wimbledon. These seven services are made up of Woking stopping services and Guildford via Cobham services.

4.2.24 For the purposes of understanding existing capacity all of the 18 services are assumed to operate using 8-car rolling stock, providing a total of 144 passenger vehicle arrivals during the high-peak. The seven using the Fast Line are assumed to be as per current rolling stock allocation. The capacity provided by these services is summarised in **Table 3.8**.

4.2.25 As in the case of Windsor Line services, when defining the capacity provided by Main Suburban services the number of seats, plus a further allowance for standing passengers making short trips is accounted for. A short trip is typically defined by funders as a journey of up to 20 minutes.

4.2.26 Capacity for standing passengers on Wessex suburban services is currently calculated assuming a minimum of 0.25m$^2$ of floor space per standing passenger (which is equivalent to a maximum of four passengers per m$^2$). The internal layout of Class 455 suburban rolling stock (and in future Class 456 and 458 rolling stock) has been specifically designed for this level of capacity.

4.2.27 Almost 17,000 passengers use Main Suburban services to access central London during the high-peak hour, measured at the busiest point on the route between Clapham Junction and Vauxhall. The number of passengers is forecast to increase to over 23,200 by 2043, principally as a result of higher levels of employment anticipated within central London.

4.2.28 Whilst the number of passengers currently using Main Suburban services during the high-peak is less than the total capacity for planning purposes (as shown in **Table 4.8**), passengers'

**Table 4.8 Existing high-peak Main Suburban capacity into London Waterloo**

| Route | Number of train services | Passenger vehicles per train | Total passenger vehicles | Average capacity per passenger vehicle | Total capacity |
|---|---|---|---|---|---|
| Total Main Suburban services (via Main Slow Line from Wimbledon) | 18 | 8 (20m vehicles) | 144 | 154[1] | 22,176 |
| Total Main Suburban services (via Main Fast Line from Wimbledon) | 7 | 1 x 8 (20m vehicles) | 8 | 117[2] | 936 |
| | | 2x 8 (20m vehicles) | 20 | 154[1] | 3,080 |
| | | 4 x 12 (20m vehicles) | 48 | 117[3] | 5,616 |

[1] 8-car Class 455 rolling stock with 472 Standard seats (arranged as 2+2 seating) plus standing capacity for 760 passengers based upon 0.25m2 of floor space per standing passenger. No First Class accommodation provided.

[2] 8-car Class 450 rolling stock with 492 Standard seats (arranged as 3+2 seating) and 48 First seats. Standing capacity of 392 passengers based upon 0.25m2 of floor space per standing passenger

[3] 12-car Class 450 rolling stock with 738 Standard seats (arranged as 3+2 seating) and 72 First seats. Standing capacity of 588 passengers based upon 0.25m2 of floor space per standing passenger

perception of the route is one of being crowded. This is best illustrated by the National Rail Passenger Survey which reports that between 27 per cent and 34 per cent of passengers who use Main Suburban services during peak hours rate the attribute "Sufficient room for all the passengers to sit / stand" as being either satisfactory or good, a figure which is below the average for the London and South East rail sector as a whole, see **Table 4.9**. This suggests that approximately 70 per cent of passengers who use Main Suburban services during peak hours are less than satisfied with the level of capacity provided, a figure which is likely to be higher during the high-peak hour.

4.2.29 There are several factors contributing to the perception of a crowded railway. Although no Main Suburban services were (at least on average) loaded in excess of planning capacity in spring 2013, most services are very busy. 12 out of the 25 high-peak Main Suburban services have been observed to leave passengers behind on departure from some stations owing to the level of crowding (whilst the railway was operating punctually and reliably), either because passengers were unable to board or because they preferred to wait for a later service. Stations where some passengers did not board busy trains include Raynes Park, Wimbledon and Earlsfield, and passengers left behind are adding to platform congestion at these stations.

**Table 4.9 Proportion of passengers satisfied with capacity provided on Main Suburban services**

| Route | % of passengers saying satisfied or good - (AM & PM) peak passengers | % of passengers saying satisfied or good - all passengers (peak and off-peak) |
|---|---|---|
| South West Trains – London[1] | 34% | 60% |
| South West Trains – Metro[2] | 27% | 63% |
| London and South East sector | 42% | 64% |
| National Rail | - | 66% |

Source: National Rail Passenger Survey 2013 (Passenger Focus, Spring & Autumn 2013 waves combined)

[1] Journeys starting from stations between Clapham Junction and London Waterloo (inclusive). This includes passengers using Windsor and Main Suburban services, and as a result is not entirely specific to Main Suburban services.

[2] Journeys starting from stations between Earlsfield and Surbiton.

4.2.30 Many of the train services observed to leave passengers behind are loaded (on average) to a standing density below the current planning standard of four standing passengers per square metre of floor space. In part, this is because passengers do not always distribute evenly throughout the entire length of a train. As a result some passengers are unable to board the busier front of the train in the morning peak (which is closer to the main concourse at London Waterloo) whilst spare capacity is available towards the rear of the train. Encouraging passengers to board trains more evenly could help to accommodate further growth.

4.2.31 The proportion of passengers unable to board a train or who prefer to wait for a later train owning to high loadings is relatively small, and accounts for less than two per cent of all high-peak Main Suburban passengers.London Waterloo.

4.2.32 Some passengers on high-peak Main Suburban services also have to stand for a period of time in excess of the 20 minute guideline. **Figure 4.2** highlights the train services where this currently occurs. Whilst some standing passengers may be able to obtain a seat before central London owing to the churn of passengers on and off trains at intermediate stations, many have to stand at least as far as Clapham Junction, if not all the way to London Waterloo.

4.2.33 On services from Shepperton and Strawberry Hill, some passengers typically have to stand from Kingston (33 minutes from London Waterloo). On services through Surbiton, standing is commonplace from Surbiton (32 minutes from London Waterloo on an all stations service), and on one service some passengers are typically standing from as far as Oxshott (also 32 minutes from London Waterloo). For services through Motspur Park, standing typically starts from Worcester Park (30 minutes from London Waterloo).

4.2.34 As described in **Chapter 3**, Network Rail and South West Trains are currently investing in the capability of the network and additional rolling stock to provide extra high-peak capacity in CP5. This investment will enable all high-peak services to be lengthened from the current maximum of 8-car trains to a maximum of 10-car trains. As a result, the amount of high-peak capacity into central London on Main Suburban services will increase by approximately 25 per cent see **Table 4.11**.

**Table 4.10 Passengers observed not boarding busy trains**

| Station | Number of high-peak services leaving passengers behind | Approximate number of passengers left behind by high-peak services |
|---|---|---|
| Raynes Park | 5 | 80 |
| Wimbledon | 7 | 30 |
| Earlsfield | 12 | 140 |
| Total | 12 | 250 |

Source: Network Rail observations, Spring 2014. No observations were taken at Clapham Junction station (where left behinds are also known to occur)

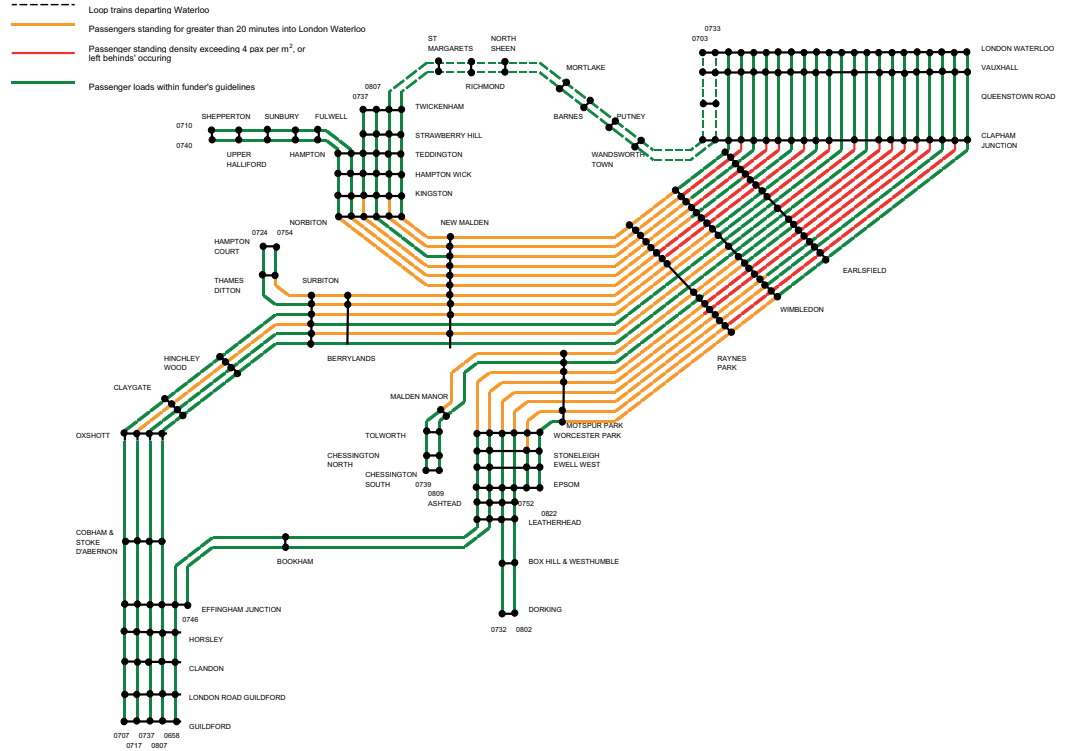
4.2.35 The assessment is that a further 40 vehicles, over and above the extra capacity planned for 2019, is required during the high-peak hour to meet the 2043 capacity conditional output for Main Suburban services (conditional output CO2). However, based upon the industry's existing rolling stock and infrastructure plans, as well as the anticipated rate of growth in the market, this extra capacity is not currently considered a priority for CP6. At the end of CP5 a further assessment is proposed to re-assess the impact of running all Main Suburban services at 10-car length, see **Table 4.12**. This will clarify the capacity gap and further inform the strategy and the timescales of any interventions.

**Table 4.11 Approximate additional high-peak capacity planned for the Main Suburban services by 2019**

| Route | Current high-peak services | 2019 high-peak services | Approximate increase in capacity by 2019 |
|---|---|---|---|
| Total Main Suburban services (via Main Slow Line from Wimbledon) | 18 x 8-car | 18 x 10-car | 25% |
| Total Main Suburban services (via Main Fast Line from Wimbledon) | 1 x 8-car<br>2x 8-car<br>4 x 12-car | 1 x 12-car<br>2 x 10-car<br>4 x 12-car | 50%<br>25%<br>- |

| Table 4.12 Assessment of passenger capacity conditional outputs on Main Suburban services | | |
|---|---|---|
| **Conditional output reference** | **Description** | **Assessment of capacity required** |
| CO2 | To provide sufficient capacity for passengers travelling into central London during peak hours, taking into account anticipated growth over the period to 2043 – Main Suburban services | Additional 40 vehicles during the high-peak hour |
| CO5 | Consistent with the longer term strategy identified to meet CO2, to provide sufficient capacity for passengers travelling into central London during peak hours, taking into account anticipated growth to the end of Control Period 6 (2024) – Main Suburban services | The capacity already planned for CP5 will be sufficient to meet this conditional output |

**Figure 4.2 Passenger loads on high-peak Main Suburban services (2013/14) (source: South West Trains automated passenger count data and Network Rail observations)**



## Main Line long distance services

4.2.36 As described in **Chapter 3** there are currently 17 Main Line long distance train services (plus seven Main Suburban services from Guildford and Woking making 24tph on the Fast Line) arriving at London Waterloo during the high-peak hour. All of these services are timetabled to operate over the Main Fast Line via Wimbledon.

4.2.37 The total high-peak capacity into London Waterloo provided by Main Line long distance services is described in Table 4.13.

4.2.38 For most Main Line long distance services, the last stop before arrival at London Waterloo is Woking (or other stations further away from central London such as Basingstoke), which is typically 30 minutes from London Waterloo. On these services, capacity is defined as the number of seats provided with no allowance for standing passengers. The Main Suburban services using the Fast Line are subject to the criteria for standing no longer than 20 minutes on a suburban service.

4.2.39 Over 19,000 passengers use Main Line long distance services to access central London during the high-peak hour, measured at the busiest point approaching London Waterloo. Capacity has failed to keep pace with rising demand, and as a result there are now more passengers than capacity during the high-peak hour. This means that most services are loaded in excess of capacity, and standing is commonplace from Woking and Basingstoke. Passengers are also standing from as far away as Winchester on fast services to London Waterloo, a journey of just under one hour, although seats are available on slower services from this station. This can be seen in **Figure 4.3**.

4.2.40 The number of passengers during the high-peak hour is forecast to increase to over 26,000 by 2043, principally as a result of higher levels of employment anticipated within central London.

4.2.41 According to the **National Rail Passenger Survey** between 42 per cent and 49 per cent of passengers who use main line long distance services during peak hours rate the attribute "Sufficient room for all the passengers to sit / stand" as either satisfactory or good a figure which is broadly in line with the average for the London and South East rail sector as a whole, see **Table 4.14**. A lower proportion (18 per cent) is reported for journeys starting from stations in the Woking area, although some caution is required as this figure is based upon a small number of survey respondents. Overall, this still suggests that over 50 per cent of passengers who use Main Line long distance services during peak hours are less than satisfied with the level of capacity provided, a figure which is likely to be higher during the high-peak hour.

4.2.42 Two of the 17 high-peak Main Line long distance services were operating at a length below the maximum permitted by the end-CP5 capability of the network in spring 2013. As a result, the amount of extra capacity which can be added by train lengthening without further investment in the network is small, approximately three per cent as shown in **Table 4.15**.

4.2.43 **Chapter 5** describes how further Main Line long distance capacity, over and above that described in **Table 4.15**, might potentially be provided within the end-CP5 capability of the network by making informed trade-offs between rail outputs. These include:

- The potential to release up to two additional Main Fast Line paths, taking the total number of Main Fast Line services during the high-peak hour up to a maximum of 26 trains per hour. At this level of network utilisation, further measures are likely to be required to ensure the service can be operated punctually and reliably
- Further deployment of 3+2 seating in standard accommodation on Main Line long distance services. Whilst this seating configuration provides additional seats for passengers making relatively short trips (for example, between Woking and London Waterloo where additional capacity is most urgently needed), the layout is unpopular with some passengers. For example, it is known that some passengers prefer to stand rather than sit in the middle seat of three on busy trains

**Table 4.13 Existing Fast Line long distance (Main Line) high-peak capacity into London Waterloo (including Main Suburban services utilising the Fast Line)**

| Route | Number of train services | Passenger vehicles per train | Total passenger vehicles | Average capacity per passenger vehicle | Total capacity |
|---|---|---|---|---|---|
| Total main line long distance services (via Wimbledon) | 17 | 12 x 12-car (20m vehicles) | 144 | 68[1] (seats only) | 9,792 |
| | | 4 x 10-car (23m vehicles) | 40 | 67[2] (seats only) | 2,680 |
| | | 1 x 5-car (23m vehicles) | 5 | 67[3] (seats only) | 335 |
| | | 1 x 10-car (23m vehicles) | 10 | 65[4] (seats only) | 650 |
| | | 1 x 9-car (23m vehicles) | 9 | 59[5] (seats only) | 531 |
| | | 1 x 8-car (20m vehicles) | 8 | 68[6] (seats only) | 544 |
| Total Main Suburban services (via Main Fast Line from Wimbledon) | 7 | 1 x 8 (20m vehicles) | 8 | 117[7] (with standing allowance) | 936 |
| | | 2x 8 (20m vehicles) | 20 | 154[8] (with standing allowance) | 3,080 |
| | | 4 x 12 (20m vehicles) | 48 | 117[1](with standing allowance) | 5,616 |
| Total | 24 | - | 228 (20m vehicles), plus 64 | - | 24,164 |

[1] 12-car Class 450 rolling stock with 738 Standard seats (arranged as 3+2 seating) and 72 First seats. Standing capacity of 588 passengers based upon 0.25m2 of floor space per standing passenger

[2] 10-car Class 444 rolling stock with 598 Standard seats (arranged as 2+2 seating) and 70 First seats. Standing capacity of 372 passengers based upon 0.25m2 of floor space per standing passenger

[3] 5-car Class 444 rolling stock with 299 Standard seats (arranged as 2+2 seating) and 35 First seats. Standing capacity of 186 passengers based upon 0.25m2 of floor space per standing passenger

[4] 2 x Class 159 + 2 x Class 158 with 572 Standard seats (arranged as 2+2 seating) and 74 First seats. Standing capacity of 388 passengers based upon 0.25m2 of floor space per standing passenger

[5] 3 x Class 159 with 516 Standard seats (arranged as 2+2 seating) and 72 First seats. Standing capacity of 270 passengers based upon 0.25m2 of floor space per standing passengers

[6] 8-car Class 450 rolling stock with 492 Standard seats (arranged as 3+2 seating) and 48 First Class seats. Standing capacity of 392 passengers based upon 0.25m2 of floor space per standing passenger

[7] 8-car Class 450 rolling stock with 492 Standard seats (arranged as 3+2 seating) and 48 First seats. Standing capacity of 392 passengers based upon 0.25m2 of floor space per standing passenger

[8] 8-car Class 455 rolling stock with 472 Standard seats (arranged as 2+2 seating) plus standing capacity for 760 passengers based upon 0.25m2 of floor space per standing passenger. No First Class accommodation provided.

**Table 4.14 Proportion of passengers satisfied with capacity provided on Main Line long distance servicescapacity into London Waterloo (including Main Suburban services utilising the Fast Line)**

| Route | % of passengers saying satisfied or good - (AM & PM) peak passengers | % of passengers saying satisfied or good - all passengers (peak and off-peak) |
|---|---|---|
| South West Trains – Mainline[1] | 43% | 61% |
| South West Trains – Portsmouth[2] | 49% | 60% |
| South West Trains – Suburban[3] | 18% (*) | 66% |
| South West Trains – West of England[4] | 47% | 67% |
| London and South East sector | 42% | 64% |
| National Rail | - | 66% |

Source: National Rail Passenger Survey 2013 (Passenger Focus, Spring & Autumn 2013 waves combined)

[1] Journeys starting from stations between Micheldever and Weymouth

[2] Journeys starting from stations in Portsmouth and the surrounding area

[3] Journeys starting from stations in the Woking area

[4] Journeys starting from stations on the line between Basingstoke and Exeter

4.2.44 An additional 60 per cent capacity is required in the high-peak hour to meet the 2043 capacity conditional output for Main Line long distance services (conditional output CO3). This implies a need for more than 150 extra passenger vehicle arrivals at London Waterloo during the high-peak hour, which is equivalent to an additional 13 paths (assuming 12-car 20 metre vehicles configured with 3 + 2 seating in standard accommodation). This additional capacity is most required inwards from Guildford and Basingstoke. However, if the additional trains were configured with 2+2 seating then an additional 16 paths would be required.

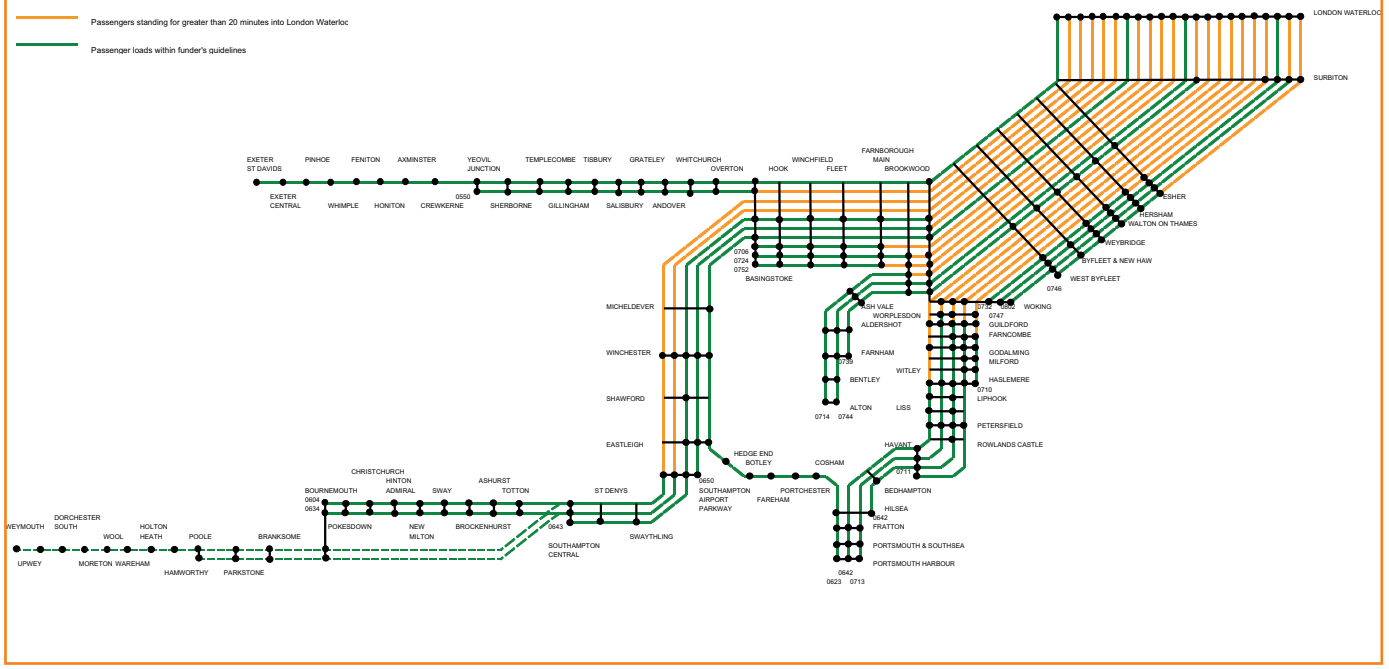
4.2.45 Approximately 20 per cent of this extra capacity is required to ease existing crowding on the route, and with continuing growth the capacity required to meet the level of demand anticipated at the end of CP6 is 72 additional passenger vehicles in the high-peak hour. This is equivalent to six additional paths (assuming 12-car 20 metre vehicles configured with 3 + 2 seating in standard accommodation), see **Table 4.16**.

**Table 4.15 Additional high-peak capacity deployable within the end-CP5 capability of the network, Main Line long distance services(including Main Suburban services utilising the Fast Line)**

| Route | Current high-peak services | Additional capacity deployable within the existing capability of the network | Total approximate % increase in capacity |
|---|---|---|---|
| Total Main Line long distance services | 152 x 20m vehicles<br>64 x 23m vehicles<br>216 passenger vehicles in total | 4 x 20m vehicles<br>6 x 23m vehicles<br>10 passenger vehicles in total | 4-5% |
| Total Main Suburban services (via Main Fast Line from Wimbledon) | 76 x 20m vehicles<br>76 passenger vehicles in total | 8 x 20m vehicles<br>8 passenger vehicles in total | 10-11% |

| Table 4.16 Assessment of passenger capacity conditional outputs on Main Line long distance services | | |
|---|---|---|
| **Conditional output reference** | **Description** | **Assessment of capacity required** |
| CO3 | To provide sufficient capacity for passengers travelling into central London during peak hours, taking into account anticipated growth over the period to 2043 – Main Line long distance services | An additional 156 vehicles in the high-peak hour |
| CO6 | Consistent with the longer term strategy identified to meet CO3, to provide sufficient capacity for passengers travelling into central London during peak hours, taking into account anticipated growth to the end of Control Period 6 (2024) – Main Line long distance services | An additional 72 vehicles in the high-peak hour |

**Figure 4.3 Passenger loads on high-peak Main Line long distance services (2013/14) (source: South West Trains Automated Passenger Count data)**



## 4.3 The level of connectivity provided by passenger rail services

### Conditional outputs from the Market Studies

4.3.1 The Long Distance and London and South East Market Studies established a number of conditional outputs relating to the level of connectivity provided by passenger rail services. There are several aspects of the passenger timetable that relate to connectivity, with the principal components being:

- Train service frequency between stations
- Timetabled journey times
- The provision of direct journeys which do not require an interchange.

4.3.2 The Wessex Route Study considers options for delivering conditional outputs based on these components during off-peak hours of operation. It translates the high level connectivity conditional outputs identified through all of the Market Studies into a set of conditional outputs specific to the Wessex route.

### Short journeys to and from central London

4.3.3 Through the London and South East Market Study conditional outputs to provide a minimum of three or four trains per hour to and from central London during off-peak hours, from stations which are broadly within a 30 mile radius of central London, were identified. The level of service within the Greater London area is relatively intense, resulting in many suburban stations on the Wessex route already providing this (or a greater) level of connectivity.

4.3.4 There are 36 stations on the Wessex route, broadly within a 30 mile radius of central London, that currently have two (or fewer) trains per hour to central London during off-peak hours. Any direct rail services which are overtaken by other services within the existing timetable are not counted towards this total. A number of these 36 stations are combined into a single conditional output where it makes operational sense to consider them together, for example, stations located on a short branch line. The conditional outputs for this market segment are listed in **Table 4.17**.

**Table 4.14 Proportion of passengers satisfied with capacity provided on Main Line long distance servicescapacity into London Waterloo (including Main Suburban services utilising the Fast Line)**

| Conditional output reference | Description |
|---|---|
| Conditional output: To provide a minimum of 3 or 4 tph for stations within 30 miles of central London, from… | |
| CO7 | Ashford |
| CO8 | Chertsey and Addlestone |
| CO9 | Chessington South, Chessington North, Tolworth and Malden Manor |
| CO10 | Strawberry Hill |
| CO11 | Fulwell, Hampton, Sunbury, Upper Halliford and Shepperton |
| CO12 | Sunningdale and Ascot |
| CO13 | Wraysbury, Sunnymeads, Datchet, and Windsor & Eton Riverside |
| CO14 | Thames Ditton and Hampton Court |
| CO15 | Berrylands |
| CO16 | Hinchley Wood, Claygate, Oxshott, and Cobham & Stoke D'Abernon |
| CO17 | Effingham Junction |
| CO18 | Horsley, Clandon, and London Road Guildford |
| CO19 | Bookham |
| CO20 | Boxhill & Westhumble |
| CO21 | Worplesdon |
| CO22 | Byfleet & New Haw |
| CO23 | Esher and Hersham |

4.3.5 The London and South East Market Study has also identified a further connectivity conditional output to improve journey times for short distance services to central London (Conditional Output CO24), see **Table 4.18**. The Wessex suburban area is densely populated and as a result the rail network is characterised by a number of relatively small stations in close proximity to each other. As a result, the potential to improve journey times to central London is relatively limited for this market segment

**Table 4.18 Conditional outputs**

| Conditional output reference | Description |
|---|---|
| CO24 | Deliver incremental journey time improvements for stations within 30 miles of central London: All stations / routes |

## Longer distance journeys to and from central London

4.3.6 The London and South East Market Study identified a conditional output to improve "generalised" journey times to and from central London, for significant centres of population which are broadly 30 miles or more from central London.

4.3.7 "Generalised" journey time is a measure of rail connectivity which combines both the speed and frequency of rail services. As a result, the generalised journey time between two stations can be improved by reducing the timetabled journey time, or by operating a more frequent service (or by doing both).

4.3.8 It is suggested that, in many cases, this conditional output can be achieved by operating a mix of two or three fast trains per hour serving the major generators of demand on a route, travelling (on average) in excess of 70 miles per hour, with an additional semi-fast service(s) picking up demand from smaller stations on the route.

4.3.9 Within the Wessex route, one station – Basingstoke – currently has this level of off-peak connectivity to central London. The typical off-peak passenger rail service between Basingstoke and central London provides five direct services every hour, with the fastest services stopping only at Clapham Junction before London Waterloo.

4.3.10 There are seven significant centres of population within the Wessex route which do not currently meet this conditional output, as described in **Table 4.19**. Due to the shorter journey times between Exeter and London Paddington (between 120 and 165 minutes compared to up to 210 minutes from London Waterloo) rail connectivity between Exeter and central London is being considered by the Western Route Study, and is therefore not shown.

**Table 4.19 Rail connectivity to central London, longer distance trips from significant centres of population within the Wessex route**

| Significant centre of population | Current direct trains to central London (off-peak services per hour) | Current Average journey time (minutes) | Average train speed (miles per hour) |
|---|---|---|---|
| Bournemouth | 2 (*) | 115 | 56 |
| Poole | 2 (*) | 132 | 52 |
| Portsmouth | 3 (*) | 102 | 44 |
| Salisbury | 2 | 90 | 56 |
| Southampton | 2 (*) | 83 | 57 |
| Winchester | 4 | 67 | 60 |
| Wokingham (included as a proxy for other locations on the Reading to London Waterloo line) | 2 | 68 | 32 |

(*) Plus one further direct journey opportunity which is overtaken by other services

4.3.11 The Conditional Outputs for this market segment are listed in **Table 4.20**.

| Table 4.20 Conditional outputs | |
|---|---|
| Conditional output reference | Description |
| CO25 | To reduce the 'generalised' journey time for longer distance journeys to central London from significant centres of population: Bournemouth |
| CO26 | To reduce the 'generalised' journey time for longer distance journeys to central London from significant centres of population: Poole |
| CO27 | To reduce the 'generalised' journey time for longer distance journeys to central London from significant centres of population: Portsmouth |
| CO28 | To reduce the 'generalised' journey time for longer distance journeys to central London from significant centres of population: Salisbury |
| CO29 | To reduce the 'generalised' journey time for longer distance journeys to central London from significant centres of population: Southampton |
| CO30 | To reduce the 'generalised' journey time for longer distance journeys to central London from significant centres of population: Winchester |
| CO31 | To reduce the 'generalised' journey time for longer distance journeys to central London from significant centres of population: Wokingham (included as a proxy for other locations on the Reading to London Waterloo line, including Bracknell and Reading) |

### Rail connectivity between large regional centres within the Wessex route

4.3.12 The **London and South East Market Study** identified a conditional output for large (non-London) regional centres within the Wessex route which are in close proximity to each other. This Conditional Output addresses incremental improvements to journey times, with a view to delivering a total journey time of less than 60 minutes (taking into account both the time spent travelling on the train, and the frequency of the service offered).

4.3.13 To address this Conditional Output three non-London rail corridors have been assessed which cover the regional centres of Basingstoke, Winchester, Southampton, Bournemouth, Poole and Portsmouth. These three corridors are:

- The South Coast rail corridor between Poole and Portsmouth
- The rail corridor between Basingstoke and Portsmouth
- The rail corridor between Basingstoke and Poole

### The South Coast rail corridor

4.3.14 The South Coast rail corridor links the large regional centres of Poole, Bournemouth, Southampton and Portsmouth. **Figure 4.4** describes the current level of rail connectivity during a typical off-peak hour on this corridor.

4.3.15 The priorities within this corridor are:

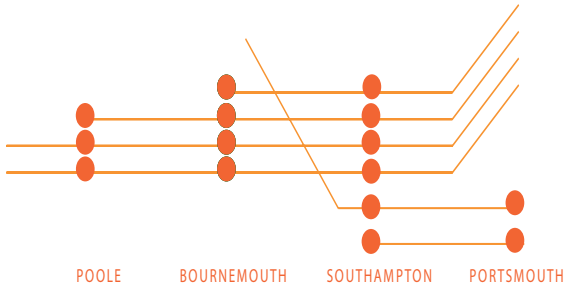
- To improve the rail journey time between Southampton and Portsmouth
- To provide connectivity between Poole / Bournemouth and Portsmouth

4.3.16 This has been reflected in the Conditional Output in **Table 4.21**.

| Table 4.21 Conditional Outputs | |
|---|---|
| Conditional output reference | Description |
| CO32 | To improve rail connectivity between (non-London) large regional centres within the Wessex route: Poole to Portsmouth corridor |

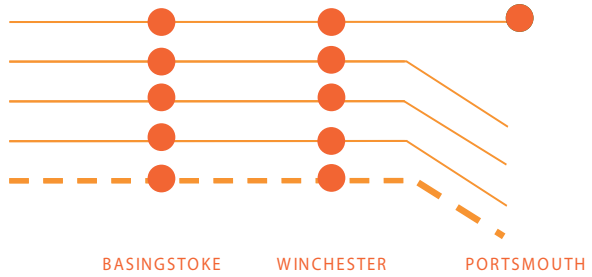
| Table 4.22 Conditional Outputs | |
|---|---|
| Conditional output reference | Description |
| CO33 | To improve rail connectivity between (non-London) large regional centres within the Wessex route: Basingstoke to Portsmouth corridor |

**Figure 4.4 Rail connectivity along the South Coast corridor**




| | | | |
|---|---|---|---|
| Typical journey time (mins) | 11 | 33 | 53 |
| Average speed (mph) | 31 | 52 | 29 |
| Off -peak frequency (tph) | 3 | 4 | 2 |

**Figure 4.5 Rail connectivity within the Basingstoke to Portsmouth corridor**




| | | |
|---|---|---|
| Typical journey time (mins) | 15 | 54 |
| Average speed (mph) | 72 | 32 |
| Off-peak frequency (tph) | 4 / 5 | 1 |

## The rail corridor between Basingstoke and Portsmouth

4.3.17 This corridor links the large regional centres of Basingstoke, Winchester and Portsmouth. **Figure 4.5** describes the existing level of rail connectivity within this corridor during a typical off-peak hour.

4.3.18 The priority within this corridor is to improve journey times and/ or train service frequency between these regional centres. This has been reflected in the conditional output in **Table 4.22**.

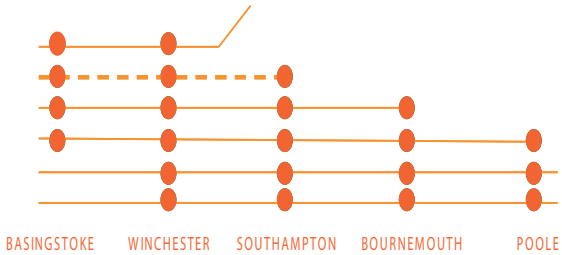
## The rail corridor between Basingstoke and Poole

4.3.19 This corridor links the large regional centres of Basingstoke, Winchester, Southampton and Poole. **Figure 4.6** describes the existing level of rail connectivity within this corridor during a typical off-peak hour.

4.3.20 The priority for the Wessex Route Study within this corridor is to improve journey times and / or train service frequency between Winchester and Southampton. This has been reflected in the conditional output in **Table 4.23**.

| Table 4.23 Conditional outputs | |
|---|---|
| **Conditional output reference** | **Description** |
| CO34 | To improve rail connectivity between (non-London) large regional centres within the Wessex route: Basingstoke to Poole corridor |

**Figure 4.6 Rail connectivity within the Basingstoke to Poole corridor**




| | | | | |
|---|---|---|---|---|
| Typical journey time (mins) | 15 | 19 | 33 | 11 |
| Average speed (mph) | 72 | 40 | 52 | 31 |
| Off-peak frequency (tph) | 4 / 5 | 4 / 5 | 4 | 3 |

## Rail connectivity with significant centres of population external to the Wessex route

4.3.21 The **Long Distance Market Study** identified conditional outputs for passenger rail connectivity between major centres of population right across Great Britain.

4.3.22 The cross-boundary passenger services relevant to the Wessex route are described in **Chapter 5**. The conditional outputs identified by the **Long Distance Market Study** are implicit in the conditional output for Wessex, in **Table 4.24**.

| Table 4.24 Conditional outputs | |
|---|---|
| **Conditional output reference** | **Description** |
| CO35 | To accommodate, during off-peak hours, the cross-boundary passenger services specified by the Cross-Boundary Working Group, as a proxy for meeting all Conditional Outputs which are not wholly internal to the Wessex Route |

## Rail connectivity to airports

4.3.23 Two major airports, London Heathrow Airport and London Gatwick Airport, are situated in close proximity to the Wessex Route, and some passenger rail services (or potential new services) serving these airports are considered by the Wessex Route Study. Rail services to and from Southampton Airport Parkway, which is situated within the Wessex route on the SWML, are also considered by the Wessex Route Study.

### London Heathrow Airport

4.3.24 London Heathrow Airport is situated adjacent to Network Rail's Western Route, being located on a spur off the Great Western Main Line. The airport is currently served by National Rail services from London Paddington. Currently, there are no rail services to London Heathrow Airport stations which operate over any part of the Wessex route.

4.3.25 Plans for a new 'western access' link between Heathrow and the Great Western Main Line (GWML) are being developed in CP5 to provide direct services to Heathrow Airport from the west, for example from Reading. Provision of this link could also enable new direct services to the airport from stations in the Wessex route, for example, by extending some London Heathrow Airport to Reading services back to Basingstoke (and potentially beyond to Southampton and Bournemouth).

4.3.26 It is also suggested that a new direct service be introduced between Southampton Central and London Paddington via London Heathrow Airport and Old Oak Common. These potential additional services are further assessed in this document and are implicit in Conditional Output CO35, see **Table 4.24**.

4.3.27 In addition to services being considered from Basingstoke (and potentially beyond) there is also a long standing aspiration to provide direct rail access to London Heathrow Airport from the suburban network. This could be achieved by providing a new rail connection between the airport and the Windsor Lines.

### London Gatwick Airport

4.3.28 Gatwick Airport is situated on the Brighton Main Line within Network Rail's Sussex Route. Services from Southampton and Portsmouth to London Victoria serve the airport. In addition there are services from Reading to Gatwick Airport via the North Downs Line.

4.3.29 Options have been developed in this Route Study to accommodate the following increase in service to Gatwick Airport via the North Downs Line:

- Two trains per hour semi-fast service between Reading (and potentially Oxford) and London Gatwick Airport. In order to deliver the best possible journey times, a third service will also be required over this route to serve stations with relatively low demand.

4.3.30 This potential change in service is further assessed in **Chapter 5** of this document and is implicit in Conditional Output CO35, see **Table 4.24**. It has also been included in the 2015 First Great Western (FGW) Direct Award as a franchise commitment.

4.3.31 Southampton Airport is situated within Network Rail's Wessex Route, and is served by Southampton Airport Parkway station located on the South West Main Line (SWML). The typical off-peak service pattern (in each direction) at this station is currently:

- Three trains per hour to London Waterloo (one from Poole and two from Weymouth)
- 1.5 trains per hour Cross Country services via Basingstoke and Reading (one train per hour between Bournemouth and Manchester Piccadilly, plus one train every two hours between Southampton and Newcastle)
- One train per hour between Salisbury and Romsey via Southampton Central and Eastleigh

4.3.32 It is suggested that up to nine trains per hour to Southampton Airport Parkway in each direction during off-peak hours would be required by 2043.

- Between three and five trains per hour to London Waterloo
- Two trains per hour cross country services via Basingstoke and Reading (to destinations in the North West and North East of England)
- One train per hour from Southampton to London Paddington, via Basingstoke, Reading, London Heathrow Airport, and Old Oak Common for connections with HS2 services
- One or two trains per hour between Salisbury and Romsey via Southampton Central and Eastleigh

### Rail connectivity with HS2

4.3.33 As described in **Chapter 3**, HS2 will provide high-speed connectivity between London, the Midlands and the North. Connectivity and interchange between the Wessex Route and HS2, for onwards travel, is therefore considered to be important.

4.3.34 The **London and South East Market Study** identified a high level conditional output for passenger rail connectivity between major centres of population in London and the South East and HS2. This can be translated into a set of conditional outputs specific to the Wessex route. These are:

- Using cross-London connections between London Waterloo and either London Euston or Old Oak Common
- Using services from the Wessex route via Wokingham which terminate at Reading, connecting on to a Great Western Main Line service to Old Oak Common
- Using services from the Wessex route via Basingstoke which call at Reading, connecting on to a Great Western Main Line service to Old Oak Common
- One train per hour direct service between Southampton and London Paddington via Old Oak Common

4.3.35 The South-East Route: Sussex Area Route Study has assessed the impact of a potential interchange on the West London Line (WLL) at Old Oak Common. If implemented this would necessitate passengers interchanging at Clapham Junction from both the Sussex and Wessex Route

4.3.36 It is likely that direct services via Basingstoke to destinations such as Birmingham may prove more attractive than travelling via HS2 at Old Oak Common.

4.3.37 If a station is built on the North London Line (NLL) at Old Oak Common then it will be possible to provide connectivity to HS2 from Richmond.

## 4.4 Providing sufficient capacity for freight services

4.4.1 As described in **Chapter 2** there is considerable freight traffic on the Wessex Route to various destinations around the network. A large part of this traffic utilises the route via Basingstoke and Reading from Southampton Docks. In common with the overall forecast for rail freight, the main freight growth on the Wessex route is forecast to be in the intermodal container market to and from the Port of Southampton.

4.4.2 Over the period from 2013 to 2043 the tonnage of containers transported by rail to and from the Port is forecast to almost triple. The bulk aggregate commodities are also forecast to increase, but to a lesser extent. For automotive and petroleum products the tonnage is forecast to remain largely unchanged although the automotive sector is currently showing strong growth. **Figure 4.7** illustrates the anticipated growth in the rail freight market across the Wessex route.

4.4.3 The Freight Market Study established a conditional output to provide sufficient network capacity and capability to accommodate the anticipated demand for freight services to 2043. This requirement is expressed by the Freight Market Study in freight paths per hour for network sections by 2043 expressed as Class 4 (intermodal) or Class 6 (aggregate) freight. For the Wessex route, these are:

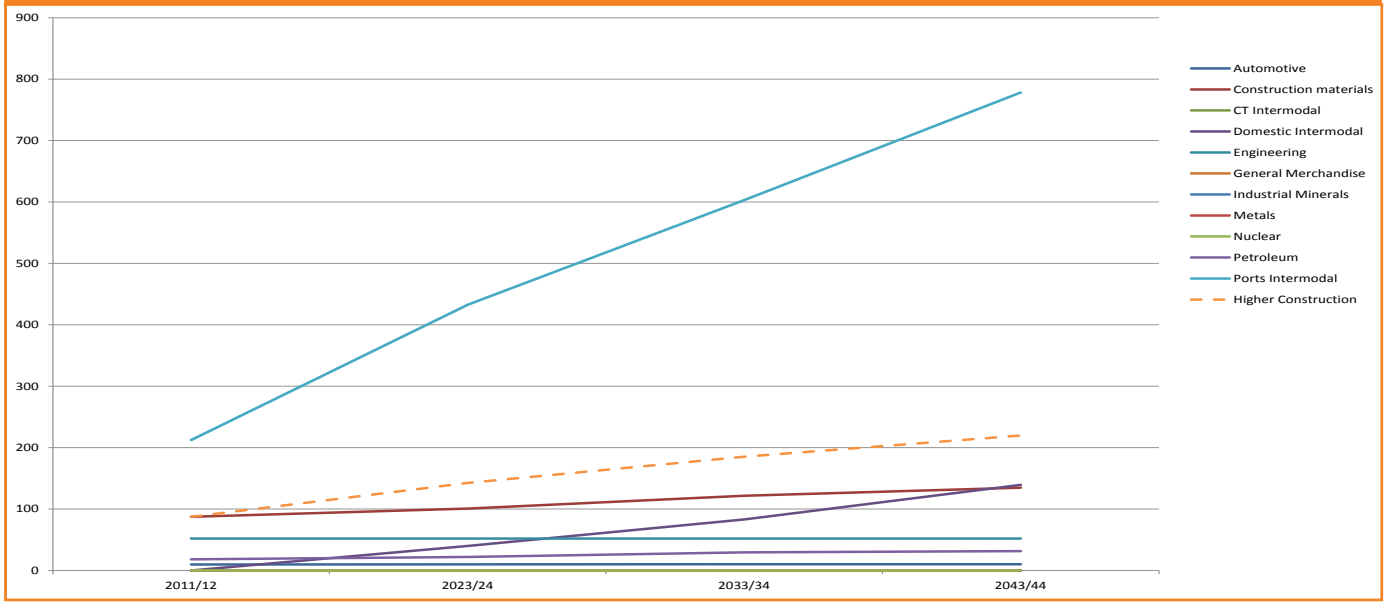
- Between Southampton and Basingstoke: A maximum of 3 to 4 Class 4 paths (for services which can operate up to 75 mph) plus 0.5 to 1 Class 6 path (for services which can operate up to 60 mph) per hour in each direction
- Between Basingstoke and Southcote Junction: A maximum of 3 to 4 Class 4 paths plus 0.5 to 1 Class 6 path per hour in each direction
- Between Basingstoke, Woking, and Kew East Junction (via Hounslow): One Class 4 or one Class 6 path per hour in each direction

4.4.4 The conditional outputs established by the Freight Market Study are implicit in the following conditional output for the Wessex Route Study, see **Table 4.25**.

**Table 4.25 Conditional outputs**

| Conditional output reference | Description |
|---|---|
| CO36 | To accommodate the anticipated demand for freight services to 2043, as expressed by the Freight Market Study |

**Figure 4.7 Anticipated growth in the Wessex rail freight market (million tonne - km per annum)**




## 4.5 Passenger circulation capacity at stations

4.5.1 Many of the railway stations on the Wessex route date from Victorian times, and in terms of overall footprint and layout, some have not changed substantially for many decades. As a result of this and growth in the market, some stations on the Wessex route are now congested during peak hours, making movement through the station to the platforms slow and potentially difficult.

4.5.2 A conditional output to reduce the level of congestion during peak hours at a number of stations where this is already a problem is proposed by the Wessex Route Study. In conjunction with stakeholders these stations have been identified as Clapham Junction, Putney, Richmond, Surbiton, Vauxhall and Wimbledon.

4.5.3 Over the next 30 years, the number of rail passengers on the Wessex route is anticipated to increase by approximately 40 per cent during peak hours, and as a result further stations may require investment to mitigate against increasing levels of congestion. This is reflected in a further conditional output (Conditional Output CO38) for the Wessex Route Study to consider, see **Table 4.26**

**Table 4.26 Conditional outputs**

| Conditional output reference | Description |
|---|---|
| CO37 | To reduce the level of passenger congestion during peak hours at the following stations: Clapham Junction, Putney, Richmond, Surbiton, Vauxhall and Wimbledon |
| CO38 | To provide sufficient passenger circulation capacity at stations within the Wessex route, taking into account anticipated growth over the period to 2043 |

## 4.6 Other Conditional Outputs

4.6.1 The **London and South East Market Study** established further conditional outputs, including:

- Providing sufficient capacity for the leisure market at weekends and weekday evenings
- Providing appropriate connectivity and capacity for tourist attractions outside of the region's large urban centres
- Providing access to higher education establishments and other social infrastructure
- Making the rail network more accessible to passengers.

4.6.2 Consideration of these conditional outputs is principally a matter for franchise specification and management, although the terms of reference for the Wessex Route Study allows consideration of any specific examples raised where a more strategic, longer term solution may be required. Whilst no specific examples were raised during the development of this Route Study, the **Long Term Planning Process** will continue to engage with stakeholders on these issues.

4.6.3 The **London and South East Market Study** also suggested a conditional output to improve the level of rail passenger satisfaction. This aspiration is well aligned to the other conditional outputs, as research commissioned by Passenger Focus highlights that improving rail performance, capacity, journey times and frequency of services are priorities for passengers, alongside improving the value for money of rail services.

# 05 Accommodating the Conditional Outputs




## 5.1 Introduction

5.1.1 This chapter details the choices or interventions that the Route Study suggests would be required to meet the conditional outputs previously set out in **Chapter 4**. These include the priorities identified for Control Period 6 (CP6), the interventions that build upon CP6 to form the future strategy required to accommodate forecast growth and demand to 2043, cross-boundary passenger and freight growth, and connectivity between destinations within the Wessex Route.

5.1.2 All of the CP6 investment choices identified for the Wessex route meet one (or more) of the following criteria:

- Investments which reduce rail industry operating costs (for example further network electrification, or the provision of new 'turnback' facilities enabling the rail industry to reduce its operational resources)
- Investments which are required to provide sufficient capacity for the anticipated level of passenger or freight demand at the end of CP6, where this investment is also consistent with the longer-term strategy for the route
- 'Once in a generation' opportunities where conditional outputs (or some part of the capital works necessary to meet conditional outputs over a longer period of time) can be delivered most efficiently during CP6, for example, in conjunction with the planned renewal of life-expired assets
- Investing in better connectivity to High Speed 2 (HS2) stations and airports
- Other investments which reflect funders' priorities

5.1.3 Deliverability is another key consideration for this Route Study. It is important that the CP6 priorities and the future strategy are not only affordable but that they also take account of when the optimum time for implementation of the proposed interventions would be. The timing of the interventions discussed in this chapter should consider how disruptive an intervention will be, particularly in light of other works on the route (such as renewals), and should be mindful of the impact on Train and Freight Operating Company (TOC and FOC) access.

5.1.4 As this Route Study seeks to address the conditional outputs identified in the **Market Studies** this chapter will be structured so as to set out how each of the conditional outputs could be addressed.

5.1.5 It should be noted that the options presented in this chapter represent the industry's current view of priorities and in future planning cycles circumstances, and therefore priorities, may change.

## 5.2 Windsor Line growth: CO1 and CO4

**Figure 5.1 – Map of Windsor Lines**


5.2.1 As stated in **Chapter 4** there are two Conditional Outputs which seek to address the growth expected on the Windsor Lines, these are:

- **CO1**: To provide sufficient capacity for passengers travelling into central London during peak hours, taking into account anticipated growth over the period to 2043 – Windsor Line services
- **CO4**: To provide sufficient capacity for passengers travelling into central London during peak hours, taking into account anticipated growth to the end of CP6 – Windsor Line services

5.2.2 It is impossible to address either one of these conditional outputs without being mindful of the how each one impacts upon the other. It is therefore important that they are consistent with one another and form a coherent strategy for addressing growth on the Windsor Lines.

5.2.3 In terms of meeting the growth in passengers expected by the end of CP6 this Route Study does not suggest any interventions are required above those already committed in Control Period 5 (CP5). This means that a fully 10-car capable Windsor Line service should be sufficient to meeting demand until Control Period 7 (CP7) or beyond. It should be noted, however, that the impact on passenger overcrowding will be re-assessed once all committed 10-car schemes are delivered at the end of CP5. This will help to clarify in which Control Period any further interventions may be required, taking into account such currently unknown factors as suppressed demand.

5.2.4 As detailed in **Chapter 3** the Wessex Capacity Programme will deliver infrastructure changes in the Queenstown Road area to enable the segregation of Main Line and Windsor Line flows and improve the operation of services by re-opening Platform 1. This forms a first step towards further works expected to be required in CP6 to re-model the area around Queenstown Road and increase capacity for Main Line services, see **Section 5.4**.

5.2.5 At the end of CP5 the Windsor Lines will be capable of accommodating 20tph in the high peak hour but will initially only operate 18 of those 20 services. This means there are potentially an additional two paths in the high peak that could be utilised to ease congestion. Although this will by no means meet the demand on the Windsor Lines beyond CP6 it is important that the full capability of the infrastructure is utilised.

5.2.6 Because level crossing down-times make it difficult to operate any more services via Richmond, these additional two trains would need to be routed via Hounslow. No further services can be routed via Richmond without considerable infrastructure intervention.

5.2.7 Most passengers from stations between Reading and Feltham travelling to London Waterloo in the peak hours use services that are routed via Richmond as these provide the quickest journey times, by approximately 15 minutes. This means that services via Richmond are already starting to become overcrowded with passengers standing from Feltham, which is above the 20 minutes deemed acceptable for services into London Waterloo.

5.2.8 In an attempt to address some of this on-train congestion the following is presented as a choice for the 8tph that would operate via Hounslow if the full 20tph capability of the Windsor Lines were being utilised:

- 4tph from Hounslow stopping all stations to London Waterloo (2tph utilising the new turnback facility planned at Hounslow in CP5 and the other 2tph operating a clockwise loop service to London Waterloo)
- 4tph operating semi-fast via the Hounslow Loop to London Waterloo (calling at Hounslow and Brentford only), with two of these services coming from the Ascot Line, and the other two services starting from Weybridge via the Chertsey branch

5.2.9 By routeing the Ascot Line services via Hounslow and removing a number of stops on the Hounslow Loop from the calling pattern it is suggested that a comparable journey time to that via Richmond could encourage as many as 500 passengers to use the capacity available in the high peak hour via Hounslow. This would mean that passengers joining trains at Twickenham and Richmond would be likely to have a less congested service than they currently experience.

5.2.10 To increase capacity above that provided by 20tph would require some sort of investment in the network. This Route Study has identified three choices that could provide the additional capacity required to 2043, or beyond:

- Increasing the number of services operating on the Windsor Lines above 20tph (to approximately 24tph, above which they would start to impact on Main Line growth), although this likely to have a deleterious effect on performance without further intervention
- Operating 20tph as 12-car trains
- Implementing a modern signalling solution such as the European Train Control System (ETCS)

5.2.11 To increase the level of service above 20tph would not only address CO4 but would also provide additional connectivity to locations across the Windsor Line network. It would, however, require quite substantial investment to remove the constraints and pinch points that prevent a service above 20tph being run today. At a high level the following interventions may be required:

- Further additional track capacity through Queenstown Road above that provided in CP5
- Additional track capacity via Richmond and/or via Hounslow
- Resolution of level crossing down-time issues particularly on the routes via Richmond and Hounslow but also elsewhere on the Windsor Line network
- Potential grade-separation at Barnes Junction to segregate the Hounslow and Richmond flows
- The possibility of additional platform capacity at London Waterloo – more work is required to understand at what point between 20tph and 24tph, or above, London Waterloo would be unable to cope – this is also dependent on platform capacity needed by Main Line services
- Capacity through Feltham where the flows via Richmond and Hounslow diverge

5.2.12 Even with these interventions there may still not be enough capacity gained to meet the conditional outputs, the costs to resolve the constraints would be substantial and since other choices appear to be more promising, no in-depth work has been carried out as part of this study.

5.2.13 As was previously stated, at the end of CP5 Windsor Line services will be operating as 10-car trains. Previous work carried out on the CP5 10-car Windsor Line project investigated passive provision for 12-car trains. That work has been revisited and validated to provide a clear understanding of the infrastructure required to facilitate operating trains of 12-car length.

5.2.14 12-car works can be split into two phases:

- Phase 1 - Reading/Aldershot to London Waterloo via Richmond fast peak services (Package 1). Platform extensions would only be required at Staines, Ashford, Twickenham, Richmond and Clapham Junction (if the option is taken in the Reading, Ascot to London Waterloo Train Lengthening CP5 project to extend to 12-car rather than 10-car)
- Phase 2 - All remaining services: Windsor & Eton Riverside to London Waterloo and Kingston and Hounslow Loops (Package 2). Extensions to the majority of remaining station platforms including Main Suburban platforms from Kingston via Wimbledon and on the route from Strawberry Hill to Shepperton.

5.2.15 It is envisaged that 10-car capability and the ability to accommodate up to eight trains per hour on the Hounslow Loop will be sufficient for initial growth on this part of the line but that the route via Richmond would still require an intervention to cope with on-train congestion.

5.2.16 Phase 1 would be the highest priority owing to the crowding levels via Richmond whereas Phase 2 would build upon the first phase to encompass the wider Windsor Lines.

5.2.17 Considerable works would be required at some of the main stations on the Windsor Lines (e.g. Richmond, Twickenham) to accommodate 12-car trains although in some quieter locations Automatic Selective Door Operation (ASDO) would be appropriate. It is estimated that these works would cost in excess of £100 million excluding the Shepperton Branch and from Kingston to London Waterloo via Wimbledon, see **Section 5.3**.

5.2.18 In terms of ETCS and modern signalling operation no specific work has been carried out as part of this Route Study. Network Rail have a 'Digital Railway' function who are currently investigating the benefit of ETCS and how it might be implemented across the national network to improve operations and increase capacity. Further work will therefore be required by the Digital Railway to look at what ETCS could potentially provide for the Windsor Lines, it being expected that any implementation of ETCS would cover most, if not all, of the Wessex Route.

## 5.3 Main Suburban growth: CO2 and CO5

**Figure 5.2 – Map of Main Suburban lines**


5.3.1 As stated in **Chapter 4** there are two Conditional Outputs which seek to address the growth expected on the lines used by Main Suburban services, particularly in relation to those services using the Main Slow Line into London Waterloo, these are:

- **CO2**: To provide sufficient capacity for passengers travelling into central London during peak hours, taking into account anticipated growth over the period to 2043 – Main Suburban services
- **CO5**: To provide sufficient capacity for passengers travelling into central London during peak hours, taking into account anticipated growth to the end of CP6 – Main Suburban services

5.3.2 As with the Windsor Lines, it is impossible to address either one of these conditional outputs without being mindful of the how each one impacts upon the other. It is therefore important that they are consistent with one another and form a coherent strategy for addressing growth on the lines used by Main Suburban services.

5.3.3 In terms of meeting the growth in passengers expected by the end of CP6 this Route Study does not suggest any interventions are required above those already committed in CP5. This means that a fully 10-car capable Main Suburban service should be sufficient to meet demand until Control Period 7 (CP7) or beyond. Having said this, today there is considerable standing on peak services for longer than the 20 minutes that is deemed acceptable for suburban services into London Waterloo. In fact at some specific locations passengers may be unable to board a train owing to on-train overcrowding. It should be noted, however, that the impact on passenger overcrowding will be re-assessed once all committed 10-car schemes are delivered at the end of CP5. This will help to clarify in which Control Period any further interventions may be required, taking into account such currently unknown factors as suppressed demand.

5.3.4 Although not necessarily required for CP6 in terms of overall capacity it is theoretically possible that Main Suburban services using the Main Slow Line into London Waterloo could be increased to 20tph, up 2tph on the current high peak hour level of service. This could enable the transfer of two of the seven Main Suburban services that currently use the Main Fast Line on to the Main Slow Line. More detail of this option has been included in **Section 5.4**.

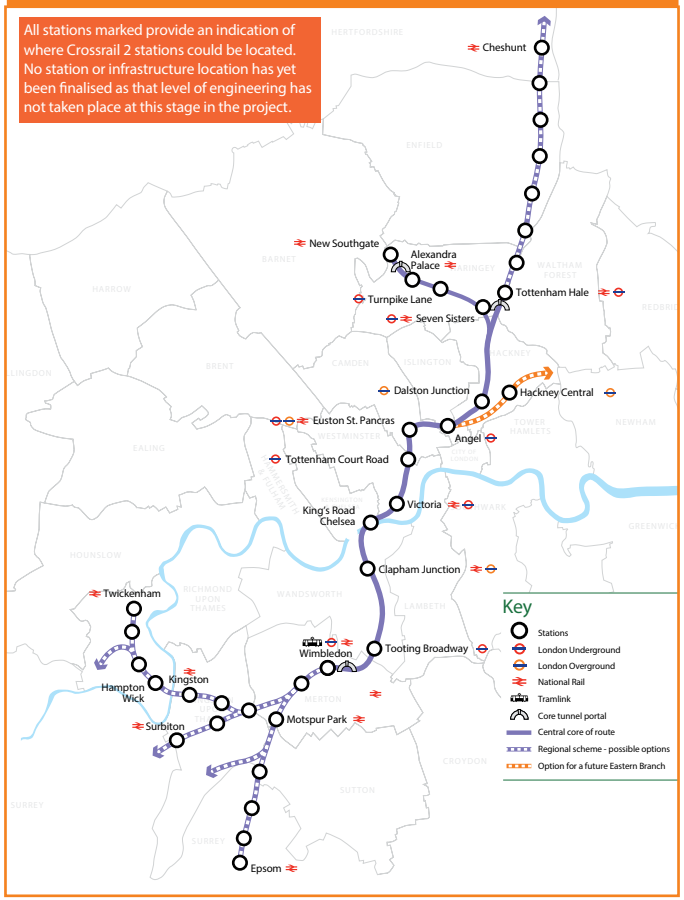
5.3.5 As previously noted there is one 60 minute period during which 19 Main Suburban services utilise the Main Slow Line into London Waterloo, but it is important to remember that increasing the level of service above the 18tph of the high peak hour across the whole three hour peak period may have a significant, negative impact on punctuality and reliability.

5.3.6 The foremost constraints to the provision of additional services on the Main Slow Line into London Waterloo are the dwell times and platform re-occupation margins at stations from Wimbledon inwards, and the capacity in Platforms 1 to 6 at London Waterloo. There are no committed interventions that would relieve these constraints and a trade-off would be required between Main Suburban and Main Line services for any platform capacity that becomes available following the integration of Waterloo International Terminal (WIT) in CP5. The addition of an extra running line, for additional suburban services, would not enable an increased level of Main Suburban service into London Waterloo in the absence of other interventions. Therefore to address these constraints beyond CP6 there are three potential choices:

- Crossrail 2
- Lengthening services to 12-car
- Implementing a modern signalling solution such as the European Train Control System (ETCS)

## Crossrail 2

**Figure 5.3 Proposed Crossrail 2 route**




5.3.7 Network Rail is currently working closely with Transport for London (TfL) on early development proposals for Crossrail 2. This would be a new rail link connecting South West London and North East London, previously known as the Chelsea / Hackney Line. The "Regional Option" for Crossrail 2 that this study puts forward as a choice for funders, connects into the national rail network in the Wimbledon and Tottenham Hale areas, providing onward suburban services to Surrey and Hertfordshire. The project is at an early stage of development and the final route alignment and proposed timetable are still being developed.

5.3.8 Crossrail 2 has been assessed as a choice for funders in this Route Study as it will support the achievement of both Main Slow Line and Main Fast Line capacity. This means that conditional outputs for both Main Suburban and Main Line service levels can be addressed through the implementation of this scheme. The impact of Crossrail 2 on Main Line services is more fully addressed in **Section 5.4**. As well as capacity conditional outputs, Crossrail 2 will also meet connectivity conditional outputs for locations on the Main Suburban network, see **Section 5.5**.

5.3.9 The Crossrail 2 infrastructure proposals to support the new cross-London service include a tunnel portal in the Wimbledon area connecting to the central tunnel section and a six-track layout between New Malden and Wimbledon that would require significant works at Raynes Park.

5.3.10 The proposal has been assessed and would allow for the following re-ordering of services:

- The proposed six-track formation between New Malden and Wimbledon would allow most Crossrail 2 services to be segregated from Main Suburban services between these points
- Inwards of Wimbledon a large proportion of existing Slow Line services would become Crossrail 2 services and therefore be routed into the central tunnel section at Wimbledon. This would release capacity on the Slow Lines inwards of Wimbledon and platform capacity at London Waterloo
- The capacity released on the Slow Line and at London Waterloo can then be used by the six to seven trains per hour which currently join the Fast Line inwards of Surbiton. If these were to

remain as 10-car outer suburban services then no platform works would be required but if they were to be 12-car services then platform extension works may be required

5.3.11 The current Crossrail 2 timetable proposals provide a minimum four trains per hour during peak hours at all stations beyond Wimbledon that Crossrail 2 serves and interchange opportunities at both Wimbledon and Clapham Junction.

5.3.12 In terms of the number of suburban services it is currently envisaged that there would be 8 residual London Waterloo services, 10 Crossrail 2 services starting at Wimbledon (and straight into the tunnel) and 20 Crossrail 2 services from locations on the Main Suburban network.

5.3.13 It is currently proposed that Crossrail 2 would operate with 10-car rolling stock of standard 20 metre car length. It is likely that the core tunnelled section would be constructed with passive provision to lengthen trains to operate with 12-car stock when appropriate.

5.3.14 Existing journey times to key destinations could be significantly improved by Crossrail 2 services. For example, journey times from Kingston to Tottenham Court Road could potentially be reduced from the current 45 minute journey by up to 15 minutes.

### 12-car Main Suburban capability

5.3.15 Owing to the known constraints of dwell times at stations from Wimbledon inwards, platform lengths and capacity at London Waterloo, an increase in Main Suburban services is not thought to be feasible without the introduction of Crossrail 2. If Crossrail 2 were not to be taken forward as a committed scheme beyond CP6 then an alternative would be to introduce 12-car capability to services operating on the Main Suburban network. The choice to extend existing services to 12-car would not be required in addition to Crossrail 2.

5.3.16 Previous work carried out as part of the Control Period 4 (CP4) 10-car South West Suburban Railway project investigated passive provision for 12-car trains on the Main Suburban network. Through this Route Study previous work has been revisited and validated to provide a clear understanding of the infrastructure required to facilitate the operation of 12-car trains. Work to enable 12-car services to operate on Main Suburban lines would include:

- Extending all platforms at London Waterloo to 12-car length
- Extending the majority of platforms at other stations on the Main Suburban network
- Implementation of ASDO at a limited number of locations outside of London

5.3.17 Because of the density of service into London Waterloo, much of the current network is already equipped with four aspect signalling and short signal sections, appropriate for the 10-car length service that will be in operation at the end of CP5. Longer trains take more time to clear signal sections, particularly at the throat of Waterloo station and at critical junctions. This risk would need to be assessed in detail if this option were taken forward. It should also be noted that in a "digital" environment with in-cab signalling and moving block, the constraint of signal position and sighting would cease to be an issue for train lengthening. Therefore it is important to be mindful of emerging technology and how it could impact on the overall strategy for the route, particularly in relation to the future cost of schemes.

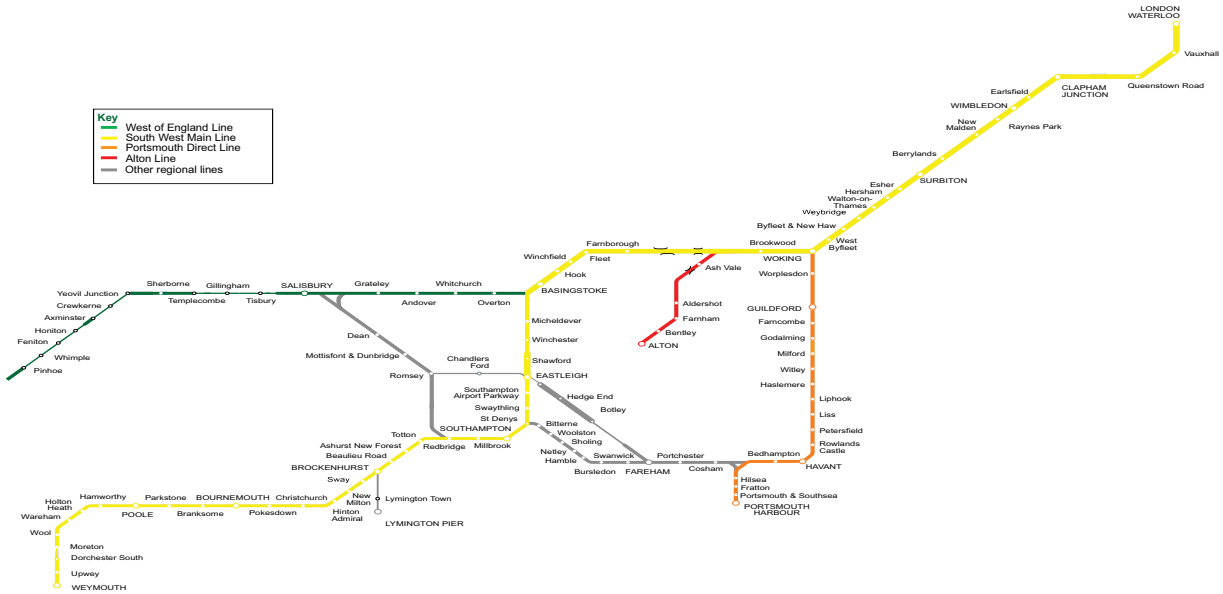
## 5.4 Main Line growth: CO3 and CO6

5.4.1 As stated in **Chapter 4** there are two Conditional Outputs which seek to address the growth expected on the lines used by Main Line services. These are:

- **CO3**: To provide sufficient capacity for passengers travelling into central London during peak hours, taking into account anticipated growth over the period to 2043 – Main Line services
- **CO6**: To provide sufficient capacity for passengers travelling into central London during peak hours, taking into account anticipated growth to the end of CP6 – Main Line services

5.4.2 As with the suburban network, it is impossible to address either one of these conditional outputs without being mindful of the how each one impacts upon the other. It is therefore important

**Figure 5.4 – Map of Main Lines**




that they are consistent with one another and form a coherent strategy for addressing growth on the lines used by Main Line services.

5.4.3 The Fast Line inwards of Woking is already highly congested. This means that increasing the level of service above the 24tph, stated in **Chapter 3** as the baseline, comes with a likely adverse effect on reliability and performance without some major interventions to improve the capability of the infrastructure. Of these 24 trains only 17 are classed as long distance or Main Line services and therefore it is growth on this service group that CO3 and CO6 are addressing. However, the seven Main Suburban services that utilise the Fast Line into London Waterloo have been considered in all analysis as they make use of paths that would otherwise be used for Main Line services.

## Making best use of the baseline infrastructure

5.4.4 Some options have been highlighted that could make use of baseline infrastructure to ease, but not eradicate, some of the current issues with overcrowding on services using the Fast Line into London Waterloo.

5.4.5 The first of these options is to lengthen all remaining high peak Main Line services to the full capability of the infrastructure. There are two high peak services in the Route Study's baseline that are currently operating at a length below the maximum possible within the CP5 capability of the network.

5.4.6 This capability can be defined as broadly 12-car trains for units formed of 20 metre vehicles or 10-car trains for units formed

of 23 metre vehicles. The number of sufficiently long platforms at London Waterloo currently prevents all high peak services from operating at these lengths but this should no longer be a problem following the re-opening of Waterloo International Terminal (WIT).

5.4.7 Lengthening these two services would provide an additional eight passenger vehicle arrivals at London Waterloo in the high peak hour, out of a total requirement of an extra 72 vehicle arrivals by the end of CP6. South West Trains have taken account of this aspiration in their rolling stock procurement strategy for delivery in CP5.

5.4.8 An appraisal was carried out for this option which gave a Benefit Cost Ratio (BCR) of 1.73, see **Appendix A**.

5.4.9 The second of these options is to reconfigure the internal accommodation of Main Line rolling stock to provide further 3+2 seating in Standard accommodation.

5.4.10 The majority of Main Line services are currently formed of Class 450 rolling stock configured with 3+2 seating in standard accommodation. During peak hours this rolling stock typically works shorter distance services for example, services starting from Alton. Class 450 vehicles are also used on some longer distance services including some high peak services starting from Portsmouth Harbour and Southampton Central.

5.4.11 In addition some Main Line services are currently formed of Class 158, 159 and 444 vehicles which are configured with 2+2 seating in standard accommodation. This rolling stock typically works longer distance services for example, from Bournemouth and the West of England Line.

5.4.12 In this scenario, further deployment of 3+2 seating in standard accommodation on Main Line services could provide an additional 750 seats into London Waterloo during the high peak hour. This equates to a capacity increase of approximately four per cent., which is the equivalent of providing approximately 11 extra vehicle arrivals at London Waterloo in the high peak hour out of a total requirement for 72 by the end of CP6.

5.4.13 As previously stated, in **Chapter 2**, 3+2 seating is not considered ideal by many passengers on longer distance services. Anecdotally, some passengers prefer to stand rather than sit in the middle seat of three on busy trains. This means that the capacity provided by implementing this option may not provide all the expected capacity benefit.

5.4.14 If all the additional 72 vehicle arrivals were formed of rolling stock with 2+2 seating, then there would still be a capacity shortfall equivalent to at least one additional peak-hour path.

5.4.15 The third of these options is to increase the level of service on the Fast Line into London Waterloo by operating two additional Main Line services during the high peak hour. This would increase capacity on the Fast Line by 24 passenger vehicles, or ten per cent additional capacity, out of a total requirement of 72 vehicles by the end of CP6.

5.4.16 Increasing the number of Main Line services from 24tph to 26tph makes more intense use of the available network capacity, and this level of utilisation would have a negative impact on the punctuality and reliability of the service unless measures to mitigate against this can be deployed.

5.4.17 Several options have been identified to make use of the additional high peak paths. The following option has been considered, for appraisal purposes (although there are, of course, other permutations which could be considered):

- An additional 1tph from Basingstoke calling at Woking then fast to London Waterloo
- An additional 1tph from Woking calling all stations to Surbiton then fast to London Waterloo, enabling an existing service from Farnham to run non-stop from Woking to London Waterloo

5.4.18 The appraisal for this particular scenario gave a financially positive BCR with positive wider benefits, see **Appendix A**.

5.4.19 More work is currently underway to understand fully whether the trade-off with reliability and performance would be acceptable against the benefit of having these additional services.

### Choices for delivery in CP6: Operational choices

5.4.20 This Route Study has found that there is no one intervention or programme of interventions, consistent with the

overall strategy to 2043, that can be affordably delivered within the CP6 timeframe to address the capacity gap expected on the Main Lines into London Waterloo by 2024.

5.4.21 A number of interventions could build upon those detailed in **Section 5.4.1** to ease, but not fully remove, the capacity gap on Main Line services in CP6.

5.4.22 Connected Driver Advisory System (C-DAS) is a system that allows drivers to operate their vehicle in a more efficient way by identifying those times in the journey when coasting, accelerating or braking are most appropriate. It is currently being developed in line with the Traffic Management System (TMS) to improve reliability and performance. Combined, these systems will enable the additional services needed to meet the 2043 capacity gap to be operated more reliably thus removing some of the inherent detrimental performance impact that running so many additional services would engender.

5.4.23 Some high-level investigation has been carried out as part of this Route Study to assess the impact of homogenising the rolling stock used for Main Line services. As previously noted in this chapter Main Line services are operated using Class 450, 444, 158 and 159 vehicles. This mixture of rolling stock means that there is in turn a mixture of train attributes that does not necessarily allow for the most efficient operation of the network.

5.4.24 Initial timetable modelling suggests that there is potential for some performance and reliability benefits through homogenisation, either through extension of the electric fleet to currently non-electrified routes or through the introduction of higher performing diesel vehicles. It should be noted that extension of the electric fleet would require electrification of the West of England Line between Worting Junction (Basingstoke) and Salisbury, as well as between Salisbury and Southampton via both Redbridge and Eastleigh. This should also be considered in the context of the Electric Spine proposals, see **Paragraph 3.3.34**.

5.4.25 As mentioned in **Section 5.3** some thought has been given to increasing the number of Main Suburban services using the Slow Line into London Waterloo to 20tph in the high peak hour. One method of achieving this could be to redirect two of the seven Main Suburban services that currently use the Fast Line into London Waterloo on to the Slow Line. This would have the additional benefit of freeing up two paths on the Fast Line that could then be utilised for Main Line long distance services. Timetable modelling suggests that this could be feasible.

5.4.26 It is likely that implementing this would require the following:

- Some modification of timings, especially those preceding the trains to be redirected. This would allow the required three minute headway (the timetabled gap between services) to be maintained on the Main Slow Line. More work will be required to understand the impact on other services on the Wessex Route
- Platform availability at London Waterloo may be impacted upon through the movements required in the Waterloo throat as well as the increased usage of Platform 5 to accommodate the additional Main Suburban services using the Main Slow Line
- All services would need to be run at the very minimum values for headways and platform re-occupation times, which would remove some of the timetable robustness and therefore have a detrimental effect on performance. Further work will be required to fully understand the impact of this
- An increase in journey time for users of the redirected services

5.4.27 Implementing this, coupled with the option for an additional 2tph on the Fast Line to give 26tph in the high peak hour could mean the provision of an additional 4tph Main Line long distance services on the Fast Line into London Waterloo. Implementing some of these operational options will give us more confidence that we can operate additional services more reliably although there is still likely to be a trade-off with journey times or performance.

### Choices for delivery in CP6: Double-deck trains

5.4.28 There is one choice that, although not forming part of the longer term route wide capacity solution for this Route Study, could, if implemented, provide some of the required capacity to meet the conditional output for Main Line services in CP6 (CO6). This choice is the introduction of double-deck trains between London Waterloo

and Basingstoke. This is a concept which was previously considered, but not recommended, in various recent reports including the **London and South East Route Utilisation Strategy** and the **Network Route Utilisation Strategy - Passenger Rolling Stock**.

5.4.29 An assessment of the suitability of double-deck rolling stock currently in operation internationally has not been able to identify a vehicle suitable for use in Great Britain, and as a result a new double-deck Electric Multiple Unit (EMU) or preferably an adaptation of an existing design, would be required for operation on the Wessex Route. The Route Study has developed an outline 'concept' double-deck train, comprising three 26 metre vehicle units operating in multiples of three (or alternatively, a fixed formation 9-car unit) with doors situated at the vehicle ends at standard floor height. This concept provides an estimated 50 per cent increase in useable floor area compared to existing Class 444 and Class 450 stock deployed on the route.

5.4.30 In this assessment, double deck services have been considered over a limited geographical area during peak hours only, in order to minimise the investment required to adapt the rail network and depot and stabling facilities. Running double-deck trains in peak hours only, would also limit the risk of running such trains without any available diversionary route.

5.4.31 However, it should be noted that this limited use will require a relatively small fleet of bespoke rolling stock, and the development costs alone are likely to be significant. When amortised over a small fleet, the cost per unit will probably result in the concept of double-deck trains providing a poor value for money solution to the SWML capacity shortfall (regardless of the size of any investment required in the capability of the network infrastructure) with the services not forecast to cover their operational costs. In addition, there are significant concerns about possibly adverse impacts on station dwell times.

5.4.32 The presented option proposes double-deck services operating between London Waterloo and Woking and Basingstoke (excluding the Alton line), with seven existing high peak services into London Waterloo operated by double-deck trains (three originating from each of Basingstoke and Woking, and one from West Byfleet). During off-peak hours of operation when the number of passengers travelling is significantly lower, it is proposed that these trains stand down at Clapham Yard, before working return journeys departing from London Waterloo in the evening peak.

5.4.33 Based upon a capacity uplift of 50 per cent per over a conventional 12-car train, this would provide the equivalent of an extra 42 (single deck) passenger vehicle arrivals at London Waterloo during the high peak hour, an increase of 18 per cent. In combination with some of the options which utilise baseline infrastructure capability (for example, running all high peak Main Line services at their maximum length, and increasing the number of service on the Fast Line to 26tph during the high peak), this option would meet the CP6 capacity gap on Main Line services. However, the potential adverse impact on dwell times, noted above, may actually reduce the number of train paths available.

5.4.34 Network Rail is continuing to undertake development work to understand the scale of network investment required to operate double-deck trains on the SWML to Basingstoke. Initial conclusions, however, indicate that this is likely to be a poor value-for-money solution.

5.4.35 Regardless of the extent of infrastructure required to permit double-deck trains between London Waterloo and Basingstoke, it should be re-iterated that double-deck train operation does not form part of the longer term route wide capacity solution on the Wessex Route. This means that it is a bespoke solution with limited scope, which will always restrict the benefits it can provide.

### Choices for delivery in CP6: Clapham Junction to London Waterloo choices

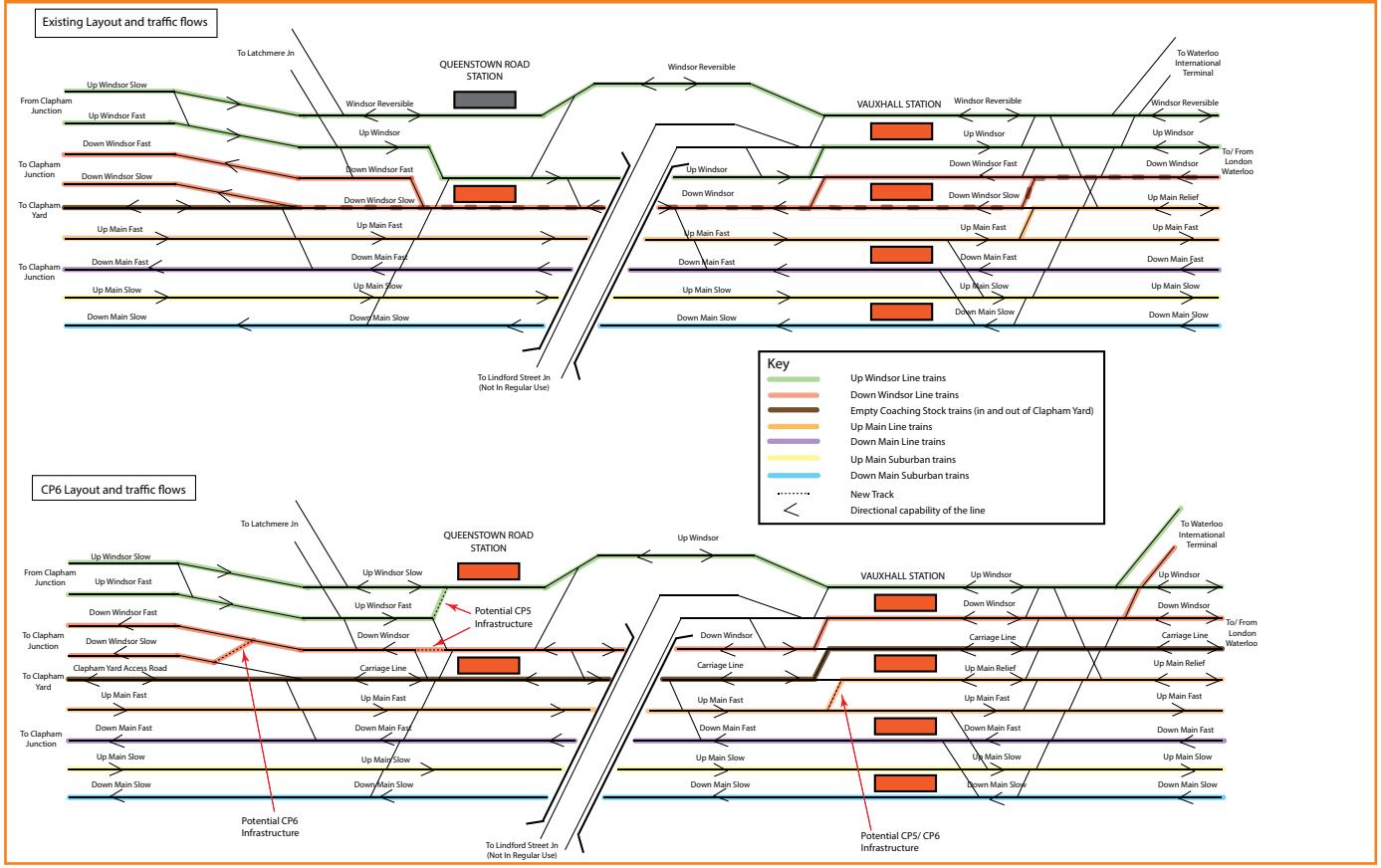
5.4.36 A key constraint to reliably increasing the capacity on the Main Line into London Waterloo is the approaches or throat of the terminus. One method of addressing congestion into London Waterloo is to build upon the work being taken forward as part of the Wessex Capacity Programme at Queenstown Road, (see **Chapter 3**).

5.4.37 This would involve extending the Up Main Relief Line back from West Crossings to approximately Nine Elms Junction so that it

replaces the currently designated Down Windsor Slow Line. The Down Windsor Fast would then become, during peak hours, a dedicated carriage line to allow Empty Coaching Stock (ECS) to access Clapham Yard without conflicting with passenger service movements.

5.4.38 The Windsor Lines would then essentially be a two track railway with the Windsor Reversible becoming the Up Windsor Line and the current Up Windsor Line becoming a reversible line for Down direction services. Segregating the traffic flows in this way allows for more efficient operation of Main Line services into and out of London Waterloo.

**Figure 5.5 – Line reconfiguration between London Waterloo and Clapham Junction**



## Choices for delivery in CP6: Woking choices

5.4.39 There are choices that form incremental steps towards the realisation of the capacity gap to 2043 that could be delivered in CP6. These choices can be more efficiently delivered in CP6 and/ or provide other benefits to other services.

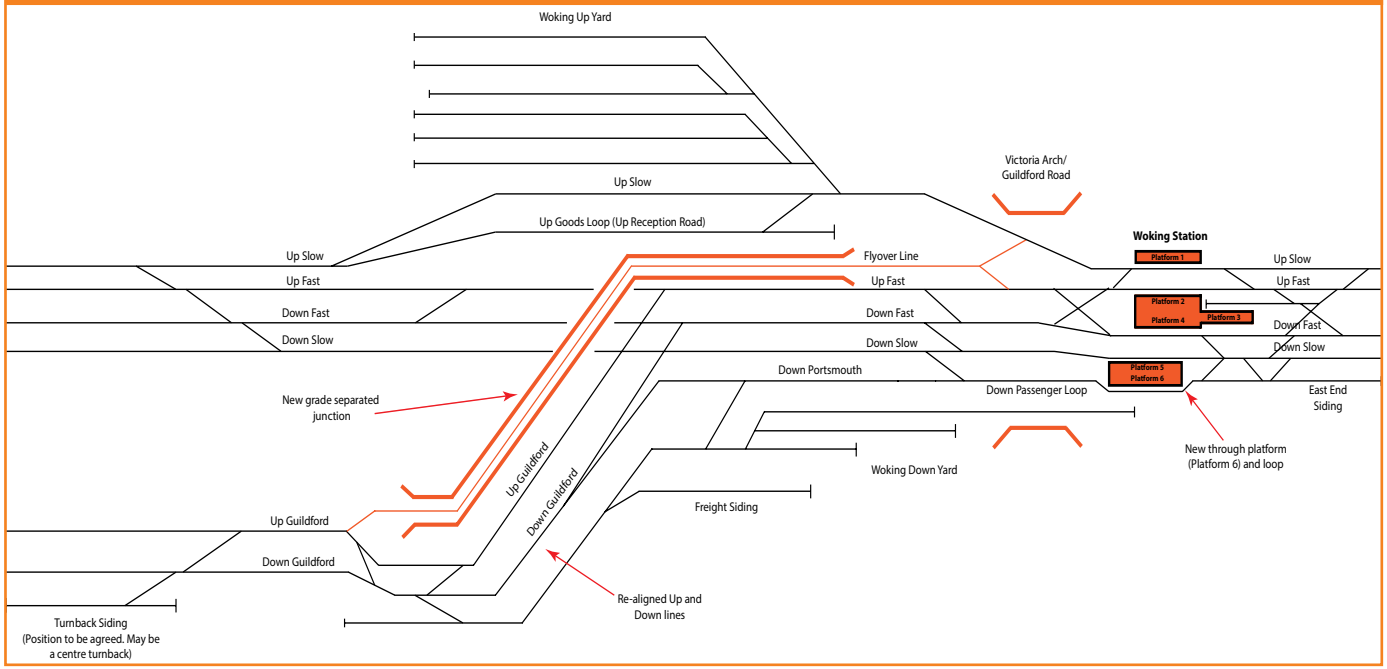
5.4.40 Some of the options discussed so far seek to provide additional services to ease the CP6 capacity gap, within the baseline capability of the network, but have a detrimental impact on performance and reliability of service.

5.4.41 Woking Junction is the point at which the SWML and the Portsmouth Direct Line converge. It is a critical constraint to the operation of enough services to meet the capacity gap to 2043 as well as the efficient operation of potential CP6 services detailed already in this chapter. Removing the constraint at Woking Junction would require grade-separation through the installation of a flyover, whereby the Up Guildford Line would be lifted up and over the SWML before connecting to both the Up Slow and Up Fast Lines just to the west of Woking.

5.4.42 This scheme would also provide a turnback on the line to Guildford to permit a grade-separated turnround facility for London Waterloo trains that terminate at Woking. This would have a beneficial impact on Main Line capacity and performance. It should be noted that any potential scheme at Guildford to increase terminating capacity at that station could also provide this function whilst improving connectivity at Guildford, as described later in this chapter.

5.4.43 Grade-separation of Woking Junction would enable up to 32tph to be timetabled through Woking Station in the high peak

**Figure 5.6 – Plan of Woking Flyover and new Platform 6**



hour towards London in combination with an "inner" solution. This means that as a stand-alone piece of infrastructure Woking grade-separation will not of itself provide any additional capacity. It will, however, improve reliability and performance for the baseline level of Main Line service.

5.4.44 Initial development work which is being carried out through the Wessex Capacity Programme in CP5 for delivery in CP6 (see **Chapter 3**), suggests that the capital cost of Woking Junction grade-separation is in the range £50 million to £100 million (Anticipated Final Cost based on 2014 prices).

5.4.45 This option reduces the net operating cost of the rail industry due to the revenue generated exceeding the option's operating costs. From a socio-economic perspective, this option provides 'very high' value for money (in other words, a Benefit Cost Ratio in excess of 4.0). **Appendix A** provides more details.

5.4.46 To stop additional services at Woking will require additional platform capacity to allow for three Up direction platforms to be in use during the morning peak period. To provide this extra capacity this Route Study suggests the construction of an additional platform (Platform 6). The scheme will involve the extension of the current Platform 6, which is a bay platform and not used for passenger services, so that it is a through platform. This enables a larger number of high peak services to call at Woking and for them to be operated more reliably.

5.4.47 It is proposed that this scheme is further developed in CP5 to enable it to be delivered at the same time as the flyover scheme.

5.4.48 Both Woking schemes can be more efficiently delivered together in CP6 particularly in light of the required renewal works on Victoria Arch Bridge, also in CP6. Packaging a number of similarly located schemes into one programme allows for cost efficiencies as well as reducing the need for extensive and prolonged disruption to services.

### Choices for delivery in CP6: Basingstoke grade-separation

5.4.49 Basingstoke Junction, which allows freight and Cross Country services to connect from the SWML to the line to Reading, is another key constraint to increasing the level of service to meet conditional outputs CO3 and CO6, as well as CO35 and CO36 for cross-boundary and freight (see **Paragraphs 5.7.43** and **5.7.85**).

5.4.50 Grade-separating Basingstoke Junction would allow southbound Cross Country and freight services to cross the junction and arrive in Platform 1 at Basingstoke without holding up services using the SWML to/ from London Waterloo.

5.4.51 It is noted in **Chapter 4** that by 2043 there is a requirement for 156 additional vehicles in the high peak hour on Main Line passenger services into London Waterloo, based on 12-car Class 450 trains. To address overcrowding on high peak passenger services some of these additional vehicles (4-5tph) will need to form services originating from south or west of Basingstoke in CP7 or beyond.

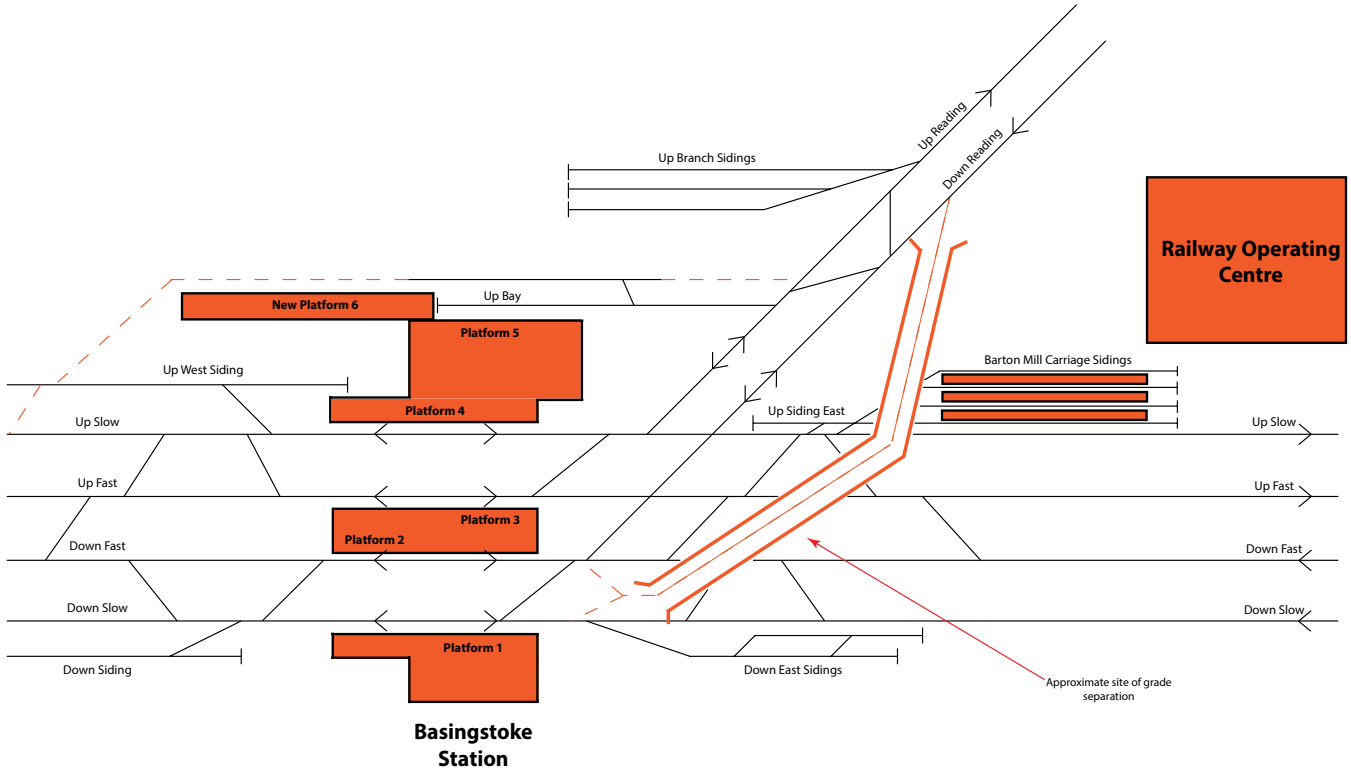
5.4.52 Because freight services do not typically operate in the peak direction between Southampton and Basingstoke it is assumed that the additional services could be accommodated in this area without any other interventions to increase track capacity. However, high peak services to meet conditional output CO3 (Main Line capacity to 2043) would require grade-separation of Basingstoke Junction.

5.4.53 On its own grade separation of Basingstoke Junction does not facilitate enough capacity to meet the 2043 requirement on the SWML or on the Basingstoke to Reading line. It is, however, an early step towards providing greater Main Line capacity in CP7 or beyond in combination with one or more "inner" solutions.

5.4.54 The key driver for seeking to deliver Basingstoke grade-separation in CP6 is not related to passenger growth as this is not required to meet conditional output CO6 (Main Line capacity to end CP6). Instead it is that an additional freight path between Reading and Basingstoke in the south direction can be delivered through grade separating the junction and therefore meeting the conditional output for freight growth.

5.4.55 As was previously stated in **Chapter 4** there is an anticipated increase in freight growth expected to 2043 both in terms of Class 4 intermodal traffic and Class 6 aggregates traffic. The majority of this traffic will use the route from Southampton

**Figure 5.7 – Plan of potential Basingstoke layout**




Docks to Reading and beyond via Basingstoke (in both directions). In CP6 this translates to a third freight path between Southampton Docks and the Midlands/North, operating via Laverstock Junction and Andover owing to capacity constraints on the more direct route via Winchester.

5.4.56 A number of grade-separation options have been developed as part of this Route Study providing varying degrees of operational flexibility. These range from a simple bi-directional flyover to a double-track flyover with a spur to enable trains terminating in Platform 1 to turnback to London Waterloo without conflicting with trains on the Fast Lines. More detailed information on these options can be found in **Appendix B**.

5.4.57 Initial development work suggests that the capital cost of grade-separation at Basingstoke Junction, without the potential operational flexibility add-ons, is in the range of £75 million and £175 million (Anticipated Final Cost based on 2014 prices) dependent on which option is implemented.

5.4.58 As the key driver for this solution in CP6 is the provision of an additional freight path between Southampton Docks and the Midlands (and beyond) there is likely to be a requirement to invest in

the capability of the network across a number of Network Rail's routes. As a result, the value for money case for grade-separation of Basingstoke Junction has not been completed at this time but will follow further work to understand the network wide timetable and infrastructure issues.

5.4.59 It should be noted that grade-separation at Basingstoke and other planned interventions across the network, such as the introduction of Crossrail and IEP rolling stock, provide the industry with an opportunity to re-assess Cross Country and freight services and the way they are timetabled across the national network.

### Choices for delivery in CP6: Guildford platform capacity

5.4.60 Guildford Station is located on the Main Line between Portsmouth and London Waterloo. It has eight platform faces, although only seven can be utilised. It acts as the junction between Main Line services from Portsmouth, North Downs Line services between Reading and Gatwick Airport, Windsor Line services to Ascot and Main Suburban services using the 'Guildford New Line' via Effingham Junction to London Waterloo.

5.4.61 It is noted in **Chapter 4** that by 2043 there is a requirement for 156 additional vehicles in the high peak hour on Main Line passenger services into London Waterloo, based on 12-car Class 450 train operation. To address overcrowding on passenger services on the line between Woking and Portsmouth Harbour some of these additional vehicles will need to form services through Guildford in CP7 or beyond. In addition to the Main Line challenge, off-peak connectivity conditional outputs on the North Downs Line, 'Guildford New Line' and potential southern access to Heathrow Airport services (being developed separately by the Network Rail Airport Study) will all contribute to the need for increased platform capacity at Guildford Station.

5.4.62 Increased platform capacity is not required to run the level of service required in CP6 on the Main Line south of Guildford but it can be seen as an early step towards providing greater Main Line capacity in CP7 or beyond once one of the "inner" solutions has been implemented, such as Crossrail 2, or the implementation of ETCS. Equally this could mean that delivery of a solution at Guildford could be postponed until CP7 due to funding and efficiency considerations. If delivered in CP6 it will allow for the provision, at a later date, of additional services to meet demand growth into London Waterloo from the Guildford, Haslemere and Portsmouth areas. It should also be noted that the layout at Guildford would allow for improved regulation of services and provide overtaking opportunities to manage the mix of fast and stopping services that operate on all routes through Guildford.

5.4.63 There are several drivers for delivery of an intervention at Guildford Station in CP6 including the proposed re-control of signalling into the Basingstoke ROC, as part of the Network Operating Strategy (NOS), see **Chapter 2**, and the potential upgrade of the signalling interlocking. Renewal schemes can provide the opportunity for more efficient delivery of capacity enhancement schemes. More investigation is required to understand the efficiencies that could be made.

5.4.64 Current proposals for a redeveloped station in CP5, through a scheme taken forward by Solum, are being reviewed against these proposals to consider how the schemes could be best aligned. Guildford Borough Council is also considering improvements around the station area which may dovetail with works suggested in this Route Study.

5.4.65 Some preliminary investigation has been carried out through this Route Study to look at what track and platform layout would meet the most conditional outputs and therefore provide the most benefit. These include the addition of platforms on the west side of the station and an additional platform on the east side, providing a new Platform 0.

5.4.66 As part of the process for securing funding for all the aforementioned schemes in CP6 further development work is progressing to build upon the work already carried out during the **Long Term Planning Process** (LTPP).

### Choices for delivery in CP7 or beyond

5.4.67 As previously noted there is a requirement by 2043 for 13 (10-11 Main Line and 2-3 Outer Suburban) additional paths in the high peak hour on Main Line passenger services into London

Waterloo, based on the capacity offered by 12-car Class 450 trains with 3+2 seating. This would rise to 16 paths if it were based on the capacity offered by Class 444 trains with 2+2 seating. The interventions proposed for CP6 will provide the incremental building blocks towards meeting this additional capacity.

5.4.68 The interventions described in this section of the Route Study seek to remove the remaining constraints to delivering these 156 additional vehicles. It should be noted that none of these interventions on its own is capable of meeting the full capacity gap. A combination of all or some of the interventions will be required to bridge the whole gap.

5.4.69 It should also be noted that some further consideration will be required to understand the impact of these choices on the evening peak. The analysis has shown that there will be conflicts between trains leaving Clapham Yard and those leaving London Waterloo for which either an infrastructure intervention between Clapham Junction and London Waterloo will be required, or there will be a constraint on the number of Down evening peak services which can be operated.

## Choices for delivery in CP7 or beyond: Crossrail 2

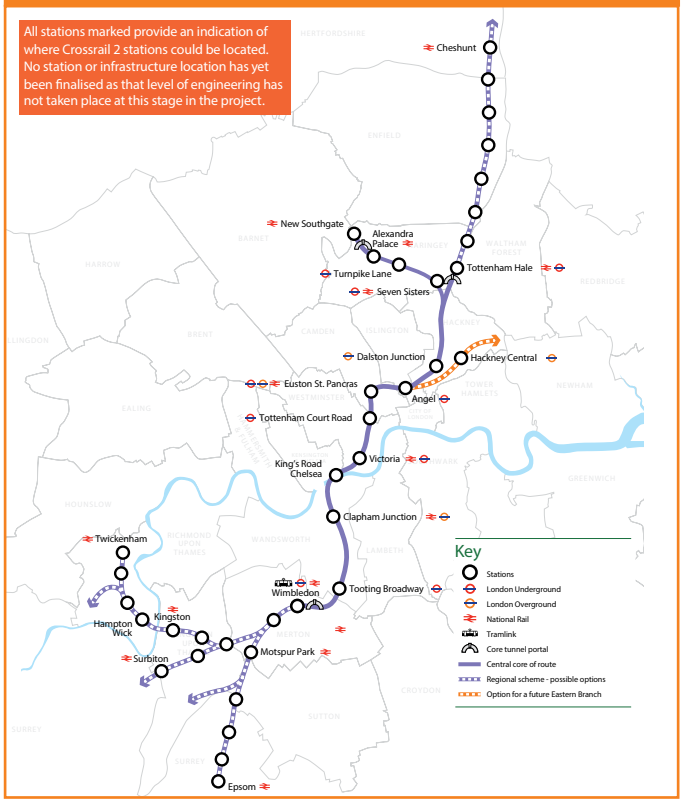
5.4.70 In **Section 5.3** Crossrail 2 was identified as a choice for the provision of additional capacity on Main Suburban services. Crossrail 2 is also a provider of Main Line capacity and is one of the choices for the "inner" solution required to meet the 2043 capacity gap.

5.4.71 The Crossrail 2 infrastructure proposals to support the new cross-London service include a tunnel portal in the Wimbledon area connecting to the central tunnel section and a six track layout between New Malden and Wimbledon.

5.4.72 The proposal has been assessed and would allow for the following re-ordering of services between the tunnel section, fast and slow lines:

- The proposed six track formation between New Malden and Wimbledon would allow most Crossrail 2 services to be segregated from Main Suburban services between these points
- Inwards of Wimbledon a large proportion of existing Slow Line services would become Crossrail 2 services and therefore be routed into the central tunnel section at Wimbledon. This would free up capacity on the Slow Lines inwards of Wimbledon and platform capacity at London Waterloo
- The capacity released on the Slow Line and at London Waterloo can then be used by the six to seven trains per hour which currently join the Fast Line inwards of Surbiton. If these were to remain as 10-car outer suburban services then no platform works would be required but if they were to be 12-car services then platform extension works may be required

**Figure 5.8 Proposed Crossrail 2 route**



5.4.73 Seven pathways are released on the Fast Line by changes to the service enabled by Crossrail 2 as described previously. These can be used to achieve a total of between 32 and 36 Main Line services per hour (28 Main Line and 8 Outer Suburban). This is potentially 1tph less than the required 37tph in the high peak hour, based on 12-car Class 450 rolling stock. An assessment of how 37tph could be achieved through combining some of the "inner" solutions is included later in this section.

### Choices for delivery in CP7 or beyond: 5th track between Surbiton and Clapham Junction

5.4.74 An alternative choice for removing the "inner" constraints to an increase in Main Line services is the installation of a fifth track between Surbiton and Clapham Junction.

5.4.75 Five-tracking is related to Option F5 from the **London & South East Route Utilisation Strategy** (RUS), published in 2011. The RUS considered a new track from Hampton Court Junction through to London Waterloo providing additional capacity for Main Line services. The 5th track option has therefore been looked at through this Route Study and previous work for the RUS has been revisited.

5.4.76 Given committed and funded investment between London Waterloo and Clapham Junction in CP5 / 6, the Route Study has concluded that full five tracking between Clapham Junction and Waterloo is not required. Further infrastructure work will be required above current investment inwards of Clapham Junction to achieve up to 36 trains per hour. Initial assessments have shown that this would include additional switches and crossings in the Vauxhall area.

5.4.77 The infrastructure development work has identified opportunities where the existing infrastructure can be utilised to reduce the amount of continuous new track which would be required through this option.

5.4.78 The additional track would allow for between 30 and 34 Main Line services between Surbiton and Clapham Junction. This is achieved by routeing up to 22 services per hour on the existing Up Fast Line and up to 12 services per hour on the new fifth track section in the morning peak. This is potentially 3tph less than the required 37tph in the high peak hour, based on 12-car Class 450 rolling stock. An assessment of how 37tph could be achieved through combining some of the "inner" solutions is included later in this section.

### Choices for delivery in CP7 or beyond: Introduction of ETCS Level 2 or 3 with ATO

5.4.79 The Digital Railway Programme is being developed by Network Rail and industry partners. The programme is seeking to accelerate the roll out of new technology on the network nationally.

5.4.80 One area which has been assessed through the Route Study is the opportunity to achieve improvements in technical signalling capability to support an increase in train services on the Fast Line into London Waterloo to achieve the capacity conditional output to 2043 (CO3).

5.4.81 The capability of the current conventional signalling between Surbiton and Waterloo on the Fast Line is such that successive trains must be two minutes apart (the planning headway). This two minute gap between services therefore limits the theoretical capacity of the Fast Line to 28tph. To be able to increase the service above this, without any other "inner" interventions, would require the capability of the signalling to be such that successive trains could be 1½ minutes apart or lower.

5.4.82 Initial modelling work has been carried out to assess two levels of a system called the European Train Control System which offers a more efficient means of signalling trains. The two levels assessed are:

- ETCS Level 2 provides a 'fixed block' system of train detection whereby one train remains a set distance away from the train in front. This is done 'in-cab' without the need for signalling infrastructure on the trackside
- ETCS Level 3 provides a 'moving block' system of train detection whereby one train is safely able to move closer to the train in front dependent on their individual speeds and locations. This is also done 'in-cab' without the need for lineside signalling


infrastructure on the trackside. Because 'moving block' allows trains to run closer together, while maintaining required safety margins, it can therefore increase a line's overall capacity

5.4.83 The study assessed both these levels with and without Automatic Train Operation (ATO). ATO is the means by which train operation will be largely automated. It is suggested that the addition of this technology alongside ETCS would further release capacity on the SWML.

5.4.84 The findings suggest that implementation of ETCS Level 3 in conjunction with ATO inwards of Woking could enable between 30 and 34 trains per hour to be accommodated on the existing Up Fast Line.

5.4.85 To achieve 34 trains per hour would require services to operate as follows:

- Up to 22tph would be routed via the Up Main Fast line into the existing Main Line Platforms 7 –15 at London Waterloo. This is the maximum number of trains that can enter the station and leave via the Down Main Fast due to the station throat layout
- Up to 12tph would be routed via the Up Main Relief line into Platforms 16 and upwards.

5.4.86 These services would use platform capacity at London Waterloo vacated by Windsor Line services having mostly transferred into Waterloo International Terminal (WIT). These Main Line trains would then depart empty from London Waterloo via either the Down Windsor Slow Line or the Down Windsor Fast Line (depending on how far back towards Clapham Junction the Up Main Relief is extended) to a suitable stabling location, such as Clapham Yard or Wimbledon

5.4.87 It should be noted that this would use all available capacity and therefore may have an impact on performance. Investment would be required at Waterloo Station to provide sufficient passenger circulation capacity at the station.

5.4.88 As the Digital Railway programme develops, further work will be required on feasibility, costs and outputs to prioritise rollout of ETCS across the network. An assessment of how 37tph could be achieved through combining some of the "inner" solutions is included later in this section.

5.4.89 To meet an aspiration to stop Main Line services at Clapham Junction in the peak would require the Up Main Relief to be extended further into a relocated Platform 7 at Clapham Junction. It is important to note that if Crossrail 2 were to be taken forward stopping Main Line services at Clapham Junction would be highly desirable for interchange with Crossrail 2.

### Choices for delivery in CP7 or beyond: 'Inner' solution combinations

5.4.90 None of the 'inner' solutions to the capacity problem inwards of Woking can on its own facilitate the running of 37tph, based on 12-car Class 450 rolling stock. This Route Study has assessed combinations of these 'inner' solutions to understand more clearly what they could theoretically provide in terms of additional paths into London Waterloo to meet the capacity gap to 2043.

**Table 5.1 Theoretical maximum capacities achievable inwards of Woking**

| | 5th Track Option | Crossrail 2 | ETCS Level 3 & ATO |
|---|---|---|---|
| 5th Track Option | 34tph | 42tph | 34tph |
| Crossrail 2 | 42tph | 36tph | 42tph |
| ETCS Level 3 & ATO | 34tph | 42tph | 34tph |

5.4.91 It can be seen in **Table 5.1** that combining some of the "inner" options for Main Line capacity can theoretically enable 42tph in the high peak hour. It is important to bear in mind that this is only theoretical at this stage and more analysis would be required if any of the combinations were to be progressed.

5.4.92 The first combination is the 5th track option and Crossrail 2. As detailed in **Section 5.3** there will be a reduction in Main Suburban services using the Up Main Slow Line inwards of Wimbledon to 8tph, these being the residual London Waterloo services. The capacity that is released could then be utilised for up

to 8tph fast or semi-fast services that currently join the Fast Line inwards of Hampton Court Junction.

5.4.93 Inwards of Wimbledon the following services could be operated:

- 12tph via the 5th track (constrained by the capability of Clapham Yard)
- 22tph via the Up Main Fast (constrained by London Waterloo throat)
- 8tph via the Up Main Slow (constrained by the stopping pattern of the residual Main Suburban services and the capacity of Waterloo Platforms 1-6)

5.4.94 Outwards of Wimbledon there are some important considerations about how this level of service might operate on the available infrastructure:

- Careful design of the track layout between Hampton Court Junction and Wimbledon to provide adequate segregation between Main Line services, residual Main Suburban services and Crossrail 2 services
- The frequency of services on the Walton-on-Thames corridor would need careful consideration as initial analysis implies that all services would need to stop at all stations on this corridor to allow for the number of services required
- If services currently originating from Effingham Junction or Epsom were started back from Guildford then more terminating capacity could be required, for instance a new bay Platform 0
- Additional through platform capacity at Woking; this is already being assessed as a CP6 choice
- Starting any of these services outwards of Woking could require improved turnback facilities in the Basingstoke/ Guildford/ Aldershot/ Farnham area

5.4.95 These considerations suggest that there are potentially trade-offs between current journey times and the requirement to increase the level of service up to 42tph beyond 2043.

5.4.96 The other combination of schemes that would theoretically provide 42tph is through combining Crossrail 2 with ETCS.

5.4.97 Implementing ETCS would remove the constraint on the Up Main Fast Line that could mean 34tph operating on the line. At London Waterloo this would be split across the available platforms in the following way:

- 22tph using Platforms 7-15 (constrained by London Waterloo throat)
- 12tph using Platforms 16-19 (constrained by the capability of Clapham Yard)

5.4.98 Services would then use the Up Main Fast Line and Up Main Relief Line to access the appropriate platform. This means that combining these options together will provide an 'inner' area capacity of 42tph, comprising:

- 34tph via the Up Main Fast Line; made possible by ETCS Level 3 in combination with ATO
- 8tph via the Up Main Slow Line; made possible by the capacity released by Crossrail 2 services inwards of Wimbledon

5.4.99 As with the previous option, outwards of Wimbledon there are some important considerations that need to be made when considering how this level of service might operate on the available infrastructure:

- The frequency of services on the Walton-on-Thames corridor would need careful consideration as initial analysis implies that all services would need to stop at all stations on this corridor to allow for the number of services required
- If services currently originating from Effingham Junction or Epsom were started back from Guildford then more terminating capacity could be required, for instance a new bay Platform 0
- Additional through platform capacity at Woking; this is already being assessed as a CP6 choice
- Starting any of these services outwards of Woking could require improved turnback facilities in the Basingstoke/ Guildford/ Aldershot/ Farnham area

5.4.100 These considerations suggest that there are potentially trade-offs between current journey times and the requirement to increase the level of service up to 42tph beyond 2043.

5.4.101 As for each of the 'inner' schemes individually some further consideration will be required to understand the impact of these choices on the evening peak. It is suggested that there will be conflicts between trains leaving Clapham Yard and those leaving London Waterloo for which either an infrastructure intervention between Clapham Junction and London Waterloo will be required, or there will be a constraint on the number of Down evening peak services which can be operated.

5.4.102 It should be noted that not only do both these combinations increase journey times as a trade-off with an increased level of service but also performance and reliability must be considered.

5.4.103 The third potential option, a combination of 5th track and ETCS has not been examined in detail. This is because ETCS is assumed to provide an alternative to constructing new infrastructure. In effect, therefore, ETCS is being appraised against the cost of a 5th track.

### Choices for delivery in CP7 or beyond: Southampton Central Station

5.4.104 Southampton Central station is located on the SWML. The station has five platforms, although Platform 5, which is a west-facing bay on the downside of the station, is not currently configured for passenger services.

5.4.105 Additional platform capacity is required at Southampton Central to accommodate the future train service specification required to meet the 2043 capacity gap (C03). By 2043 it is suggested that an additional five to six passenger services per hour may be required to serve Southampton Central. This in combination with predicted freight growth, particularly in respect of intermodal container traffic from Southampton Docks, is expected to put additional pressure on the capability of the infrastructure.

5.4.106 In addition it is possible that increased services will be required to Poole, Bournemouth, Bristol, Portsmouth, Brighton and Reading (and beyond) to improve connectivity.

5.4.107 An option has been developed providing two new island platforms in each direction, which will allow trains to arrive/ depart the station using the minimum time between services (the headway) that can be afforded by the existing signalling system. Central platforms will then be used to accommodate additional services that are expected to terminate at Southampton Central.

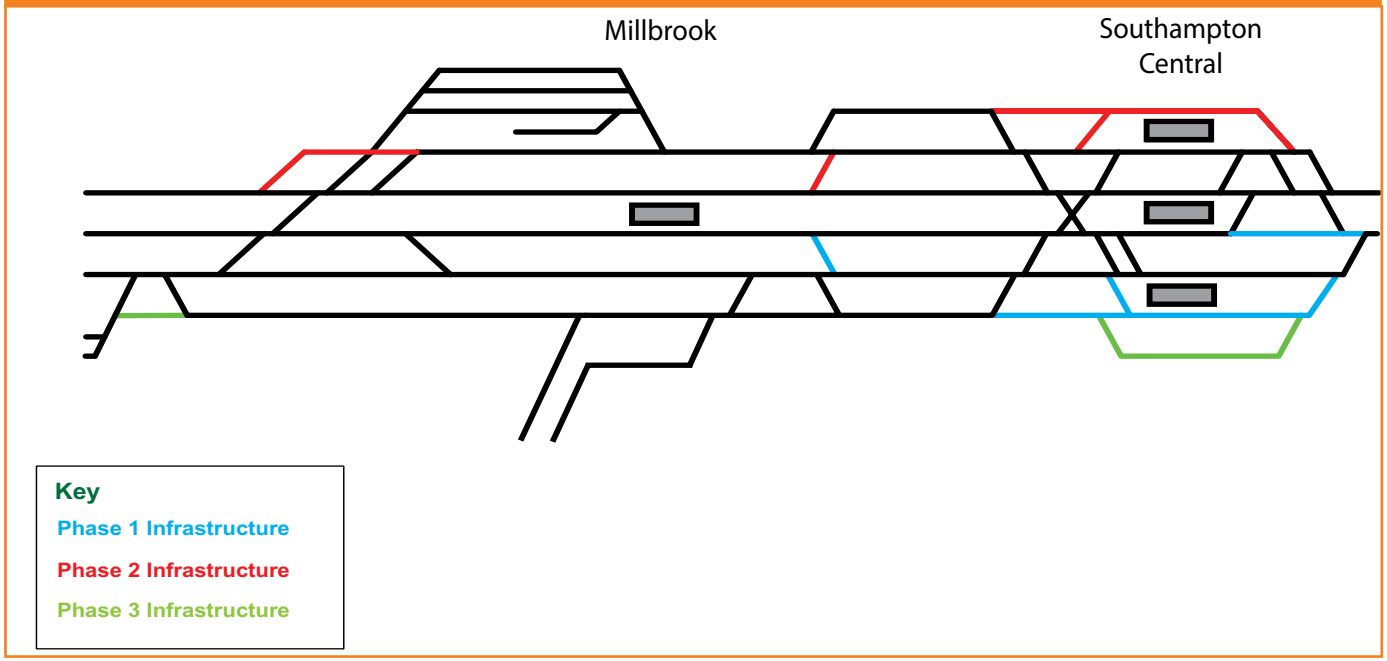
5.4.108 Feasibility work carried out as part of this Route Study has shown that increased platform capacity could be delivered in three phases:

- Phase One - the bay Platform 5 would be extended to provide a Down island platform
- Phase Two - a new Platform 0 on the Up side of the station to provide an Up island platform
- Phase Three - an additional through line on the Down side of the station to provide capacity for freight services to by-pass Platforms 4 and 5 that may be occupied by passenger trains

5.4.109 The work would require both station buildings to be rebuilt with new road transport connectivity (drop off and taxi ranks). The proposals support these changes and can conceivably be developed alongside Southampton City Council's development aspirations for the area that support onward travel from the station. The industry would be willing to explore developing options with the relevant stakeholders.

5.4.110 The full outputs of the additional capacity at Southampton are not required until Main Line capacity is increased above 28 trains per hour and freight growth from Southampton Docks increases.

Figure 5.9 Proposed Southampton Central layout




## 5.5 Suburban Connectivity: CO7 to CO23

5.5.1 There are several options that could be implemented to improve connectivity on both the Windsor and Main Suburban Lines to meet the Conditional Outputs included in **Table 5.2**. These conditional outputs facilitate the provision of 3 to 4tph from specific stations that are within 30 miles of central London.

5.5.2 The franchise specification process will determine which connectivity Conditional Outputs (or which combination of Conditional Outputs) provide best value within the end of CP5 capability of the network, and whether or not an improved level of off-peak connectivity is value for money and affordable to funders. In practice, these decisions will also be influenced by the level of capacity provided during peak hours, which typically defines the amount of resources which are available to be deployed during off-peak hours. The performance and reliability of services operating at this enhanced level of trains per hour will be an important consideration when deciding which, if any, connectivity conditional outputs can be accommodated and funded.

### Suburban Connectivity: Windsor Lines

5.5.3 On the Windsor Line network, the existing off-peak service provides a total of 12tph into London Waterloo. In addition to these services there are freight services which utilise paths via Hounslow as far as Old Kew Junction during off-peak hours.

| Table 5.2 Conditional Outputs | |
|---|---|
| Conditional Output reference | Description |
| Conditional Output: To provide a minimum of 3 or 4tph for stations within 30 miles of central London, from… | |
| CO7 | Ashford |
| CO8 | Chertsey and Addlestone |
| CO9 | Chessington South, Chessington North, Tolworth and Malden Manor |
| CO10 | Strawberry Hill |
| CO11 | Fulwell, Hampton, Sunbury, Upper Halliford and Shepperton |
| CO12 | Sunningdale and Ascot |
| CO13 | Wraysbury, Sunnymeads, Datchet, and Windsor & Eton Riverside |
| CO14 | Thames Ditton and Hampton Court |
| CO15 | Berrylands |
| CO16 | Hinchley Wood, Claygate, Oxshott, and Cobham & Stoke D'Abernon |
| CO17 | Effingham Junction |
| CO18 | Horsley, Clandon, and London Road Guildford |
| CO19 | Bookham |
| CO20 | Boxhill & Westhumble |
| CO21 | Worplesdon |
| CO22 | Byfleet & New Haw |
| CO23 | Esher and Hersham |

5.5.4 As stated in **Chapter 3** the Windsor Line network will potentially be able to support a maximum of 20tph into London Waterloo during a typical off-peak hour, based on the infrastructure capability of the network at the end of CP5. This mirrors the capability assumed at the end of CP5 for peak services into London Waterloo. Two paths, both via Hounslow, are required for freight services, leaving a maximum of six extra paths which could be used to improve off-peak connectivity (although operating up to 18tph into London Waterloo on an all-day basis is likely to have a negative impact upon the punctuality and reliability of the service).

5.5.5 The six additional network paths are not, however, sufficient to meet all of the relevant conditional outputs listed in **Table 5.2**, and as a result choices must be made between them. **Table 5.3** illustrates an example of an off-peak service specification to make best use of the Windsor Line network during off-peak hours, and in doing so illustrates a number of the choices available.

5.5.6 This example service specification improves the level of connectivity to central London from a number of stations.

- Putney: 14tph to London Waterloo (+4tph relative to the current level of service)
- Brentford and Hounslow: 6tph to London Waterloo (+2tph). The additional two services also offer a 7 minute journey time improvement to London Waterloo
- Richmond and Twickenham: 12tph to London Waterloo (+4tph)
- Whitton: 6tph to London Waterloo (+2tph). The average journey time to London Waterloo across all off-peak services from this station will also improve owing to a greater proportion of fast services
- Feltham and Staines: 10tph to London Waterloo (+6tph). The average journey time to London Waterloo will improve owing to a greater proportion of fast services
- Ashford: 4tph to London Waterloo (+2tph)
- Wraysbury, Sunnymeads, Datchet, Windsor & Eton Riverside: 4tph to London Waterloo (+2tph)
- Egham and Virginia Water: 6tph to London Waterloo (+2tph)
- Sunningdale: 4tph to London Waterloo (+2tph), and the fastest services will be approximately 2 minutes faster than now
- Ascot: 6tph to London Waterloo (+4tph), and the fastest services will be approximately 4 minutes faster than now
- Bagshot, Camberley and Frimley: 2tph to London Waterloo

(+2tph), through the introduction of a new direct service

- Bracknell, Wokingham and Reading: 4tph to London Waterloo (+2tph), with an overall improvement in average journey time
- Queenstown Road: 8tph to London Waterloo (as per today)

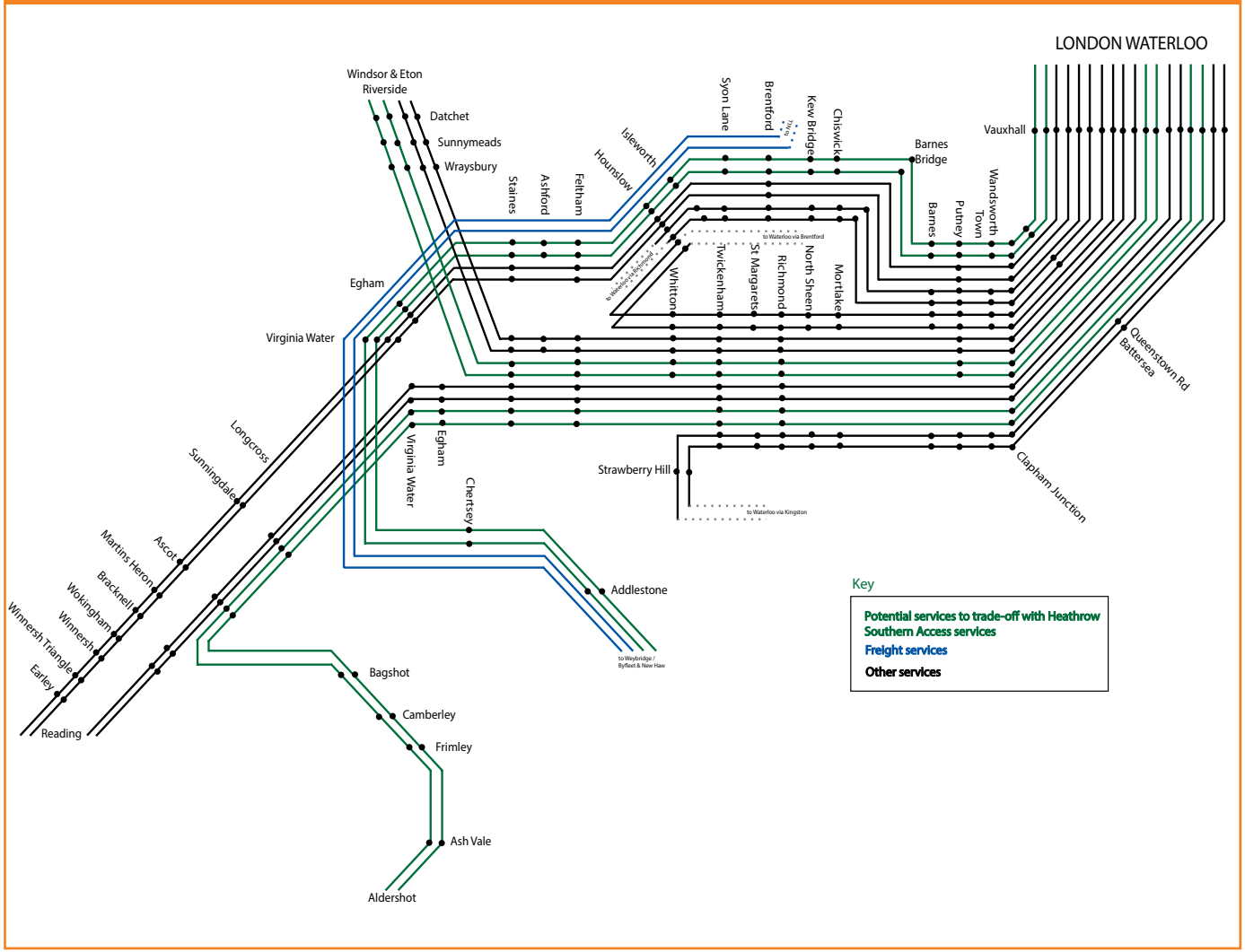
5.5.7 The trade-off with these proposed changes to the service specification is that in some cases there will be a reduction in the level of connectivity on some small non-London flows, for example between Winnersh and Twickenham.

5.5.8 To implement all Windsor Line connectivity conditional outputs to 2043 would require a service level of four trains per hour to Windsor Line destinations. To achieve this level of service frequency the total number of trains on the Windsor Lines would need to increase above 20tph. The baseline infrastructure

**Table 5.3 Example off-peak train service specification to meet a number of connectivity conditional outputs within the end-CP5 capability of the Windsor Line network**

| Proposed use of Windsor Line paths | Proposed stopping pattern |
|---|---|
| 4 stopping services via Richmond | 2tph all stations to the Kingston Loop<br><br>2tph all stations to the Hounslow Loop |
| 4 semi-fast services via Richmond | 2tph to Windsor & Eton Riverside (calling at Vauxhall, Clapham Junction, Putney, Richmond, Twickenham, Whitton, Feltham, Ashford, Staines then all stations to Windsor & Eton Riverside)<br><br>2tph to Windsor & Eton Riverside (calling at Vauxhall, Clapham Junction, Putney, Richmond, Twickenham, Whitton, Feltham, Staines then all stations to Windsor & Eton Riverside) |
| 4 fast services via Richmond | 2tph to Reading (only calling at Vauxhall, Clapham Junction, Richmond, Twickenham, Feltham, Staines, Egham, Virginia Water, Sunningdale, Ascot, Bracknell, Wokingham and Reading)<br><br>2tph to Aldershot (only calling at Vauxhall, Clapham Junction, Richmond, Twickenham, Feltham, Staines, Egham, Virginia Water, Sunningdale, Ascot, then all stations to Aldershot) |
| 4 stopping services via Hounslow | 2tph all stations to Weybridge<br><br>2tph all stations to London Waterloo via Richmond |
| 2 semi-fast services via Hounslow | 2tph to Reading (calling at Vauxhall, Clapham Junction, Putney, Brentford, Hounslow, Feltham, Staines, Egham, Virginia Water, Sunningdale, Ascot, Martins Heron and all stations to Reading) |
| 2 freight services via Hounslow | |
| To note: If Southern Rail Access to Heathrow is developed there is potential for some of the paths mentioned above to be altered to serve Heathrow. | |

**Figure 5.10 Proposed off-peak train spec for Windsor Line connectivity**



capability cannot support this and therefore a number of interventions would be required.

5.5.9 These interventions could include the following:

- ETCS
- Further additional track capacity through Queenstown Road above that provided in CP5 – this may be provided by the proposed works stated in **Section 5.4** as a Main Line intervention
- Additional track capacity via Richmond and/or via Hounslow
- Resolution of level crossing down-time issues particularly on the routes via Richmond and Hounslow but also across the whole Windsor Line network
- Potential grade-separation at Barnes Junction to segregate the Hounslow and Richmond flows
- The possibility of additional platform capacity at London Waterloo – more work is required to understand at what point between 20tph and 24tph, or above, London Waterloo would be unable to cope
- Capacity through Feltham/ Whitton/ Hounslow areas where the flows via Richmond and Hounslow merge

5.5.10 Removing these constraints could allow an increase up to 24tph, without impacting on Main Line service growth. It would however be both extremely costly and highly disruptive, to rail and road users, to achieve. In common with the peak capacity conditional outputs on the Windsor Lines, no further development has been carried out in this Route Study.

### Suburban Connectivity: Main Suburban Lines

5.5.11 On Main Suburban services the current off-peak timetable provides a total of 16 trains per hour into London Waterloo. As stated in **Chapter 3** the Main Suburban network will potentially be able to support a maximum of 18tph into London Waterloo during a typical off-peak hour on the Slow Line, based on the infrastructure capability of the network at the end of CP5. This mirrors the capability assumed at the end of CP5 for peak services into London Waterloo.

5.5.12 A number of options that utilise the baseline infrastructure to improve connectivity to central London during off-peak hours have been identified to meet the relevant conditional outputs in **Table 5.2**. However, at the end of CP5 there will be insufficient network capacity to meet all of the relevant conditional outputs for connectivity, and as a result choices must be made between them.

5.5.13 It should be noted that no option has been assessed which seeks to increase the number of Main Suburban services into London Waterloo, using the Slow Line, during off-peak hours to 20tph. In the busiest hour on the Slow Line, see **Chapter 3**, there are 19 services into London Waterloo. Operating 19 or more services every hour is likely to have a significant negative impact upon the overall level of punctuality and reliability of the network.

5.5.14 The first of these sees the operation of 18tph to London Waterloo during off-peak hours on the Slow Line, an increase of 2tph relative to the current level of off-peak service, to meet a number of connectivity conditional outputs within the end of CP5 capability of the network.

5.5.15 This option enables one of the following seven service pattern choices to be operated:

- +2tph to stations on the Shepperton branch
- +2tph to Epsom via Worcester Park
- +2tph to Effingham Junction via Worcester Park
- +2tph to Guildford via Epsom
- +2tph to Chessington South
- +2tph to Hampton Court
- +2tph to Guildford via Cobham

5.5.16 The second option that makes best use of the baseline infrastructure would see the operation of shuttle services between Shepperton and Kingston and between Hampton Court and Surbiton and by changing stopping patterns on the line to Dorking. It is suggested that the following services could be operated:

- Operate 2tph shuttle service on the branch between Shepperton and Kingston. This option improves the level of service from stations between Fulwell and Shepperton to 4tph during off-peak hours, two of which provide a through journey to London Waterloo
- Operate 2tph shuttle service on the branch between Hampton Court and Surbiton. This option increases the level of service from Hampton Court and Thames Ditton to 4tph during off-peak hours, two of which provide a through journey to London Waterloo. However, this may require the provision of an additional crossover in the Thames Ditton area
- Improve the connectivity between Box Hill & Westhumble station and central London by inserting additional stops into existing off-peak services to London Waterloo or London Victoria. Currently Box Hill & Westhumble Station has 1tph to central London (to London Victoria) during off-peak hours. In order to meet the conditional output additional stops at Box Hill & Westhumble can be inserted into any of the other three existing trains per hour between Dorking and London (one to London Victoria and two to London Waterloo), all of which do not currently stop at Box Hill & Westhumble Station. This would probably impact adversely on journey times for passengers travelling from Dorking or south thereof

5.5.17 The third, and potentially most beneficial, option is the implementation of Crossrail 2. One of the key benefits of the scheme is that it would allow up to 4tph to be operated from each Main Suburban branch either into the tunnel at Wimbledon or through to London Waterloo. Further details of the Crossrail 2 proposals can be found earlier in this chapter.

**Figure 5.11 Proposed options for off-peak Main Suburban connectivity**

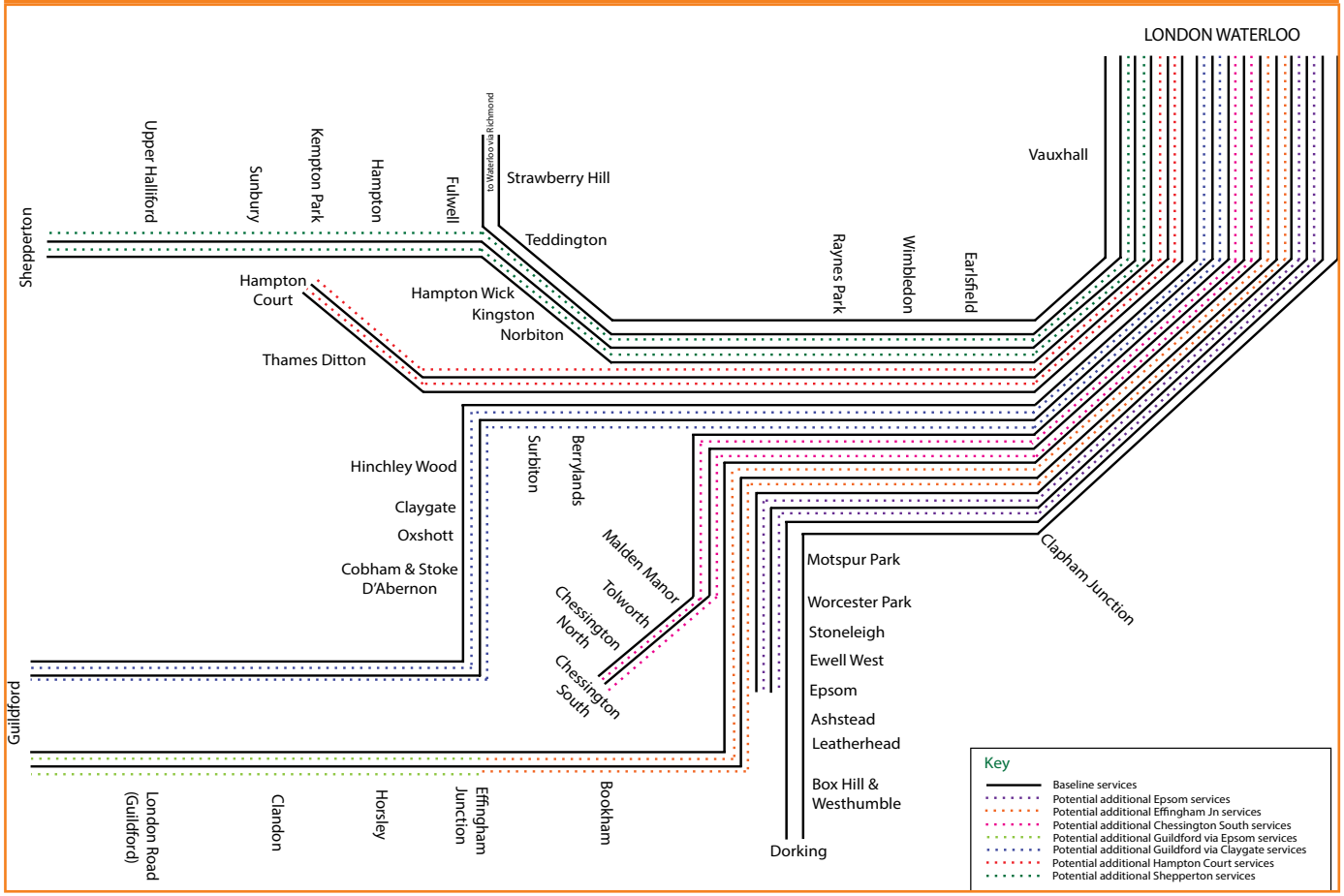
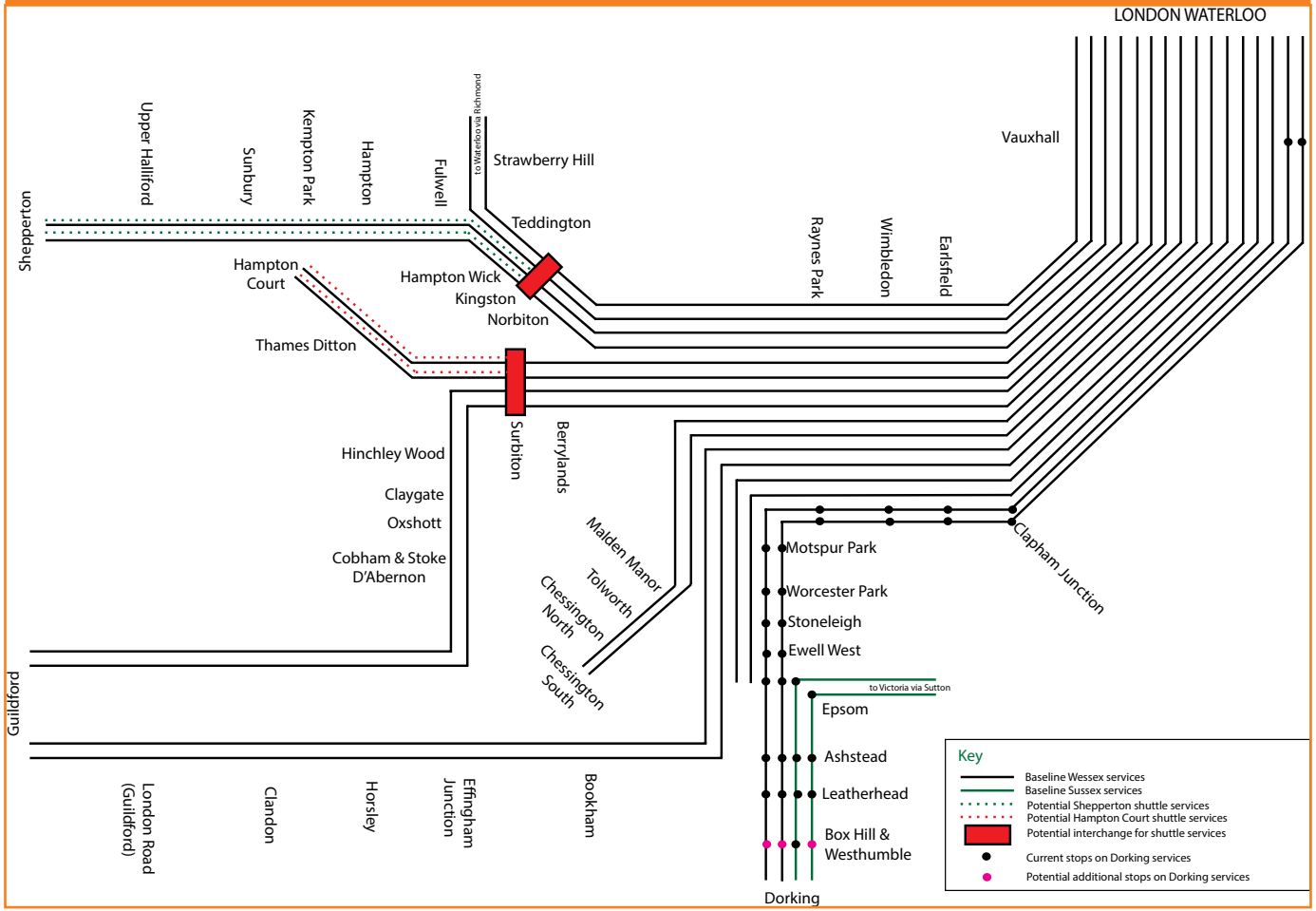


**Figure 5.12 Proposed options for off-peak Main Suburban connectivity – shuttle services**



## 5.6 Incremental journey time improvements for stations within 30 miles of central London: CO24 (including C031 for longer distance suburban journeys)

5.6.1 Outside the Long Term Planning Process there has been some investigation of the potential for improving journey times into central London from the suburban network.

5.6.2 Owing to the 'metro' style service that is operated on the suburban network, it is difficult to take advantage of improved line speeds. This 'metro' style service means that stopping patterns do not allow the trains to accelerate to increased line speeds before they have to brake for the next station.

5.6.3 Changing stopping patterns to improve journey times may require a trade-off with connectivity and frequency of service at some stations. Conversely, improving frequency of service can improve the generalised, or overall, journey time across the service group, particularly if those services are 'semi-fast' and therefore have fewer stops.

5.6.4 Some of the options previously discussed for Windsor Line and Main Suburban connectivity will also address this conditional output through an increase in connectivity and the addition of 'semi-fast' services. For instance, the additional Reading to London Waterloo via Hounslow services calling selectively at stations on the Hounslow Loop would provide a faster journey whilst improving connectivity to Reading and other key stations.

5.6.5 Finally, the introduction of Crossrail 2 will offer significant end-to-end journey time improvements especially for people travelling to central London destinations who currently need to travel via London Waterloo.

## 5.7 Longer distance journeys to and from central London, and other non-London passenger and freight flows: CO25 to CO36

5.7.1 The conditional outputs listed in **Table 5.4** are best considered together as, operationally, the relevant rail services interact significantly with each other. In some cases, the network capacity available at the end of CP5 will not be sufficient to support all of the conditional outputs, and as a result choices will exist between them.

**Table 5.4 Conditional Outputs**

| Conditional Output reference | Description |
|---|---|
| **To reduce the 'generalised' journey time for longer distance journeys to central London from significant centres of population -** | |
| CO25 | Bournemouth |
| CO26 | Poole |
| CO27 | Portsmouth |
| CO28 | Salisbury |
| CO29 | Southampton |
| CO30 | Winchester |
| **To improve rail connectivity between (non-London) large regional centres within the Wessex Route -** | |
| CO32 | Poole to Portsmouth corridor |
| CO33 | Basingstoke to Portsmouth corridor |
| CO34 | Basingstoke to Poole corridor |
| **Other connectivity conditional outputs** | |
| CO35 | To accommodate, during off-peak hours, the cross-boundary passenger services specified by the Cross Boundary Working Group, as a proxy for meeting all conditional outputs which are not wholly internal to the Wessex Route |
| CO36 | To accommodate the anticipated demand for freight services to 2023 and 2043, as expressed by the Freight Market Study |

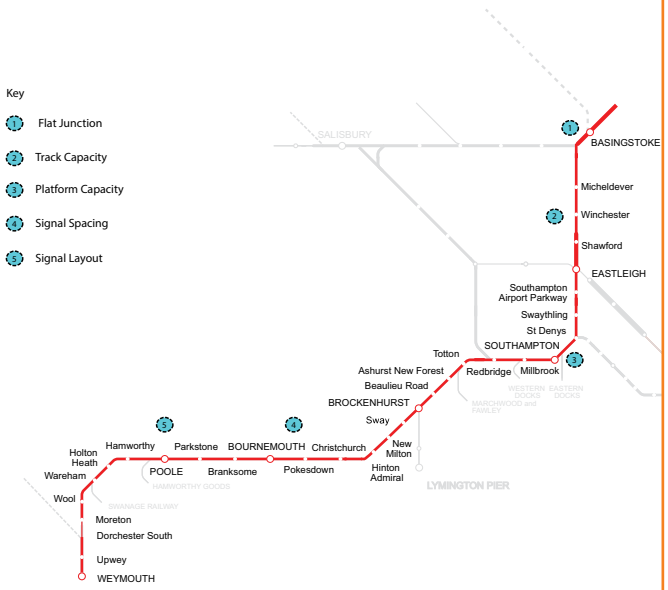
### Generalised journey times south of Basingstoke to London Waterloo: CO25, CO26, CO29 and CO30

5.7.2 Conditional Outputs CO25, CO26, CO29 and CO30 are all impacted by the constraints on the SWML south of and including Basingstoke. As previously explained for suburban services

generalised journey time can be influenced by increases in frequency. Several options were considered to deliver both improvements in journey times and increases in frequency to meet these conditional outputs.

5.7.3 In **Section 5.4** Basingstoke grade-separation was highlighted as a key intervention for unlocking capacity for Main Line services. Removing the conflicts between southbound services

**Figure 5.13 Corridor south of Basingstoke with constraints**




from Reading and beyond and services to/ from London Waterloo means that an increase in level of service to address generalised journey time is feasible through Basingstoke. Grade-separation at Basingstoke increases the capacity between Basingstoke and Eastleigh to 11 trains per hour. This would be made up of eight passenger and three freight paths with one freight path via Andover which would carry a significant time and cost penalty to the operator. To meet the 2043 service specification 13 to 14 trains per hour would need to be accommodated in the off-peak between Basingstoke and Eastleigh, and 18 to 19tph between St Denys and Southampton Central.

5.7.4 Off-peak services to be accommodated on the track south of Basingstoke, including those to London Waterloo, are:

Wessex Route:

- Four trains per hour London Waterloo – Southampton Central (and beyond) (fast)
- One train per hour London Waterloo – Southampton Central/ Poole (stopping)
- Two trains per hour London Waterloo – Eastleigh – Portsmouth Harbour (an increase from one train per hour)
- Two trains per hour Portsmouth Harbour to Southampton Central (with one train per hour extending to Poole)
- One train per hour Romsey – Salisbury via Eastleigh (joining the line at Eastleigh)

Cross-Boundary:

- One train per hour Manchester Piccadilly – Bournemouth via Reading
- One train per hour NE England – Southampton Central via Reading (an increase from one train every two hours)
- One train per hour Heathrow T5 – Southampton Central/ Bournemouth (potentially originating at London Paddington via Old Oak Common)
- One train per hour Portsmouth Harbour - Cardiff (south of St Denys only)
- One train per hour London Victoria – Southampton Central (south of St Denys only)
- One train per hour Brighton – Southampton Central (south of St Denys only)
- One train per hour on the corridor between Cosham and Bristol Temple Meads originating from either Brighton or Portsmouth Harbour (south of St Denys only)

Freight:

- Three Class 4 paths per hour
- One Class 6 path every two hours

5.7.5 The drivers for an intervention to address capacity between Basingstoke and Eastleigh are:

- The growing demand for freight paths on this direct route from Southampton Docks to the Midlands and North, and the consequent speed mix of trains
- The need to provide enhanced off-peak connectivity from Basingstoke to Southampton, Bournemouth, Poole and Portsmouth
- Reduced journey times from Basingstoke to Southampton, Bournemouth, Poole and Portsmouth
- Additional Cross Country and new Paddington services operating via this route

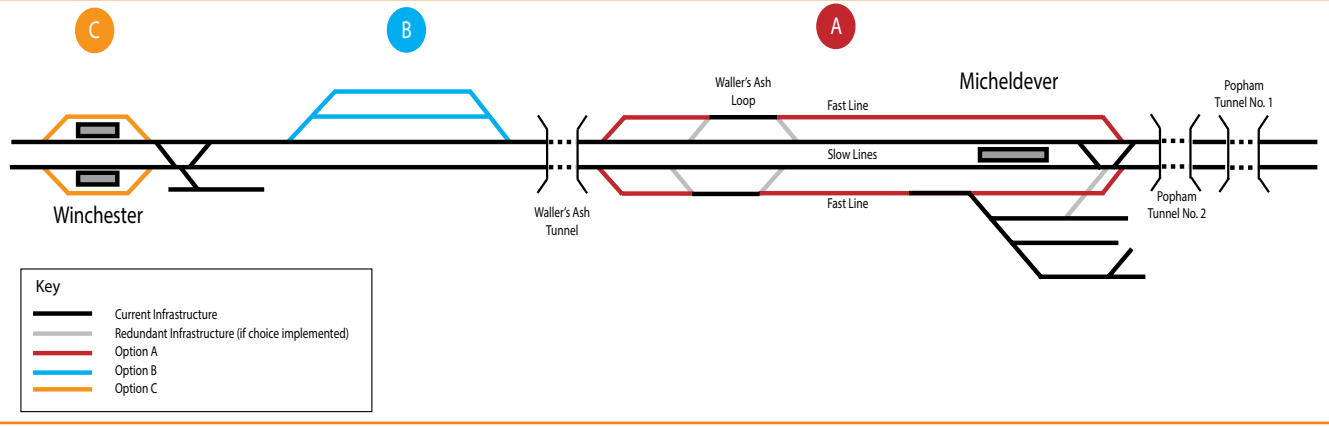
5.7.6 To address these, the Route Study has investigated options that provide facilities for fast passenger services to pass freight and slower passenger services. **Figure 5.14** shows the options developed to facilitate additional freight and off-peak connectivity conditional outputs.

5.7.7 Of the three options identified, 'Option A' provides the optimal capacity through the installation of a four mile loop, in both the Up and Down directions. This is achieved by extending the existing loops at Wallers Ash northwards, through and beyond Micheldever station, forming new Up and Down fast tracks, with current lines containing the Micheldever platforms reserved for stopping and freight services. The exact location and requirement of an overtaking facility on this line should be reassessed if any changes to line speed or service levels are proposed.

5.7.8 As previously described in **Section 5.4** an intervention would be required at Southampton Central to accommodate an increase in through and terminating services. This would take the form of additional platform capacity and freight passing capacity at the station. More details of the proposed enhancements can be found in **Section 5.4**.

5.7.9 The potential constraint to increasing the level of service beyond Southampton Central towards Weymouth, particularly between Totton and Poole, is the long distances that successive trains must be spaced due to signal location (the headway). To ensure the safe operation of services within the capability of the signalling the required number of services cannot be operated without some work to re-position or add signals to shorten the headways so services can travel closer together.

**Figure 5.14 Additional passing loop between Basingstoke and Eastleigh**



5.7.10 This Route Study investigated reducing the signalling headways from around 5 minutes to 3 minutes for services following a fast service and 3½ minutes for those following a slow service. It is suggested that replacing a total of 48 signals (24 in each direction) would achieve this along with some additional works to the signalling layout around Poole Station and a review of the benefits of line speed improvements. As an alternative to conventional re-signalling it may prove beneficial to await the deployment of ETCS on this route. Whichever signalling solution is adopted it is likely that the impact of additional trains on the level crossing at Poole will need to be assessed.

5.7.11 The potential AC electrification of the route between Basingstoke and Southampton (replacing the current DC system, see **Section 3.3**) would produce only a marginal journey time benefit between these two points. However if the AC electrification were extended as far as Woking, this would give an opportunity to raise line speeds to 125 mph. If the AC electrification were also extended from Southampton to Poole, then taken together, analysis has shown that journey times between London Waterloo and Weymouth could be reduced by several minutes:

- If the AC electrification were only to be provided between Basingstoke and Southampton, then the savings are approximately 2-3½ minutes in the down direction and 3½-4 minutes in the up direction.
- If the AC electrification were provided between Basingstoke and Poole (and depending on the stopping pattern of the train), savings of between 4 and 7½ minutes (Down) could be achieved, and between 6½ and 9 minutes (Up).
- If AC were provided all the way from Woking to Poole, the figures would be 5½-9 minutes (Down) and 7½-11½ minutes (Up). These figures do not include any potential additional benefit from raising linespeeds between Woking and Basingstoke to, say, 125mph (which might be achievable at the same time as providing the AC electrification).

5.7.12 As this section of the Wessex Route is an important corridor for Cross Country services from the South Coast to destinations in the north some further work is required to understand the corridor in its entirety. This is particularly significant for understanding how current services can be improved in terms of journey times and reliability of service. Key timetable changes due for implementation in CP5 could provide an opportunity for looking at the wider picture.

### Generalised journey times from Portsmouth to London Waterloo: CO27

5.7.13 The "Portsmouth Direct" line is a two-track route between Portsmouth and Guildford, connecting the South Coast to London Waterloo. The line has a topography that makes it difficult to increase line speeds, which, coupled with a relatively high number of stations, does not provide optimum journey times into central London. Previous investigation has shown enhancing the infrastructure to reduce journey times provides little benefit at a high cost. Therefore, choices which reduce the generalised journey time by increasing service frequency have been developed as part of this Route Study.

5.7.14 The key constraint to improving connectivity in terms of frequency and journey time is the ability for fast services to overtake slower ones. Currently between Guildford and Havant the only location where overtaking is possible is at Haslemere using the loop facility. The most efficient way in which a reduced generalised journey time can be achieved is through the introduction of two additional fast services per hour from Portsmouth Harbour running non-stop between Fratton and Guildford. To do this would require additional infrastructure to enable trains to overtake each other.

5.7.15 This study has looked at options for new or additional loops at:

- Liphook (a Down Loop)
- Haslemere (an extension of the Up Loop)
- Petersfield (an Up Loop)

5.7.16 The optimal solution for providing the best operational flexibility and journey time improvement would be through the installation of a loop of up to four miles in length.

5.7.17 As well as overtaking capability, platform capacity for terminating at Portsmouth Harbour is also a constraint on any increase in the number of services operating on this line. To deliver

the 2043 service specification, that meets all conditional outputs, 13 – 15 trains per hour need to be accommodated, made up of the following:

- Five or six trains per hour Portsmouth – Waterloo via Guildford
- Two trains per hour Portsmouth – Waterloo via Eastleigh
- Three trains per hour Portsmouth – Victoria / West Coastway via Barnham
- One or two trains per hour Portsmouth – Cardiff
- Two trains per hour Portsmouth – Southampton / Poole

5.7.18 To accommodate these services, more platform capacity is required at Portsmouth. This study therefore sets out options for the re-instatement of Platform 2 at Portsmouth Harbour and a new platform at Portsmouth & Southsea low level. **Table 5.5** details the number of trains per hour that could be achieved.

**Table 5.5 Terminating capacity in the Portsmouth area**

| Infrastructure Layout | Terminating at Portsmouth Harbour (tph) | Terminating at Portsmouth & Southsea (tph) | Total Trains Per Hour |
|---|---|---|---|
| Current | 8 | 3 | 11 |
| With re-instatement of Platform 2 at Portsmouth Harbour | 10 | 3 | 13 |

5.7.19 As can be seen in **Table 5.5** the overall line capability of the southern end of Portsmouth Direct Line is limited to 13tph if Platform 2 at Portsmouth Harbour is in place and 11tph if Platform 2 at Portsmouth Harbour is not in place equating to three Portsmouth & Southsea services and eight to ten Portsmouth Harbour services. This is because of the following constraints:

- Turnround times at Portsmouth Harbour are considerably longer than timetable planning rules would suggest owing to other constraints on the route such as paths to and from London Waterloo
- Track capacity that is affected by differential speeds between trains, crossing moves at Portcreek, Farlington and Havant Junctions and lost capacity owing to services that do not run into Portsmouth Harbour taking up paths
- The throat of Portsmouth & Southsea Station owing to conflicting train movements
- The throat of Portsmouth Harbour Station owing to conflicting train movements

5.7.20 The accommodation of the 14-15tph is only possible when solving at least two of these constraints. The reduction of turnround times at Portsmouth Harbour would remove the platform usage constraint, but crossing moves at the throats of Portsmouth Harbour and Portsmouth & Southsea stations will still prevent the operation of the full 14-15tph. Increasing the number of parallel movements in and out of Portsmouth Harbour or doubling the single junction into Portsmouth & Southsea is likely to also be required to provide the full 14-15tph.

5.7.21 The choice to reinstate Platform 2 has been investigated with the following variations:

- A 12-car platform with minor track changes that would potentially cut into the final length of the platform
- A 12-car platform with full track modification
- An 8-car platform

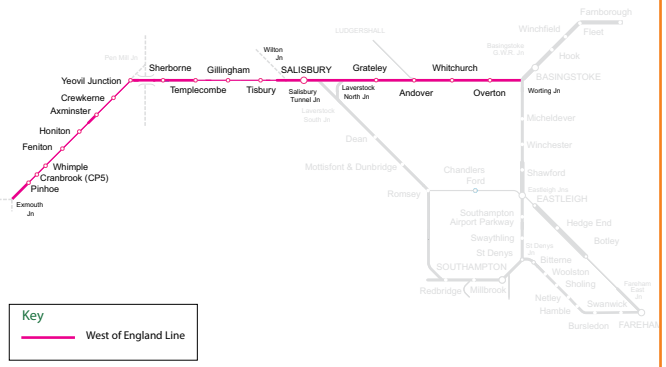
5.7.22 An additional 8-car platform in the low level part of Portsmouth & Southsea station has also been investigated.

5.7.23 Initial costings suggest that works to re-instate Platform 2 at Portsmouth Harbour would cost in excess of £20 million and works at Portsmouth & Southsea would cost in excess of £13 million. Without such investment the alternative option would be to reduce the number of conditional outputs that could be accommodated.

## Generalised journey times from Salisbury to London Waterloo: CO28

5.7.24 The route known as the West of England Line is the line between Worting Junction (west of Basingstoke) and Exeter via Salisbury and Yeovil Junction. The whole length of the line from Worting Junction to Exeter is not currently electrified, which has a direct impact on the journey times achievable on the line. Between Salisbury and Exeter the line is characterised as a mixture of double and single track sections.

**Figure 5.15 Map of West of England Line**




5.7.25 Previous investigation of line speeds on the West of England Line, particularly between Salisbury and Basingstoke, has highlighted the technical difficulties that raising line speeds would present. For the purposes of this Route Study no further work has been taken forward on line speeds at this time.

5.7.26 AC electrification enables the operation of rolling stock that is able to both accelerate and decelerate more efficiently thus providing significant journey time improvements. A high level investigation into the benefit of electrification on the West of England Line showed that a potential 14 minutes could be saved on journeys from Exeter St Davids to London Waterloo. This saving was based on AC electrification between Basingstoke and Exeter St Davids, not all the way through to London Waterloo therefore requiring dual voltage rolling stock.

5.7.27 Electrification in itself cannot deliver this level of journey time saving on its own. Speeding up services in this way has the knock on effect of impacting on the locations at which services travelling in opposite directions need to cross to fit in with the single and double track sections. Therefore the Route Study has investigated a number of options for infrastructure that would facilitate a journey time saving for services on the line.

5.7.28 **Table 5.6** details the choices that this study has developed based on fixed crossing points at Axminster, Wilton South Junction or Gillingham. These are the points around which a timetable must be built to understand the infrastructure that would be required to facilitate operation of that timetable.

5.7.29 Should any of these options be taken forward by a funder more work will be required to understand the benefit and value for money that each would provide.

5.7.30 As noted previously in this section in relation to the corridor south of Basingstoke increasing frequency of service is a key input into improving generalised journey time. This study has not investigated increased frequency as part of this Route Study but it is suggested that operating additional services east of Salisbury would require the implementation of Basingstoke grade-separation and potential works at Salisbury to accommodate terminating and originating services.

| Table 5.6 Choices to facilitate electrification journey time improvements on the WoE Line | |
|---|---|
| **Fixed Crossing Point** | **Additional Infrastructure Needed** |
| **Axminster** | either:<br>• An extension of the double track section that currently becomes a single line at Wilton South junction<br>or<br>• An increased line speed between Templecombe and Wilton to allow services to reach the double track earlier and depart from it later |
| **Wilton South Junction** | To prevent the need for extended dwell times, either:<br>• An extension of Axminster loop to the north<br>or<br>• An increased line speed between Templecombe and Axminster to allow services to reach Axminster East Junction earlier and depart later |
| **Gillingham** | • An additional loop at Crewkerne<br>And, to prevent an extended dwell time at Honiton, either:<br>• An additional loop at Feniton<br>or<br>• An extension of the existing loop at Honiton |

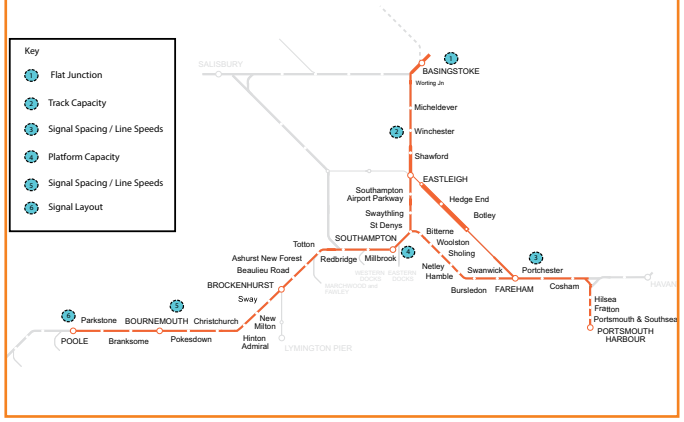
### Improved rail connectivity between Poole, Basingstoke and Portsmouth: CO32, CO33 and CO34

5.7.31 These Conditional Outputs seek to improve the connectivity between larger, non-London centres of population; specifically:

- Poole to Portsmouth Harbour corridor
- Basingstoke to Portsmouth Harbour corridor
- Basingstoke to Poole corridor

5.7.32 Although the Main Line passenger market into central London has formed the main part of the Wessex strategy to 2043, due to the size of the capacity gap to 2043, it is important to note that there are other passenger flows that provide the means for economic growth in specific areas.

**Figure 5.16 Map of three South Hampshire corridors with constraints**



5.7.33 This Route Study has been unable to investigate every conditional output in as much detail as might be desirable but in the following section will try to set the foundation for future work to be taken forward in collaboration with Local Authorities and Local Enterprise Partnerships (LEP), especially in relation to issues of connectivity.

5.7.34 Off-peak services that are required to accommodate these conditional outputs are:

Wessex Route:

- Four fast trains per hour London Waterloo – Southampton Central, and beyond (an increase from two trains per hour)
- One stopping train per hour London Waterloo – Southampton Central/ Poole (as current)
- Two trains per hour London Waterloo – Eastleigh – Portsmouth Harbour (an increase from one train per hour)
- Two trains per hour Portsmouth Harbour to Southampton Central (with one train per hour extending to Poole)
- One train per hour Romsey – Salisbury via Eastleigh (as current, joining the line at Eastleigh)

Cross Boundary:

- One train per hour Manchester Piccadilly – Bournemouth via Reading
- One train per hour NE England – Southampton Central via Reading (an increase from one train every two hours)
- One train per hour Heathrow T5 – Southampton Central/ Bournemouth (potentially originating at London Paddington via Old Oak Common)
- One train per hour Cardiff – Portsmouth Harbour (south of St Denys only)
- One train per hour London Victoria – Southampton Central (south of St Denys only)
- One train per hour Brighton – Southampton Central (south of St Denys only)
- One train per hour on the corridor between Cosham and Bristol Temple Meads originating from either Brighton or Portsmouth Harbour (south of St Denys only)

Freight:

- Three Class 4 paths per hour
- One Class 6 path every two hours

5.7.35 There are several constraints that would need to be addressed to enable such a level of service on these corridors.

5.7.36 Increasing the level of service on the corridor between Poole and Portsmouth Harbour would require signalling works to reduce the required time/ distance between successive trains, the headway. This Route Study has looked at two areas where long headways are a concern.

5.7.37 Between Totton and Poole on the SWML a reduction in signalling headways is suggested from around 5 minutes to 3 minutes for services following a fast service and 3½ minutes for those following a slow service. This may require replacement of a total of 48 signals (24 in each direction) to achieve this headway reduction along with some additional works to the signalling layout around Poole Station and a review of the benefits of line speed improvements. Whichever solution is adopted it is likely that the impact of additional trains on the level crossing at Poole will need to be assessed.

5.7.38 Similarly between Cosham and St Denys it is suggested that the signalling headways, particularly west of Fareham, should be reduced from around 5 minutes to around 3 minutes. This would require approximately 20 - 24 signals to be installed (10 - 12 in each direction). More investigation is required on the benefit of raising line speeds to allow reduced running times to clear signals, although it should be noted that the potential for increasing line speeds west of Fareham would be very limited. Alternatively, in both cases, a solution exploiting ETCS may be preferable.

5.7.39 As described in **Section 5.4** an increased level of service through Southampton Central could require additional platform capacity at the station.

5.7.40 Increasing the level of service on the corridor between Basingstoke and Portsmouth Harbour through the addition of a

further service to London Waterloo via Eastleigh on its own is unlikely to require any infrastructure interventions. If considered alongside the other conditional outputs for these three corridors then some intervention will be required. In particular additional services between Eastleigh and Basingstoke would necessitate additional track capacity, as described previously in this section, probably through the extension of Waller's Ash Loops. Basingstoke grade-separation would then be required to operate all additional services using the corridor beyond to the north or east.

5.7.41 Basingstoke grade-separation, the extension of Waller's Ash Loops, reduction of headways and increased line speeds between Totton and Poole, as well as increased platform capacity at Southampton Central and Portsmouth Harbour would all be required to improve connectivity on the Poole to Basingstoke corridor. Further details can be found previously in this section in relation to generalised journey times from Bournemouth/ Poole.

5.7.42 It is worth noting that although a service specification is suggested the conditional outputs do not specify that direct services are the only way of providing improved connectivity. It could equally be enabled through better interchange connectivity at key points to make a journey easier to undertake.

### Off-peak cross-boundary connectivity: CO35

5.7.43 Cross-boundary services are those services that traverse two or more of Network Rail's Routes. CO35 seeks to amalgamate all cross boundary conditional outputs identified in the Market Studies including amongst others, connectivity to airports (specifically Heathrow Airport and Gatwick Airport) and connectivity to HS2. **Table 5.7** details the boundaries between Wessex and other Routes and the services that traverse them.

5.7.44 As part of the Route Study some gaps were identified where additional journey opportunities could be implemented to provide improved connectivity with other parts of the country.

- One train per hour on the corridor between Cosham and Bristol Temple Meads originating from either Brighton or Portsmouth Harbour
- An hourly journey opportunity between Brighton and Bournemouth (for example, an extension of the Brighton to Southampton Central service)
- The increase in service levels on North Downs Line services to Gatwick Airport (two trains per hours to Gatwick and one stopping train per hour to Redhill)
- An hourly journey opportunity between the South Coast and the NE of England (an increase from one train every two hours)
- One train per hour Heathrow T5 – Southampton Central/ Bournemouth (potentially originating at London Paddington via Old Oak Common)
- One train per hour Heathrow T5 – Basingstoke (potentially originating at London Paddington via Old Oak Common)
- One train per hour Exeter – Axminster ('Devon Metro' service)
- Connectivity to Heathrow Airport (to be determined by a separate southern access study)
- A potential 10 trains per hour between Clapham Junction and a new interchange station with HS2 at Old Oak Common (analysed as part of the South East Route: Sussex Area Route Study)

5.7.45 There are constraint areas within the Wessex Route that will impact on the ability of the network to facilitate the operation of all or some additional cross boundary services without some sort of infrastructure intervention. These are summarised in **Table 5.8**. Further work will be required to fully understand which constraints and which services will drive the need for an intervention.

5.7.46 It is worth noting that although a service specification is suggested the conditional outputs do not specify that direct services are the only way of providing improved connectivity. Journey opportunities could be enabled through better interchange connectivity at key points to make a journey easier to undertake.

**Table 5.7 Passenger cross-boundary services**

| | Route boundary | Service Details |
|---|---|---|
| Boundaries between Wessex and Sussex Route Studies | Latchmere Curve | London Overground suburban services between Stratford and Clapham Junction |
| | Epsom to Leatherhead is a shared line controlled by Wessex route operations. Box Hill & Westhumble and Ewell East form the boundaries) | Limited suburban services between Guildford and London Victoria / London Bridge |
| | | Suburban services between Dorking and London Victoria / London Waterloo |
| | | Suburban services between Epsom / Horsham and London Victoria / London Bridge |
| | Dorking Deepdene | Regional services between Redhill / Gatwick Airport and Reading |
| | Warblington / Emsworth | Regional services between Southampton Central / Portsmouth Harbour and London Victoria |
| | | Regional trains between Southampton Central / Portsmouth Harbour and Brighton |
| | | Limited regional services between Bristol Temple Meads and Brighton |
| Boundaries between Wessex and Western Route Studies | Southcote Junction | Long distance services between Southampton Central / Bournemouth and Manchester Piccadilly / Newcastle / Birmingham New Street<br>Regional services between Basingstoke and Reading |
| | Castle Cary | Regional services between Weymouth and Bristol Temple Meads |
| | Warminster | Long distance services between Portsmouth Harbour and Cardiff Central |
| | | Long distance services between London Waterloo and Bristol Temple Meads |
| | | Regional services between Southampton Central and Great Malvern |
| | | Regional services between Salisbury and Bristol Temple Meads |
| | Whimple | Long distance services between London Waterloo and Exeter St Davids |
| Boundaries between Wessex and Kent Route Studies | Ludgate Lines | London Overground suburban services between Clapham Junction, Surrey Quays and Highbury & Islington |
| Boundaries between Wessex and non-Network Rail infrastructure | Wimbledon North Junction | A very few South West Trains Main Line services between Basingstoke and London Waterloo via East Putney (London Underground) |
| | Point Pleasant Junction | A very few South West Trains Main Line services between Basingstoke and London Waterloo via East Putney (London Underground) and Empty Coaching Stock between London Waterloo and Wimbledon Park |

| Table 5.8 Additional cross-boundary services and Wessex infrastructure constraints | |
|---|---|
| **Additional service** | **Potential constraints on the Wessex Route** |
| **One train per hour on the corridor between Cosham and Bristol Temple Meads originating from either Brighton or Portsmouth Harbour** | • Signalling headways, particularly between Fareham and St Denys<br>• Line speeds and topography, particularly between Fareham & St Denys<br>• Capacity over St Denys Junction<br>• Platform capacity at Southampton Central and Salisbury<br>• Platform capacity at Portsmouth Harbour |
| **An hourly journey opportunity between Brighton and Bournemouth (potentially an extension, both east and west, of the services operating between Portsmouth Harbour and Southampton Central)** | • Signalling headways, particularly between Fareham and St Denys; and Totton and Poole<br>• Line speeds and topography, particularly between Fareham & St Denys; and Totton and Poole<br>• Capacity over St Denys Junction<br>• Platform capacity at Southampton Central<br>• Platform capacity at Portsmouth Harbour |
| **An hourly journey opportunity between the South Coast and the NE of England (an increase from one train every two hours)** | • Capacity over Basingstoke Junction<br>• Capacity between Basingstoke and Eastleigh<br>• Platform Capacity at Southampton Central<br>• Capacity between Basingstoke and Reading, particularly in relation to the mixture of passenger and freight services |
| **One train per hour Heathrow T5 – Southampton Central/ Bournemouth (potentially originating at London Paddington via Old Oak Common)** | • Capacity over Basingstoke Junction<br>• Capacity between Basingstoke and Eastleigh<br>• Platform Capacity at Southampton Central<br>• Signalling headways, particularly between Totton and Poole (should the service be extended to Bournemouth)<br>• Capacity between Basingstoke and Reading, particularly in relation to the mixture of passenger and freight services |

**Table continued overleaf...**

| Table 5.8 Additional cross-boundary services and Wessex infrastructure constraints...continued | |
|---|---|
| **Additional service** | **Potential constraints on the Wessex Route** |
| **One train per hour Heathrow T5 – Basingstoke (potentially originating at London Paddington via Old Oak Common)** | • Capacity over Basingstoke Junction<br>• Capacity between Basingstoke and Reading, particularly in relation to the mixture of passenger and freight services<br>• Platform capacity at Basingstoke (if the service is not an extension or replacement of the existing shuttle service) |
| **The extension of some North Downs services to Gatwick Airport (2tph to Gatwick Airport and 1tph to Redhill)** | • Signalling headways, particularly between Wokingham and Guildford<br>• Line speeds<br>• Pathing and platform capacity through Guildford |
| **One train per hour Exeter – Axminster ('Devon Metro' service)** | • Single track sections between Pinhoe and Axminster |
| **A potential 10 trains per hour between Clapham Junction and a new interchange station with HS2 at Old Oak Common** | • Platform capacity at Clapham Junction |

### .Off-peak cross-boundary connectivity: South Hampshire

5.7.47 In relation to services operating over the Cosham to St Denys corridor some high level work has been done to look at what could be achieved to reduce the headways between Fareham and St Denys. Although this was not looked at in detail Network Rail would welcome the opportunity to work with relevant stakeholders to investigate a solution to the constraints on this route.

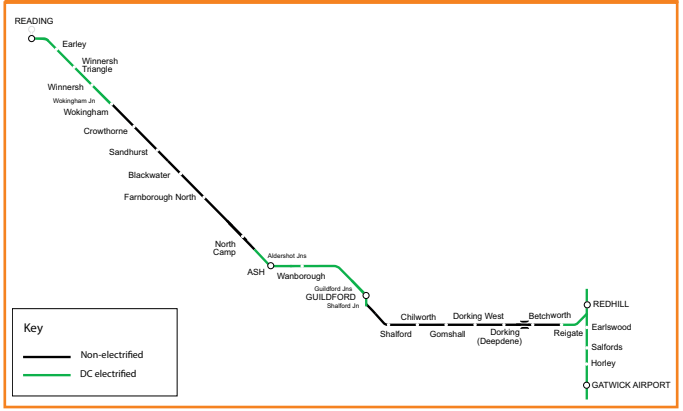
5.7.48 Any additional services through Southampton Central would necessitate extra platform capacity at the station as detailed in **Section 5.4**. For those services continuing on towards Bournemouth the signalling headways between Totton and Poole become a constraint that would need to be addressed as described previously in this section. Salisbury platform capacity may become an issue for services via Westbury. Some initial work with South West Trains is being considered to look at future operation and platform capacity at Salisbury.

5.7.49 Additional cross-boundary services between Bournemouth and the Midlands and the North, would require improved signalling headways between Totton and Poole, platform capacity at Southampton Central, track capacity between Basingstoke and Eastleigh and grade-separation at Basingstoke.

5.7.50 As in the case of freight services it is important to look at the route that a cross-boundary service takes in its entirety. Therefore further work is required to understand in more detail how some of these services could be accommodated on the network. Consideration should also be given to how improvements can be made to current services to improve the overall cross-boundary journey experience. Some of the changes happening in CP5 provide the opportunity to understand the implications of providing some of these cross-boundary services.


## Off-peak cross-boundary connectivity: North Downs Line/ improved access to Gatwick Airport

**Figure 5.17 Map of the North Downs Line**




5.7.51 The North Downs Line is a two-track railway linking Reading with the Brighton Main Line via Wokingham, Guildford and Redhill.

5.7.52 At present two services per hour operate over the line for the majority of their timetabled journey; one semi-fast service from Reading to Gatwick Airport, and one stopping service between Reading and Redhill. FGW hopes to introduce a third train per hour during CP5 providing two semi-fast services and one stopping service.

5.7.53 At present, off-peak stopping patterns on the line mean that stations either receive one train every two hours (for example, at Chilworth, Gomshall, Dorking West and Betchworth), one train every hour (for example, Sandhurst and Shalford) or two trains every hour (for example, at Dorking Deepdene, and North Camp).

5.7.54 A number of other services interact with the North Downs Line for part of their journey. These are two trains per hour between Reading and Waterloo, two trains per hour between Guildford and Ascot via Aldershot, one train per hour Reigate to London Bridge, plus a number of other services on the South West Main Line which operate through Guildford as well as the Govia Thameslink Railway (GTR) services operating on the Brighton Main Line.

5.7.55 The service specification to meet the cross-boundary conditional output, which includes connectivity to Gatwick Airport, is as follows:

- A two train per hour semi-fast service between Gatwick Airport and Reading, with options to improve journey times to be identified by this Route Study (the potential to extend this service beyond Reading to Oxford is considered by the Western Route Study)
- A third stopping service between Reading and Redhill or Gatwick Airport which is required to maintain connectivity to and from smaller stations on the North Downs Line.

5.7.56 Initial business case analysis suggests that providing an additional service on the North Downs Line, as described, would have a Benefit Coast Ratio (BCR) of 2.00.

5.7.57 Depending on whether the extra services are both peak and off-peak it may also be necessary to provide additional infrastructure in the Redhill area as described in the **South East Route: Sussex Area Route Study**. In addition it may be necessary to implement upgrades to level crossings on the route to ensure safe operation is maintained. Further investigation is ongoing to fully understand the implications of providing this level of service throughout the day.

5.7.58 This Route Study has assessed the impact of increasing line speeds on the North Downs Line and the key sections over which the most journey time benefit could be realised. This was assessed for diesel (Class 165), AC electric (Class 350) and DC electric (Class 450) rolling stock.

5.7.59 Potential benefits in journey time from line speed improvements are highly dependent on the rolling stock and stopping patterns of the services. Analysis suggests that the most journey time benefit that an increase in line speeds could enable would be through the use of Class 350 rolling stock. It should be noted that this would therefore necessitate AC electrification of the line.

5.7.60 To complement this choice the Route Study has looked at

an electrification option to see if this could also reduce journey time on the route, without increasing line speeds.

5.7.61 The sub options tested here were:

- DC third rail infill electrification
- AC overhead infill electrification
- Complete AC electrification between Reading and Reigate

5.7.62 **Table 5.9** shows the improvements that electrification could realise for journey times. Pattern 1 represents timings for semi-fast services; Pattern 2 represents stopping services on current stopping patterns; and Pattern 3 represents all station services (for comparison purposes). It can be seen that provision of AC electrification would provide the most journey time benefit and that the more stops made the more significant the journey time improvement.

5.7.63 The Electrification RUS (draft for consultation), due to be published later in 2015, will set out the case for North Downs Line electrification. It will compare the costs and benefits with other electrification schemes nationally to determine priorities for CP6 and beyond.

5.7.64 It is worth noting that there is potential for enhancements linked to re-signalling that could address long signalling headways on the North Downs Line that could have a beneficial impact on journey times and the efficient operation of services on the line.

**Table 5.9 The effect of electrification on journey times**

| | Class 165 Diesel | | | Class 450 DC Electric | | | Class 350 AC Electric | | |
|---|---|---|---|---|---|---|---|---|---|
| **Reading to Gatwick Airport** | Pattern 1 | Pattern 2 | Pattern 3 | Pattern 1 | Pattern 2 | Pattern 3 | Pattern 1 | Pattern 2 | Pattern 3 |
| **Journey time (mins)** | 72.5 | 92 | 100.5 | 70 | 86.5 | 93.5 | 67.5 | 82.5 | 89 |

### Off-peak cross-boundary connectivity: Exeter to Axminster

5.7.65 The **Western Route Study** carried out some demand analysis that identified that by 2023 there will be on-train crowding between Yeovil Junction and Exeter. An additional train per hour between Exeter and Axminster will not only address the capacity gap but will also provide improved connectivity in the area. The provision of 2tph on this route is also an aspiration of the local authorities and forms part of the Devon Metro proposal and for this reason has been analysed within the **Western Route Study**. With the opening of a new station at Cranbrook, it is anticipated that demand growth will continue to rise on the West of England Line, particularly for shorter journeys.

5.7.66 Initial work carried out by Western Route has suggested that a new loop would be required at Whimple to facilitate the operation of 2tph along this section and that it would cost between £5 million and £15 million with a BCR of 1.25. The business case for this service is improved if considered alongside the interventions required to provide an additional train path into the timetable to allow for 1tph to be diverted from the Western Route at Castle Cary when the route via Taunton is blocked, as described later in this section.

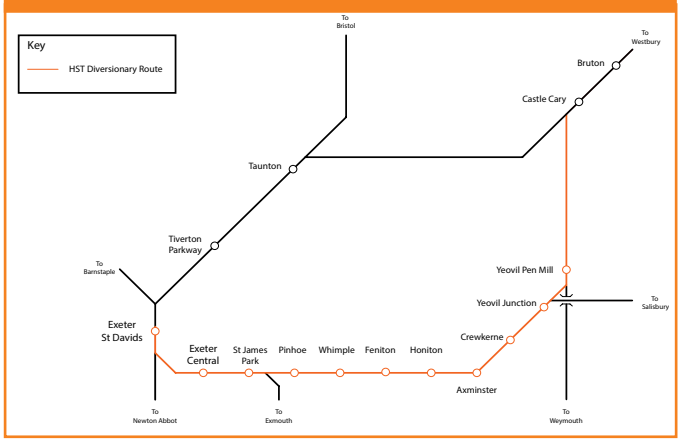
### Off-peak cross-boundary connectivity: West of England Line diversionary route

5.7.67 The West of England Line is a key diversionary route for Great Western services during major engineering works or times of severe perturbation, for instance the effects of extreme weather experienced in early 2014. Although not specifically addressing conditional outputs, options have been developed for inclusion in this study that would allow one HST service per hour to be diverted in each direction.

5.7.68 Several scenarios have been investigated to understand what infrastructure interventions would be required for the existing diesel timetable and an electrified one as follows:

- The current diesel timetable plus an additional hourly Exeter – Axminster service (explored fully in the **Western Route Study**)
- The current diesel timetable plus an hourly Great Western diversionary service between Castle Cary and Exeter (that uses the path of the additional Exeter – Axminster service developed by the **Western Route Study**)
- The current diesel timetable plus an hourly Great Western diversionary service between Castle Cary and Exeter, plus the additional hourly Exeter – Axminster service
- A timetable for each of those options above given the use of electric traction

**Figure 5.18 Map of Castle Cary to Exeter Diversionary Route**




5.7.69 The study has considered the section of route between Pinhoe, Yeovil Junction and Castle Cary. It should be noted that the pathing of services outside of this area has not been considered, and will require further analysis when any option is taken forward. We will continue to work with stakeholders on the options that are identified.

5.7.70 **Table 5.10** details the infrastructure required for these additional services, which could also provide a performance benefit for existing services.

| Table 5.10 Infrastructure requirement for diversionary choices | | |
|---|---|---|
| **Base Timetable** | **Train Service Specification** | **Possible alterations to infrastructure** |
| **Current Diesel** | Hourly Exeter – Waterloo service only | • None |
| | Hourly Exeter – Waterloo + additional hourly Axminster – Exeter/ Barnstaple | • Static / dynamic loop at Whimple Station (including new platform) |
| | Exeter – Waterloo + hourly diverted Great Western service between Castle Cary - Exeter | • Static / dynamic loop at Whimple Station (including new platform)<br>• Dynamic passing loop between Chard Junction – Crewkerne<br>• Extension of loop westwards from Yeovil Junction, with the potential for Platform 3 to be brought back in to passenger use<br>• Three additional signal sections between Yeovil Pen Mill – Castle Cary |
| | Hourly Exeter – Waterloo + additional hourly Axminster – Exeter/ Barnstaple + hourly diverted Great Western service between Castle Cary - Exeter | • Re-double between Pinhoe and existing Axminster loop<br>• Dynamic passing loop between Chard Junction – Crewkerne<br>• Extension of loop westwards from Yeovil Junction, with the potential for Platform 3 to be brought back in to passenger use<br>• Three additional signal sections between Yeovil Pen Mill – Castle Cary |

Note: The proposed infrastructure changes detailed above are currently being reviewed as part of a GRIP 2 project led by Western Route.

**Table continued overleaf...**

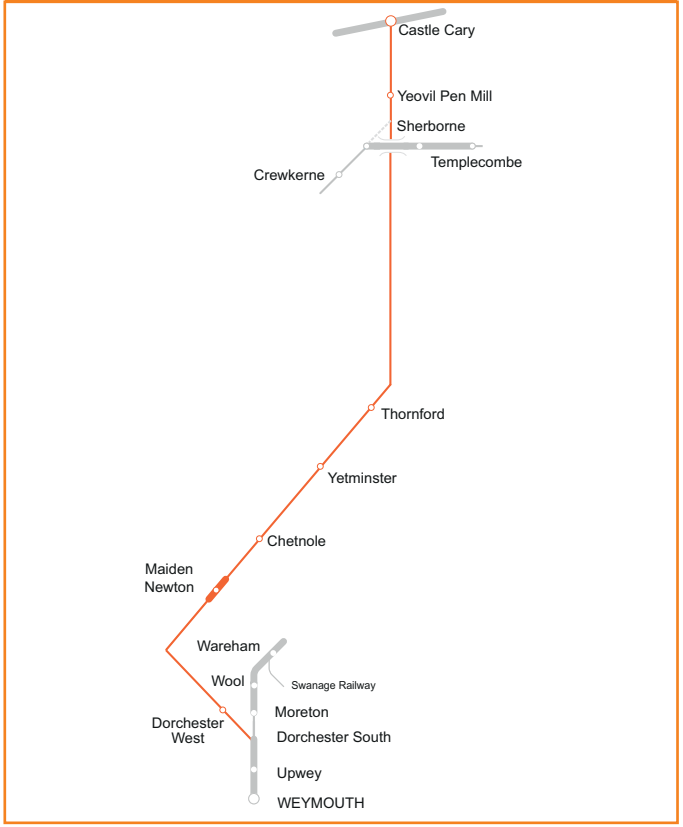
**Table 5.10 Infrastructure requirement for diversionary choices...continued**

| Base Timetable | Train Service Specification | Possible alterations to infrastructure |
|---|---|---|
| Future 25kV OLE Electrified | Hourly Exeter – Waterloo service only | • Extension of double track from Wilton South Junction westwards or increased line speeds between Templecombe & Wilton South Junction |
| | Hourly Exeter – Waterloo + additional hourly Axminster – Exeter/ Barnstaple | • Extension of double track from Wilton South Junction westwards or increased line speeds between Templecombe & Wilton South Junction<br>• Dynamic loop at Whimple Station (including new platform) |
| | Exeter – Waterloo + hourly diverted Great Western service between Castle Cary - Exeter | • Static / dynamic loop at Whimple Station (including new platform)<br>• Dynamic passing loop between Chard Junction – Crewkerne<br>• Extension of loop westwards from Yeovil Junction, with the potential for Platform 3 to be brought back in to passenger use<br>• Extension of double track from Wilton South Junction westwards or increased line speeds between Templecombe & Wilton South Junction<br>• Three additional signal sections between Yeovil Pen Mill – Castle Cary |
| | Hourly Exeter – Waterloo + additional hourly Axminster – Exeter/ Barnstaple + hourly diverted Great Western service between Castle Cary - Exeter | • Re-double between Pinhoe and existing Axminster loop<br>• Dynamic passing loop between Chard Junction – Crewkerne<br>• Extension of loop westwards from Yeovil Junction, with the potential for Platform 3 to be brought back in to passenger use<br>• Extension of double track from Wilton South Junction westwards or increased line speeds between Templecombe & Wilton South Junction<br>• Three additional signal sections between Yeovil Pen Mill – Castle Cary |

Note: The proposed infrastructure changes detailed above are currently being reviewed as part of a GRIP 2 project led by Western Route.

## Off-peak cross-boundary connectivity: The Heart of Wessex Line

**Figure 5.19 Map of Heart of Wessex Line**




5.7.71 The line connecting Weymouth to Bristol is known as the Heart of Wessex Line. Although the section of the line between Castle Cary and Dorchester West is part of the Wessex Route this line has been assessed in more detail by the **Western Route Study**.

5.7.72 The **Western Route Study** suggests that one train per hour is operated between Bristol Temple Meads and Yeovil Pen Mill increasing the current frequency on this section from around one train per two hours Bristol Temple Meads to Weymouth. Every other hour one of these services would extend to Weymouth therefore maintaining the current level of services on the southern section of the line.

5.7.73 The Yeovil Pen Mill terminating service could be extended to Yeovil Junction to improve connectivity with the West of England Line but this is likely to require the re-instatement of Platform 3 at Yeovil Junction for passenger use.

## Off-peak cross boundary connectivity: Wessex connectivity to HS2

5.7.74 To achieve connectivity to High Speed 2 (HS2) from the Wessex Route several different options have been considered:

- Cross boundary services from Southampton Central via Basingstoke and Reading to Old Oak Common (although it is likely that direct services via Basingstoke to destinations such as Birmingham may prove more attractive than travelling via HS2 at Old Oak Common.)
- A connection to Old Oak Common from the West London Line (WLL) as assessed in the **South-East Route: Sussex Area Route Study**
- Connectivity via the interchange with the North London Line (NLL) at Richmond

5.7.75 This Route Study has suggested that two trains per hour are operated between Basingstoke and Heathrow Airport which could be extended on to London Paddington via Old Oak Common to connect to HS2. One train per hour would originate from Southampton Central with a further one train per hour originating from Basingstoke. The **Western Route Study** addresses how these services could potentially be operated beyond Southcote Junction.

5.7.76 In terms of interchange with HS2 via the West London Line, TfL has produced a draft timetable for a 10tph service following the implementation of a link to Old Oak Common station. The **South-East Route: Sussex Area Route Study** suggests that if allied with 8-car operation of all peak services a 10tph peak timetable would accommodate the capacity conditional output

gap to 2043. There are some infrastructure alterations that would be needed to support robust operation of a full 10tph timetable:

- Provision of 8-car turnback capability within the designs for Old Oak Common Station (or at locations beyond Old Oak Common Station) on the WLL/North London Line (NLL) link
- Provision of 8-car capability at a new Clapham Junction Platform 0 and/or existing LOROL platforms
- Lengthening of platforms on the NLL through to Stratford to allow 8-car services to run, if the provision of turnback facilities proves impossible
- Any depot and stabling implications identified from some further operation of additional 8-car formations in the long term

5.7.77 There are also aspirations from Local Authorities such as a proposal from the London Borough of Hounslow for 4tph between the Hounslow Loop and Old Oak Common.

### Off-peak cross-boundary connectivity: Improving connectivity to Heathrow Airport

5.7.78 As part of the ongoing consideration of airport capacity in South East England, the Government is supporting a study into options for southern rail access to Heathrow. This is in response to one of the recommendations in the Airports Commission's interim report of December 2013. The Wessex Route Study therefore does not provide choices for funders to address southern access to Heathrow by rail as these will be delivered through the aforementioned Study, which will report to DfT in summer 2015.

5.7.79 The Study is being undertaken in two stages. The first stage considers the potential markets that could be served by such a rail link and which of these would be of most value. The second considers infrastructure feasibility and a value for money assessment.

5.7.80 Should the Government choose to investigate further any of the choices presented in the Southern Rail Access to Heathrow Study, Network Rail will develop the potential infrastructure solutions and work with key stakeholders to understand the cost and outputs of the scheme so that funding decisions can be taken.

5.7.81 The output of the Southern Access to Heathrow study will be considered alongside the Wessex Route Study to ensure that both studies form part of a coherent and integrated funding strategy for the whole Wessex Route taking account of the full complement of offered choices.

### Off-peak cross boundary connectivity: Improving connectivity to Southampton Airport

5.7.82 As well as addressing connectivity to Heathrow and Gatwick Airports this study has made some assessment of improved connectivity with Southampton Airport. Although no specific scheme is suggested for Southampton Airport it is proposed that Southampton Airport Parkway could be included as a stop for proposed additional services to London Waterloo originating from Southampton Central, Bournemouth and Poole.

5.7.83 As previously stated in **Chapter 2**, connectivity to Southampton Airport was raised by several respondents to the Wessex Route Study consultation, especially in relation to connectivity from the east. There are several constraints involved in addressing this connectivity, which were highlighted in the London and **South-East Route Utilisation Strategy**, published in 2011.

5.7.84 Network Rail welcomes engagement from South Hampshire stakeholders to further investigate connectivity and journey times between key centres within the area.

### Improving Freight service provision: CO36

5.7.85 The following freight services need to be accommodated on the Wessex Route to meet the 2043 capacity gap:

- Between Southampton and Basingstoke: a maximum of 3 to 4 Class 4 paths (for services which can operate up to 75 mph) plus 0.5 to 1 Class 6 path (for services which can operate up to 60 mph) per hour in each direction
- Between Basingstoke and Southcote Junction: a maximum of 3 to 4 Class 4 paths plus 0.5 to 1 Class 6 path per hour in each direction
- Between Basingstoke, Woking, and Kew East Junction (via

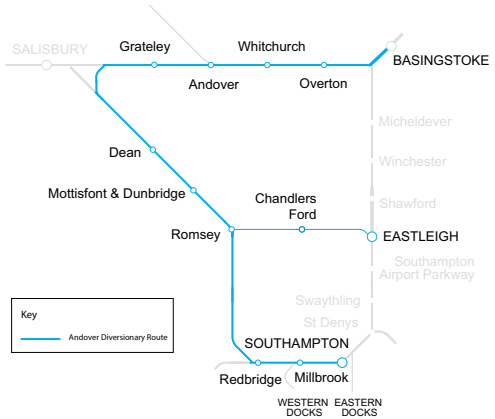
Hounslow): one Class 4 or one Class 6 path per hour in each direction

5.7.86 The total number of extra freight paths required by 2043 is not deliverable within the end of CP5 capability of the network, even if no additional passenger services are provided. However, opportunities exist to partially achieve this growth through the operation of additional freight services via Andover using the diversionary route.

5.7.87 Operating via Andover adds both journey time and operational cost to each freight service using the diversionary route. Therefore the trade-off that is presented to freight operators is either to:

- Run additional services in the short term without any infrastructure intervention but accept the additional costs associated with operating via Andover; or
- Await the implementation of infrastructure interventions on the line between Basingstoke and Southampton to enable additional capacity on the route in the longer term

**Figure 5.20 Map of Andover Freight Diversionary Route**




5.7.88 As part of the Electric Spine concept it is intended to provide 25kV AC overhead line electrification between Basingstoke and the docks at Southampton at some point during CP6. This could enable a proportion of intermodal freight traffic to and from the port to be electrically hauled (potentially playing a part in enabling longer, heavier trains to be operated, and therefore using capacity more efficiently), as well as being an incremental step towards the electric operation of cross-country passenger trains.

5.7.89 It is recognised that as a standalone scheme, there are potential disadvantages, including for example:

- At present, freight operators have the option of a gauge-cleared diversionary route between Southampton and Basingstoke via Laverstock and Andover. This diversionary route would not be available for electrically-hauled freight, potentially requiring diesel-haulage to be specially arranged whenever the main route was unavailable
- A significant cost is involved in converting the present-day DC electric passenger fleet to dual-voltage capability, it being assumed that it will not prove possible or practicable to keep in place the third-rail DC system as well as the AC system
- Whilst some minor passenger journey time improvements might be achievable between Basingstoke and Southampton, there is very little overall passenger benefit in the short to medium term
- From an asset management and maintenance perspective, the scope of AC electrification may be insufficient to offer efficiencies of scale

5.7.90 For these reasons it is proposed to extend the scope of the Southampton to Basingstoke project to include consideration of electrification of the lines between Basingstoke and Salisbury (including the Laverstock loop), between Salisbury and Redbridge, and between Romsey and Eastleigh.

5.7.91 This would provide an electrified diversionary route for freight, and offer the potential for electric operation of Waterloo to Salisbury passenger services, and Salisbury to Southampton local passenger services.

5.7.92 As these electrification schemes form part of the Electric

Spine they are dependent on wider governmental decisions associated with the future of electrification schemes.

5.7.93 Operating freight services via Winchester instead of the route via Andover will require a number of Wessex based interventions, possibly over a number of control periods:

- Platform capacity at Southampton Central, particularly Phase 3 of the scheme proposed in **Section 5.4** that includes the provision of an additional freight loop on the south side of the station
- Track capacity between Eastleigh and Basingstoke, particularly the extension of Waller's Ash Loop as detailed previously in this section
- Grade-separation of Basingstoke Junction to provide the ability for southbound freight services to cross the SWML without conflicting with other services

5.7.94 Freight diversionary capability is a key concern for Freight Operating Companies (FOCs). At present the route via Kew is only cleared for W8 gauge whereas freight operators would prefer to achieve W10 or W12 clearance on this route. Recent studies, however, have indicated that such gauge clearance on this route has a weak business case and the Strategic Freight Network Steering Group has decided not to prioritise this scheme at present. This may need to be reviewed in due course especially if gauge enhancement works will be required for AC electrification or double-deck trains.

5.7.95 Interventions will be required on other Routes as it is important that any decisions made on freight service provision take into account the whole corridor over which a service travels.

## 5.8 Improved passenger circulation at Wessex stations: CO37 and CO38

5.8.1 Many of the stations on the Wessex Route date from Victorian times, and in terms of overall footprint and layout have not changed substantially for many decades. As a result of this and growth in the market, some stations on the Wessex Route are congested during peak hours, making movement through the station to and from the platforms slow and potentially difficult.

5.8.2 Conditional Output CO37 looks to address existing station pedestrian congestion at London Waterloo, Wimbledon, Vauxhall and Clapham Junction. The Route Study anticipates that the CP5 Wessex Capacity Programme will fund capacity improvements at a number of stations including London Waterloo, Wimbledon, Vauxhall, Clapham Junction and Queenstown Road Battersea which would meet this Conditional Output.

5.8.3 Based upon existing levels of congestion, Richmond was identified as a priority for congestion relief. However, funding for improvements at this station in CP5 has not been confirmed. As a result the Route Study has included Richmond Station as a priority for investment during CP6, although CP5 funding options are still being pursued.

5.8.4 The size and scale of the problems at Clapham Junction, London Waterloo and Vauxhall are significant. The Wessex Capacity Programme is remitted to provide congestion relief to 2024 and the interventions proposed for these stations are not significant enough to address the station capacity shortfall in the long term. These three stations have also been included in the CP6 Priority List.

5.8.5 The Route Study also assumes that some planned interventions during CP5 (for example, the introduction of 10-car suburban trains) will alleviate existing station congestion. This is the case with existing crowding on the up platforms in the morning peak at Putney, Earlsfield, New Malden and Wandsworth Town.

5.8.6 At Southampton Central and Guildford it is assumed that longer term strategies proposed to alter track and platform layout in the station area will include an element of pedestrian capacity works.

5.8.7 Elsewhere on the Wessex Route, it is anticipated that investment will be required at a number of other suburban stations to meet Conditional Output CO38 during CP6. These stations are listed in Table 5.11. This list builds upon the **Network RUS: Stations** and has been compiled by Network Rail in conjunction with South West Trains and other industry stakeholders.

5.8.8 The Route Study estimates that capital investment in the range £25 million to £125 million is required to provide the

| Table 5.11 Station investment priorities for Control Period 6 | |
|---|---|
| **Station** | **Control Period 6 investment priority** |
| Basingstoke | Increased capacity for passengers to leave from the island Platforms (2 and 3). |
| Clapham Junction | New vertical circulation will be required at Clapham Junction. A masterplan is being developed to address medium and long-term requirements at Clapham Junction. This includes future track and platform capacity requirements for both Wessex and Sussex routes. A scheme is also in development to address immediate congestion issues at Clapham Junction in CP6. |
| Farnham | Increase capacity for passengers exiting the station from Platform 2 to the station car park. |
| Isleworth | Additional canopy coverage on the London bound Platform 1. |
| Kingston | Increase capacity through the ticket gates, or relocate the existing ticket gates to prevent queuing on the stairs. |
| Norbiton | Increase capacity for passengers exiting the station from Platform 2. |
| Portsmouth & Southsea | Additional staircase off the island Platform (1 and 2). |
| Putney | Increase capacity for passengers exiting from all platforms over the footbridge. This could potentially be via secondary access the east end of the station. This would also ease interchange with the London Underground District Line station at East Putney. |
| Raynes Park | Platform de-cluttering to reduce platform congestion and potentially further measures to increase platform capacity on the Down platform. |
| Richmond | Additional ticket gates and gateline reconfiguration, plus de-cluttering of Platform 2. |
| Syon Lane | Increase capacity for passengers exiting the station from Platform 2. |
| Vauxhall | It is expected that the station will require a further upgrade following CP6 to cater for forecast passenger demand on the Main Suburban platforms. This could potentially involve a new Platform 9 on the existing Down Slow Line. |
| Walton-on-Thames | Increase capacity for passengers exiting the station from Platform 2. |
| Wandsworth Town | Additional canopies to encourage use of the entire platform during bad weather. |
| Waterloo | The interventions proposed in CP5 as part of the Wessex Capacity Programme do not address all of the long term issues expected at London Waterloo, particularly as part of the Main Line capacity uplift. Further work will be required to mitigate future congestion. A masterplan is also being developed for London Waterloo, to establish practical options that ensure it can cater for projected future passenger demand, with and without Crossrail 2. |
| Weybridge | Increase capacity for passengers exiting the station from all platforms. |
| Woking | Additional capacity in the northern ticket hall. |

necessary station capacity identified in **Table 5.11**. At this early stage of development, this figure is based upon typical costs for similar schemes at other stations. Network Rail plans to develop more specific costs over the forthcoming months to better inform funder's choices for CP6.

5.8.9 Feedback from train operators has suggested that the following stations should also be taken into account in any analysis of pedestrian capacity at stations:

- Ascot
- Ash
- Ash Vale
- Earlsfield
- Esher
- Farncombe

# 06 Summary



## 6.1 Summary of choices

6.1.1 This chapter provides a quick reference summary of the choices that have been identified in this Route Study and detailed in **Chapter 5**. This chapter will also show how the baseline interventions, described in **Chapter 3** form the initial building blocks for future interventions in CP6 and beyond.

6.1.2 **Table 6.1** lists, grouped by high-level output, the baseline, CP6, and CP7 (and beyond) choices and interventions that form the strategy for enhancement of the Wessex Route.

**Table 6.1 Summary Table**

| High-level output | CP5 (baseline schemes) | Potential CP6 schemes | Potential CP7 and beyond schemes |
|---|---|---|---|
| Main Suburban Peak Demand | • 10-car operation (including power supply and platform lengthening) | • Nil | • Crossrail 2 or 12-car operation or ETCS Level 3 + ATO |
| Windsor Peak Demand | • 10-car operation (including power supply and platform lengthening)<br>• At least an additional 2tph via the Hounslow Loop to London Waterloo<br>• Waterloo International Terminal fully converted to domestic operation<br>• Hounslow Turnback<br>• Re-open Queenstown Road Platform 1 | • Operation of full 20tph capability of Windsor Lines (may happen in CP5)<br>• Extension of Up Main Relief Line and re-configuration of lines between Queenstown Road and London Waterloo | • 12-car operation or ETCS Level 3 + ATO |
| Main Line Peak Demand | • Residual strengthening of Main Line services | • Woking Grade Separation<br>• Woking Platform 6<br>• Extension of Up Main Relief Line and re-configuration of lines between Queenstown Road and London Waterloo<br>• Basingstoke Grade Separation | • Crossrail 2 or 5th Track between Surbiton and Clapham Junction or ETCS Level 3 + ATO<br>• Additional London Waterloo services<br>• Guildford platform capacity<br>• Southampton Central platform capacity<br>• Relocation of Clapham Junction Platforms 7&8 (also see Sussex Route Study for works proposed for Platforms 13-17) |

Table continued overleaf...

| Table 6.1 Summary Table...continued | | | |
|---|---|---|---|
| **High-level output** | **CP5 (baseline schemes)** | **Potential CP6 schemes** | **Potential CP7 and beyond schemes** |
| **Station Pedestrian Capacity** | • Clapham Junction Phase 1 congestion schemes<br>• Putney Station<br>• Twickenham Station | • Clapham Junction Phase 2 congestion schemes<br>• Various stations (final priorities to be agreed) | • Clapham Junction Phase 3 congestion schemes or Masterplan<br>• Various stations (final list to be agreed) |
| **Freight Capacity** | • Train, siding and loop lengthening | • Basingstoke Grade Separation<br>• AC Electrification (Basingstoke to Redbridge, Basingstoke to Salisbury, Redbridge to Salisbury and Romsey to Eastleigh) | • Additional track capacity between Basingstoke and Eastleigh (Waller's Ash Loop extension)<br>• Southampton Central platform capacity and additional freight loop |
| **Airport Connectivity (Heathrow)** | • Nil | • Direct services between Basingstoke/ Southampton Central and Heathrow (possibly on to London Paddington) | • Southern Access to Heathrow (to be defined and agreed in a separate study) |
| **Airport Connectivity (Gatwick)** | • Additional service between Reading and Gatwick Airport (as identified in FGW's Direct Award) | • Nil | • AC electrification (North Downs Line)<br>• Guildford platform capacity<br>• Headway and line speed improvements |
| **Airport Connectivity (Southampton)** | • Nil | • Nil | • Additional cross-boundary services via Basingstoke<br>• Additional London Waterloo services |
| **HS2 Connectivity** | • Nil | • Platform 0 at Clapham Junction (benefits realised once HS2 is operational and dependent on opening of an Old Oak Common Station on the West London Line) | • Old Oak Common Station (on West London Line)<br>• Direct services between Basingstoke/ Southampton Central and Old Oak Common via Heathrow (possibly on to London Paddington) |

Table continued overleaf...

**Table 6.1 Summary Table...continued**

| High-level output | CP5 (baseline schemes) | Potential CP6 schemes | Potential CP7 and beyond schemes |
|---|---|---|---|
| **Main Suburban – journey time, frequency and connectivity (off-peak)** | • Nil | • 2tph new services to Main Suburban destinations<br>• Shuttle services between Shepperton and Kingston<br>• Shuttle services between Hampton Court and Surbiton | • Crossrail 2 |
| **Windsor Lines – journey time, frequency and connectivity (off-peak)** | • At least an additional 2tph via the Hounslow Loop to London Waterloo<br>• Waterloo International Terminal fully converted to domestic operation<br>• Hounslow Turnback<br>• Re-open Queenstown Road Platform 1 | • Operation of full 20tph capability of Windsor Lines (may happen in CP5)<br>• Additional 2tph in the off-peak | • ETCS Level 3 + ATO<br>• Additional track capacity via Richmond and/ or Hounslow<br>• Resolution of level crossing downtime issues<br>• Capacity works through Feltham<br>• Southern Access to Heathrow |
| **Portsmouth Direct – journey time, frequency and connectivity (off-peak)** | • Nil | • Nil | • Additional London Waterloo services<br>• Re-instate Portsmouth Harbour Platform 2<br>• Additional track capacity between Petersfield and Haslemere (additional loop)<br>• Resolve turnround times at Portsmouth Harbour and/ or interventions to address conflicts in the throat of Portsmouth Harbour and Portsmouth & Southsea<br>• Guildford platform capacity |

**Table continued overleaf...**

**Table 6.1 Summary Table...continued**

| High-level output | CP5 (baseline schemes) | Potential CP6 schemes | Potential CP7 and beyond schemes |
|---|---|---|---|
| **South West Main Line – journey time, frequency and connectivity (off-peak)** | • Nil | • Basingstoke Grade Separation | • Additional track capacity between Basingstoke and Eastleigh (Waller's Ash Loop extension)<br>• Southampton Central platform capacity and additional freight loop<br>• Headway and line speed improvements between Totton and Poole<br>• AC Electrification and line speed increases Woking to Basingstoke<br>• AC Electrification west of Southampton |
| **West of England Line – journey time, frequency and connectivity (off-peak)** | • Nil | • 1tph between Exeter and Axminster (Devon Metro service) - also peak<br>• Diversionary route between Castle Cary and Exeter via Yeovil Junction<br>• AC Electrification (Basingstoke to Salisbury and Test Valley)<br>• Potential platform re-instatement at Salisbury | • AC Electrification (Salisbury to Exeter)<br>• Additional loops and double track sections to realise full journey time benefits of electrification |
| **North Downs Line – journey time, frequency and connectivity (off-peak)** | • Additional service between Reading and Gatwick Airport (as identified in FGW's Direct Award)<br>• Platform 0 at Redhill | • Potential enhancements associated with re-signalling to address signalling headways | • AC electrification (North Downs Line)<br>• Guildford platform capacity<br>• Headway and line speed improvements<br>• Possible 4tph service Reading to Gatwick Airport |

Table continued overleaf...

**Table 6.1 Summary Table...continued**

| High-level output | CP5 (baseline schemes) | Potential CP6 schemes | Potential CP7 and beyond schemes |
|---|---|---|---|
| **South Hampshire – journey time, frequency and connectivity (off-peak)** | • Nil | • Nil | • Southampton Central platform capacity and additional freight loop<br>• Headway and line speed improvements between Totton and Poole<br>• Headway and line speed improvements between Cosham and St Denys<br>• Re-instate Portsmouth Harbour Platform 2 |
| **Cross-boundary – journey time, frequency and connectivity (off-peak)** | • Nil | • Additional 0.5tph CrossCountry service south of Reading<br>• Direct services between Basingstoke/ Southampton Central and Heathrow (possibly on to London Paddington) | • Southampton Central platform capacity and additional freight loop<br>• Headway and line speed improvements between Totton and Poole (to facilitate additional services from Brighton)<br>• Headway and line speed improvements between Cosham and St Denys (for additional services from Brighton/ Portsmouth Harbour to Bristol/ Cardiff)<br>• Re-instate Portsmouth Harbour Platform 2<br>• Resolve turnround times at Portsmouth Harbour and/ or interventions to address conflicts in the throat of Portsmouth Harbour<br>• Southern Access to Heathrow<br>• Crossrail 2 |
| **Resilience** | • CP5 resilience works lead by Western Route<br>• Route Weather Resilience and Climate Change Adaptation Plans | • Diversionary route between Castle Cary and Exeter via Yeovil Junction<br>• Route Weather Resilience and Climate Change Adaptation Plans | • Route Weather Resilience and Climate Change Adaptation Plans |

**Table continued overleaf...**

| Table 6.1 Summary Table...continued | | | |
|---|---|---|---|
| **High-level output** | **CP5 (baseline schemes)** | **Potential CP6 schemes** | **Potential CP7 and beyond schemes** |
| **Accessibility** | • Access for All schemes at: Whitton, Barnes, Godalming, Virginia Water and Walton on Thames | • Access for All (or successor fund) schemes to be determined | • Access for All (or successor fund) schemes to be determined |

## Figure 6.1 South West Main Line Summary

**London Waterloo to Clapham Junction**

Constraints:
* Track capacity to accommodate required Main Line demand
* ECS movements into and out of Clapham Yard
* Platform lengths (London Waterloo)
*Station pedestrian congestion at Clapham Junction, Vauxhall and London Waterloo

CP6 choices:
*Lengthen remaining Main Line services
*Re-configure the internal layout of rolling stock to 3+2 seating
* 2tph extra Main Line services but with a trade-off against reliability and performance
* 2tph extra Main Line services provided by transferring 2tph Main Suburban services on to the Slow Line
* Homogenisation of rolling stock capability
* Extension of the Up Main Relief line
*Station pedestrian congestion works at Clapham Junction, Vauxhall and London Waterloo

Longer-term choices:
* Inner solution - Crossrail 2 or 5th Track or ETCS Level 3 + ATO or a combination of these options
* Extension of London Waterloo Platforms 1-7 to allow 12-car Main Suburban services transferred to Slow Line from Fast Line in the event of Crossrail 2 implementation or introduction of full 12-car Main Suburban operation

**Woking to Southampton Central**

Constraints:
* Track capacity to accommodate required Main Line demand, freight growth and connectivity conditional outputs
* Flat Junction at Basingstoke
* Platform capacity at Southampton Central
* Journey times
* Station pedestrian capacity at Farnham and Basingstoke

CP6 choices:
*Lengthen remaining Main Line services
*Re-configure the internal layout of rolling stock to 3+2 seating
* 2tph extra Main Line services but with a trade-off against reliability and performance
* Homogenisation of rolling stock capability
* Basingstoke Flyover
* AC Electrification Basingstoke to Southampton
* Station pedestrian capacity works at Farnham and Basingstoke

Longer-term choices:
* Inner solution - Crossrail 2 or 5th Track or ETCS Level 3 + ATO or a combination of these options
* Additional track between Basingstoke and Eastleigh, potentially Waller's Ash Loop extension to accommodate additional freight, cross-boundary and London-bound services
* Additional platforms and freight loop at Southampton Central
* AC Electrification and line speed increases Woking to Basingstoke

**Southampton Central to Weymouth**

Constraints:
* Signalling headways
* Journey times

CP6 choices:
*No CP6 choices have been identified

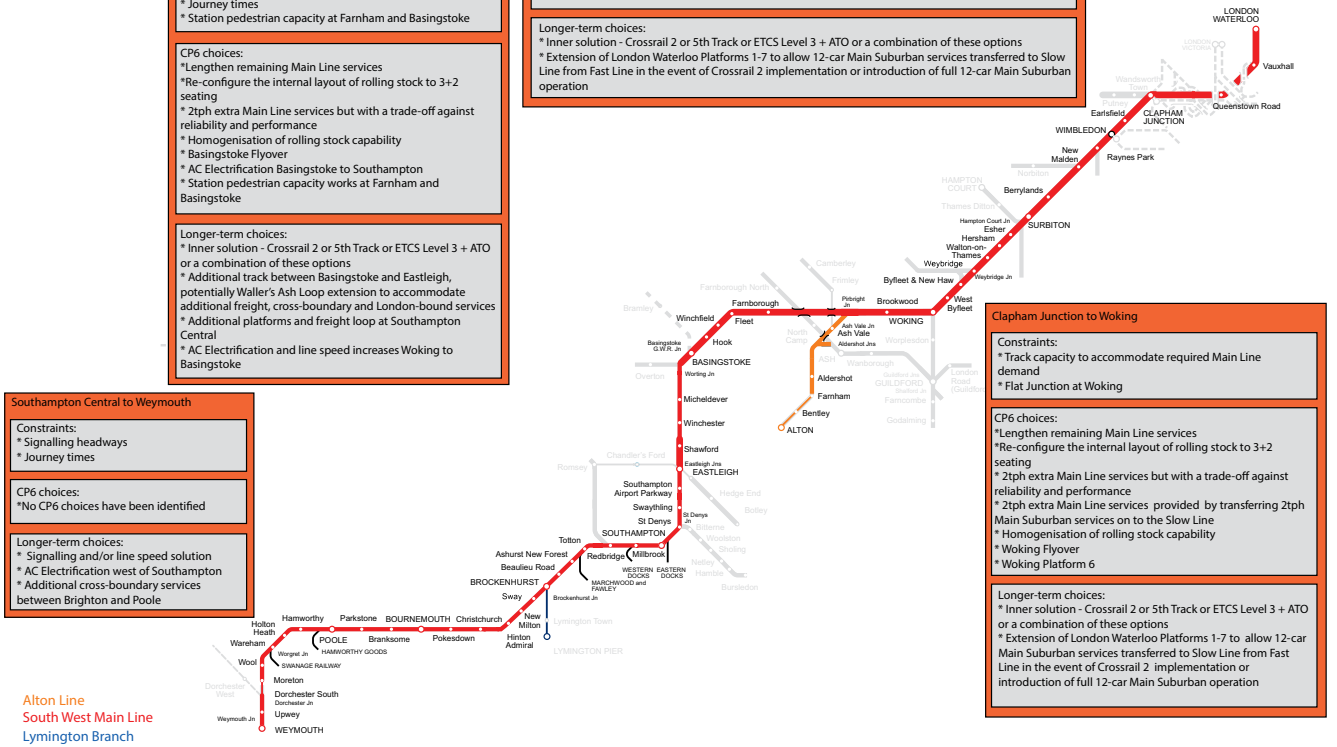
Longer-term choices:
* Signalling and/or line speed solution
* AC Electrification west of Southampton
* Additional cross-boundary services between Brighton and Poole

**Clapham Junction to Woking**

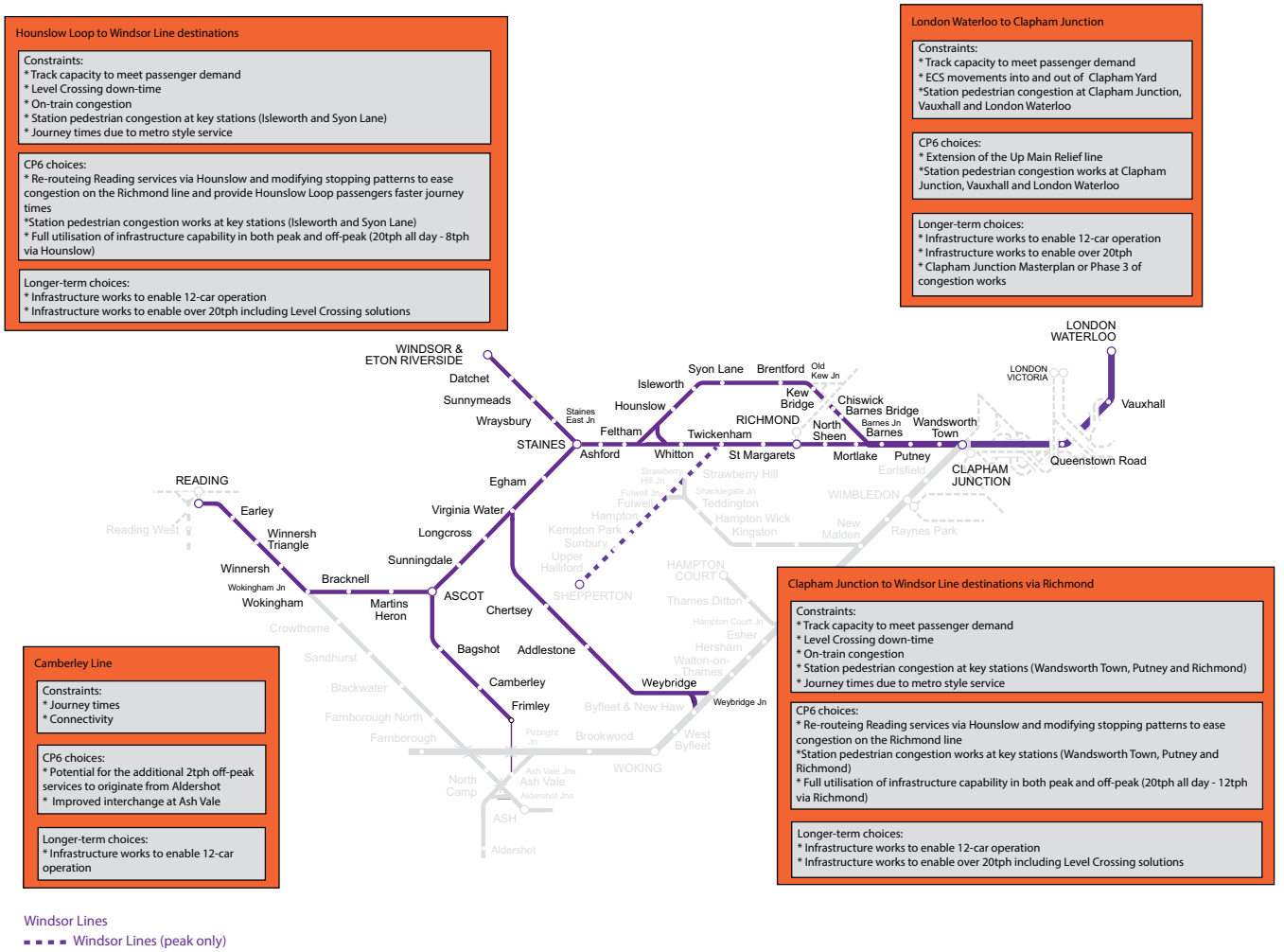
Constraints:
* Track capacity to accommodate required Main Line demand
* Flat Junction at Woking

CP6 choices:
*Lengthen remaining Main Line services
*Re-configure the internal layout of rolling stock to 3+2 seating
* 2tph extra Main Line services but with a trade-off against reliability and performance
* 2tph extra Main Line services provided by transferring 2tph Main Suburban services on to the Slow Line
* Homogenisation of rolling stock capability
* Woking Flyover
* Woking Platform 6

Longer-term choices:
* Inner solution - Crossrail 2 or 5th Track or ETCS Level 3 + ATO or a combination of these options
* Extension of London Waterloo Platforms 1-7 to allow 12-car Main Suburban services transferred to Slow Line from Fast Line in the event of Crossrail 2 implementation or introduction of full 12-car Main Suburban operation



## Figure 6.2 Windsor Lines Summary



## Figure 6.3 Main Suburban Lines Summary

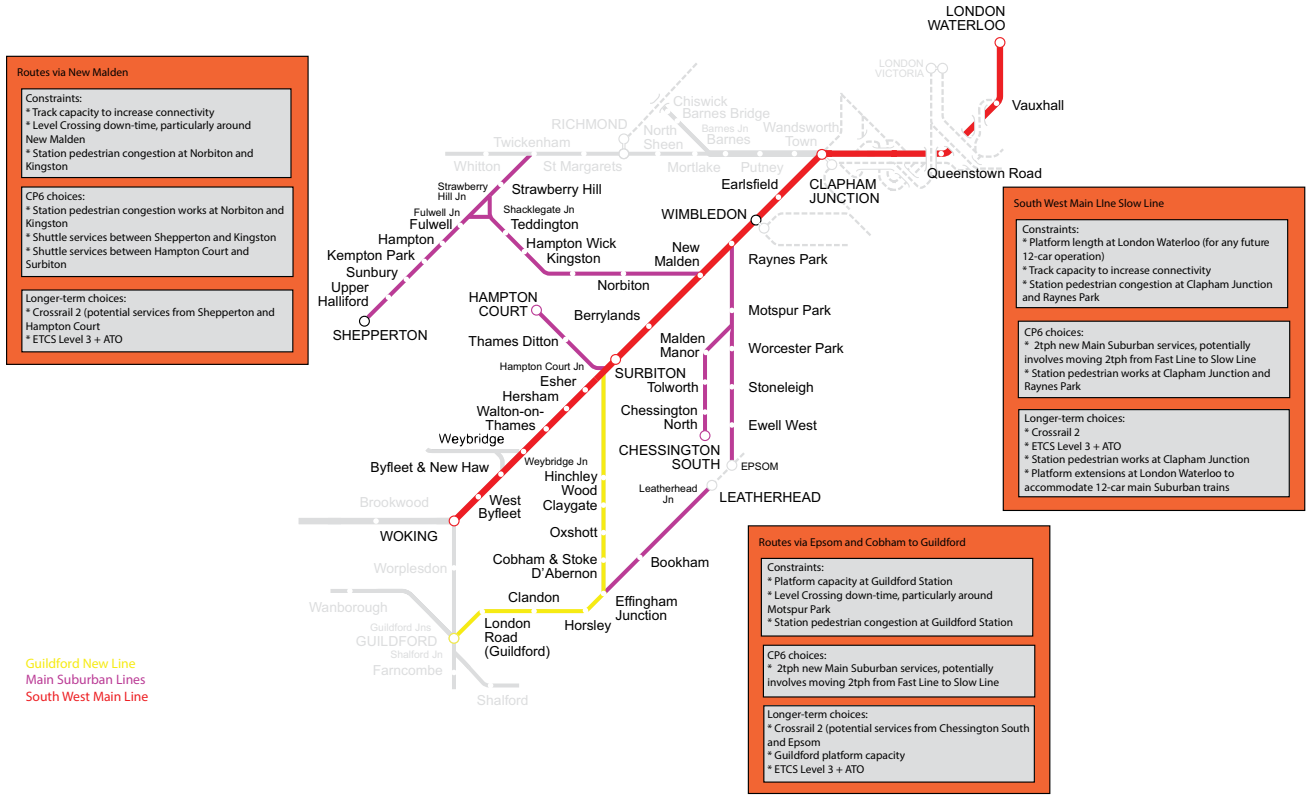


**Figure 6.4 Portsmouth Direct Line Summary**

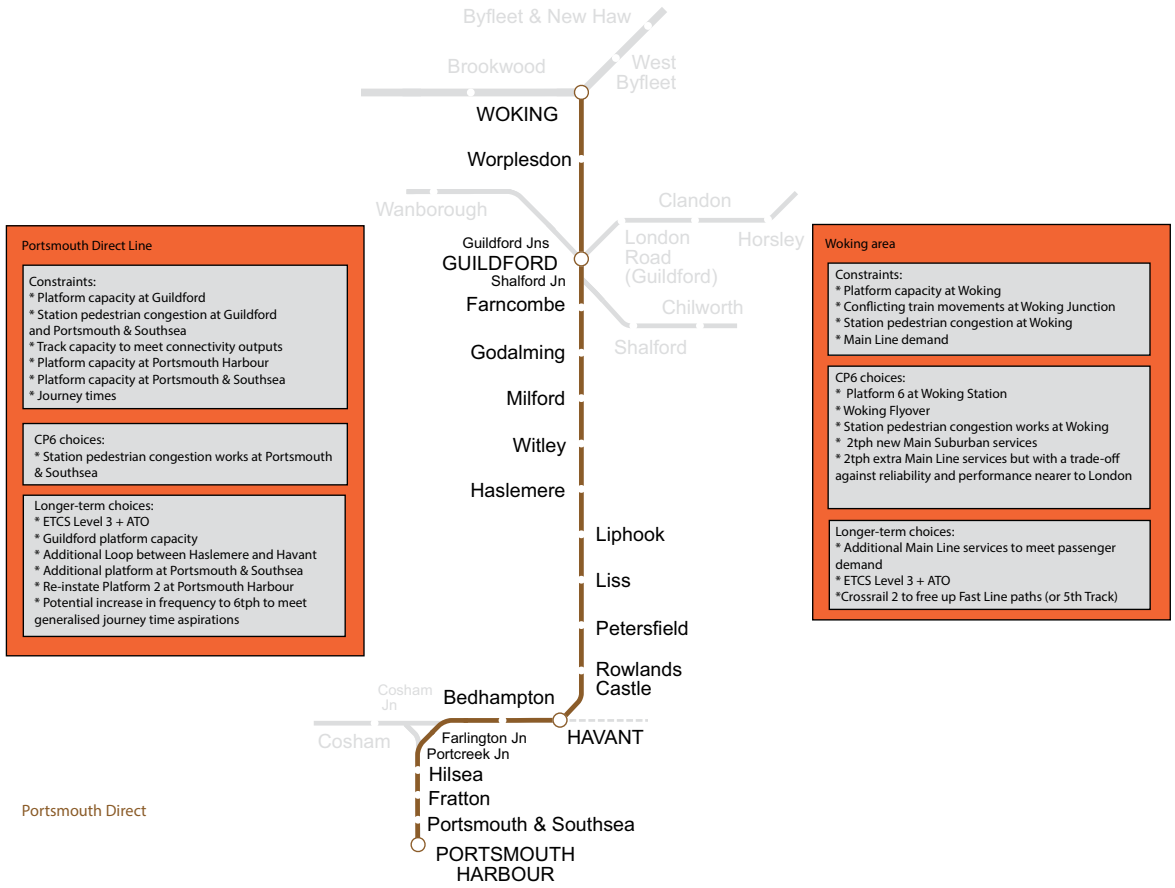
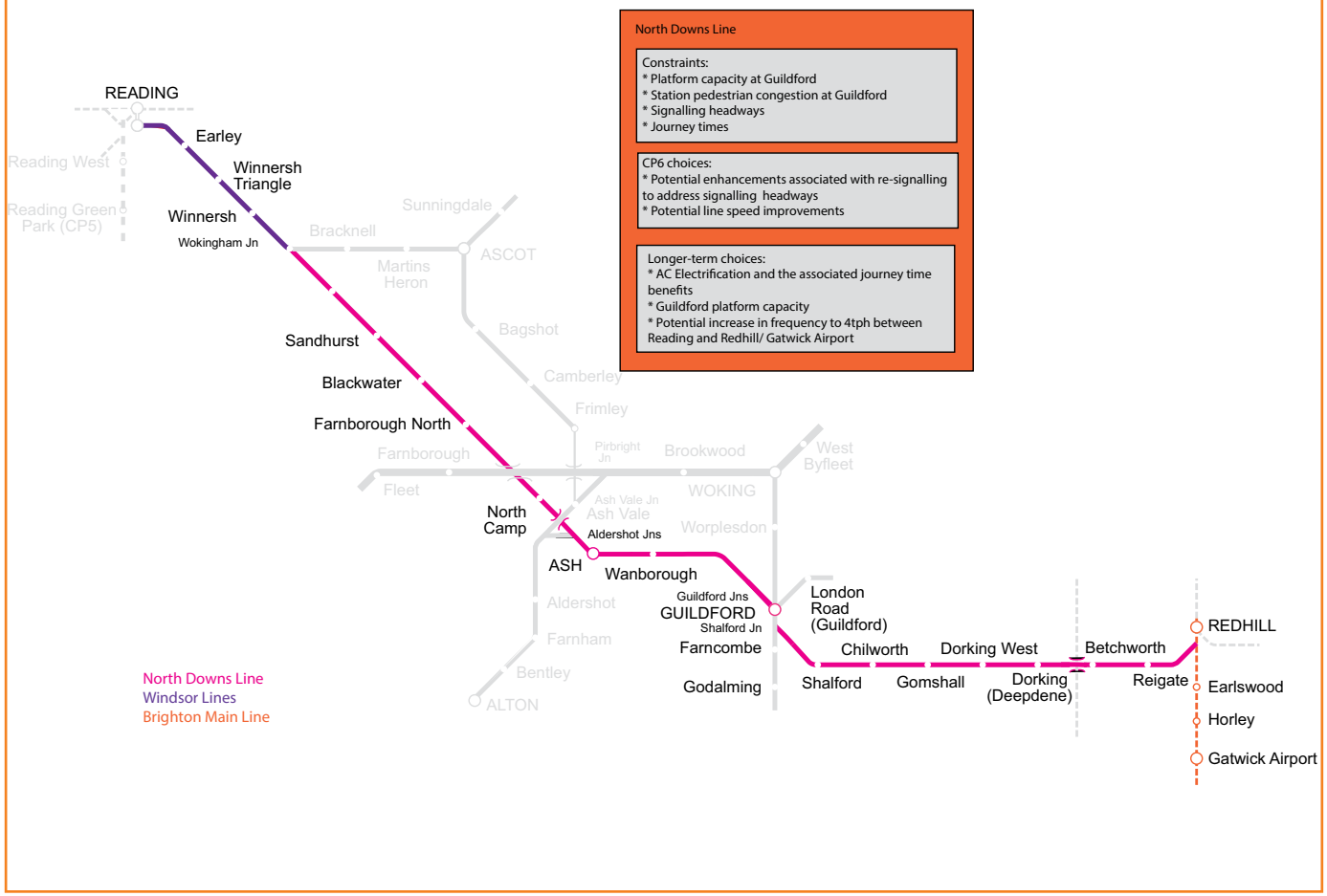
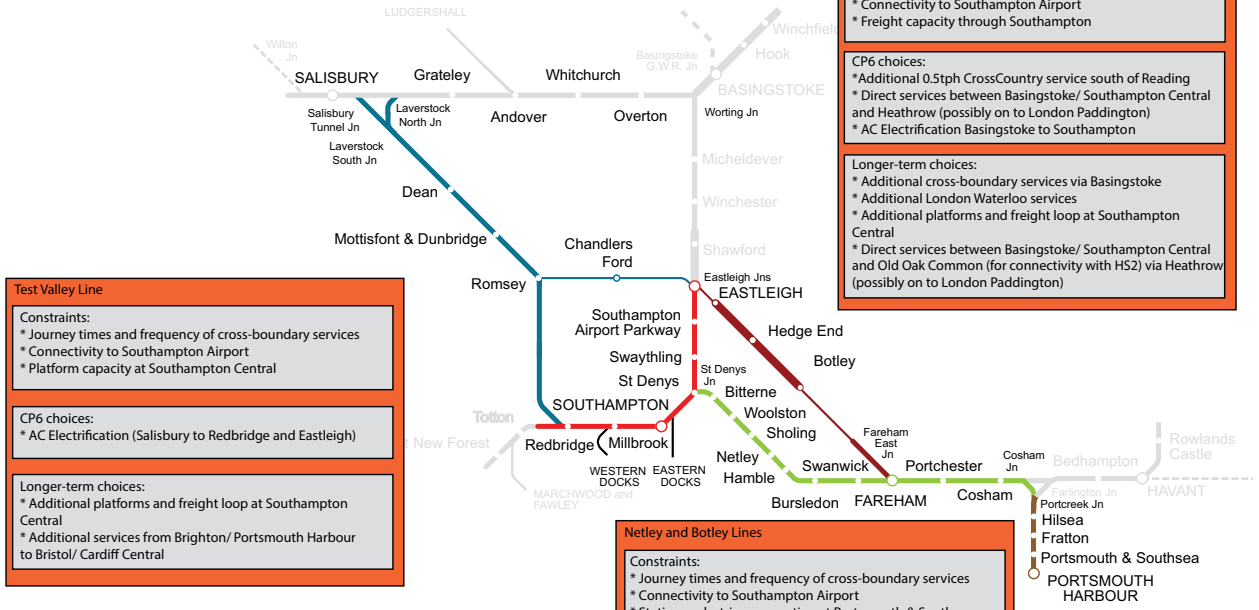


**Figure 6.5 North Downs Line Summary**



## Figure 6.6 South Hampshire Summary




**Eastleigh to Southampton Central**

Constraints:
* Platform capacity at Southampton Central
* Journey times and frequency of cross-boundary services
* Connectivity to Southampton Airport
* Freight capacity through Southampton

CP6 choices:
*Additional 0.5tph CrossCountry service south of Reading
* Direct services between Basingstoke/ Southampton Central and Heathrow (possibly on to London Paddington)
* AC Electrification Basingstoke to Southampton

Longer-term choices:
* Additional cross-boundary services via Basingstoke
* Additional London Waterloo services
* Additional platforms and freight loop at Southampton Central
* Direct services between Basingstoke/ Southampton Central and Old Oak Common (for connectivity with HS2) via Heathrow (possibly on to London Paddington)

**Test Valley Line**

Constraints:
* Journey times and frequency of cross-boundary services
* Connectivity to Southampton Airport
* Platform capacity at Southampton Central

CP6 choices:
* AC Electrification (Salisbury to Redbridge and Eastleigh)

Longer-term choices:
* Additional platforms and freight loop at Southampton Central
* Additional services from Brighton/ Portsmouth Harbour to Bristol/ Cardiff Central

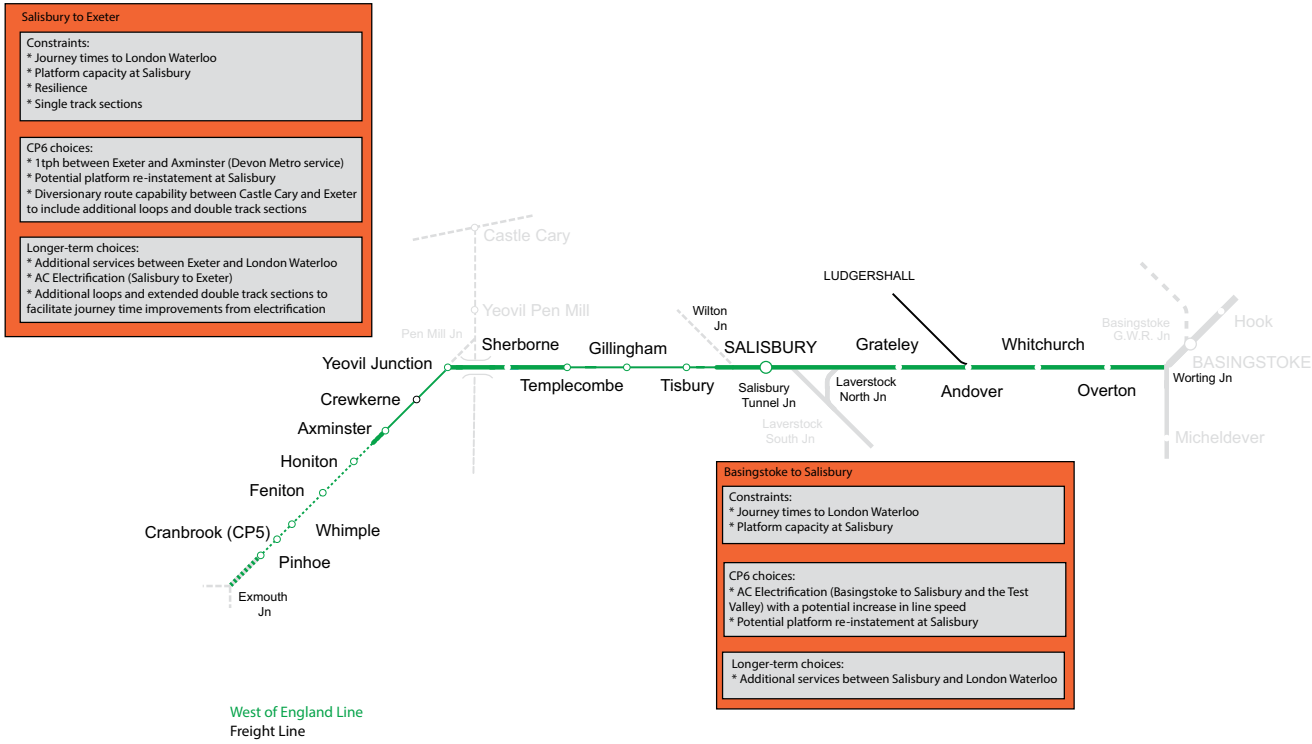
**Netley and Botley Lines**

Constraints:
* Journey times and frequency of cross-boundary services
* Connectivity to Southampton Airport
* Station pedestrian congestion at Portsmouth & Southsea
* Track capacity to meet connectivity outputs
* Platform capacity at Portsmouth Harbour
* Platform capacity at Portsmouth & Southsea
* Platform capacity at Southampton Central

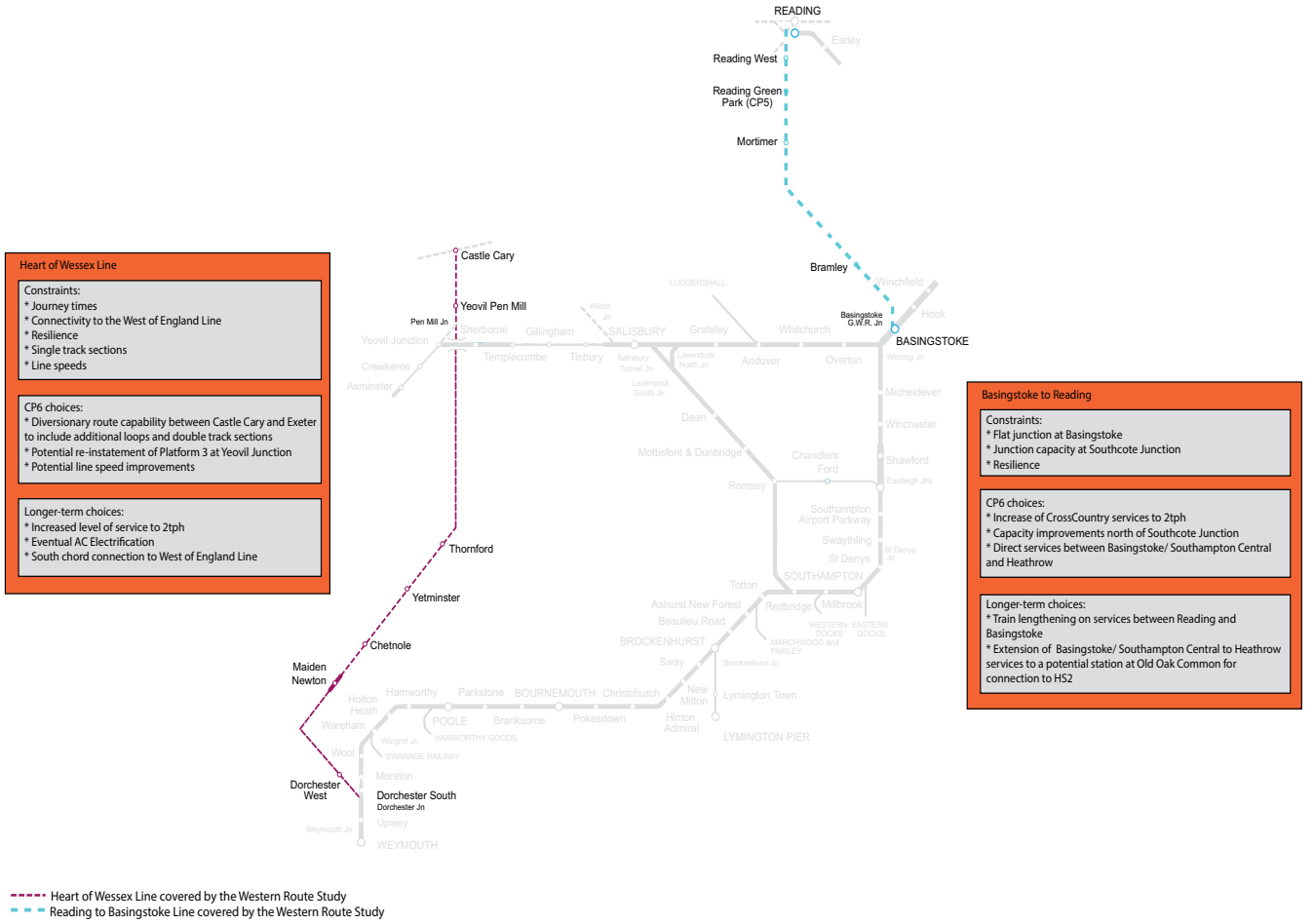
CP6 choices:
* Station pedestrian congestion works at Portsmouth & Southsea

Longer-term choices:
* Additional platform at Portsmouth & Southsea
* Re-instate Platform 2 at Portsmouth Harbour
* Headways and line speed imprvements between Cosham and St Denys
* Additional platforms and freight loop at Southampton Central
* Additional London Waterloo services via Botley
* Potential re-doubling of Botley to Fareham section
* Additional services from Portsmouth Harbour/ Brighton to Bristol/ Cardiff Central

## Figure 6.7 West of England Line Summary



## Figure 6.8 Heart of Wessex and Basingstoke to Reading Summary



## 6.2 Establishment of the Route Study

6.2.1 This route study is published on 21 August 2015, and is subject to the ORR's Route Study objection procedure.

6.2.2 Under this procedure, if ORR does not give a notice of objection to a proposed route study, each route study will be established 60 days after the date on which the proposed route study was provided to ORR and published.

6.2.3 ORR may object to a proposed route study within 60 days of it being published. If any third parties wish to make representations to ORR in relation to a proposed route study, they should do so within 30 days of Network Rail publishing the proposed route study in order to allow ORR time to give adequate consideration to the issues raised.

6.2.4 ORR will object to a proposed route study if it considers that it does not adequately promote the long term planning objective and does not meet the following criteria:

- Fit for purpose - does the route study provide a sound basis for promoting the route utilisation objective;
- Compliance with the process - was the route study developed in a transparent and inclusive manner, with engagement from stakeholders and customers; and
- Objections- are any third party objections to the route study reasonable.

6.2.5 If ORR objects, it will publish a notice of objection explaining why it has objected.

6.2.6 If ORR has given a notice of objection for any proposed route study, Network Rail should, within 60 days (or such other time period as ORR may agree) of receiving such a notice, publish and provide ORR with a revised route study which addresses the deficiencies which ORR has identified.

6.2.7 ORR then has a further 30 days in which to object to the revised proposed route study by issuing a second notice of objection. In giving this notice, ORR must state that the revised proposal has failed to remedy the deficiency/deficiencies specified in its first notice or has raised a further deficiency/deficiencies. The notice must specify why in ORR's view the revised proposal is deficient. ORR will publish the second notice of objection.

6.2.8 If ORR does not give a second notice of objection, the revised proposed route study will be established 30 days after it was published.

6.2.9 If ORR serves a second notice of objection, the route study has not been established.

## 6.3 Next steps

6.3.1 This Route Study forms an input into the industry's planning process for the longer term. This process is detailed in **Figure 6.9.**

6.3.2 The indicative milestones leading up to the start of Control Period 6 are shown in **Figure 6.10**.

## 6.4 Acknowledgments

6.4.1 This Route Study has been developed through a process of wide industry collaboration, and the Route Study team wishes to acknowledge the considerable assistance provided by industry stakeholders and others in the development of this document.

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Figure 6.9 How the planning process works

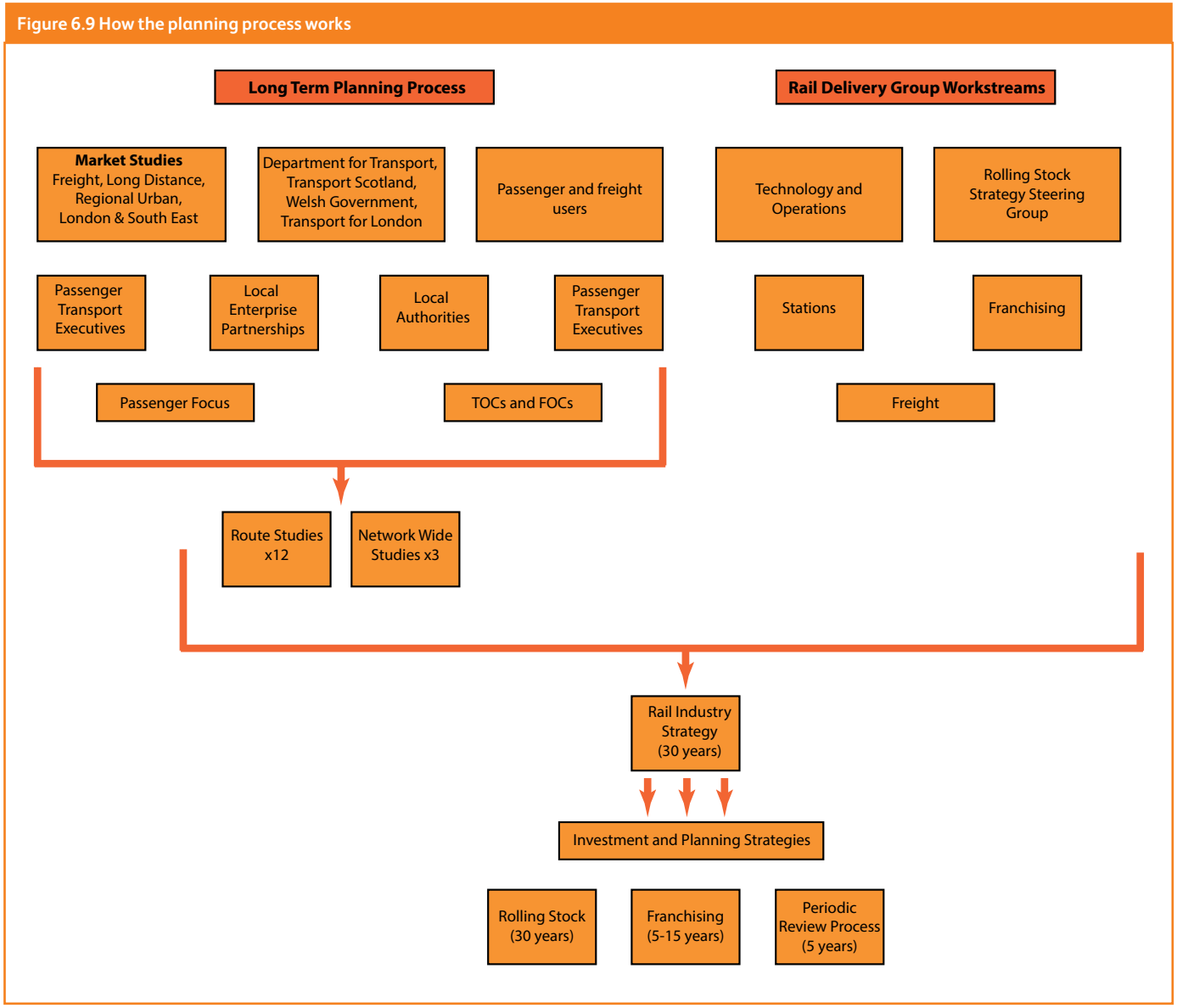
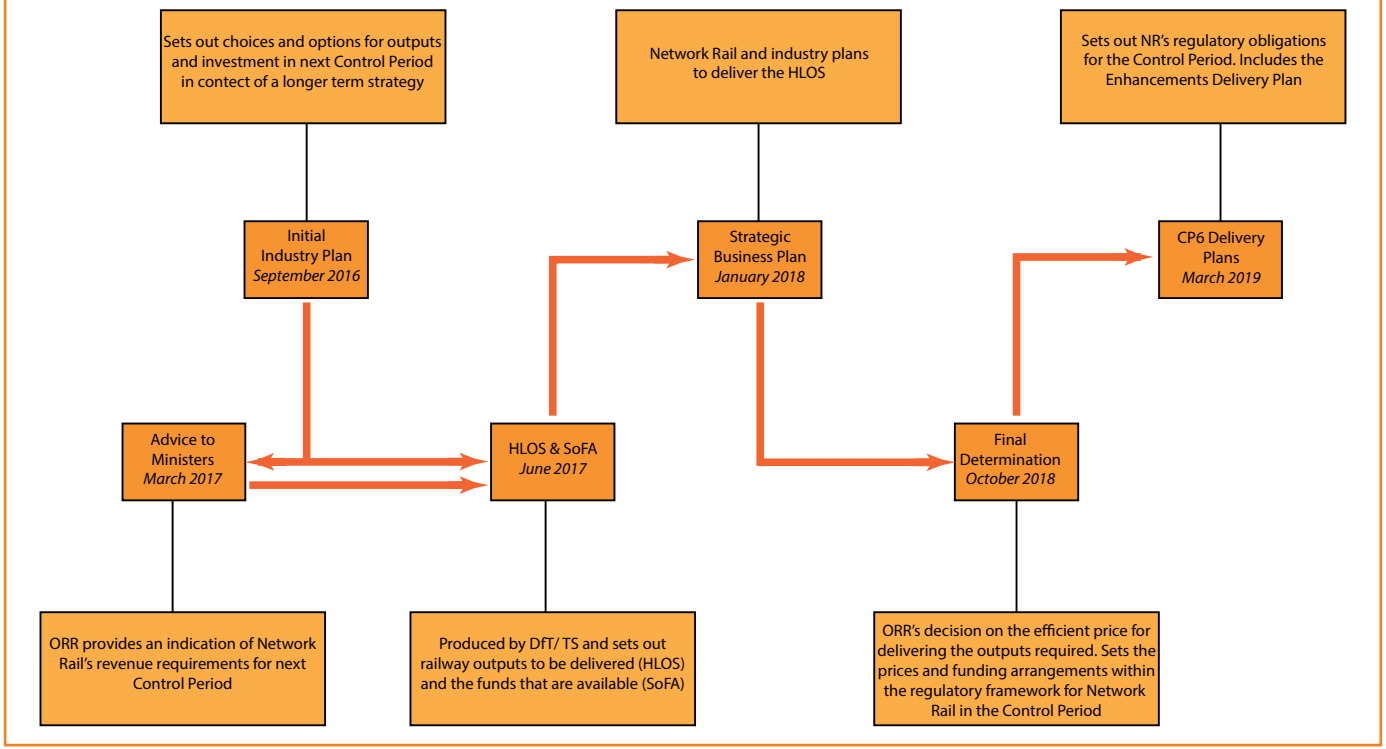


**Figure 6.10 Indicative milestones to Control Period 6**



# Appendix A

## Appraisal Results

### A.1 Introduction

A.1.1 The investment choices identified by the Wessex Route Study for Network Rail's next Control Period (CP6, commencing April 2019) have been categorised from a financial and socio-economic perspective.

A.1.2 In the context of the former, CP6 investment choices have been categorised into either of the following

- Choices which worsen the rail industry's net operating position (in other words, the additional operating costs exceed the value of any revenue generated)
- Choices which improve the rail industry's net operating position. For these schemes, the Route Study also indicates the extent to which this improvement is able to cover the capital cost of the initial investment

A.1.3 The investment choices have also been appraised from a 'socio-economic' perspective, which compares the value of benefits (principally to rail users and non-users) to the net financial cost to funders (for further information see funder's investment appraisal guidelines, here).

**Lengthen existing Main Line long distance services in the high peak (within the existing capability of the network)**

**Table A.1 Financial and socio-economic categorisation**

| Rail industry financial impact (Categorisation of Revenue, Operating costs, and Capital costs over appraisal period) | | | Socio-economic impact (WebTAG VfM category, see summary TEE table for further details) |
|---|---|---|---|
| Scheme increases operating subsidies (i.e. R - O < 0) | | √ | Medium |
| Scheme decreases operating subsidies (i.e. R - O > 0) | Low capital cost coverage (i.e. (R - O) / C < 33%) | N/A | |
| | Medium capital cost coverage (33 – 66%) | N/A | |
| | High capital cost coverage (66 – 100%) | N/A | |
| | Positive financial case (> 100%) | | |

**Table A.2 Summary TEE Table**

| 30 year appraisal | £m (2010 PV) |
|---|---|
| **Costs** | |
| Investment costs | 0.0 |
| Operating costs | 19.5 |
| Revenue | -10.4 |
| Other impacts (broad transport budget) | -0.02 |
| **Total costs** | **9.2** |
| **Benefits** | |
| Rail user benefits | 12.5 |
| Non user benefits | 5.6 |
| Indirect taxation impacts | -2.3 |
| **Total quantified benefits** | **15.8** |
| Net Present Value (NPV) | 6.7 |
| Benefit Cost Ratio (BCR) | 1.73 |

## Operate up to two additional Main Line long distance trains in the high peak hour (within the end CP5 capability of the network)

**Table A.3 Financial and socio-economic categorisation**

| Rail industry financial impact (Categorisation of Revenue, Operating costs, and Capital costs over appraisal period) | | | Socio-economic impact (WebTAG VfM category, see summary TEE table for further details) |
|---|---|---|---|
| Scheme increases operating subsidies (i.e. R - O < 0) | | | |
| Scheme decreases operating subsidies (i.e. R - O > 0) | Low capital cost coverage (i.e. (R - O) / C < 33%) | N/A | |
| | Medium capital cost coverage (33 – 66%) | N/A | |
| | High capital cost coverage (66 – 100%) | N/A | |
| | Positive financial case (> 100%) | √ | |

**Table A.4 Summary TEE Table**

| 30 year appraisal | £m (2010 PV) |
|---|---|
| **Costs** | |
| Investment costs | 0.0 |
| Operating costs | 55.0 |
| Revenue | -59.7 |
| Other impacts (broad transport budget) | -0.1 |
| **Total costs** | **4.8** |
| **Benefits** | |
| Rail user benefits | 85.0 |
| Non user benefits | 32.4 |
| Indirect taxation impacts | -13.0 |
| **Total quantified benefits** | **104.5** |
| Net Present Value (NPV) | 109.3 |
| Benefit Cost Ratio (BCR) | Financially positive. with positive wider benefits |

## Operate 3 trains per hour over the North Downs line during off-peak hours within the end-Control Period 5 capability of the network to improve connectivity to and from London Gatwick Airport

**Table A.5 Financial and socio-economic categorisation**

| Rail industry financial impact (Categorisation of Revenue, Operating costs, and Capital costs over appraisal period) | | | Socio-economic impact (WebTAG VfM category, see summary TEE table for further details) |
|---|---|---|---|
| Scheme increases operating subsidies (i.e. R - O < 0) | | √ | High |
| Scheme decreases operating subsidies (i.e. R - O > 0) | Low capital cost coverage (i.e. (R - O) / C < 33%) | N/A | |
| | Medium capital cost coverage (33 – 66%) | N/A | |
| | High capital cost coverage (66 – 100%) | N/A | |
| | Positive financial case (> 100%) | | |

**Table A.6 Summary TEE Table**

| 30 year appraisal | £m (2010 PV) |
|---|---|
| **Costs** | |
| Investment costs | 0.0 |
| Operating costs | 59.7 |
| Revenue | -27.8 |
| Other impacts (broad transport budget) | -0.04 |
| **Total costs** | **31.8** |

| **Benefits** | |
|---|---|
| Rail user benefits | 64.5 |
| Non user benefits | 2.1 |
| Indirect taxation impacts | -3.4 |
| **Total quantified benefits** | **63.3** |
| Net Present Value (NPV) | 31.4 |
| Benefit Cost Ratio (BCR) | 2.00 |

## Operate 28 trains per hour on the Main (Fast) Line in the high peak, enabled by grade separation of Woking Junction

**Table A.7 Financial and socio-economic categorisation**

| Rail industry financial impact (Categorisation of Revenue, Operating costs, and Capital costs over appraisal period) | | | Socio-economic impact (WebTAG VfM category, see summary TEE table for further details) |
|---|---|---|---|
| Scheme increases operating subsidies (i.e. R - O < 0) | | | Very High |
| Scheme decreases operating subsidies (i.e. R - O > 0) | Low capital cost coverage (i.e. (R - O) / C < 33%) | N/A | |
| | Medium capital cost coverage (33 – 66%) | √ | |
| | High capital cost coverage (66 – 100%) | N/A | |
| | Positive financial case (> 100%) | | |

**Table A.8 Summary TEE Table**

| 30 year appraisal | £m (2010 PV) |
|---|---|
| **Costs** | |
| Investment costs | 75.3 |
| Operating costs | 78.1 |
| Revenue | -102.9 |
| Other impacts (broad transport budget) | -0.2 |
| **Total costs** | **50.4** |
| **Benefits** | |
| Rail user benefits | 184.8 |
| Non user benefits | 55.8 |
| Indirect taxation impacts | -20.7 |
| **Total quantified benefits** | **219.9** |
| Net Present Value (NPV) | 169.4 |
| Benefit Cost Ratio (BCR) | 4.36 |

# Appendix B



## CP6 scheme details

This appendix sets out the details of the choices suggested for delivery in Control Period 6 (CP6). It should be noted that a summary has not been provided for Guildford platform capacity at this time. Guildford requires further investigation to understand what the solution might be, how it could be funded and at what point it may be efficient to deliver.

| Table B.1 Utilising spare network capacity on the route via Hounslow to ease the level of crowding on the route via Richmond |
|---|
| **Conditional output: CO1** |
| **Description:** This option increases the total number of Windsor Line services operating into London Waterloo during the high peak hour to 20tph (the maximum possible within the end-CP5 capability of the network), by operating two additional services via Hounslow (taking the total number of high peak services on the route via Hounslow to 8tph). The eight services via Hounslow would consist of:<br>• 4tph from Hounslow stopping all stations to London Waterloo (2tph utilising the new turnback facility planned at Hounslow in CP5 and the other 2tph operating a clockwise loop service to London Waterloo).<br>• 4tph operating semi-fast via the Hounslow Loop to London Waterloo (calling at Hounslow and Brentford only on the Hounslow Loop), with two of these services coming from the Ascot Line, and the other two services starting from Weybridge via the Chertsey branch. |
| **Passenger impact:** Most passengers from stations between Feltham and Reading travelling to central London during peak hours currently use the services routed via Richmond as these provide a quicker journey (by approximately 15 minutes) relative to the services routed via Hounslow. Introducing new semi-fast services on the route via Hounslow will provide passengers from these stations with a similar journey time via both routes (of about 35 minutes in total to London Waterloo). This will encourage more passengers to use the spare capacity which will be available via Hounslow, resulting in a better overall match between capacity and demand across both routes.<br><br>The Route Study's assessment of this option is that approximately 500 passengers from stations between Feltham and Virginia Water could be encouraged to use the capacity available via Hounslow in the high peak, reducing the level of crowding via Richmond (in a manner equivalent to the provision of four additional passenger vehicles via Richmond).<br><br>Increasing the overall level of service into London Waterloo to 20tph on the Windsor Lines may have a small negative impact upon the overall level of punctuality and reliability. |
| **Freight impact:** None. No freight services are operated via the Hounslow Loop in the peak and therefore no impact is expected. |
| **Infrastructure & operational requirements:** No capital investment is required as this option can be delivered within the end-CP5 capability of the network (although the Route Study has made no assessment of the potential requirement for extra depot and stabling capacity). Additional operational resources, including rolling stock, would be required, although this has been taken account of in South West Train's (SWT's) rolling stock strategy. |
| **Timeframe:** SWT have accommodated the operation of 20tph within their rolling stock strategy for CP5, it is therefore conceivable that the full 20tph could be operated in CP5 although this may not occur until CP6. |
| **Value for money assessment:** To be considered through the franchise specification process. |

| Table B.2 Lengthen existing Main Line long distance services in the high peak |
|---|
| **Conditional output: CO3, CO6** |
| **Description:** This option proposes to operate all Main Line long distance services in the high peak at their maximum length within the end-CP5 capability of the network, by lengthening two existing services. |
| **Passenger impact:** Two high peak services in the Route Study's base year are operating at a length below the maximum possible within the end-CP5 capability of the network (which is broadly 12-car trains for units formed of 20 metre vehicles or 10-car trains for units formed of 23 metre vehicles).<br><br>The number of passengers on these services typically exceeds the planning capacity of the train. Lengthening these two services would provide an additional eight passenger vehicle arrivals into London Waterloo in the high peak hour (out of a total requirement for an extra 72 vehicle arrivals by the end of CP6). |
| **Freight impact:** None. |
| **Infrastructure & operational requirements:** No capital investment is required as this option can be delivered within the end-CP5 capability of the network (although no assessment has been made of any potential requirement for extra depot and stabling capacity). Eight additional passenger vehicles would be required.<br><br>Additional operating costs can be minimised by standing down the extra capacity during off-peak hours (for appraisal purposes, one lengthened service is assumed to be berthed at Clapham Yard during off-peak hours before working an evening peak service from London Waterloo. The other lengthened services are assumed to work a contra-peak service enabling the rolling stock to be berthed away from London during off-peak hours, before returning to London Waterloo to work a PM peak service). |
| **Timeframe:** The additional capacity provided by this option is required to relieve existing levels of crowding and can be accommodated by the SWT rolling stock strategy. It is therefore expected that this option will be delivered within CP5. |
| **Value for money assessment:** This option increases the net operating cost of the rail industry. From a socio-economic perspective, this option provides medium value for money. Further details are provided in **Appendix A.** |

| Table B.3 Further deployment of 3+2 seating in standard accommodation on Main Line long distance services |
|---|
| **Conditional output: CO3, CO6** |
| **Description:** In the medium to longer term, reconfigure the internal accommodation of Main Line long distance rolling stock to provide further three plus two seating in Standard accommodation. |
| **Passenger impact:** The different types of rolling stock currently deployed on Main Line long distance routes have a mix of seating configurations in standard accommodation.<br><br>Most Main Line long distance services are currently formed of Class 450 rolling stock configured with 3+2 seating in standard accommodation. During peak hours this rolling stock typically works shorter distance services within the service group (for example, services starting from Alton). Class 450 rolling stock is also used on some longer distance services within the service group (including some high peak services starting from Portsmouth Harbour and Southampton Central).<br><br>A number of Main Line long distance services are currently formed of Class 158, 159 and 444 rolling stock, all of which are configured with 2+2 seating in standard accommodation. This rolling stock typically works longer distance services within the service group (for example, from Bournemouth and the West of England Line).<br><br>Further deployment of 3+2 seating in standard accommodation on Main Line long distance services could provide an additional 750 seats into London Waterloo during the high peak hour, a capacity increase of approximately four per cent. This is equivalent to providing about 11 extra passenger vehicle arrivals into London Waterloo in the high peak hour (out of a total requirement for 72 by the end of CP6).<br><br>It should be noted that if all the required 72 passenger vehicles were formed of rolling stock with 2+2 seating, then there would still be a capacity shortfall equivalent to at least one additional peak-hour path.<br><br>Whilst this option would provide extra seats for some peak passengers, 3+2 seating is not ideal for all passengers. Feedback during the consultation of this document has shown that some passengers prefer to stand rather than sit in the middle seat of three on busy trains. |
| **Freight impact:** None. |
| **Infrastructure & operational requirements:** Investment would be required to reconfigure the internal layout of rolling stock. |
| **Timeframe:** This option represents a medium term choice to increase capacity on Main Line long distance services and could therefore be delivered in CP6 or beyond dependent on the timescales for conversion of rolling stock interiors. This option represents a medium term choice to increase capacity on Main Line long distance services and could therefore be delivered in CP6 or beyond dependent on the timescales for conversion of rolling stock interiors.. |
| **Value for money assessment:** To be considered through the franchise specification process.. |

| Table B.4 Operate up to two additional Main Line long distance trains in the high peak hour |
|---|
| **Conditional output: CO3, CO6** |
| **Description:** Following investment in the capability of the network planned for CP5, increase the total number of services on the Main (Fast) Line into London Waterloo during the high peak hour to a maximum of 26tph, an increase of up to 2tph. |
| **Passenger impact:** This option provides up to two additional Main Line long distance services into London Waterloo during the high peak hour, increasing capacity by up to 24 passenger vehicles (or 10 per cent extra capacity across the service group), out of a total requirement for 72 extra vehicle arrivals by the end of CP6.<br><br>Increasing the number of Main (Fast) Line services from 24tph to 26tph (note that the 24tph is comprised of 17 Main Line long distance services and 7 Main Suburban services) makes more intense use of the available network capacity, and this level of utilisation may have a negative impact on the punctuality and reliability of the service unless measures to mitigate against this can be deployed (see **Table B.5**).<br><br>Several options have been identified to make use of the additional high peak paths. The following option has been considered, for appraisal purposes:<br><br>• +1tph from Basingstoke calling Woking then fast to London Waterloo.<br><br>• +1tph from Woking calling all stations to Surbiton then fast to London Waterloo, enabling an existing service from Farnham to run non-stop from Woking to London Waterloo. |
| **Freight impact:** None. |
| **Infrastructure & operational requirements:** It is possible that no capital investment would be required as this option may be deliverable within the end-CP5 capability of the network (although no assessment has been made of any potential requirement for extra depot and stabling capacity arising from the overall increase in rolling stock).<br><br>This option requires two additional 12-car trains to be leased, along with other train operating resources. Additional operating costs can be minimised by standing down the capacity during off-peak hours (for example, by stabling at Clapham Yard). Additional performance mitigation measures may be required and for this reason doubt remains as to whether this option is viable without some further infrastructure investment, see **Table B.5**. |
| **Timeframe:** This option represents a medium term choice to increase capacity on Main Line long distance services and could therefore be delivered in CP6 using baseline infrastructure but is likely to require other mitigations to be run reliably. |
| **Value for money assessment:** This option has a positive financial case, as the additional revenue generated exceeds the option's operating costs. Further details are provided in **Appendix A**. |

| Table B.5 Operational and performance mitigations to allow the reliable operation of additional Main Line services |
|---|
| **Conditional output: CO3, CO6** |
| **Description:** Implementation of a number of operational mitigations in CP6 that could enable the reliable operation of additional Main Line long distance services into London Waterloo. These mitigations are:<br>• Connected Driver Advisory System (C-DAS) – a system that allows train drivers to operate their train in an efficient way by identifying at which points the vehicle should coast, accelerate or decelerate.<br>• Traffic Management System (TMS) – currently being developed in line with C-DAS to improve the reliable management of conflicts thereby improving performance and recovery.<br>• Homogenisation of rolling stock – introduction of rolling stock across the fleet that have similar or identical characteristics (either through full electrification of all rolling stock or through higher performing diesel trains to replace older diesels). |
| **Passenger impact:** These mitigations, in isolation, are unlikely in themselves to provide any additional paths on the Main Line. However, it is expected that current services and any additional services provided by other interventions could be operated more reliably and efficiently if one or a combination of these mitigations is employed. |
| **Freight impact:** None. |
| **Infrastructure & operational requirements:** C-DAS and TMS are currently being developed in CP5 and will be integrated into the Rail Operating Centre (ROC) at Basingstoke.<br><br>Homogenisation of rolling stock would require additional rolling stock to be leased. This would either be new diesel stock to replace Class 159 and 158 vehicles or additional Desiro electric rolling stock for London Waterloo to Salisbury services. It should be noted that homogenisation through replacing current diesel services with electric rolling stock would require the electrification of the West of England Line at least as far as Salisbury.<br><br>A third option might be the procurement of bi-mode rolling stock for the West of England Line. |
| **Timeframe:** This option represents a medium to longer term choice. C-DAS and TMS could be delivered in CP6 with a potential longer timescale to implement homogenisation of rolling stock, dependent on. |
| **Value for money assessment:** The business case for C-DAS and TMS has been assessed separately and is not included in this Route Study. Homogenisation of rolling stock could be considered through the franchise specification process. |

| Table B.6 Woking grade separation and extension of Woking Platform 6 |
|---|
| **Conditional output: CO3, CO6** |
| **Description:** Construction of a flyover at Woking Junction to separate Up direction services from the Portsmouth Direct Line from services routed on the South West Main Line.<br><br>The extension of the bay platform, Platform 6, at Woking Station so that it can be operated as a through platform. This will provide increased platform capacity to facilitate additional services to stop at Woking Station in future Control Periods. |
| **Passenger impact:** Although the provision of a flyover at Woking does not in itself enable any additional services to be operated without other interventions such as one of the 'inner solutions', it will allow the current service and any future increase to be operated reliably. This means that passengers should see immediate benefit in terms of service performance.<br><br>An additional through platform will allow future additional services to stop at Woking Station. This will provide passengers at Woking more journey opportunities and therefore ease congestion at the station, as well as improving connectivity from elsewhere. |
| **Freight impact:** Improved performance and reliability of freight services through the removal of crossing conflicts as well as the provision of potential freight loop and siding infrastructure. |
| **Infrastructure & operational requirements:** Woking Flyover is currently being developed as part of the Wessex Capacity Programme and is proposed for CP6 investment or delivery. It would be efficient to deliver the Platform 6 solution at the same time to minimise disruption to both the South West Main Line (SWML) and the Portsmouth Direct Line.<br><br>Current development work suggests that infrastructure will be modified and added to, to provide turnback facilities for services terminating at Woking as well as improved siding and loop capability throughout the area. The flyover will lift the Up Guildford Line over the SWML before connecting to both the Up Slow and Up Fast Lines.<br><br>The Platform 6 works will require the current bay platform at Woking on the south side of the station to be extended through the station building to allow Down direction services to operate in the platform.<br><br>There is an opportunity to renew and upgrade the Victoria Arch road overbridge at the same time, part-funded by the Enterprise M3 LEP or Local Authority. |
| **Timeframe:** It is suggested that this could be a medium term choice through delivery in CP6. |
| **Value for money assessment:** To be assessed as part of the wider Main Line capacity work. |

| Table B.7: Improving off-peak Windsor Line connectivity within the end-CP5 capability of the network |
|---|
| **Conditional output: See 'Passenger impact', below** |
| **Description:** Operate the 20tph train service specification proposed in **Table 5.3** during off-peak hours, to meet a number of connectivity conditional outputs within the end-CP5 capability of the network. |
| **Passenger impact:** The proposed service specification improves the level of connectivity to central London from a number of stations, highlighted below. Any increase in the frequency of train services to central London, relative to the current level of service, is noted in brackets. It is also noted where the improved level of connectivity meets a conditional output identified for the Wessex Route Study:<br><br>**Putney:** 14tph to London Waterloo (+4tph relative to the current level of service).<br>**Brentford and Hounslow:** 6tph to London Waterloo (+2tph). The additional two services offer a 7 minute journey time improvement to London Waterloo. (Conditional Output CO24)<br>**Richmond and Twickenham:** 12tph to London Waterloo (+4tph).<br>**Whitton:** 6tph to London Waterloo (+2tph). The average journey time to London Waterloo across all off-peak services from this station will also improve owing to a greater proportion of fast services. (Conditional Output CO24)<br>**Feltham and Staines:** 10tph to London Waterloo (+6tph). The average journey time to London Waterloo will improve owing to a greater proportion of fast services. (Conditional Output CO24).<br>**Ashford:** 4tph to London Waterloo (+2tph). (Conditional Output CO7)<br>**Wraysbury, Sunnymeads, Datchet, Windsor & Eton Riverside:** 4tph to London Waterloo (+2tph). (Conditional Output CO13)<br>**Egham and Virginia Water:** 6tph to London Waterloo (+2tph).<br>**Sunningdale:** 4tph to London Waterloo (+2tph), and the fastest services will be 2 minutes faster than now. (Conditional outputs CO12 and CO24)<br>**Ascot:** 6tph to London Waterloo (+4tph), and the fastest services will be 4 minutes faster than now. (Conditional outputs CO12 and CO24)<br>**Bagshot, Camberley and Frimley:** 2tph to London Waterloo (+2tph), through the introduction of a new direct service.<br>**Bracknell, Wokingham and Reading:** 4tph to London Waterloo (+2tph), with an overall improvement in average journey time. (Conditional Outputs CO24 and CO31)<br>The proposed service specification reduces the level of connectivity on some small non-London flows, for example, between Winnersh or Martin's Heron and Twickenham or Richmond. |
| **Freight impact:** None. Freight capacity has been assumed as part of this option. |
| **Infrastructure & operational requirements:** No capital investment required as this option can be delivered within the end-CP5 capability of the network. In practice, the resources available to commuter train operators (including the amount of rolling stock) is typically determined by the level of peak capacity provided, with these resources then being deployed at low marginal cost during off-peak hours in order to generate (net) revenues and/or to meet wider socio-economic objectives. As a result, the marginal cost of resources required to deliver this option will be influenced by the future level of peak capacity.<br><br>From a track capacity point of view, capacity exists to operate up to four additional services via Richmond during off-peak hours compared to today. However, further work would be needed to understand the impact of this level of off-peak service on level crossing down-times and road traffic impact on an all-day basis, and identify appropriate mitigations as required |
| **Timeframe:** It is suggested that this could be a medium term choice through delivery in CP6. |
| **Value for money assessment:** To be considered through the franchise specification process. |

| Table B.8: Improving Main Suburban connectivity within the end-CP5 capability of the network by operating extra off-peak services to London Waterloo |
|---|
| **Conditional output: See 'Passenger impact', below** |
| **Description:** Operate 18tph to London Waterloo during off-peak hours on the Main (Slow) Lines, an increase of 2tph relative to the current level of off-peak service, to meet a number of connectivity conditional outputs within the end-CP5 capability of the network. |
| **Passenger impact:** This option enables one of the seven service pattern choices identified below to be operated. It is noted next to each choice where the increased level of connectivity provided meets a conditional output identified for the Wessex Route Study.<br>• Operate +2tph to stations on the Shepperton branch. (Conditional Output CO11)<br>• Operate +2tph to Epsom via Worcester Park, allowing stops to be removed from existing services between Dorking and London Waterloo providing a journey time benefit. (Conditional Output CO24)<br>• Operate +2tph to Effingham Junction via Worcester Park. (Conditional Outputs CO17 and CO19)<br>• Operate +2tph to Guildford via Epsom. (Conditional Outputs CO17, CO18 and CO19)<br>• Operate +2tph to Chessington South. (Conditional Output CO9)<br>• Operate +2tph to Hampton Court. (Conditional Outputs CO14 and CO15)<br>• Operate +2tph to Guildford via Claygate. (Conditional Outputs CO15, CO16, CO17 and CO18) |
| **Freight impact:** None, except for the Chessington South Branch where conflicts may occur with aggregates traffic to Tolworth.. |
| **Infrastructure & operational requirements:** No capital investment will be required as this option can be delivered within the end-CP5 capability of the network. In practice, the resources available to commuter train operators (including the amount of rolling stock) is typically determined by the level of peak capacity provided, with these resources then being deployed at low marginal cost during off-peak hours in order to generate (net) revenues and/or to meet wider socio-economic objectives. As a result, the marginal cost of resources required to deliver this option will be influenced by the level of peak capacity. It should be noted that the equivalent level of service currently operated during the peak includes extended journey times when compared to the off-peak to protect performance. It is therefore likely that a move to 18tph would extend off-peak journey times also if no alterations to the current infrastructure are made. |
| **Timeframe:** It is suggested that this could be a medium term choice through delivery in CP6. |
| **Value for money assessment:** To be considered through the franchise specification process. |

| Table B.9: Improving Main Suburban connectivity within the end-CP5 capability of the network, in a manner which does not increase the overall number of off-peak services operating into London Waterloo |
|---|
| **Conditional output:** See 'Passenger impact', below |
| **Description:** Operate 2tph shuttle service on the branch between Shepperton and Kingston (bay Platform 1), for onwards connection to central London.<br><br>Operate 2tph shuttle service on the branch between Hampton Court and Surbiton (Platform 4), for onwards connection to central London.<br><br>Improve the connectivity between Box Hill and Westhumble station and central London by inserting additional stops into existing off-peak services to London Waterloo or London Victoria.. |
| **Passenger impact:** The first of these options improves the level of service from stations between Fulwell and Shepperton to 4tph during off-peak hours, two of which provide a through journey to London Waterloo. Opportunities to interchange between the branch shuttle and connecting services to London Waterloo exist at Teddington and Hampton Wick (both of which currently provide 6tph into London Waterloo, four of which would not require passengers to change platform for onwards travel towards central London), and also at Kingston (which currently provides 4tph into London Waterloo excluding overtaken services, all of which would require passengers to change platforms via the station's subway for onwards travel to central London). This option partially meets conditional output CO11.<br><br>The second of these options increases the level of service from Hampton Court and Thames Ditton to 4tph during off-peak hours, two of which provide a through journey to London Waterloo. Interchange exists between the Hampton Court branch shuttle and connecting services to London Waterloo at Surbiton (which currently provides up to 5tph to London Waterloo, excluding the through services from Hampton Court and any overtaken services), which would require passengers to change platforms at Surbiton using the overbridge for onwards travel towards central London. This option partially meets conditional output CO14.<br><br>Currently Box Hill and Westhumble station has 1tph to central London during off-peak hours. In order to meet conditional output CO20 the final option suggests that additional stops at Box Hill and Westhumble can be inserted into any of three existing trains per hour between Dorking and London (one to London Victoria and two to London Waterloo). |
| **Freight impact:** None. |
| **Infrastructure & operational requirements:** The first of these options requires no capital investment required as it can be delivered within the end-CP5 capability of the network. The operation of this option would require additional unit diagrams (and other operational resources).<br><br>The second of these options requires no capital investment required as it can be delivered within the end-CP5 capability of the network. The operation of this option would require an additional unit diagram (and other operational resources).<br><br>The final option requires no capital investment required as it can be delivered within the end-CP5 capability of the network. The option will result in a small increase in operational costs. |
| **Timeframe:** It is suggested that this could be a medium term choice through delivery in CP6. |
| **Value for money assessment:** To be considered through the franchise specification process. |

| Table B.10 Operate 3tph during off-peak hours over the North Downs line within the end-CP5 capability of the network, to improve connectivity to and from London Gatwick Airport |
|---|
| **Conditional output: CO35** |
| **Description:** During off-peak hours, operate 3tph over the North Downs line. Two of these are semi-fast services calling only at Reading, Wokingham, Blackwater, North Camp, Guildford, Dorking Deepdene, Reigate, Redhill and Gatwick Airport. A third stopping service between Reading and Redhill maintains connectivity to and from smaller stations on the line. |
| **Passenger impact:** Stations which are major generators of demand on the line would gain one additional semi-fast service per hour to and from London Gatwick Airport during off-peak hours, with broadly the same journey time as the current fastest service. The journey time between some smaller stations on the route across Guildford would be increased as the third (stopping) service between Reading and Redhill requires an extended 15 minute stop at Guildford to allow other services to overtake. |
| **Freight impact:** None. |
| **Infrastructure & operational requirements:** No capital investment required as the timetable can technically be delivered within the end-CP5 layout. However, no assessment has yet been made of any potential requirement for extra depot and stabling capacity arising from the overall increase in rolling stock, or of the need to upgrade Automatic Half Barrier (AHB) and foot crossings on the route. To achieve this on the current infrastructure requires trade-offs in journey time owing to the need for a very long dwell at Guildford.<br><br>A number of infrastructure alterations would be desirable in order to support the introduction of a 3rd train. Approximately three additional unit diagrams would be required to operate the enhanced level of service, along with other extra train operating resources. The existing 2tph service is currently operated by 3-car Diesel Multiple Units. For appraisal purposes the Route Study assumes that the additional diagrams would also be resourced by 3-car units, although if it were possible to deploy 2-car units whilst still providing sufficient capacity for passengers the financial case for this option would improve. |
| **Timeframe:** A similar requirement for an additional service has been included in the First Great Western Direct Award for operation in CP5. |
| **Value for money assessment:** This option increases the net operating cost of the rail industry. From a socio-economic perspective, this option provides high value for money. Further details are provided in **Appendix A.**. |

| Table B.11 Basingstoke grade separation |
|---|
| **Conditional output: CO3, CO6, CO35, CO36** |
| **Description:** Provision of grade separation at Basingstoke Great Western Junction to lift the Down Reading Line over the South West Main Line (SWML), removing the conflicts that arise from southbound passenger and freight services crossing the current flat junction. This will free up capacity on both the SWML and the Reading to Basingstoke line. |
| **Passenger impact:** Constructing a flyover (the likely type of grade separation) at Basingstoke Great Western Junction will allow additional cross-boundary (CrossCountry) services to be operated on the Reading to Basingstoke line as well as additional services on the SWML to meet connectivity conditional outputs.<br><br>On its own grade separation of Basingstoke Junction does not facilitate enough capacity to meet the 2043 requirement on the SWML or on the Basingstoke to Reading line. It is, however, an early step towards providing greater Main Line capacity in CP7 or beyond in combination with one or more of the "inner" solutions. |
| **Freight impact:** The key driver for seeking to deliver Basingstoke grade-separation in CP6 is not related to passenger growth as this is not required to meet conditional output CO6 (Main Line capacity to end CP6). Instead it is that an additional freight path between Reading and Basingstoke in the south direction can be delivered through grade separating the junction and therefore meeting the conditional output for freight growth.<br><br>There is an anticipated increase in freight growth expected to 2043 both in terms of Class 4 intermodal traffic and Class 6 aggregates traffic. The majority of this traffic will use the route from Southampton Docks to Reading and beyond via Basingstoke (in both directions). In CP6 this translates to a third freight path between Southampton Docks and the Midlands/North, operating via Laverstock Junction and Andover owing to capacity constraints on the more direct route via Winchester (further interventions are required to release capacity on the main route). |
| **Infrastructure & operational requirements:** Several options have been looked at to provide a flyover at Basingstoke. These are:<br>• Provision of bi-directional flyover in the down direction from the Reading Lines to the Down Slow into Platform 1. This would provide a "simple", minimum, solution allowing southbound services to cross the SWML without conflict.<br>• Provision of bi-directional flyover in the down direction from the Reading Lines to the Down Slow into Platform 1 with a spur from the new flyover to the Up Slow. The addition of a spur means that London Waterloo services that originate in Platform 1 can access the Up Slow Line without conflicting with Down direction services on the SWML.<br>• A double track flyover including a spur to the Up Slow. This option will allow the use of the spur for Up direction London Waterloo services without holding up Down direction services from Reading.<br>• Extension of the spur to the Up Slow to enable 12-car Empty Coaching Stock (ECS) moves to reverse in to Barton Mill Sidings. This option could be added to the options with the spur to add functionality that allows the removal of ECS conflicts on the SWML.<br>• A new independent line north of the station which provides an additional platform face on the Up side. This allows freight services and passenger services to pass around the back of Basingstoke and utilise a new, through Platform 6 (passenger services), therefore freeing up capacity on other platforms. |
| **Timeframe:** This option could be delivered in CP6 to provide freight service benefit or could be delivered later to meet future freight and passenger conditional outputs |
| **Value for money assessment:** To understand the full value-for-money impact of this option would require a wider understanding of the infrastructure required on other routes. Therefore no assessment has been made as part of this Route Study at this time. |

# Glossary



| Term | Meaning |
|---|---|
| AC | Alternating Current. Specifically for 25 kV Overhead Line Equipment. |
| ASDO | Automatic Selective Door Operation, used where the whole of a passenger train is longer than a station platform |
| ATO | Automatic Train Operation |
| BCR | Benefit to Cost Ratio, a measure of the value for money presented by an option. |
| C-DAS | Connected Driver Advisory System. A system that provides real-time advice for train drivers to identify precise points where to coast, power and brake to conserve energy while helping ensure on-time running. |
| Bi-mode | A type of train which can use two different sources of power, either being electrically powered where suitable infrastructure is available, and self-powered elsewhere. |
| Class 4 | A classification of freight train timetabled to operate at up to 75mph, typically carrying intermodal containers or automotive traffic. |
| Class 6 | A classification of freight train timetabled to operate at up to 60mph, typically heavier than a Class 4 train owing to the goods carried such as aggregates |
| Control Period 4 (CP4) | Network Rail is funded in five yearly periods. Control Period 4 is the funding period between 2009 – 2014. |
| Control Period 5 (CP5) | Network Rail is funded in five yearly periods. Control Period 5 is the funding period between 2014 – 2019. |
| Control Period 6 (CP6) | Network Rail is funded in five yearly periods. Control Period 6 is the funding period between 2019 – 2024. |
| Control Period 7 (CP7) | Network Rail is funded in five yearly periods. Control Period 7 is the funding period between 2024 – 2029. |
| Crowding standards | The level of on-train crowding for planning purposes, above which triggers the need for measures to provide extra capacity. The standards used in the Route Study typically reflect funder's aspiration to provide a seat for all but the shortest of journeys (where a short journey is typically defined as less that 20 minutes). For short journeys it is assumed that standing is acceptable, within guidelines specified by funders. |
| DC | Direct Current. Specifically 750 volt third rail. |
| DfT | Department for Transport, a Government department. |
| Digital Railway | Digital Railway is a rail industry-wide programme designed to benefit Great Britain's economy by accelerating the digital-enablement of the railway. |
| Down Line | Usually the line(s) in a direction away from London. |
| Dynamic Loop | A passing loop that allows two trains to pass without stopping. |
| Electric Spine | 25 kV AC railway electrification from the Port of Southampton northwards to major cities and dry port container terminals in the Midlands and the North. |
| EMU | Electric Multiple Unit. A type of train using an external electric power source which can be joined together to make longer trains. |
| ERTMS | European Rail Traffic Management System. A system for managing train movements using ETCS to signal trains and GSMR to communicate with trains. |

| Term | Meaning |
|---|---|
| ETCS | European Train Control System. A new signalling control and train protection system. |
| FOC | Freight Operating Company. |
| Gauge | Key dimensions of the railway which define the size of trains which can be accommodated. Track gauge is the distance between rails. Loading gauge is the width, height and shape of the trains which can be accommodated. |
| Generalised Journey Time | A measure of the passenger rail service offer that takes account of in-vehicle time, service frequency and interchange penalty. |
| Grade Separation | Infrastructure which allows trains to pass over or under another route to avoid the timetable conflicts which would otherwise occur. |
| GRIP | Governance for Railway Investment Projects, a Network Rail standard for project managing changes to the infrastructure. |
| GWML | Great Western Main Line |
| HLOS | High Level Output Specification, the Government's statement of what it wishes to buy from the industry over a Control Period. |
| HST | High Speed Train. A train typically of 8-car length plus two power cars, used on long distance passenger services. |
| HS2 | High Speed 2 - the planned high speed railway between London and Birmingham in Phase 1, and beyond to Manchester and Leeds in Phase 2. |
| IIP | Initial Industry Plan. A plan to examine the key choices and options facing funders in specifying the future outputs of the railway and the level of funding required. |
| Interoperability | A European initiative enabling the railway to compete more effectively with other forms of transport, particularly road transport, by harmonising rail capabilities across Europe.. |
| LEP | Local Enterprise Partnership. |
| LTPP | Long Term Planning Process, the programme of Market and Route Studies which together define the capacity and capability required of the Great Britain railway network over a 30-year time horizon. |
| Market Study | One of four studies undertaken at the beginning of the Long Term Planning Process, to forecast demand and to articulate Conditional Outputs for the markets, namely London and South East, Long Distance, Regional Urban and Freight. |
| MCB-OD | Manually Controlled Barriers-Obstacle Detection. |
| mph | miles per hour. |
| National Operating Strategy (NOS) | A Network Rail programme to centralise the control of signalling at a limited number of Rail Operating Centres (ROCs) to reduce costs and to improve performance. |
| OLE | Overhead Line Electrification. A system to transfer power to trains using electric cables mounted above and along the tracks (also see Third Rail). |
| ORR | Office of Rail Regulation, the safety and economic regulator for the rail industry in Great Britain. Renamed the Office of Rail and Road in April 2015 |

| Term | Meaning |
|---|---|
| Peak period | The busiest hours of the day for passenger train loading, often defined as 7am to 10am,and 4pm to 7pm, at a particular location, for example London Waterloo station. |
| Periodic Review | The process which establishes Network Rail's outputs and funding for the next Control Period. |
| Planning headways | The minimum time which can be used with in a timetable for one train to follow another. This is determined by the signalling system, signal spacing, line speed and train braking characteristics. |
| PPM | Public Performance Measure, a metric of the proportion of trains which arrive within a defined time window starting at the scheduled arrival time. |
| Programme Board | A body formed to steer development and approve publication of the Route Study composed of senior representatives from Network Rail, passenger and freight train operating companies, Department for Transport and Transport for London. |
| RDG | Rail Delivery Group, a cross-industry body which exists to promote greater co-operation between train operators and Network Rail through leadership in the industry and by working together with Government, the supply chain and stakeholders. |
| Regional Working Group | A stakeholder group formed of representatives of local authorities with transport responsibilities plus ports, airports and freight end-users. |
| Resilience | The ability of the railway to continue to operate despite the impact of events such as severe weather. |
| RIPG | Rail Industry Planning Group, a cross-industry body which exists to provide industry input into the structure and development of the national railway strategic planning processes. Its members are drawn from railway funders, operators and users. |
| ROC | Rail Operating Centre. See National Operating Strategy. |
| Route Study | A piece of work to define the future required long-term capacity and capability of part of the network, taking into account the demand forecasts and relevant Conditional Outputs from the Market Studies. |
| RUS | Route Utilisation Strategy, a report which considers the future development of the railway in a particular area (geographic RUS), or one aspect of its development in depth (Network RUS). Geographic RUSs are being superseded by Market Studies and Route Studies in the Long Term Planning Process. |
| SFN | Strategic Freight Network. |
| SWML | South West Main Line (between London Waterloo and Weymouth) |
| SSWT | Stagecoach South Western Trains |
| SWT | South West Trains |
| TEE Table | Table summarising the economic efficiency of the transport system for the options appraised. |
| TEN-T | Trans-European Network – Transport, a strategy to develop a trans-European network in the transport sector, adopted by the European Parliament and the Council in 1996, to establish a 'master plan' connecting national networks of all transport modes. |

| Term | Meaning |
|---|---|
| TfL | Transport for London. |
| Third rail | A system to transfer electric power to trains using an additional (i.e. third) rail running alongside the rails used to carry and guide the trains. |
| TOC | Train Operating Company. |
| tpd | trains per day. |
| tph | trains per hour. |
| Traffic Management | A system to assist signallers to regulate train services by automating certain functions and providing advice to signallers where there is a decision which requires their input. See also ERTMS. |
| Up Line | Usually the line(s) in the direction towards London. |
| W10 | A loading gauge which allows 9' 6" high containers to be conveyed on conventional railway wagons |
| W12 | A loading gauge which allows a 9'6 high container to be carried on a standard container wagon, including refrigerated containers up to 2,600mm wide; this is the recommended loading gauge for renewed structures |
| WebTAG | Transport Appraisal Guidance (online version). A document produced by Government to define how the value for money of publicly-funded transport projects should be assessed. |
| WIT | Waterloo International Terminal |
| WTT | Working Timetable. |

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