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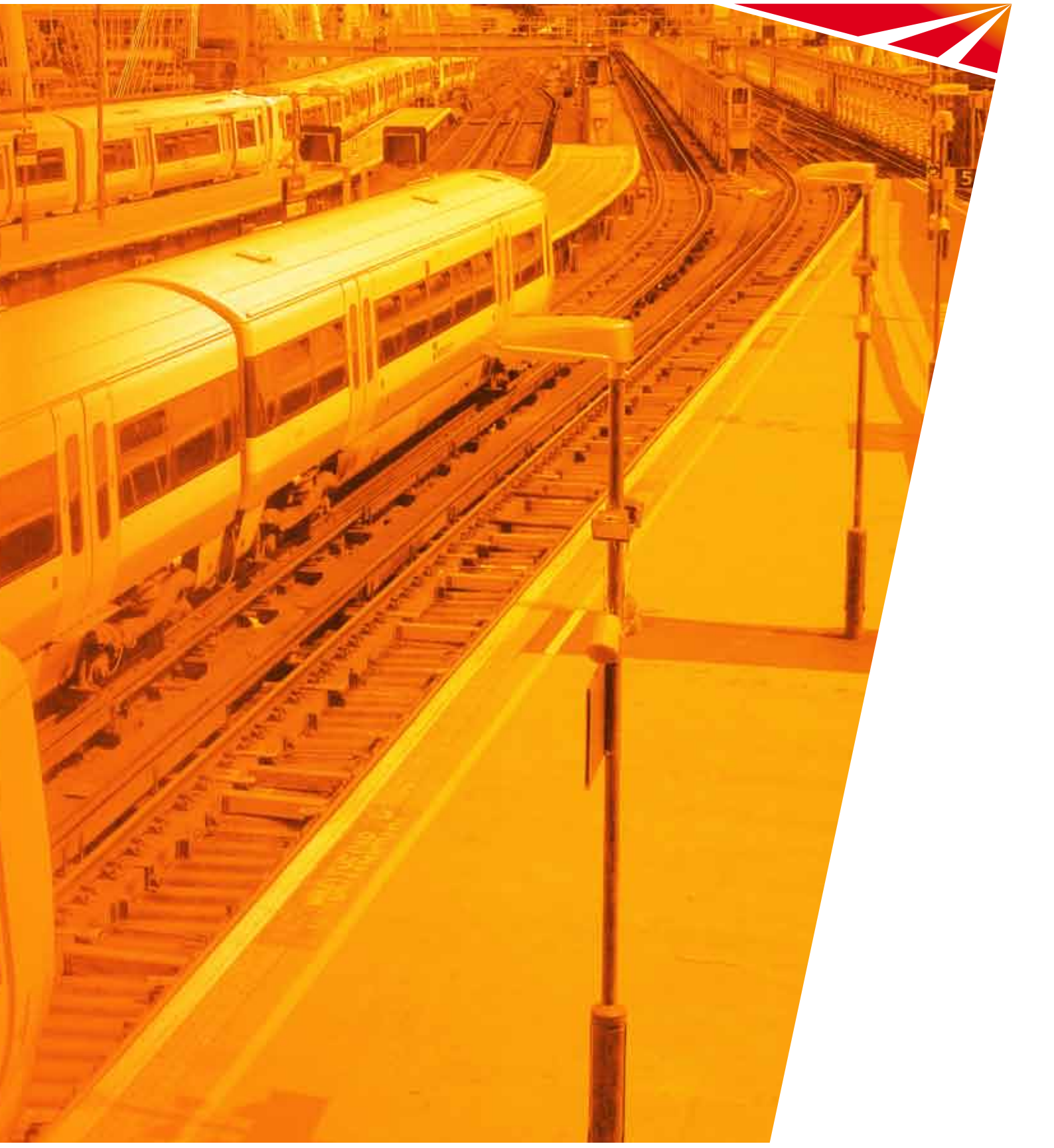
London and South East
Route Utilisation Strategy
Draft for Consultation

NetworkRail



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Foreword

This London and South East Route Utilisation Strategy (RUS) builds on the series of previous RUSs, published between 2005 and 2010, covering routes into and around the capital. Given the length of time which has passed since some of these earlier publications, and the current circumstances which now apply, updates are needed in several areas and this 'Generation Two' RUS therefore provides these. As a result it represents our latest analysis with respect to an appropriate strategy to 2031 for the South East England railway network as a whole.

The RUS focuses on how to increase rail capacity to accommodate for extra demand.

The RUS forecasts an increase of over 30 per cent in the numbers of commuters using National Rail services into the capital during the weekday morning peaks. This is linked to economic forecasts for central London employment, which is expected to grow throughout the lifetime of this strategy. The RUS therefore focuses on how to increase rail capacity to accommodate this extra demand. This is a central theme in the document, as is the growing role of rail freight, removing lorries from increasingly congested roads.

As in all RUSs, the methodology for providing solutions to the future requirements asked of the rail network requires the development of a range of options which are subsequently tested to determine the best value for money intervention, which in turn is tested for affordability. On a small number of routes within the area covered by the London and South East RUS there remains a significant challenge to meet these criteria, and the RUS will need to assess this further as part of a wider planning context.

In the shorter term the RUS is consistent with the findings of the 2010 Comprehensive Spending Review and subsequent announcements, including new train fleets of approximately 1200 carriages for Thameslink and 600 carriages for Crossrail. This RUS considers the effects of current ongoing projects such as these, but also looks beyond them to identify train service changes, infrastructure upgrades and potential new routes for the future.

The RUS contains a detailed study of the South Hampshire and Solent area, which was only partially covered by the 2005 South West Main Line RUS. This section has been developed closely with the local authorities and train operators using this part of the network.

There is now a 12-week consultation period on this Strategy and we welcome your comments and feedback, particularly on the interventions suggested. Stakeholder views will be incorporated wherever possible prior to the final RUS which will be published in summer 2011.

Whilst the views expressed in this document are those of Network Rail the RUS has been developed closely with the Department for Transport, Transport for London and our customers, the passenger and freight train operating companies, whom I thank for their involvement to date.

Paul Plummer
Director, Planning and Development

Executive summary

Introduction

Since June 2005, the Network Licence has required Network Rail to publish Route Utilisation Strategies, which establish the most effective and efficient ways to use the capacity available across the network.

The Network Licence requires that Network Rail maintain established RUSs – those that have been established by the Office of Rail Regulation. This has led to development of a second generation of RUSs, of which this London and the South East RUS is the third.

Scope and planning context

This London and South East Route Utilisation Strategy (RUS) builds upon the Generation One RUSs previously produced by Network Rail between 2005-2010 which cover most of the area within its remit. This Generation Two RUS extends the strategy as follows:

- it looks at all corridors into London at the same time and in a consistent way, so results are now directly comparable between routes
- it considers current economic conditions, which have changed since the time of earlier RUSs, impacting on demand forecasts and affordability
- it recognises that many infrastructure projects from previous RUSs – for example platform lengthening, resignalling schemes and the remodelling of capacity constraints (such as at Reading) – are now committed. It now considers these projects in more detail to identify how they could best facilitate the desired additional peak capacity into the capital
- following recent Government announcements both Crossrail and the Thameslink Programme are now also fully committed schemes, providing additional north-south and east-west capacity and connectivity. The RUS considers whether future development of the Crossrail network in particular could assist with growth. In the longer term it also notes that further new cross-London rail tunnels (such as the Chelsea-Hackney line/Crossrail 2) might be a step up for the development of London's rail network
- it forecasts the growth in peak passenger demand up to 2031 in detail for all routes into the capital, an extension to some Generation One RUSs which only looked up to 2019. It identifies the gaps between existing strategy and future demand on all key corridors, and where gaps exist considers how best to bridge them
- the first of Network Rail's RUSs, the South West Main Line, was developed as a prototype and was produced within comparatively short timescales in order to inform the South Western re-franchising process in 2006. As a result, it did not address certain parts of the network fully (eg the South Hampshire and Solent area), so the opportunity has been taken in this RUS to remedy this
- several projects affecting freight are now committed, principally involving capacity enhancement schemes and loading gauge clearance for international standard 9'6" containers on conventional wagons. Also more is now known about freight trends and anticipated terminal developments
- the RUS recognises that the current Government has a different policy from its predecessor with respect to the treatment of airport development in South East England in particular, with the RUS considering options consistent with this policy
- Government policy now includes the proposed development of a High Speed Rail network from London to the West Midlands and beyond. The RUS therefore now considers that High Speed 2 will be completed within the RUS timescales.

RUS baseline – committed schemes

The baseline for the RUS includes committed infrastructure schemes (as defined in Network Rail's Control Period 4 (CP4) Delivery Plan, together with subsequent announcements by Government) and committed service changes (as defined in franchise agreements between the Department for Transport and the train operating companies).

Key investments in this category include Crossrail, the Thameslink Programme, Reading remodelling, electrification to Oxford and Newbury, the Evergreen 3 project on the Chiltern Line, a major programme of train and platform lengthening in many parts of the capital, a revised timetable structure on the East Coast Main Line (ECML), initial elements of the Felixstowe to Nuneaton freight upgrade scheme and completion of the London Overground network. For all these schemes we have used the latest position with respect to future timetables to inform our analysis of the effect on travel patterns and associated train loadings.

It is recognised that there is some uncertainty with respect to certain elements of erstwhile committed schemes, principally relating to precise details regarding the deployment of new and cascaded rolling stock. The RUS has made assumptions in this area which will be kept under review as the position becomes clearer.

Other existing strategy

In considering its strategy the RUS draws heavily on the interventions considered by Generation One RUSs, with recommendations remaining uncommitted at present in most cases carried forward into this RUS.

The Intercity Express Programme (IEP), along with electrification of the Great Western Main Line (GWML) to Bristol and Swansea, has been considered in this category, since at the time of writing full details of the IEP Programme remain under review.

Other elements of Generation One RUS strategy carried forward include additional rolling stock to enable further train lengthening, infrastructure enhancements aimed at resolving operational constraints not delivered in CP4 (eg Redhill, the Medway Towns), additional trains on certain routes (eg from the Hertford Loop to Moorgate) and other proposed timetable changes (eg stopping some peak Gatwick Express trains at Clapham Junction).

Construction of High Speed 2 is also considered in this category, with comments provided in this London and South East RUS regarding its potential impact on transport links in London.

2031 Commuter peaks to London: gaps and options beyond existing strategy

In terms of the London morning peak period detailed modelling undertaken for the RUS forecasts a growth in demand (when combined across all corridors) at an average annual rate of 1.3 per cent per annum (34 per cent between 2008 and 2031), a rate which is broadly in line with historical growth. There are, however, significant variations between route corridors, linked to future housing provision and other development plans for specific areas. These development plans are in accordance with the London Plan forecasts and similar policy with respect to areas outside the capital.

On certain lines this RUS has identified the need for new additional options, seeking to provide sufficient peak capacity into London

On many routes the combination of existing schemes and non-committed existing strategy is forecast to be sufficient to accommodate the increasing demand. However on certain lines this RUS has identified the need for new additional options, seeking to provide sufficient peak capacity into London to accommodate the forecast future demand.

The capacity strategy for the main routes in and around the capital is summarised below. In many cases options shown are currently at an early stage of development and detailed further investigation is required before final publication of this RUS, influenced by stakeholder views arising from the consultation.

On a small number of route corridors the emerging picture is that conventional interventions (eg timetable changes, train lengthening, infrastructure upgrades) become much more complex and costly within the lifetime of this strategy, so more extensive options such as the provision of additional tracks outside the existing railway boundary may be needed if the desired capacity is to be provided, and even then there would be major challenges to provide robust performance if additional trains were to run. Wider consideration of any corridors where gaps remain unresolved may be necessary, extending beyond the RUS process into areas such as the pricing structure for peak and shoulder peak trains.

Great Western Main Line peak capacity

The forecast capacity gap in 2031 in the busiest peak hour is some 5,200 seats, even allowing for implementation of the existing Great Western RUS strategy, which only provides sufficient peak capacity for growth up to 2019. The anticipated shortfall is on a combination of outer suburban and long distance services from Reading and the outer Thames Valley, with no capacity gap forecast on the inner stopping services (given the Crossrail network to Maidenhead in 2018). In coming to

this conclusion the impact of committed schemes including Reading remodelling and the influx of new vehicles has been fully considered, with the impact of electrification and the IEP Programme, (which remains a RUS recommendation, even though it is not yet funded), also having been included.

In identifying a gap of this magnitude the RUS notes, crucially, that the existing strategy for the GWML does not include any additional high-peak trains into Paddington. This is due to existing capacity constraints associated with London Paddington station and its approaches and due to the main lines having no spare capacity at present between Ladbroke Grove and Airport Junction.

The RUS therefore seeks to provide additional capacity in the peak from Reading and the outer Thames Valley in response to the gap. The following additional options are therefore now under consideration, with the current status indicated.

New peak capacity options for Thames Valley commuters		
Option A1	Extend Crossrail services beyond the committed terminus of Maidenhead to Reading.	Further development is recommended, to simplify operations and as a facilitator to Option A6 below, subject to business case, but this option would not resolve the gap in isolation.
Option A2	Increase peak IEP service from 15 tph to 16 tph.	Further development is recommended, subject to business case, but extra capacity from this option may require additional platforms at London Paddington; would not resolve the gap in isolation and may impact on performance.
Option A3	Lengthening of peak IEP trains.	Further development is recommended, subject to business case, but extra capacity from this option would not resolve the gap in isolation.
Option A4	New 4 tph 12-car high seating capacity Reading/ outer Thames Valley to London Paddington peak additional fast services. No changes to other services.	Not operationally viable without other interventions.
Option A5	New 4 tph 12-car high seating capacity Reading/ outer Thames Valley to London Paddington peak additional fast services. London Paddington capacity freed up by extending Heathrow Express through the Crossrail tunnels whilst keeping it on the GWML fast lines at all times.	Not operationally viable because signalling headways do not permit additional fast line paths.
Option A6	New 4 tph 12-car high seating capacity Reading/ outer Thames Valley to London Paddington peak additional fast services. London Paddington capacity and main line paths freed up by extending Heathrow Express through the Crossrail tunnels and running it onto the GWML relief lines at least at peak times.	Further development is recommended, subject to business case and optimisation of the option.

On this route it is felt that implementation of **Option A6** (possibly also with some of **Options A1 – A3**) would broadly address the gap, enabling four extra fast main line trains in the busiest peak hours into London Paddington in response to Reading and outer Thames Valley commuter growth. The RUS recognises that there is a variety of sub-options with regard to origin point and stopping patterns for these additional trains and further work is therefore now planned to optimise the proposal. However the concept of extending Heathrow Express into Crossrail and running this service on the relief lines (at least at peak times) appears to be necessary to allow the operation of any additional peak main line trains without major infrastructure enhancement over a considerable distance. Further development is required, with implementation not anticipated to be required before 2019.

It is also emphasised that significant further development is required regarding how best to serve the proposed High Speed 2 station at Old Oak Common, an issue which has potential interactions with the new options listed above.

In the more immediate term further work and additional development of the strategy for the GWML is also recommended, focusing on:

- a funding decision regarding the IEP Programme and electrification
- the integration of IEP and Crossrail timetables
- the strategy for outer-suburban IEP trains (or equivalent), including work on optimising calling patterns for Slough, Maidenhead and Twyford, given that these would utilise significant capacity by either requiring main line station calls or crossing services between the main and relief lines
- whether any further infrastructure enhancement (in addition to committed Crossrail-funded interventions) on the section of line between Westbourne Park and Old Oak Common West/ Acton East is required, as well as at London Paddington to receive longer trains on the suburban side of the station.

Marylebone routes peak capacity

On the Chilterns corridor the committed Evergreen 3 project will provide route-wide service improvements; increasing frequencies, reducing journey times and providing a new London Marylebone to Oxford service.

Analysis indicates that increasing numbers of London commuters from the Chilterns, together with additional demand stimulated by the Evergreen 3 project service improvements, will result in further interventions potentially being required beyond completion of that project. However the specific details of train service changes which will be needed are dependant on the overall distribution of passenger loadings following implementation of the Evergreen 3 project timetable and the RUS analysis has not identified a need to make more specific train-by-train recommendations at the present time.

The new Oxford service also has potential to alleviate the London Paddington capacity gap to a certain degree, though not to a great enough extent to avoid the above changes being considered on GWML.

West Coast Main Line capacity

In the absence of the ongoing planning for a new High Speed Rail network this RUS (and the West Coast Main Line RUS Draft for Consultation, published December 2010) would forecast a significant peak and all day capacity gap in 2031 on the West Coast Main Line (WCML). The key issue affecting the London commuter market would be a shortfall in capacity for some 2500 passengers on outer suburban services into London Euston in the busiest morning peak hour, linked to the planned growth of areas such as Milton Keynes. Capacity shortfalls would also exist on long distance services all day, potentially creating difficulties for price-sensitive passengers as more restrictive fare policies would be needed to manage demand. There would also be limited paths available for freight growth.

Consistent with Government policy this RUS therefore assumes that construction of a new High Speed Rail network will go ahead, resolving the above issues for future generations. However current plans involve large numbers of people arriving in both the London Euston and Old Oak Common areas and this RUS highlights that additional interventions may be necessary.

Midland Main Line peak capacity

On this route the Thameslink Programme will provide a large amount of extra capacity, enabling most peak outer suburban services to be lengthened from 8-car to 12-car. Beyond this the principal future crowding concern to London is forecast to relate to commuters from towns such as Wellingborough and Bedford on longer distance trains, with a forecast gap in 2031 of some 800 seats in the busiest peak hour, based on current commitments.

Consistent with the recommendations of the Network RUS: Electrification Strategy and the East Midlands RUS the recommended approach to resolve this gap will be to replace the existing High Speed Train (HST) fleet used on the Midland Main Line (MML) with IEP or similar, following on from High Speed Train replacement on the GWML and ECML. Based on our analysis such an approach would broadly address the gap.

In the longer term it is also anticipated that there would be significant transfer of long distance demand from the MML to the North East leg of the proposed high speed rail network, assuming the construction of the stations planned to serve the East Midlands and Sheffield. High speed rail would also release capacity on the MML for additional passenger and freight services.

East Coast Main Line capacity

The Thameslink Programme will alleviate suburban capacity constraints and improve connectivity on this route by enabling commuter services to continue through the Thameslink tunnels rather than needing to terminate at London King's Cross. However, other than minor retimetabling no additional trains relative to today will be able to run through the critical Welwyn viaduct area, so outer suburban and main line peak capacity will be restricted to that gained through running all trains at maximum length, as previously explained in the East Coast Main Line RUS.

Long distance timetables will be improved through the East Coast May 2011 timetable and, in the longer term, by major infrastructure enhancements at several locations along the route. The modelled strategy for the ECML also assumes that IEP will be implemented, though this is currently anticipated as being a replacement for existing HSTs rather than fully replacing all Mark IV coaching stock.

Inner suburban services are anticipated to benefit from frequency increments following a combination of the Thameslink Programme and committed infrastructure enhancements in the Finsbury Park to Alexandra Palace area. These services are not directly constrained by capacity over the Welwyn viaduct and hence the train service frequency on both the Hertford Loop and to Welwyn Garden City can be expected to increase once the Finsbury Park to Alexandra Palace section comprises six fully usable tracks and additional capacity overall is provided at London King's Cross through the connection to the Thameslink tunnels. Beyond this the Moorgate branch is restricted to six-car trains by underground station platforms so the usual RUS options of lengthening are not available here. As a result, the East Coast Main Line RUS recommendation for increasing the overall peak frequency to Moorgate (requiring the installation of additional signals on the branch) is re-emphasised as necessary to avoid a capacity gap, though this is currently anticipated as being some years later than the increment provided by implementation of the post-Thameslink timetable.

As long as the existing strategy is implemented this RUS does not then forecast a peak period capacity gap on the ECML in 2031. However, given the national importance of this route, further options are being considered in response to off-peak growth and stakeholder aspirations for additional train paths on the route in the East Coast Main Line 2016 Capacity Review. The specific options in this category are listed below.

The emerging strategy, consistent with the East Coast Main Line 2016 Capacity Review, is to optimise the timetable and also in the slightly longer term the rolling stock in use on this route. There is insufficient evidence of benefits to enable options aimed at enhancing the infrastructure on the London approaches (additional tracks through the Welwyn area and/or installing ERTMS) to be recommended at present though there is expected to be a wider case for ERTMS on this route as signalling renewals become due.

With respect to the longer term there would be significant transfer of long distance demand to the proposed high speed rail network, with passengers from Leeds, Newcastle and Scotland in particular seeing additional capacity and significant journey time reductions to London. High speed rail would also release capacity on the southern end of the ECML for additional passenger and freight services.

East Coast Main Line capacity options – London approaches		
Option B1	Reconfigure existing ECML electric trains to allow the busiest services to be formed of 10 Mark IV coaches.	Potentially requires further investigation.
Option B2	ECML rolling stock replacement (beyond replacing HST sets with IEP trains).	Potentially requires further investigation.
Option B3	Run seven tph long distance services in alternate off-peak hours on the ECML.	Further development is recommended, subject to business case and optimisation of the option (see the East Coast Main Line 2016 Capacity Review, published in December 2010).
Option B4	Implement advanced signalling (European Rail Traffic Management System (ERTMS)) on ECML to create additional train paths.	Unlikely to be a solution to capacity issues in isolation.
Option B5	Four-tracking throughout the Welwyn North area to create additional train paths.	Unlikely to be recommended, due to insufficient evidence of benefits.

West Anglia peak capacity

Certain elements of the previous strategy for this route are now being reconsidered, given that the Lea Valley four-tracking scheme recommended by the Greater Anglia RUS was heavily influenced by plans for the major expansion of Stansted Airport, a scheme which is not now going ahead.

As with the Greater Anglia RUS, the strategy for outer suburban capacity is heavily reliant on implementing 12-car operations on all main line services. As a result the small number of stations not having platforms lengthened in CP4 will still require to be served by longer trains at a subsequent stage. Once this is complete the principal capacity gap on West Anglia will then be on inner suburban services. It remains a recommendation that the necessary capacity on the Southbury Loop should be provided by implementation of a new Cheshunt to Seven Sisters (for the London Underground Victoria Line) peak shuttle, given that the critical loadings of Cheshunt and Enfield Town services are approaching Seven Sisters.

On the assumption that the above will all be implemented the forecast peak capacity gap in 2031 would then be a shortfall of some 800 passengers, solely affecting the Lea Valley line. This RUS therefore considers how to provide extra capacity on this corridor, focusing on the need to alleviate the critical loadings which are north of Tottenham Hale (for the London Underground Victoria Line). The options in the table below are currently being investigated in response to this gap.

It can be seen that on the West Anglia route further development work is required, to enable a decision to be taken between the various options available to increase capacity on the Lea Valley line in particular, focusing mainly on the critical load point north of Tottenham Hale. South thereof it is emphasised that the destination for any additional trains appears to be Stratford, given the difficulty in adding extra trains on the constrained route via Hackney Downs. However it is possible that some of the Stratford trains could be extended to London Liverpool Street at some stage after Crossrail has been implemented.

In addition the RUS also recognises that aspirations exist to increase service frequencies on the Chingford corridor and potentially from Enfield Town. However at present the main Lea Valley corridor appears to be a higher priority, so frequency increases on other routes should not be at the expense of potential improvements to the main line.

New options for Lea Valley corridor		
Option C1	Run additional trains on the West Anglia route utilising existing infrastructure.	Additional two tph Hertford East/Broxbourne to Stratford can run without extra infrastructure (beyond current commitments at Stratford) so likely to be recommended, subject to business case.
Option C2	Four-tracking of the Lea Valley route and run additional trains.	Scheme would enable an additional four tph from the Lea Valley to Stratford, in addition to Option C1 (ie six tph additional in total). Recommended for further development to confirm if a business case exists.
Option C3	Additional infrastructure in the Tottenham Hale to Coppermill Junction area and Tottenham Hale to Stratford service.	Enables an additional two tph shuttle service from Tottenham Hale to Stratford, in addition to Option C1. Potentially requires further investigation as an option to improve connectivity, but would not reduce peak crowding into Tottenham Hale.
Option C4	Additional infrastructure between Tottenham Hale and Angel Road to extend the Tottenham Hale to Stratford shuttle considered in Option E3 to Angel Road.	Enables an additional two tph from Angel Road to Stratford, in addition to Option C1. Potentially requires further investigation, but only provides limited additional peak capacity to Tottenham Hale from the north.
Option C5	Infrastructure enhancements in the Broxbourne area and run additional trains.	Enables an additional two tph from the Lea Valley to Stratford, in addition to Option C1 (ie four tph additional in total). Recommended for further development to confirm if a business case exists.
Option C6	Lengthen Hertford East peak services from eight-car to 12-car.	Likely to be required to resolve gap in the event that at least one of Options C1 to C5 is not implemented, subject to business case.
Option C7	Extend West Anglia to Stratford services through to London Liverpool Street.	Further analysis is required.

Great Eastern Main Line new peak capacity options		
Option D1	Run additional Great Eastern Main Line outer services, utilising capacity freed up by Crossrail.	Not operationally viable without additional infrastructure.
Option D2	Implement ERTMS to create additional train paths.	Unlikely to be recommended to resolve capacity issues in isolation due to insufficient evidence of benefits.
Option D3	Run an additional three tph on the Great Eastern Main Line.	Requires significant infrastructure enhancements. Further analysis is required.

It is anticipated that, subject to a robust business case being found, the development work on the Lea Valley corridor will inform Network Rail's Initial Strategic Business Plan for Control Period 5.

Great Eastern Main Line peak capacity

The RUS has forecast a major capacity challenge on the Great Eastern Main Line (GEML), with options for increasing peak capacity beyond that previous outlined in the Greater Anglia RUS strategy appearing at present to be extremely limited.

Assuming that the Greater Anglia RUS recommendations are implemented in full, with replacement of intercity rolling stock, full 12-car operations and an extra peak train beyond current plans, modelling still forecasts a capacity shortfall of some 4,200 people.

The RUS has sought to consider whether additional trains could run, perhaps using capacity released at London Liverpool Street by Crossrail under **Option D1**. Operational analysis has identified that significant infrastructure enhancement, focusing on the main constraints at London Liverpool Street, Stratford, Shenfield and elsewhere, will be required to provide for around three additional services. Eventual further infrastructure interventions may be required to mitigate the performance risk of operating this level of service on the main line. With respect to technological solutions, as with the ECML through the Welwyn area, there is insufficient evidence at present to suggest that a new signalling solution such as the ERTMS system under **Option D2** would enable additional trains to run on this route.

As major interventions appear to be necessary to provide a solution to the forecast gap, further work is required to develop **Option D3** including whether a business case exists for high cost schemes of this nature. Alternative solutions such as the pricing structure for the high-peak hour should also be considered.

Fenchurch Street routes peak capacity

Capacity enhancements on the c2c route corridor to London Fenchurch Street are planned, with increasing 12-car operations. The modelling used by this London and South East RUS forecasts that this approach will provide sufficient additional peak capacity to match demand on this line.

Kent route peak capacity

As previously recommended by the South London and Kent RUSs, additional capacity in this area will be required through a programme of train and platform lengthening. The carriages to facilitate this are not committed at present, but are anticipated to be provided by the major rolling stock cascade that can be expected upon completion of the Thameslink Programme. The platform lengthening programme in the south east London suburbs will commence shortly, with further work anticipated at complex locations such as Rochester and London Charing Cross in Network Rail's Control Period 5.

Once the lengthened trains are in place and the Thameslink Programme complete (providing additional trains on certain routes via London Blackfriars) the RUS modelling does not forecast a peak capacity gap. The Kent RUS identified options for lengthening and extension further back into Kent of certain trains using High Speed 1 and these options remain a recommended approach if demand on these routes dictates.

Sussex route peak capacity

Significant additional capacity is now being provided on Network Rail's Sussex route – the Brighton Main Line (BML) and branches, plus the south London suburban area – through an extensive train lengthening programme and the implementation of the Thameslink Programme. This is in response to recent growth and current overcrowding problems on these lines.

The committed extra capacity comprises main line and Redhill corridor services to the Thameslink network (which will be lengthened from eight-car to 12-car and peak trains re-routed to run via London Bridge), the East Grinstead Line (where platform lengthening works to lengthen from eight-car to 12-car have now commenced), the Sydenham Line (where lengthening is planned from eight-car to 10-car) and all routes via Balham to London Victoria (where lengthening is planned from eight-car to 10-car). In addition to this a small number of additional trains are planned to run upon completion of the Thameslink Programme, though this can only be to a very limited degree as the major constraint through the East Croydon area will remain.

Sussex route new peak capacity options		
Option E1	Increase envisaged post-Thameslink service level by running additional trains to London Bridge.	Not operationally viable.
Option E2	Implement ERTMS on BML to create additional train paths.	Unlikely to be recommended to resolve capacity issues in isolation, due to insufficient evidence of benefits.
Option E3	Construct new tunnel from outer London to create additional train paths on Brighton Main Line.	Potentially required over the longer term.
Option E4	Construct new BML2 avoiding Gatwick Airport and East Croydon.	Not recommended due to high cost, disbenefits created, not solving the problem and not serving the key demand drivers.

The Sussex RUS recommended further train lengthening which is not currently committed. This included running 10-car trains on the Uckfield Line and running longer trains on the Purley corridor (now anticipated as Caterham and Tattenham trains joining into a 10-car train at Purley, thence running to Victoria). Inserting Clapham Junction calls in certain peak Gatwick Express services was also recommended to provide improved connectivity from Brighton from this area and spread loadings more evenly between peak trains. This London and South East RUS re-emphasises the need for these changes.

Modelling forecasts that 10-car operations will provide sufficient capacity on inner suburban services.

If the above strategy is implemented this RUS forecasts a peak capacity gap on this corridor in 2031 of some 1,600 outer suburban passengers in the busiest peak hour on the BML, principally to London Bridge. The options shown in the next table have therefore been considered in response to this gap.

From the above it can be seen that this London and South East RUS has not been able to recommend any interventions beyond existing strategy, as outlined in the Sussex RUS. Whilst the capacity gap on the BML is not forecast to be fully resolved by existing strategy, it is significantly smaller than the unresolved gaps on the GEML or South West Main Line (SWML) in particular so this London and South East RUS considers that these routes must be regarded as a higher priority for any major infrastructure interventions.

Further work will be required by operators to optimise service patterns to minimise the numbers of standing passengers and the duration of such standing on a train-by-train basis. Significant levels of spare capacity will exist during 'shoulder peak' times and effectively utilising the opportunity this provides is likely to be a key consideration in the future.

South West Main Line peak capacity

The most significant committed scheme at present on the SWML is 10-car inner suburban operations, which includes the re-use of the currently disused former international platforms at London Waterloo. This scheme was a recommendation of the South West Main Line RUS and is now fully committed. As a result the modelling for this RUS does not indicate a peak capacity gap on inner suburban services in 2031, with the 10-car scheme providing sufficient on-train space, though additional rolling stock has been assumed in order to run all such peak trains at full length.

However the above scheme only directly benefits suburban passengers, given that main line trains are generally already full length and no additional paths can be found elsewhere on the route for extra trains, regardless of capacity at Waterloo. With respect to longer distance services the RUS therefore notes that a significant peak capacity gap may arise, with a forecast shortfall of some 7,100 passengers in the busiest peak hour. This could potentially be reduced slightly with additional lengthening for example on the Salisbury line and semi-fast services from Guildford via Cobham (given that the latter run fast from Surbiton at peak times) but this would only marginally reduce the gap to 6,100 passengers. The RUS has therefore considered new options in response to this forecast gap as shown in the table.

Two options have been identified as potentially worth investigating further. **Option F3** would allow for the operation of 16-car trains into London Waterloo from selected mainline destinations, through the provision of a flyover at Clapham Junction, allowing London Waterloo International to be used for these services.

New options for South West Main Line		
Option F1	Implement 12-car SWML inner suburban operations.	Not recommended since the forecast capacity gap is on outer services so this would not solve the problem. It is emphasised that providing 12-car suburban capability at London Waterloo is complex and high cost.
Option F2	Run double-deck trains on SWML outer services.	Not recommended due to insufficient evidence that the gap would be resolved. In addition the high cost of this scheme is such that there is unlikely to be a robust business case.
Option F3	Run 16-car trains on SWML outer services into London Waterloo International.	Potentially needed in the longer term if other options cannot be identified. However this appears to require a major new grade-separated connection from the SWML in the Clapham Junction area into London Waterloo International platforms and would create significant operational difficulties with 16-car trains needing to split/join on route.
Option F4	Run four tph additional SWML outer services.	Requires significant infrastructure enhancement. Further analysis is required.

This option would however involve high cost and would not provide increased service frequencies.

In contrast, **Option F4** would provide for increased service frequency through up to an additional four trains per hour from Basingstoke or possibly elsewhere, but would require significant infrastructure alteration in the form of major remodelling of London Waterloo station throat, grade separation at Woking and works at Queenstown Road (also required for **Option G2**). In addition, further infrastructure interventions may be required elsewhere on the route in order to mitigate the performance impacts of the increased service level. This option will require further analysis and development, including identification of whether a business case is likely to exist. Alternatively, solutions such as the pricing structure for the high peak hour should be considered.

Windsor Lines peak capacity

As with the SWML the most significant committed scheme at present on the Windsor Lines (routes via Putney) is the operation of 10-car services. However the committed CP4 platform lengthening programme only extends as far out as Virginia Water, so the recommendation for further lengthening to Reading is carried forward into this RUS. As with other routes, additional rolling stock would be required to enable all trains on this corridor to be lengthened.

Assuming full 10-car operations and an increase from 15 to 16 trains in the busiest peak hour (as planned once the international platforms at London Waterloo are brought back into use) the forecast gap in 2031 is then anticipated to be 700 passengers in this hour. The gap primarily affects the longer distance services on the corridor. The RUS has therefore considered the new options shown in the table below in response to this forecast gap.

On this route it is likely that implementation of **Options G1** and **G2** would broadly address the gap in the short term.

At some stage the origin point for two trains per hour on this route is anticipated to be Heathrow Terminal 5, with implementation as part of the BAA Heathrow Airtrack scheme. However it is emphasised that there is likely to be a strong case for extra trains over the Windsor line corridor regardless of whether they originate from Heathrow Airport or elsewhere. This potentially impacts on level crossing downtimes to road vehicles on the Richmond line, though routeing options via Hounslow also exist.

New options for the Windsor Lines		
Option G1	Run 17 tph at peak times on the Windsor lines	Increasing Windsor Line service levels from 15tph to 17tph does not require any additional infrastructure (other than the anticipated reopening of London Waterloo International). This is likely to result in an increase in journey time for some outer Windsor Line services and may have a negative impact on performance without any further mitigation. This is likely to be recommended, subject to business case.
Option G2	Run 18 tph at peak times on the Windsor Lines, with infrastructure enhancements at Queenstown Road	Further increasing Windsor Line service levels to 18 tph is believed to require reopening of Platform 1 at Queenstown Road, with associated track layout changes. This would mitigate the performance impact identified above. Further development work is recomended subject to business case.
Option G3	Implement 12-car operations on Windsor Lines	Potentially required in a high growth scenario, subject to business case.
Option G4	Reconfigure London Waterloo – Barnes Junction and run additional trains	This option potentially requires further investigation at time of the Waterloo area resignalling scheme.

Whilst 18 trains in the busiest hour would provide significant extra capacity relative to today it is likely that the increased frequency and a potential Heathrow Airport origin point would enable additional passengers to travel, so there might still be a need for **Option G3** later, possibly with **Option G4** in the longer term.

Elephant & Castle corridor to Blackfriars/ Thameslink peak capacity

Committed capacity increments on this route include the major impact of the Thameslink Programme. The completion of Key Output 2 of the Thameslink Programme will enable additional trains to operate into the new London Blackfriars bay platforms and capacity will be freed up over Herne Hill Junction by re-routeing Brighton Main Line trains via London Bridge which will enable additional local services, including a four trains per hour service from Wimbledon to Blackfriars via Tooting.

Consistent with the recommendations of the South London RUS, operational analysis indicates that services routed via Herne Hill will need to operate into the new London Blackfriars bay platforms, whilst services routed via Catford will need to operate through the Thameslink core. Given the track and station layout currently under construction at London Blackfriars, reversing this arrangement would not be operationally viable.

Following the impact of the above the modelling forecasts a capacity gap of some 900 passengers in the busiest peak hour in 2031, primarily inner suburban services on the Herne Hill corridor.

The RUS has considered train lengthening on this route but this is considered highly complex due to track layouts at locations such as Herne Hill and Tulse Hill, where major works would be required. It is therefore anticipated that the use of higher density rolling stock will be required at some stage to enable all passengers to board trains. However, it is possible that this might lead to passengers standing for longer periods than the 20 minutes currently considered acceptable so further consideration is required.

In the longer term the London Underground Bakerloo Line has potential to be extended southwards from Elephant & Castle. This approach has potential to provide extra capacity to the inner south London area.

Orbital routes peak capacity

The RUS has identified a significant peak capacity gap on the West London Line (WLL) in particular, a corridor which has experienced very high levels of growth in recent years. By 2031 the forecasts suggest a capacity gap of some 2500 passengers in the busiest peak hour on this route, a figure which does not include the potential major impact of the proposed High Speed 2 station at Old Oak Common.

The options shown in the table below have been considered in response to the gap in the short term. One particular problem at present is the 73-minute gap in the morning peak on otherwise hourly direct services from the WCML to the WLL. No operationally viable solution has yet been identified to resolve this, but further work is recommended under **Option I1**, with the eventual aim of a 30-minute frequency. The RUS has also identified a strong business case for eight-car operation of Southern services on the WLL (**Option I2**), most likely utilising rolling stock cascaded as a result of the Thameslink Programme. Further solutions on the WLL would involve London

Overground services, but these trains are already configured at a high standing density so have not been considered at this stage.

The RUS notes significant potential for future demand increases on orbital routes. For example in the medium term, development plans for the Earl's Court area can be expected to exacerbate existing crowding problems on the WLL. Further work is required with respect to the long term on all orbital routes linked to ongoing demand growth. There is also the possible need to provide capacity on the West and North London Lines to carry large numbers of people on local journeys to the proposed High Speed 2 station at Old Oak Common.

On the South London Line service changes as part of the London Overground extension to Clapham Junction are planned, and the RUS considers that the post-Thameslink Programme timetable is likely to provide the opportunity for a four trains per hour all day service to/from London Victoria at Denmark Hill and Peckham Rye.

New options for the West London Line		
Option I1	Increase West London Line – Watford Junction (or beyond) peak service to two tph	Further work recommended to identify an operationally viable solution.
Option I2	Lengthen Southern WLL services to eight-car	Recommended

Connectivity – gaps and options

The RUS notes several strategic connectivity gaps in the London area. It has only sought to consider gaps in this category related to major drivers of demand and recognises that other smaller-scale gaps and options exist at a more local level.

Access to Heathrow Airport

The RUS considers that the difficulty in accessing Heathrow Airport by rail (except from central London) is a strategic gap. The following options are described:

Heathrow connectivity options		
Option A6	Heathrow Express incorporation into Crossrail	Recommended for further development, subject to business case, to resolve GWML peak capacity issues as described earlier. This option would also improve connectivity to Heathrow Airport, by increasing the central London Crossrail to Heathrow Airport frequency and by allowing direct Heathrow Airport trains from both the Abbey Wood and Shenfield eastern branches.
Option J1	BAA Heathrow Airtrack	Currently under development through the Transport and Works act process.
Option J2	Heathrow Airport Western connection	Would enable direct services from the west via Slough. Potentially requires further investigation.
Option J3	New high speed rail station complex serving Heathrow Airport directly	The Government's proposed high speed rail strategy includes a new station at Heathrow Airport, to be provided when the high speed rail network is extended to include Manchester and Leeds.
Option K1	Increasing connectivity to Old Oak Common from WCML South	See Crossrail option below. Passengers from WCML South for Heathrow Airport would have a single change at Old Oak Common.

Maximising the benefits of Crossrail

The RUS emphasises the desirability of optimising the usage of Crossrail tunnels, focusing on avoiding the need for services to terminate from the east in sidings at Westbourne Park (later at the proposed High Speed Rail station at Old Oak Common). The following extentions appear to be consistent with RUS principles:

Crossrail extension options		
Option A6	Heathrow Express incorporated into Crossrail	Recommended for further development, subject to business case, to resolve GWML peak capacity issues as described earlier. This option would also remove the need for many passengers to/from Heathrow Airport to change trains at London Paddington.
Option K1	Crossrail extension onto WCML slow lines	Recommended for further investigation, subject to business case, for several reasons: • to provide direct trains from this corridor to the West End, City of London and locations such as Canary Wharf, avoiding the need to change onto the London Underground system at London Euston • to free up capacity on the London Underground system, both at Euston station and on the Northern and Victoria lines, for passengers from High Speed 2 • to reduce the number of trains and passengers needing to be accommodated at London Euston during High Speed 2 construction works • to potentially make it easier for High Speed 2 to reach London Euston, by removing most if not all trains from one of the pairs of tracks on the existing tunnelled approaches to the terminus • to enable full benefit to be made of the central London Crossrail tunnels, with 24 tph arriving from key corridors to the west and none needing to start at Old Oak Common/ Westbourne Park • to improve access to Heathrow Airport, by providing the WCML corridor with access to Heathrow Airport with a single change at Old Oak Common
Option A1	Crossrail extension to Reading	Recommended to simplify operations, subject to business case, and as an enabler to **Option A6**.
Kent RUS option	Crossrail extension to Gravesend	Safeguarded scheme to improve connectivity to Dartford area, subject to business case.

The combination of **Options A6** and **K1** would lead to all the peak 24 trains per hour trains from the west into the Crossrail core coming from further afield, rather than 14 trains per hour Crossrail trains starting their journey at London Paddington.

Implications of High Speed Rail demand on the London area

The RUS advises that further development of the strategy for accommodating High Speed 2 local flows between London, the wider South East and Euston/Old Oak Common is required. This includes local connectivity and capacity to Old Oak Common, capacity as a whole at London Euston and what, if any, Great Western Main Line trains should call at Old Oak Common.

Future Chelsea – Hackney Line (Crossrail 2)

The RUS restates the currently safeguarded alignment of a new cross-London rail tunnel. This would improve connectivity on a South West to North East axis and alleviate London Underground congestion. The RUS notes that a potential modification to the safeguarding may be appropriate, so as to provide a connection to the high speed rail network at London Euston.

Capacity implications of the proposed link from High Speed 2 to High Speed 1

The RUS advises that detailed consideration of the effect of a High Speed 1 to High Speed 2 connection is required, focusing on the impact on other elements of this strategy, given that the only viable route for such a connection appears to interact significantly with the North London Line.

Other connectivity schemes

The existing railway network has certain gaps in connectivity between routes, with passengers sometimes needing to travel via London to make journeys indirectly. The RUS notes certain potential opportunities for further development, for example the proposed East–West Rail link which would also improve freight routeing options as described in the following text.

Freight in South East England

The RUS has considered capacity issues associated with the interaction between passenger and freight in south east England in detail.

The principal capacity issue is the need to accommodate growing intermodal import traffic from the container ports in addition to the passenger growth discussed earlier. Most of this traffic is heading for the Midlands or north of England rather than serving the London area. Given that the London railway network is heavily congested the RUS has therefore considered how best for routes avoiding London to be improved such that traffic not serving London directly can have alternative routeing options, whilst not incurring cost or journey time increases for freight companies, which reduce their competitiveness. In addition it is emphasised that diversionary routes via the capital will also be required.

The main on this basis, the RUS recommends the following freight outputs as outlined below. Capability recommendations are being addressed separately through the detailed Strategic Freight Network workstream, with options under development consistent with this preferred routeing strategy.

Key freight growth area	2010 average traffic	2031 traffic forecast	Proposed routeing during normal operations
Felixstowe/ Bathside Bay	28 tpd	58 tpd	Proposed route for current and future traffic recommended as being the cross-country route via Bury St Edmunds. To achieve this, the cross-country route would need to be progressively upgraded beyond current commitments, with services using this route needing to be just as efficient to operators as a London routeing.
Southampton traffic	20 tpd	51 tpd	Proposed route for traffic recommended as being via Oxford. Redoubling of sections of the Leamington Spa – Coventry line could assist with future growth, but would not in isolation resolve the need for freight traffic from the WCML to Southampton to make flat crossing moves at both Nuneaton and Coventry or to travel via central Birmingham. The RUS therefore notes that reopening of the East-West Rail corridor is potentially highly beneficial to freight, enabling traffic for Southampton to leave the WCML at Bletchley, though this is subject to paths on the WCML itself.
Essex Thames-side (London Gateway etc)	8 tpd	50 tpd	Proposed route for traffic recommended as being the Gospel Oak – Barking route and the WCML. This would minimise the passenger/freight interactions in the Forest Gate/Stratford area. Electrification of the Gospel Oak – Barking route and the associated Thames route was recommended in the Thameshaven Branch and Ripple Lane Sidings Network RUS: Electrification. Further consideration is required regarding trains bound for the ECML and also capacity over the Gospel Oak to Willesden Junction section.
Channel Tunnel traffic	6 tpd	35 tpd	Proposed route for traffic envisaged as remaining via Maidstone East, Catford and the West London Line to the WCML.
Kent Thameside (Isle of Grain, Howbury Park, Medway etc)	9 tpd	24 tpd	Various routeings via the London area, dependant on destination.

In addition to the above, new domestic intermodal traffic serving the capital could be achieved, given the development of suitable new terminal sites.

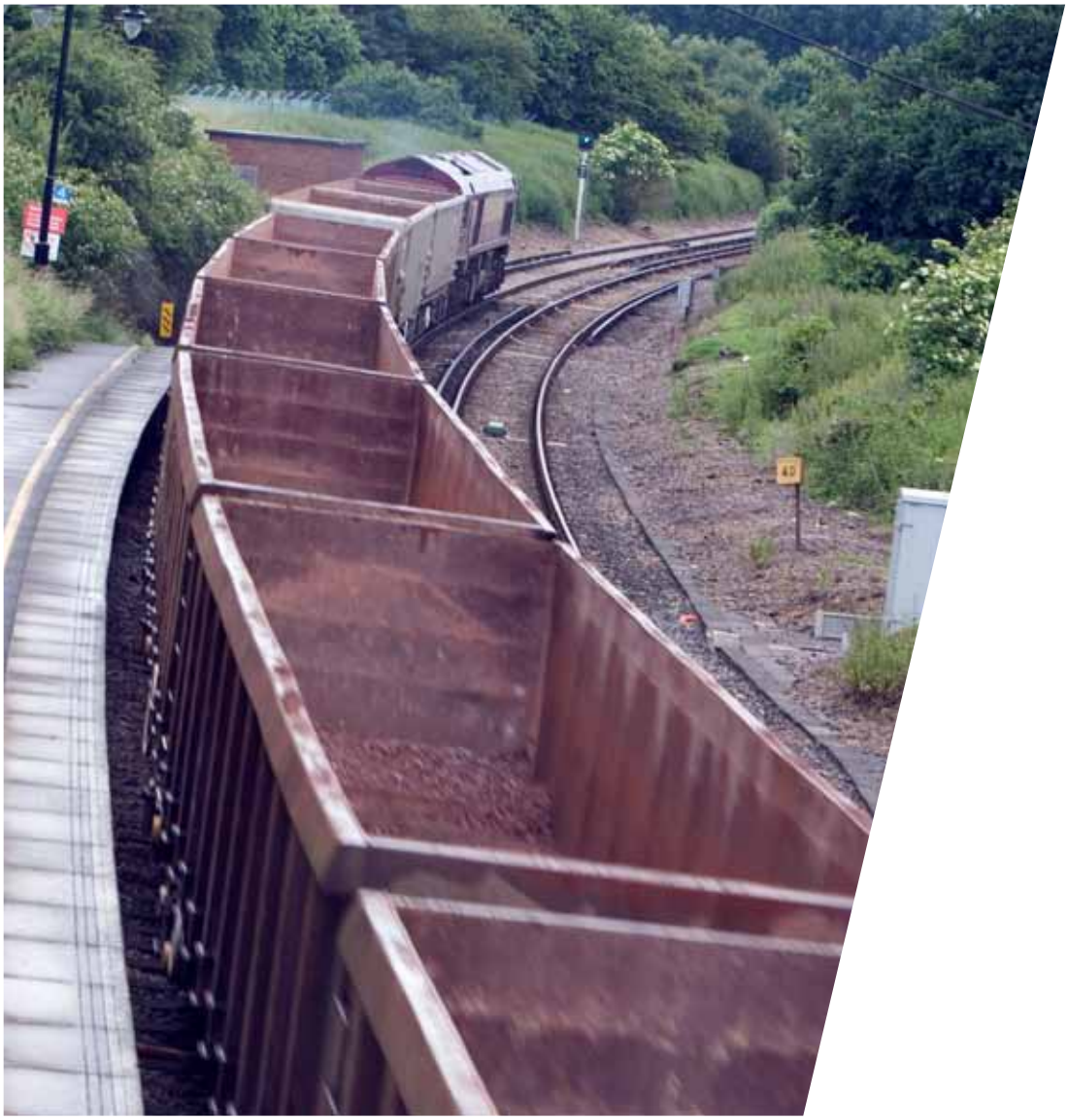
South Hampsire and Solent

This RUS has provided the equivalent to a first generation RUS for this area, which was not covered in detail by the South West Main Line RUS. The key recommendations are:

- Brighton to Southampton Central service to run via Botley instead of via Netley, so as to serve Southampton Airport Parkway, requiring a timetable recast due to capacity on the single line on the Botley route
- provision of a new service between Portsmouth and Southampton Central to address the gap of infrequent fast trains between these cities
- Netley line recommended to remain as heavy rail (consideration was given by the RUS as to whether a conversion to light rail might be appropriate)
- further investigation into small-scale infrastructure enhancements, in particular redoubling of the Botley line and consideration of an additional Platform 4 at Eastleigh
- provision of four freight paths per hour between Basingstoke and Southampton Central
- extension of South West Trains 'Figure 6' Salisbury to Romsey service, via Southampton Central and Chandler's Ford, back to Salisbury.

Consultation process

We now seek stakeholder views, particularly on the options described, before finalising this strategy. Details of how to respond can be found in **Chapter 12**.



1. Background

1.1 Introduction to Route Utilisation Strategies

1.1.1 Following the Rail Review in 2004 and the Railways Act 2005, the Office of Rail Regulation (ORR) modified Network Rail's network licence in June 2005 to require the establishment and maintenance of Route Utilisation Strategies (RUSs) across the network. Simultaneously, the ORR published guidelines on RUSs and both of these documents were then updated and re-issued on 1 April 2009.

1.1.2 A RUS is defined in condition 1 of the network licence as, in respect of the network or a part of the network, a strategy which will "promote the route utilisation objective". The route utilisation objective is defined as:

> **"the effective and efficient use and development of the capacity available on the network, consistent with the funding that is, or is likely to become, available during the period of the route utilisation strategy and with the licence holder's performance of the duty."**
>
> Extract from ORR Guidelines on Route Utilisation Strategies, April 2009

1.1.3 The ORR Guidelines explain how Network Rail should consider the position of the railway funding authorities, their statements, key outputs and any options they should wish to be tested. Such strategies should address:

> **"• network capacity and railway service performance**
> **• train and station capacity including crowding issues**
> **• the trade-offs between different uses of the network (eg. between different types of passenger and freight services)**
> **• rolling stock issues including deployment, train capacity and capability, depot and stabling facilities**
> **• how maintenance and renewals work can be carried out while minimising disruption to the network**
> **• opportunities from using new technology**
> **• opportunities to improve safety."**
>
> Extract from ORR Guidelines on Route Utilisation Strategies, April 2009

1.1.4 The guidelines also set out principles for RUS scope, time period, processes to be followed and assumptions to be made. Network Rail has developed a RUS manual which consists of a consultation guide and a technical guide. These explain the processes used to comply with the licence condition and guidelines. These and other documents relating to individual RUSs and the overall RUS programme are available at **www.networkrail.co.uk**.

1.1.5 The ORR Guidelines require options to be appraised, and the RUS has been developed using economic analysis carried out by Network Rail to the Department for Transport's (DfT's) appraisal criteria, on which further information can be found at **www.dft.gov.uk/pgr/economics**. The appraisal criteria are based on maximising the value of the railway to society at large, not just to companies within the rail industry. Analysis of operational issues and infrastructure capability has been carried out by specialists within Network Rail.

1.2 Second generation RUSs

1.2.1 The network licence requires Network Rail to both establish and maintain Route Utilisation Strategies. Since 2005 Network Rail has consulted on and published several Generation One RUSs of relevance to London and South East England, starting with the South West Main Line RUS Draft for Consultation in November 2005 and most recently the West Coast Main Line RUS Draft for Consultation in December 2010. Given the length of time which has passed since the start of the programme – and developments affecting the railway industry in this period – this Generation Two RUS aims to make sure the strategy is consistent across the multiple route corridors into the capital and to bring all the recommendations affecting this part of the country up to date.

1.2.2 This strategy builds on the established Generation One RUSs, which generally made detailed recommendations covering the period to 2019. It takes into account Government rail policy decisions made during the programme of Generation One RUSs, and most recently the Comprehensive Spending Review (October 2010), which confirmed full funding for Crossrail and ongoing design work on High Speed 2.

1.2.3 This RUS extends detailed analysis of peak passenger and freight demand to 2031, identifying gaps where supply will not meet demand. Where conventional interventions can address these gaps, recommendations are made to bridge the gap to meet this demand within the time period. In line with other Generation Two RUSs the strategy also looks further ahead to 2040, extrapolating demand trends and potential interventions where possible. Given the time period studied, there may be routes where conventional interventions will be exhausted and can no longer deliver the required capacity in an affordable way. It is appropriate that the RUS identifies these future constraints, and recommends future studies, rather than interventions.

1.2.4 The process is designed to be inclusive. Joint work is encouraged between industry parties, who share ownership of each RUS through its industry Stakeholder Management Group. Briefings are carried out to wider stakeholders during the RUS consultation period now commencing.

1.2.5 RUSs occupy a particular place in the planning activity for the rail industry, providing non-binding recommendations which influence future activities such as refranchising, rolling stock deployment and infrastructure enhancement schemes. The recommendations are based on detailed modelling of passenger and freight demand and are shaped by Government policy in terms of affordability in the short term, but seek to influence policy where necessary over the longer term. For this Generation Two RUS, the identification of longer-term constraints which require strategic interventions is an important output in order to influence policy.

1.2.6 RUSs form an essential building block of Network Rail's Initial Strategic Business Plan, itself a precursor to the High Level Output Specification process which will define the outputs required from Network Rail in the next control period (Control Period 5 2014–2019).

1.2.7 Network Rail will also take account of the recommendations from RUSs when carrying out its shorter-term activities. In particular, they will be used to inform decisions regarding the allocation of capacity through application of the normal Network Code processes. The ORR will also take account of established RUSs when exercising its functions, for example when considering requests for train paths.

1.3 About this document

1.3.1 This Draft for Consultation is the third Generation Two RUS published by Network Rail.[1]

1.3.2 The initial chapters set the scene for the RUS analysis. **Chapter 2** covers the geographic scope and timeframe of the document as well as the planning context which it sits within. Current operations and train performance on routes into and around the capital are reviewed in **Chapter 3**, while recent passenger demand trends for the morning peak period are reviewed in **Chapter 4**. **Chapter 5** covers existing strategy with respect to this peak period, including both committed (funded) schemes and other recommendations still outstanding from previous RUSs.

1.3.3 The later chapters describe future forecasts, gaps identified and options under development. **Chapter 6** reviews the modelled peak passenger demand on key corridors into the capital to 2031. Based on these forecasts **Chapter 7** then quantifies strategic gaps between capacity and demand at a route corridor level, contains operational analysis of options to resolve them and makes recommendations for further development. **Chapter 8** covers rail connectivity gaps and options in the London area, for example how to improve access to Heathrow Airport. **Chapter 9** develops a strategy for growing rail freight, focusing primarily on imports of intermodal traffic from the key ports. **Chapter 10** provides a particular strategy for the South Hampshire and Solent area, given that this area was not covered by a Generation One RUS.

1.3.4 Finally, **Chapter 11** summarises the emerging strategy and considers wider impacts such as those on the London Underground system. **Chapter 12** explains the consultation process and next steps. The responses from stakeholders will shape the final London and South East RUS and Network Rail would accordingly welcome your feedback on it.

1.3.5 Work will be ongoing during and following the consultation period, steered by the responses received. Options will be supported by further analysis for the final RUS and recommendations made where value for money cases are identified.

1 The first two being the Northern RUS and the Scotland RUS, each currently published as a Draft for Consultation.

2. Scope and planning context

2.1 Introduction

2.1.1 This chapter details the geographic scope for the London and South East Route Utilisation Strategy (RUS), its purpose, governance arrangements, timeframe, the planning context in which it is set and the linkages to other studies.

2.2 Stakeholders and RUS governance arrangements

2.2.1 The RUS has been managed through a Stakeholder Management Group (SMG), the governing authority for the strategy, who met at the start of the process, then prior to publication to agree the emerging strategy and contents of this Draft for Consultation.

2.2.2 The SMG included representatives from Network Rail, Department for Transport (DfT), the Office of Rail Regulation (ORR), Transport for London (TfL), Association of Train Operating Companies, CrossCountry, Stagecoach, First Capital Connect, First Greater Western, Grand Central, London Midland, National Express, Virgin Trains, Chiltern Railways, East Midlands Trains, British Airports Authority, Passenger Focus, London Travelwatch, DB Schenker, Freightliner Limited, Rail Freight Group, Southern and Southeastern. The ORR also sits on the SMG in an observing capacity.

2.2.3 Reporting to the SMG, a number of working group meetings were held during the development of the RUS. These were Central London, cross-London Freight and Solent and South Hampshire. Each had a specific remit to develop an understanding of future demand requirements and appraise options to address RUS gaps. Membership of the working group comprised of relevant representatives from the SMG. A representative from the ORR was invited to attend sub-group meetings in an observing capacity.

2.3 Purpose of the London and South East RUS

2.3.1 The London and South East RUS builds upon the existing Generation One RUSs previously produced which cover most of the area within its remit. However the London and South Eastern RUS looks beyond these existing RUSs, for example in the following areas:

- the London and South Eastern RUS looks at all corridors into London in a consistent way, so results are now directly comparable between routes
- following publication of the Transport White Paper in 2007, all subsequent RUSs were expected to look towards a 30-year planning horizon. Some of the previous RUSs (and those being worked on at the time of the White Paper) looked at a shorter-term horizon, typically to around 2019. For consistency, therefore, these earlier RUSs are having their planning horizons extended by this RUS
- economic conditions have changed markedly since the time of earlier RUSs, impacting on both forecast demand and affordability
- unlike in some of the earlier RUSs, schemes such as the Thameslink and Crossrail Programmes and platform lengthening in Network Rail's Control Period 4 are now committed schemes. This has led to further understanding of the effects of these (on both infrastructure and train services), which is now incorporated into this RUS
- similarly in the freight sector, funding has been made available for a number of projects, principally involving capacity enhancement schemes and gauge clearance for 9'6" containers on conventional wagons. Also more is now known about freight trends and anticipated freight terminal developments.
- several of the previous RUSs indicated that London terminal capacity would become a limiting factor for accommodating growth in the future. Given that a potential solution to this could be further future development of the Crossrail network, the Thameslink network or the construction of further cross-London rail corridors (such as the Chelsea – Hackney line/ Crossrail 2) it is considered appropriate for such issues to be addressed through a London-wide analysis rather than on a line-by-line basis.
- the first of Network Rail's RUSs, the South West Main Line RUS, was developed as a prototype and was produced within comparatively short timescales in order to inform the South Western re-franchising process in 2006. As a result, certain parts of the network (for example the South Hampshire and Solent area) were not considered fully, so the opportunity is taken in this RUS to remedy this

- Government policy has changed with respect to airport growth at Heathrow Airport and Stansted Airport in particular
- Government policy now includes the development of a High Speed 2 network from London to the West Midlands and beyond. This has significant implications for the whole of the West Coast Main Line, for the Old Oak Common area and also for possible links to High Speed 1.

2.3.2 It is important to emphasise that the London and South East RUS will not be re-examining the established RUS strategies relating to Control Period 4, and will only re-examine strategies for subsequent control periods if there has been a material or significant change in circumstances since the strategy was established. In general the detailed Generation One RUS recommendations will therefore be carried forward into this strategy, with the starting point being the assumption that these are implemented before new options are sought.

2.3.3 The outputs and recommendations of Generation One RUSs are being used to inform development of the Hign Level Output Specification for Network Rail's Control Period 5, covering 2014 – 2019. In general the recommendations in this RUS are to influence transport and other planning policy for Control Period 6 and beyond. However there are some which would be appropriate to implement in advance.

2.4 Geographic scope

2.4.1 The RUS covers passenger and freight demand in the Greater London area and abutting regions of South East England. Unlike Generation One RUSs it has no specific scope in terms of railway network geography, instead considering issues as appropriate to the gaps which are identified.

2.4.2 This Generation Two RUS interfaces with following Generation One geographic (ie line of route) or other RUSs:

- South West Main Line (March 2006)
- Cross London (August 2006)
- Freight (March 2007)
- Greater Anglia (December 2007)
- East Coast Main Line (February 2008)
- South London (March 2008)
- Kent (January 2010)
- Sussex (January 2010)
- East Midlands (February 2010)
- Great Western (March 2010)
- West Midlands and Chilterns (Draft for Consultation published November 2010)
- West Coast Main Line (Draft for Consultation published December 2010)
- Network (Scenarios and Long Distance Forecasts – June 2009; Electrification – October 2009; Stations – in preparation; Rolling Stock and Depots – in preparation).

2.4.3 Each of the above geographic RUSs contains a substantial volume of background information regarding issues such as infrastructure capability, characteristics of the railway network and train operations for their respective areas. This baseline information is not fully repeated in this document in order to preserve brevity but all the above RUSs are available at **www.networkrail.co.uk**

2.5 Time horizon

2.5.1 The strategy will cover a 30-year period from 2010. The RUS covers the period to 2031 in detail and then describes broader high level strategic interventions that may be required over a longer timescale. As noted above, the early RUSs considered a shorter time period and the London and South East RUS will extend their planning horizon. Additionally, any material changes in circumstances published in later RUSs will be revisited so that strategies are consistent.

2.6 Government strategy – Department for Transport

2.6.1 The DfT published the 'Delivering a Sustainable Railway' White Paper in July 2007. This confirmed that the policy of the Government in place at that time for the railways was to facilitate significant growth, with a commitment to a continuing investment programme.

2.6.2 The White Paper described a long-term ambition for a railway that:

- can handle double today's level of freight and passenger traffic
- is even safer, more reliable and more efficient than now
- can cater for a more diverse, affluent and demanding population
- has reduced its own carbon footprint and improved its broader environmental performance.

2.6.3 The White Paper described how demand nationally has grown by 40 per cent within the 10 years to 2007 and was predicted to grow by at least 30 per cent over the decade to 2017. Combined with high levels of crowding at present, this results in a capacity challenge for the railway. This led to the specification of a number of High Level Output Specification (HLOS) metrics, covering the specific requirements for Control Period 4 to 2014. On many routes current franchise commitments now require delivery of extra capacity to meet the HLOS.

2.6.4 Since the present Coalition Government came to power in May 2010, there has been no fundamental change to the policy of a growing railway. However, in light of current and future public spending constraints the rail industry has now been challenged to reduce the cost of providing rail services whilst improving overall efficiency. To contribute towards this aim, a value-for-money study headed by Sir Roy McNulty is developing these themes with contributions from across the industry. The study contributed to the wider transport planning decisions made in autumn 2010, with the final recommendations being made to the Secretary of State in March 2011.

2.6.5 Recent Government announcements have included full approval to the Crossrail and Thameslink schemes, together with new rolling stock.

2.6.6 Further details of schemes currently funded by the DfT can be found in **Chapter 5**.

2.7 Transport for London

2.7.1 In addition to central government strategy, the transport and spatial planning development for the Greater London area is covered by the London Plan, which has significant interface with this RUS. The London Plan covers the entire Greater London Authority area. The Mayor of London published a draft replacement of the existing London Plan in October 2009.

2.7.2 The draft plan is comprised of three documents: The London Plan is the overall strategic development plan for the capital, and sets out an integrated economic, social, environmental and transport policy framework for London over the years to 2031; The Economic Development Strategy sets out ambitions for the economic future of London; and the Mayor's Transport Strategy (MTS) sets out a vision for transport in London over the next 20 years. The draft Plan was open for public consultation until 12 January 2010, and is currently being developed through the examination in public process.

2.7.3 The MTS was published in May 2010, and sets the following strategic goals:

- economic development and employment growth (managing public transport crowding and highway congestion, preparing for further population and employment growth, strengthening the role of outer London in London's economy)
- quality of life (addressing poor air quality and climate change and ensuring that journeys are as comfortable as possible)
- safety and security (maintaining and improving safety and security of streets and the transport network)
- transport opportunities for all (improving the accessibility of the transport system)
- climate change (cutting CO_2 emissions and preparing for change).

2.7.4 In response to these challenges the MTS sets out a comprehensive range of proposals to improve London's transport network, with 14 specific proposals for the national rail network in the Greater London area. These would be delivered by a range of stakeholders including TfL itself, passenger and freight train operating companies and Network Rail.

Figure 2.1 – Mayor's Transport Strategy proposals with respect to the National Rail network
Proposal 1
The Mayor, through TfL, and working with the DfT, Network Rail, the operators of international rail services and other transport stakeholders, will encourage the provision of direct international rail services to a wider range of European destinations, with some of those new services serving Stratford International station.
Proposal 2
The Mayor, through TfL, and working with the DfT, Network Rail, train operating companies, freight operating companies, London boroughs and other transport stakeholders, will support the development of more rail freight terminals in or near London, including connections to HS1 for international freight, in line with the London Plan policy to identify new sites for strategic rail freight interchanges.
Proposal 3
The Mayor, through TfL and working with the DfT, Network Rail, train operating companies, freight operating companies, London boroughs and other transport stakeholders, will support the development of National Rail routes that relieve London of freight without an origin or destination in the capital.
Proposal 4
The Mayor and TfL support the development of a national high speed rail network and will work with the DfT, Network Rail, High Speed Two and other transport stakeholders to ensure that the main London terminal for any new high speed line is centrally located, well connected to the existing public transport network, and widely accessible to maximise access to jobs and London's population. It is currently considered that London Euston best meets these criteria. Further evaluation will be made of this and other potential termini, in particular, in relation to links to Heathrow Airport.

Figure 2.1 – Mayor's Transport Strategy proposals with respect to the National Rail network
Proposal 5:
The Mayor, through TfL, and working with the DfT, Network Rail, train operating companies, freight operating companies, boroughs and other transport stakeholders, will seek to ensure that Crossrail is delivered by 2017[1], and that it is fully integrated with the rest of London's public transport system; that the impacts of construction on residents and businesses are minimised as far as possible; and that the future benefits Crossrail brings are monitored to ensure the rail link achieves its objectives.
Proposal 6
The Mayor, through TfL, and working with the DfT, Network Rail, train operating companies and other stakeholders, will consider future extensions of Crossrail that reduce congestion and improve connectivity on London commuter routes.
Proposal 7
The Mayor, through TfL, will seek to ensure that Network Rail and the train operating companies deliver the committed improvements to the rail network and services in London as set out by the DfT's High Level Output Specification for the period 2009 to 2014.
Proposal 8
The Mayor, through TfL, and working with the DfT, Network Rail, train operating companies, London boroughs and other transport stakeholders, will seek further rail capacity across London's rail network, beyond those schemes already committed. The highest priorities in the medium term are to further increase capacity on London Overground; on southwest routes; on West Anglia routes, including access to Stratford; on Great Northern services; and at congested stations. In the longer term, further capacity solutions may be required on a number of rail corridors, such as the Brighton Main Line.
Proposal 9
The Mayor will support new rail capacity in the broad southwest to northeast corridor, for example, new lines or services using the Chelsea Hackney line safeguarded alignment. TfL will undertake a review of the route to ensure it is providing the maximum benefits, including helping the onward dispersal of passengers from central London termini and value for money.
Proposal 10
The Mayor, through TfL, will seek to ensure that the DfT, Network Rail and the train operating companies achieve the HLOS 'public performance measure' for reliability, as well as an overall reduction in significant lateness and cancellations for London and southeast services.
Proposal 11
The Mayor, through TfL, and working with the DfT, Network Rail, train operating companies and London boroughs, will seek to deliver capacity enhancements at some of London's most congested stations. The highest priorities include: a) Central London termini station congestion relief and onward distribution enhancements (the potential of all onward modes will be considered) b) Clapham Junction station capacity enhancement (new improved links between platforms, additional entrances and more ticketing facilities) c) Improved capacity at National Rail stations with severe congestion, including Finsbury Park, Bromley South, Wimbledon, Vauxhall and Barking d) Improved capacity at National Rail stations with moderate congestion, including Willesden Junction, Balham, West Croydon, Putney, Norwood Junction and Surbiton
Proposal 12
The Mayor, through TfL, and working with Network Rail, the train operating companies and other transport stakeholders, will encourage the achievement of a seven day railway by better planning and management of necessary engineering and maintenance work on the railway.

1 Now 2018

Figure 2.1 – Mayor's Transport Strategy proposals with respect to the National Rail network (cont'd)
Proposal 13
The Mayor, through TfL, and working with Network Rail, the train operating companies and other transport stakeholders, will encourage the provision of rail services in London that meet common service standards, including improved ambience, amenities and wayfinding at all stations, and staff availability at each station. It is intended these improvements will be rolled out as franchises are renewed. However, they would be better achieved if the Mayor had more control over suburban rail services in the London area.
Proposal 14
The Mayor, through TfL, working with the DfT and Network Rail, will deliver the committed investment in the Overground network, investigate the feasibility of providing further capacity to assist orbital movement, and will review potential benefits of extensions to the network of services.

2.7.5 In addition to the above the MTS also describes in detail ongoing improvements to the London Underground network, buses, river, Tramlink, the Docklands Light Railway, streets, walking and cycling.

2.7.6 With respect to potential further expansion of the London Underground system and other TfL networks the MTS specifically notes potential future extensions of the Northern Line towards Nine Elms/ Battersea, of the Bakerloo Line south of Elephant & Castle, of the Metropolitan Line to Watford Junction, of the DLR (to Dagenham Dock, south of Lewisham, west of Bank and north of Stratford International) and to the Tramlink system.

2.7.7 The proposals in the MTS have informed this strategy. The RUS has sought for the options it has considered to be consistent with the proposals in **Figure 2.1** where possible.

2.8 South Hampshire and Solent area

2.8.1 The planning context of this area is provided in **Chapter 10**, which considers this part of the network in detail.

3. Current operations and train performance

3.1 Overview

3.1.1 This London and South East Route Utilisation Strategy (RUS) considers the future development of train operations in and around the capital. This area currently encompasses a wide variety of rail services, including long distance high speed (LDHS) trains (on the Great Western, East Coast, West Coast and Midland Main Lines), commuter services of various types operating over an extensive and dense network of lines in the London area, freight container trains from ports such as Felixstowe and Southampton and other rail freight. In addition, even in this part of the country, there are also some quieter routes, serving comparatively rural communities.

3.1.2 This chapter presents a high-level overview of current train operations and day-to-day performance of the various train operators concerned. For more detailed information the first generation geographical RUSs, available at **www.networkrail.co.uk**, provide localised descriptions of the relevant passenger and freight services for specific routes, including analysis of key timetabling factors, infrastructure constraints and other operational issues.

3.2 Passenger services

3.2.1 The routes converging on Central London are some of the busiest in the world, carrying over half a million people a day to numerous stations within the capital on their way to work. These services may be broadly categorised between LDHS, other main line and suburban, with most of the London terminals catering for a complex mix of trains within these categories. Away from central London there are some routes which are more rural in nature.

3.2.2 The following train operators run services into London at the busiest times so are of particular relevance to this RUS:

- most services out of London Paddington are operated by First Great Western, who operate the complex mix of LDHS, interurban, suburban and regional services between London Paddington, the Thames Valley, the West of England and South Wales
- other services out of London Paddington are operated by Heathrow Express, who operate the non-stop Heathrow Express to Heathrow Terminal Five and, in partnership with First Great Western, the Heathrow Connect service to the airport via intermediate stations
- Chiltern Railways operates the Chiltern franchise between London Marylebone and Birmingham Snow Hill, with routes to Stratford-upon-Avon and Aylesbury. These trains share tracks with the London Underground Metropolitan Line on the approaches to London
- London Midland holds the West Midlands franchise, which includes suburban and inter-urban services on the West Coast Main Line (WCML) from London Euston
- Virgin Trains operates the LDHS trains on the WCML. These run between London Euston and destinations in the West Midlands, North Wales, North West England and Scotland
- London Overground operates several orbital routes across London, obviating the need to interchange at the busy terminal stations. These are the North London Line between Stratford and Richmond, the Gospel Oak – Barking route, the East London Line between Dalston Junction and West Croydon/Crystal Palace/ New Cross, and the West London Line between Clapham Junction and Willesden Junction. London Overground also operates an all stations suburban service between Watford Junction and London Euston, sharing tracks with the London Underground Bakerloo Line
- Stagecoach Midland Rail, trading as East Midlands Trains, currently runs the East Midlands franchise, centred on the Midland Main Line with LDHS services between London St Pancras International and destinations across the Midlands, including regional journeys
- the East Coast Main Line Company operates LDHS services on the East Coast Main Line between London King's Cross, the north east of England and Scotland
- First Capital Connect holds the Thameslink and Great Northern franchise, which comprises a complex mix of inner and outer suburban routes. Former Great Northern routes run between Cambridgeshire and Norfolk and London King's Cross and Moorgate terminals. The Thameslink routes run between Bedford and Luton in the North, via London Blackfriars, to South London via the Wimbledon Loop, Brighton and various destinations in Kent

- the Greater Anglia franchise is currently operated by National Express East Anglia, comprising services to and from London Liverpool Street. The franchise comprises the West Anglia routes, including services to Stansted Airport, and a mix of suburban, long distance and regional services centred on the Great Eastern Main Line
- the Essex Thameside franchise is let to National Express under the c2c branding, comprising services between south Essex and London Fenchurch Street on the London, Tilbury and Southend lines
- Southeastern holds the Integrated Kent franchise, comprising the intricate suburban network in the south east London suburbs, the main line routes to Kent and parts of East Sussex, local services, and the high speed domestic services operating on High Speed 1 to London St Pancras International. The operator offers a variety of London terminal destinations for suburban and main line services – London Charing Cross, London Cannon Street and London Victoria
- Southern operates the South Central franchise, which comprises the dense network of suburban routes in south London, main line routes to East and West Sussex, Gatwick Express and regional journeys. London journeys begin or end at London Bridge or London Victoria. Southern also operates an orbital route between East Croydon and Milton Keynes via the West London Line
- Stagecoach South West Trains holds the South Western franchise, operating a comprehensive service into and out of London Waterloo. This covers the South West Main Line from London to Southampton/Portsmouth, regional services, and the extensive network of suburban routes in south west London and the outer suburbs, including trains on the Windsor lines towards Reading
- Eurostar operates services from Europe to St Pancras International via High Speed 1.

3.2.3 In addition to those above, some services to London terminals are run by other operators (mostly open access operators). These are the Wrexham, Shropshire and Marylebone Railway to London Marylebone, the ScotRail Caledonian sleeper services to London Euston, Grand Central and Hull Trains to London King's Cross, as well as regular charter train operators on many routes. However these are mostly off-peak in nature, and as those in the morning peak are infrequent, they are unlikely to have a significant impact on this RUS. Relevant issues are covered by the geographic RUS concerned where appropriate.

3.2.4 CrossCountry operates the new cross-country franchise. Of particular relevance to this RUS are the services from Bournemouth and Reading to the Midlands via Oxford.

3.2.5 Generation One RUSs identified capacity constraints affecting nearly all of the operators in and around the capital, with the railway network as a whole in South East England considered to be very close to running the maximum number of trains achievable with existing infrastructure at peak times. These issues are explored in detail later in this RUS.

3.3 Freight operations

3.3.1 South East England sees a significant volume and variety of freight traffic, including imported goods from ports such as Southampton and Felixstowe, plus flows from the Channel Tunnel and locations such as the Isle of Grain in the Thames Estuary. Additionally a large volume of manufacturing and construction materials, fuel and waste products and specialist flows (such as retail) are transported between various handling facilities within the RUS area.

3.3.2 The following freight operating companies operate services of relevance to this RUS:

- DB Schenker (UK) which is the largest freight operator in the UK and also has the licence to operate European services. DB Schenker runs services for a wide range of markets including energy, construction, industrial, consumer goods, intermodal traffic and Royal Mail.
- Freightliner which serves the deep sea containerised traffic market as well as bulk goods via its Heavy Haul branded service
- GB Railfreight moves goods from a wide range of customers, including bulk goods for heavy industrial and construction industries, as well as general commodities
- Direct Rail Services which transports a variety of commodities. In the last few years the company has expanded into running services for the domestic intermodal market.

3.3.3 Other licensed freight operators run services on the RUS area, which by their nature are more specialised in nature.

3.3.4 All the major routes used by freight are also used by passenger trains, thus restricting the available capacity for both types of service. This issue is explored in detail later in this document. In addition, many routes have restrictions as to the gauge, length, axle weight and traction types that are permitted to run, thus inhibiting operational flexibility. The lack of diversionary routes of equivalent capability is a particular problem on many routes, meaning that traffic cannot run when the normal route is closed for maintenance.

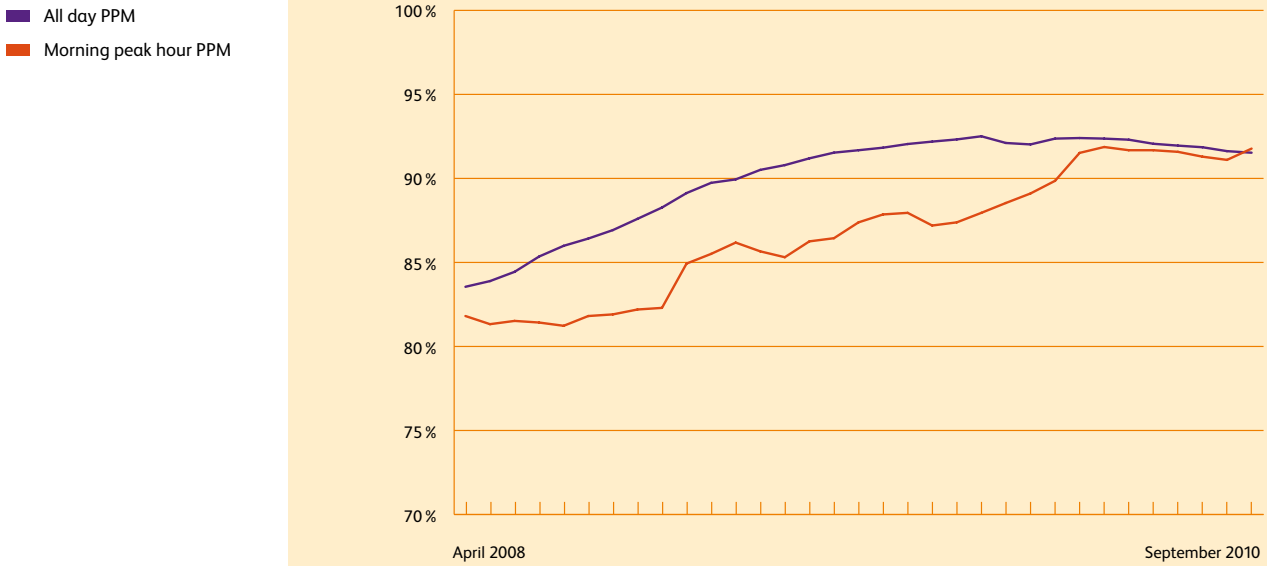
3.4 Overview of recent performance trends for passenger services

3.4.1 Services covered by this London and South East RUS operate on one of the busiest railway networks in the world. In order to accomodate the large commuter flows into the capital, timetables seek to operate the maximum achievable number of trains, with intensive infrastructure utilisation throughout the morning and evening peaks in particular. This results in particular potential for congestion in the event of even a small incident affecting these times. Peak train performance is, as a result, in general at lower levels than in the off-peak.

3.4.2 Train performance during the London peaks is particularly affected by major constraints such as track layouts, terminal station capacity and the interaction of numerous different service groups. Timetables are developed that offer the best compromise between capacity and performance, whilst serving all the various converging routes combining into a small number of corridors into central London. The margins available to maintain a robust service are extremely tight and therefore any incident during critical periods can result in knock-on effects from one service group to another.

3.4.3 The industry measures punctuality and reliability through the Public Performance Measure[1] (PPM). Across the London terminals, there is a wide variation in PPM, reflecting the issues highlighted above. The following diagrams provide an overview of recent punctuality trends for the busiest morning peak hour, compared to all day performance.

Figure 3.1 – First Great Western performance



1 PPM provides an all-industry metric for overall passenger train punctuality and reliability and is expressed as a percentage of all trains arriving on time at destination, compared to the total number of trains planned. For long distance services 'on time' describes trains up to 10 minutes late, for shorter distance services a five-minute margin is used.

Figure 3.2 – Chiltern Railways performance

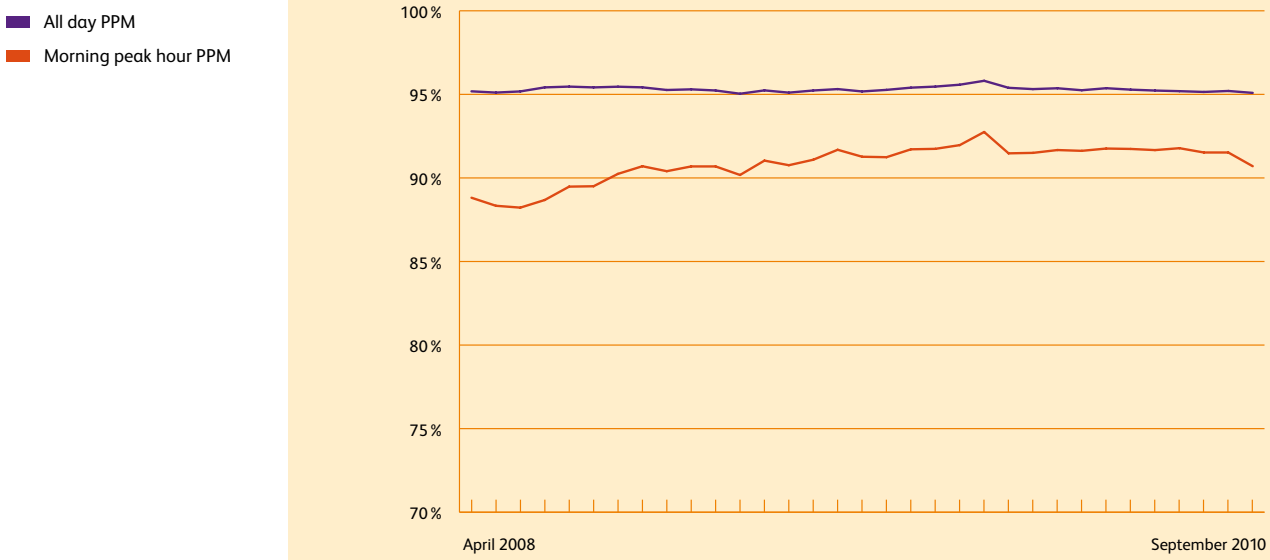


Figure 3.3 – London Midland performance

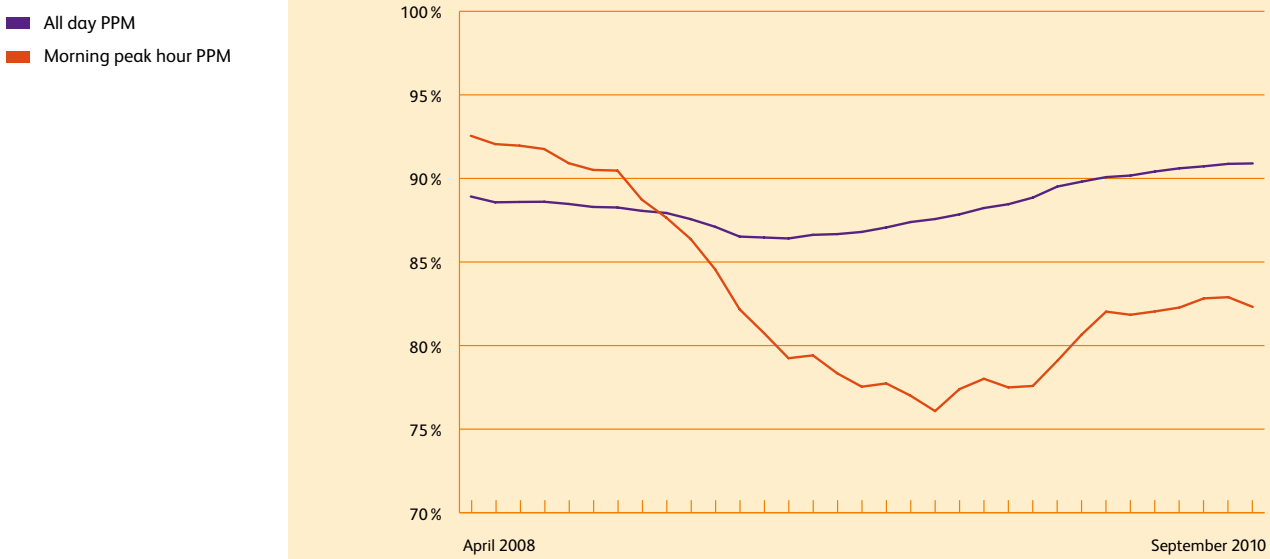


Figure 3.4 – Virgin Trains performance

All day PPM
Morning peak hour PPM

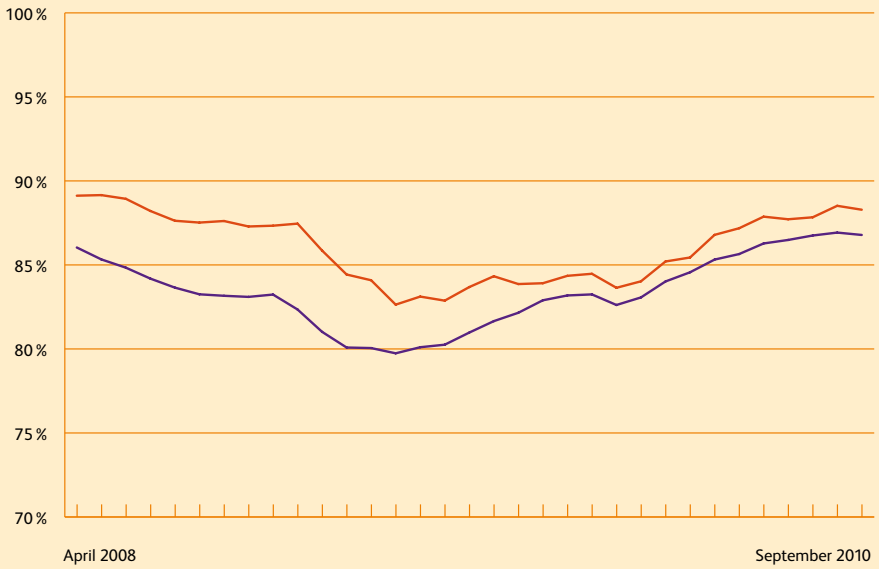


Figure 3.5 – East Midlands Trains performance

All day PPM
Morning peak hour PPM

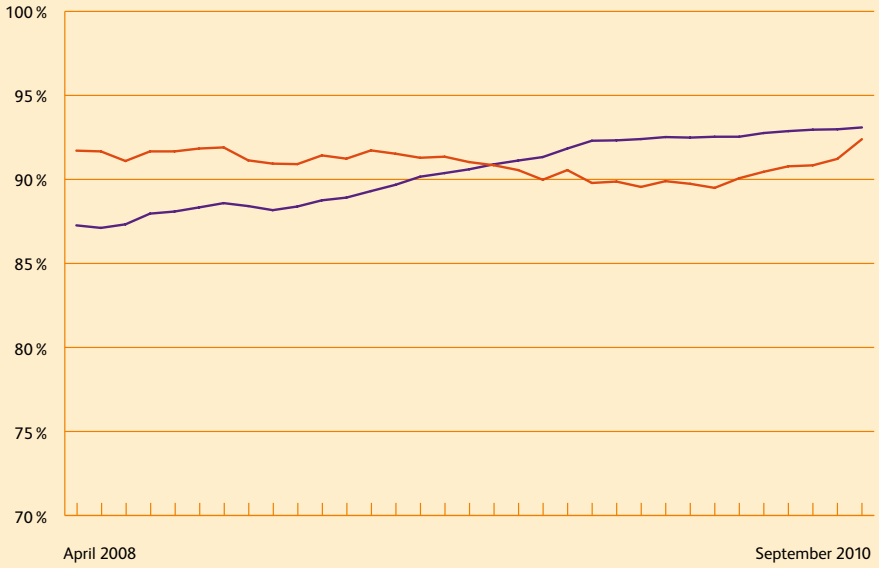


Figure 3.6 – First Capital Connect performance

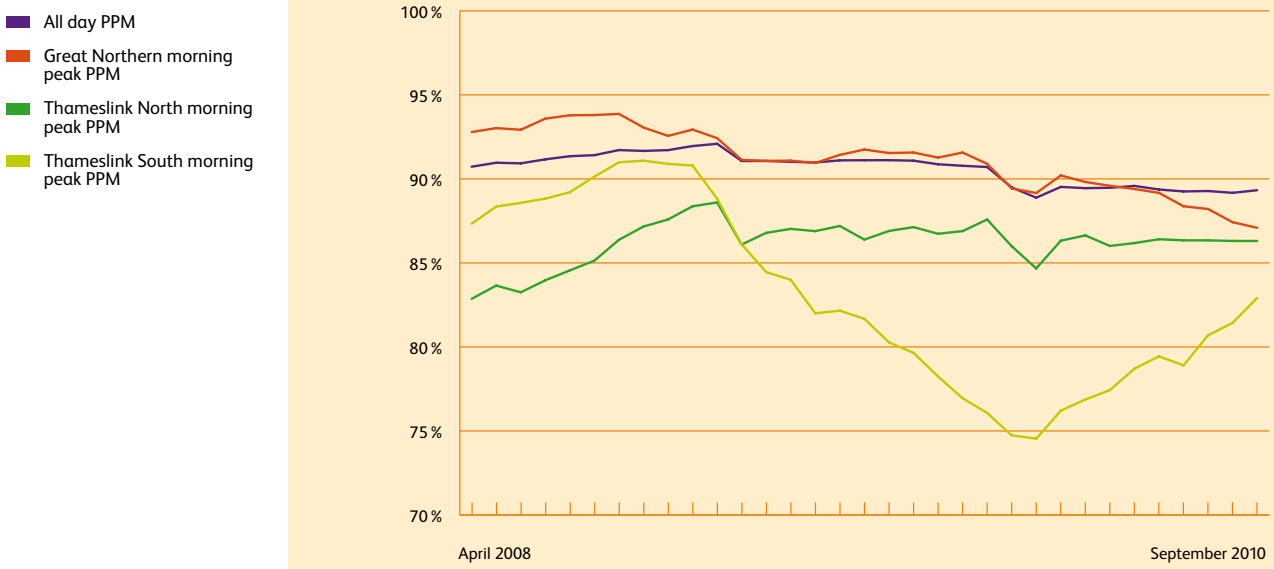


Figure 3.7 – East Coast performance

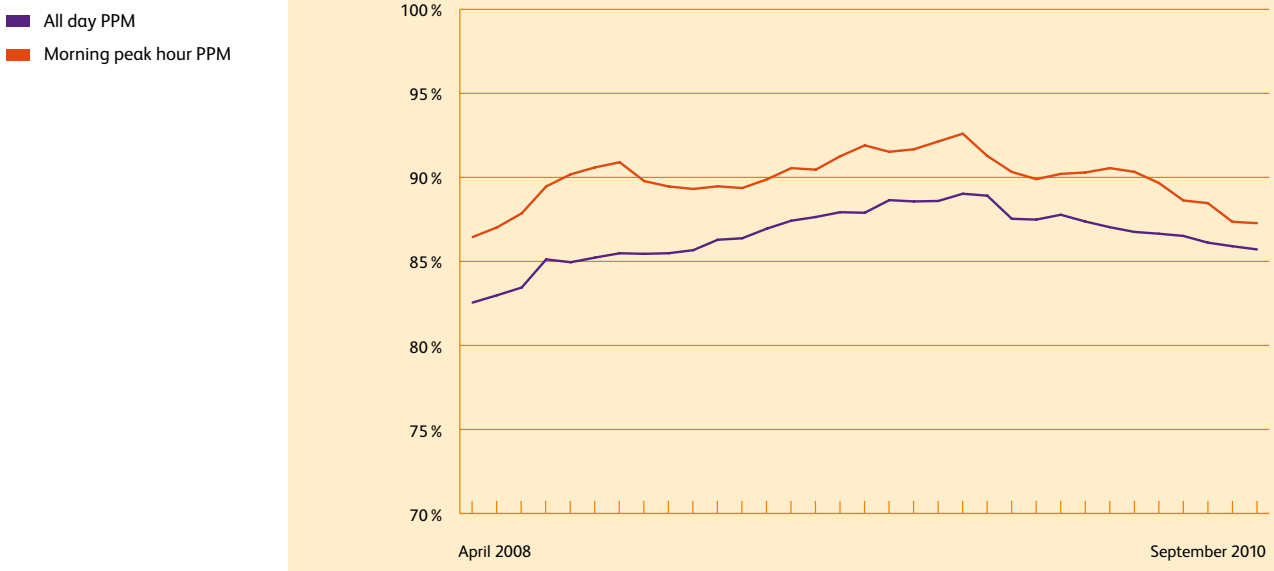


Figure 3.8 – c2c performance

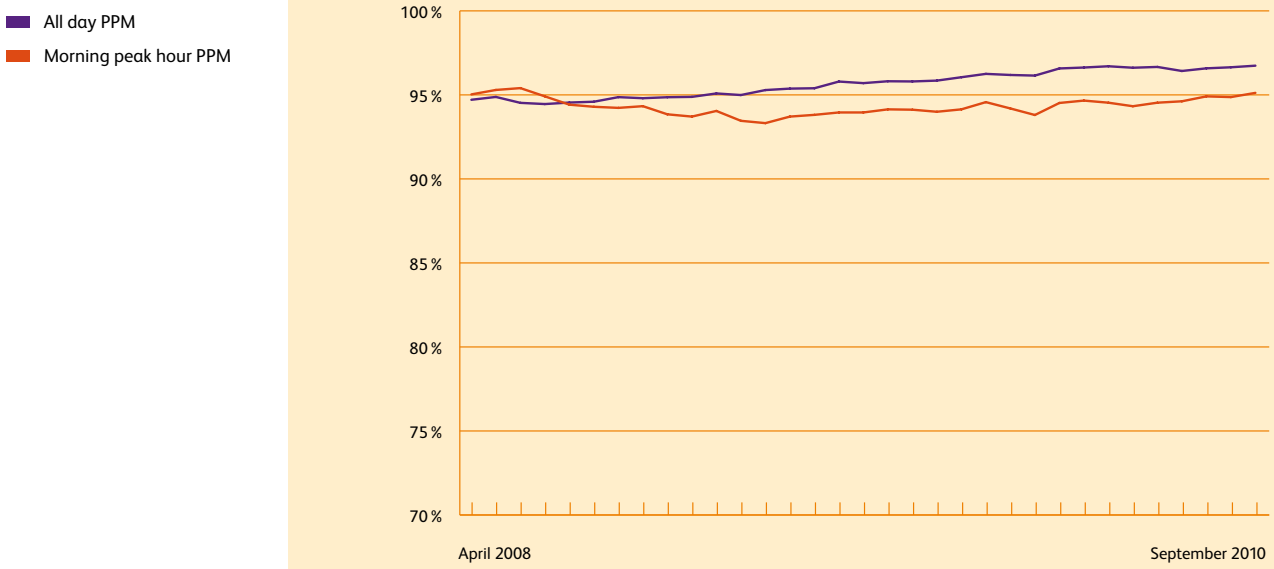


Figure 3.9 – National Express East Anglia performance

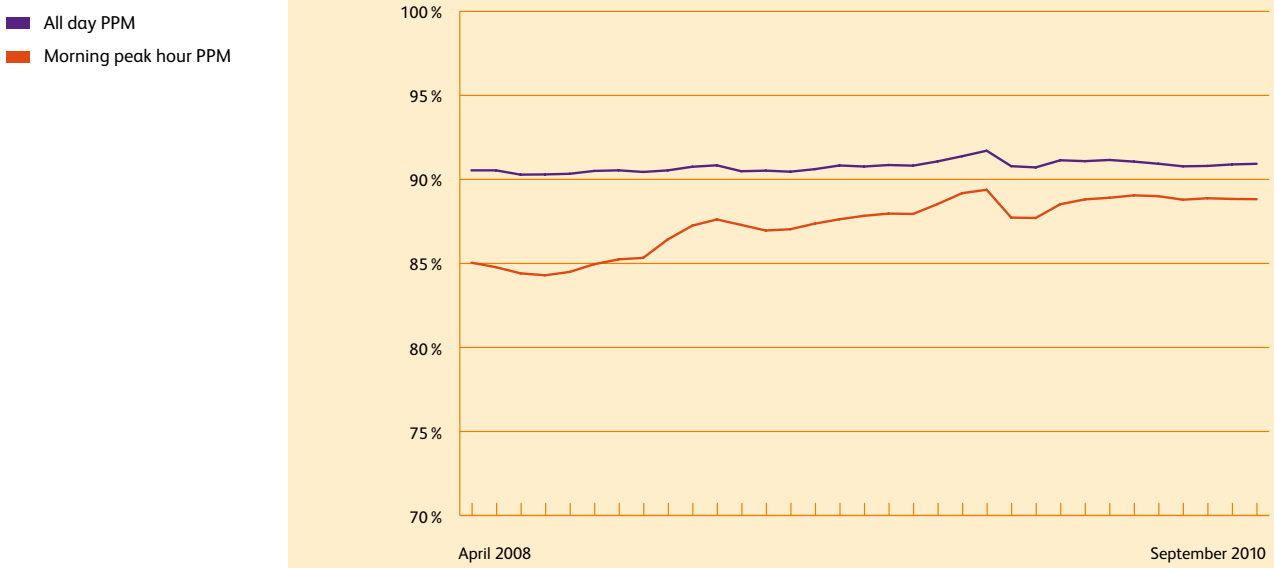


Figure 3.10 – Southeastern performance

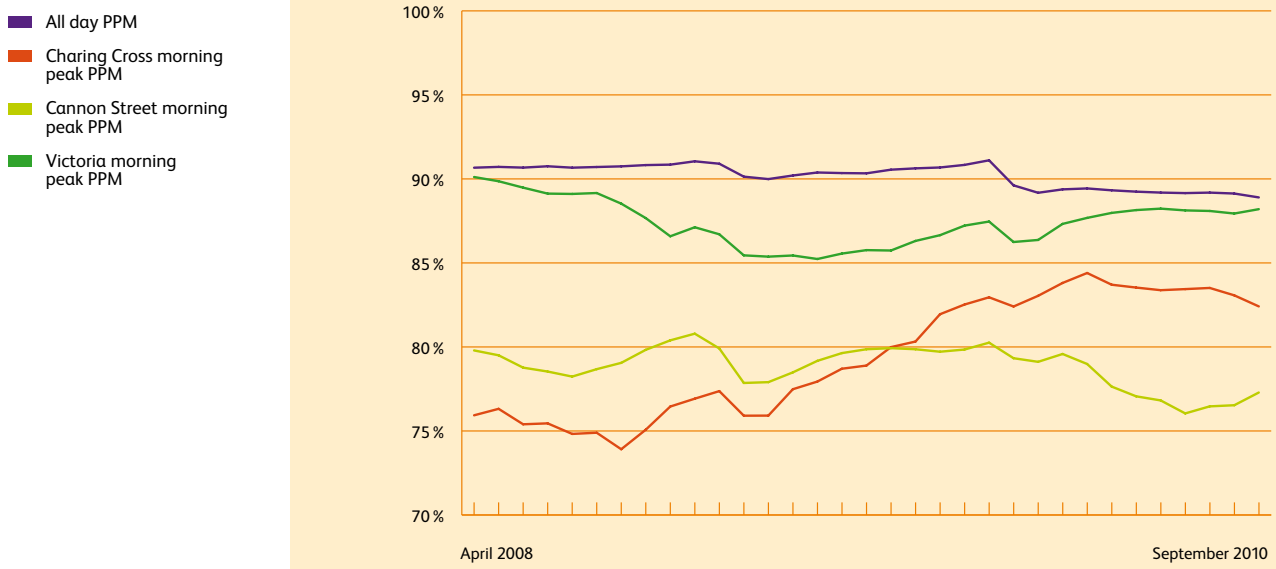


Figure 3.11 – Southern performance

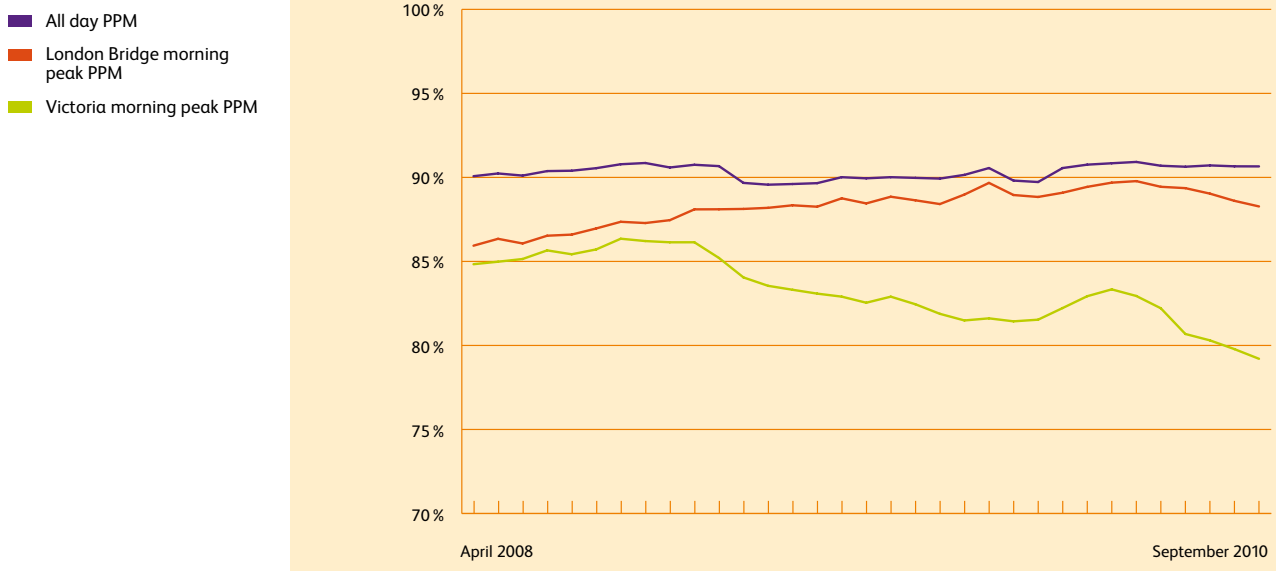
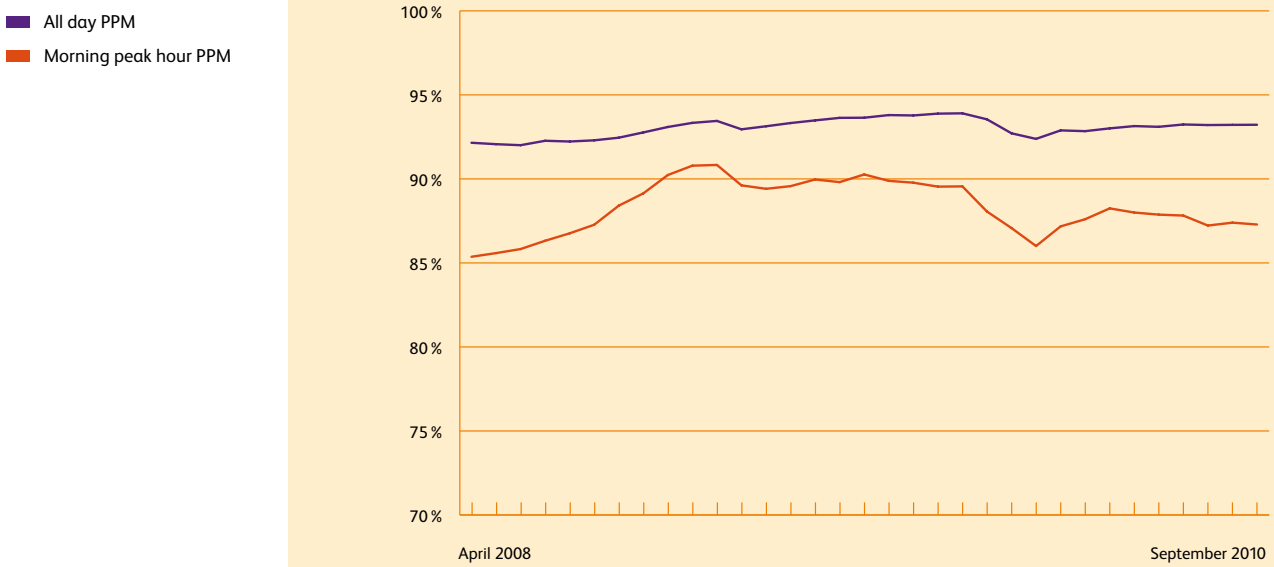


Figure 3.12 – South West Trains performance



3.4.4 Despite the congested nature of the network, it can be seen from the above that the industry has a good record in improving performance over the last 10 years, with most train operators showing ongoing PPM improvements. The RUS does not therefore in general consider train performance to be a strategic level gap on a typical day, but emphasises the need to bring peak train performance up to off-peak levels.

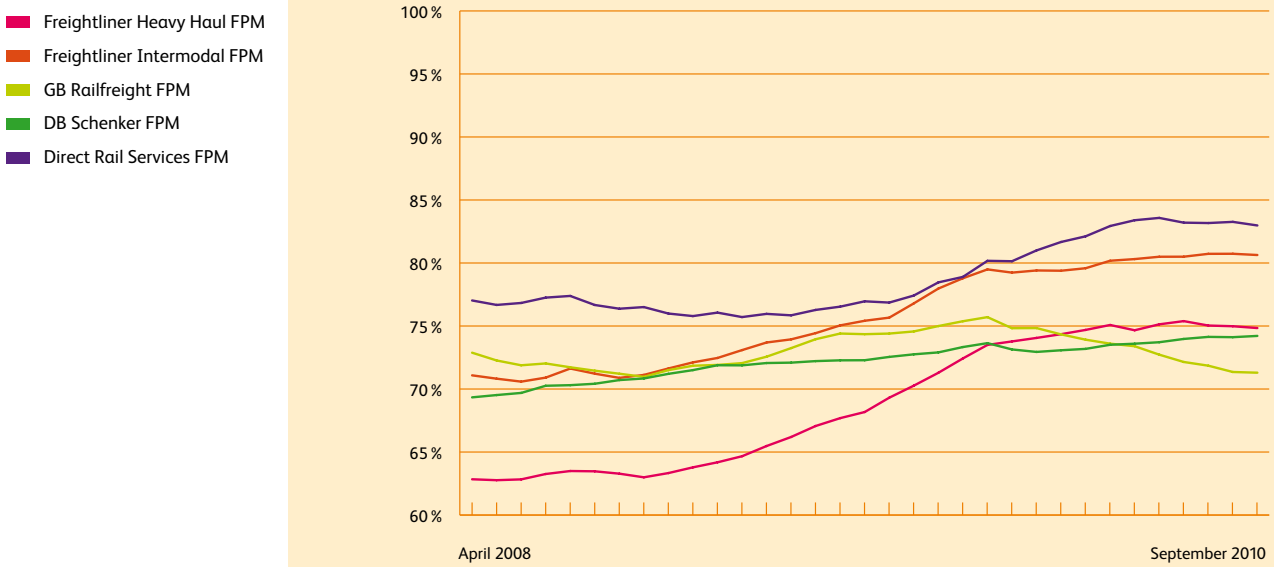
3.4.5 Capacity solutions to further improve performance are possible in some cases, but are often expensive and may not have a robust economic case when performance is already good. It is therefore unlikely that widespread infrastructure capacity upgrades purely for performance reasons can at present be justified across the network, so improving reliability beyond current levels will tend to need to focus on factors such as infrastructure maintenance and design, reliability during adverse weather conditions, the timetable structure and management of external incidents. However, further improvements to performance are anticipated through committed schemes and other route utilisation strategy as described in **Chapter 5**.

3.5 Freight performance

3.5.1 In addition to passenger services, the RUS area sees a significant volume of freight on a daily basis. Much of this traffic currently runs over the congested London commuter network, with no other adequate alternative being available for many flows at present. Careful timetabling is undertaken to make sure that the potential for disruption to either passenger or freight traffic is minimised, but delays do occur in the event of incidents on these routes.

3.5.2 The rail industry has recently introduced a Freight Performance Measure (FPM) to evaluate freight operations. This is a national measure for each freight operator and cannot be disaggregated for London and the South East. The national FPM for each relevant freight operator is provided in **Figure 3.13**.

Figure 3.13 – Freight operator performance



3.5.3 In a similar manner to passenger trains, the RUS does not see future freight performance as a strategic gap, but emphasises the need for attention on those freight flows which are less reliable than the average or particularly time-critical in nature.

3.6 Summary

3.6.1 This section has outlined the passenger and freight operators covered by this RUS, then describing the train performance trends which are in the main continuing to improve. **Chapter 4** moves on to consider the current passenger demand for such services.

4. Morning peak to London – current demand

4.1 Introduction

4.1.1 In this chapter, the current morning peak passenger demand on the rail network into the capital is described. Profiles are provided for all key corridors into and around London. This forms the baseline for analysis and demand forecasting for the detailed capacity analysis work undertaken by this Route Utilisation Strategy (RUS), which is introduced in this chapter.

4.1.2 The Central London capacity workstream focuses on the morning peak period, as this is in most cases the busiest time of the day on the railway network and therefore drives when strategic level interventions are needed to supply more capacity. If sufficient capacity can be provided in the morning peak then the evening peak should generally be resolvable using the same interventions. Weekday off-peak, evening and weekend demand have not been considered in detail by the RUS, but if the network has sufficient capacity to cope with the commuter peaks then these should be capable of being managed at a more tactical level through timetable changes implemented by operators or through the franchising process.

4.2 London

4.2.1 London is the largest attractor of rail trips in the UK. Over 500 million rail journeys are made to or from Central London[1] annually.[2] London is the largest employment centre of the UK. In 2008, over 4.5 million people were employed in the Greater London area, and around a fifth of these jobs were filled by people that live outside the capital.[3] The commuter market is mature and commuters dominate the flows into the city. Passengers on business travel are both attracted to and generated by the capital with its strong service sector. London is also an international centre for leisure and tourism, so flows to and around London, including flows to the city's three major airports, Heathrow, Gatwick and Stansted, are substantial.

4.2.2 Greater London covers some 607 square miles, and rail demand on radial routes tends to build up as it gets closer to the centre. The route analysis uses the demand at the busiest point of the route, whether this is on arrival at the Central London terminus or at an earlier station on the journey. The demand forecast (in **Chapter 6**) also shows how growth varies across three boundaries: Greater London, approximately equivalent to the area inside the M25; inner London, the area within travelcard zone 2; and Central London, encompassing only the zone 1 area.

4.3 The morning peak market

4.3.1 Of all the morning peak journeys into London on all modes, 80 per cent of journeys originate from within Greater London. The majority of peak trips use public transport, as shown in **Figure 4.1**. The Central London share of private transport looks high, but this is because of the high share of journeys made on foot or by bike, rather than by car.

4.3.2 The morning peak is dominated by commuter travellers, going into or around London. In 2008, over 2.2 million people were employed in Central London, and over 4.5 million people were employed in the Greater London area.

4.3.3 Around a fifth of these jobs are filled by people who live outside the capital. **Figure 4.2** shows the distribution of where London commuters live.

4.3.4 Over all modes, 20 per cent of morning peak travellers are from outside Greater London. On the railways 50 per cent of trips originate from beyond Greater London. Despite the greater distances being travelled on the railways, 80 per cent of morning peak passengers are commuting to their normal place of work.

4.3.5 The rest of this chapter focuses on the rail demand on routes into Central London.

1 Central London is defined as the London Boroughs of the City of London, Camden, Islington, Kensington and Chelsea, Southwark, Tower Hamlets and Westminster.
2 MOIRA flows for May 2008 timetable to London National Rail stations, 2008.
3 Source: Greater London Authority Economics.

Figure 4.1 – Origin and mode type of morning peak trips to London

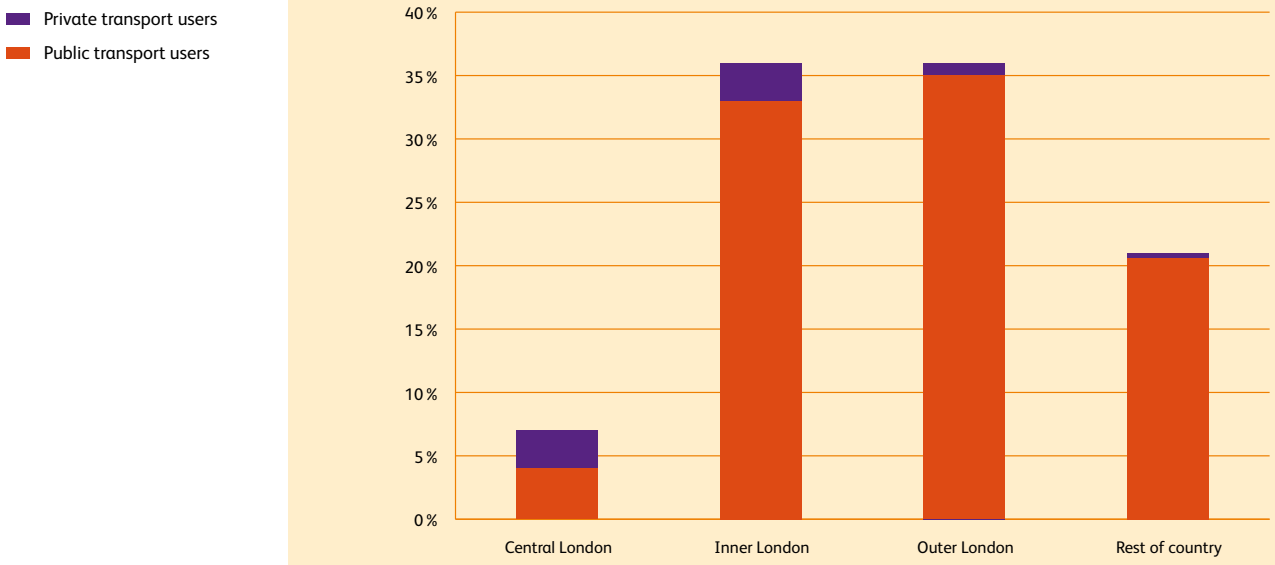
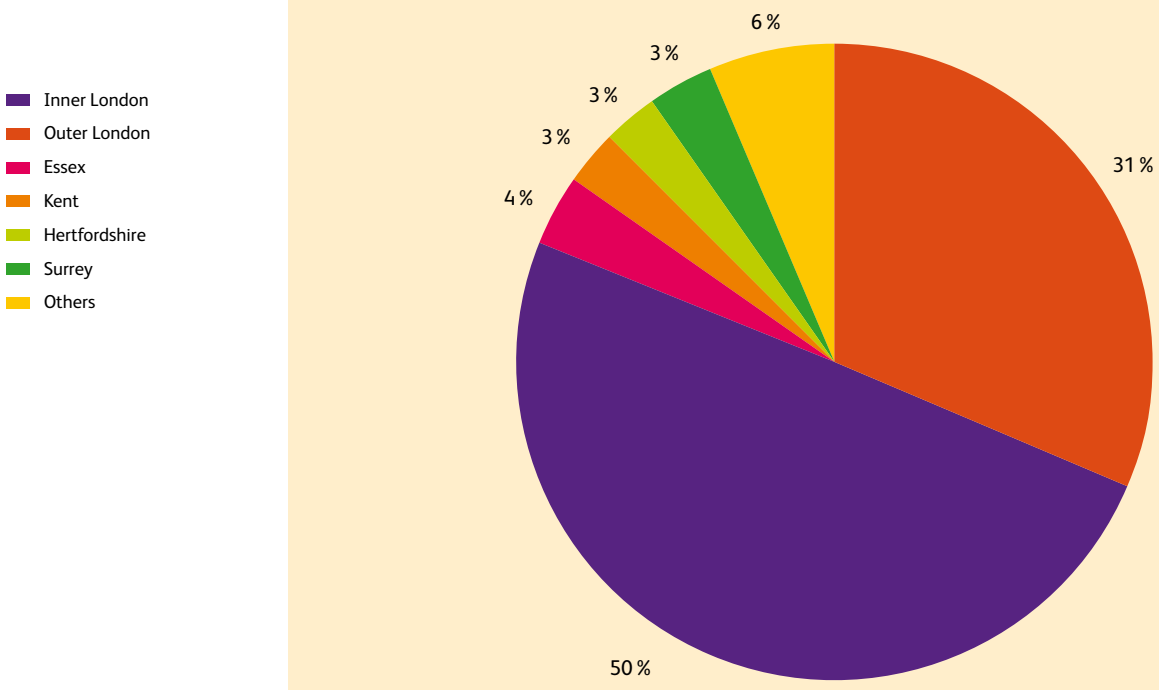


Figure 4.2 – Contribution to London workforce by region



4.4 Central London baseline

4.4.1 Thirteen routes into London plus one orbital route are considered in the Central London capacity modelling, as shown in **Figure 4.3**. Ten of these routes are defined according to their Central London terminus: London Paddington, London Marylebone, London Euston, London St Pancras International, London King's Cross, Moorgate, London Fenchurch Street, London Liverpool Street, London Victoria and London Waterloo. The remaining three are defined as cordons: London St Pancras International (low level) southbound, Elephant & Castle northbound, and London Bridge westbound all of which directions apply to the morning peak. All trains into London are allocated to one of these 13 routes. The West London Line is also considered by this RUS.

4.4.2 The baseline data comes from the Department for Transport's (DfT's) Green Book counts from autumn 2008. This is based on the May 2008 timetable. All morning peak services into London run by franchised train operating companies are covered by the Green Book counts. The count data is provided on a train-by-train basis, and includes standard class passengers, and an uplift for first class passengers.

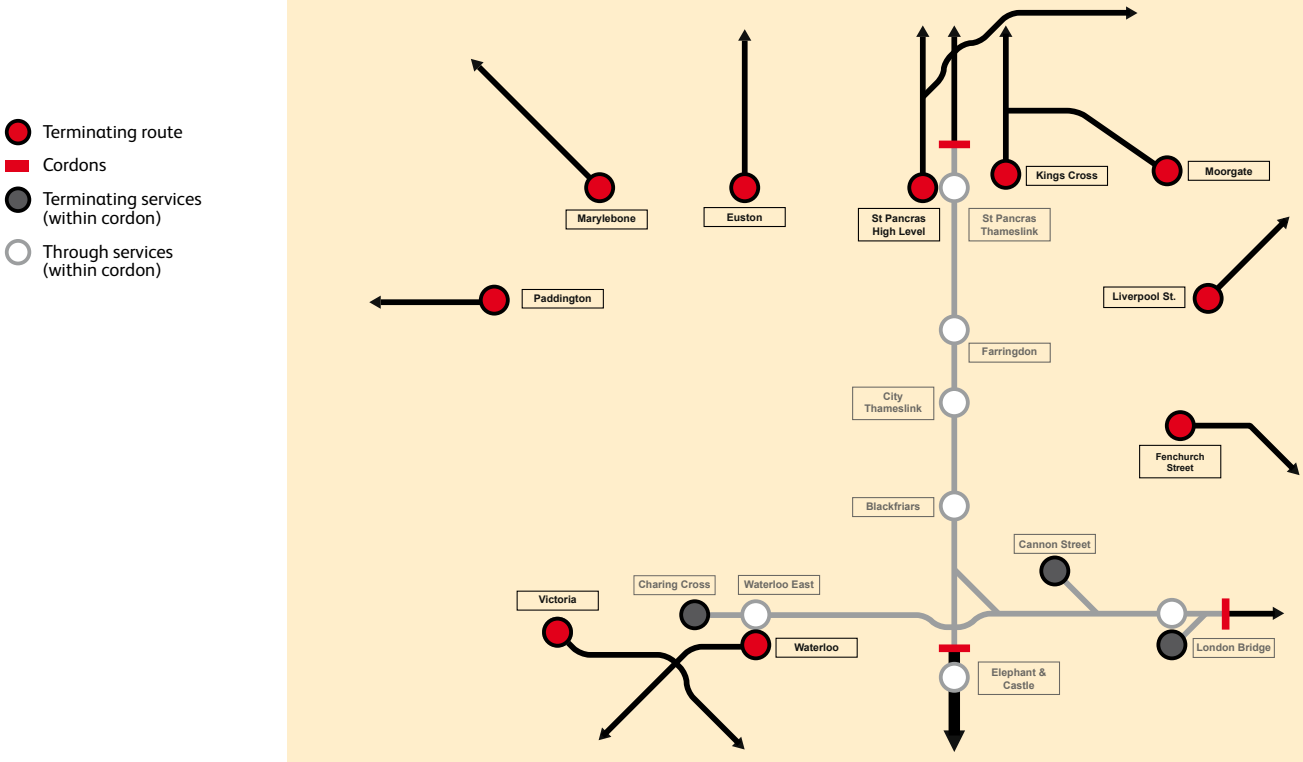
4.4.3 The morning peak period is defined by the RUS as 07:00 – 09:59 arrivals in London inclusive. Trains have been allocated into 15 minute time bands to show when the routes are busiest. The time band is based on the time that the train arrives at its final London destination, or for a cordon, crosses that cordon.

4.4.4 The demand on each train is taken as the number of passengers when the train is at its busiest, known as the critical load. The critical load point is the location where the train is busiest, and in some cases is at a station before the final terminus (eg Clapham Junction rather than London Waterloo). The route demand is simply the sum of the critical loads for all the trains on the route.

4.4.5 The capacity on each train is also measured. This is defined as the total number of seats if the train does not call within 20 minutes of its London terminus or cordon crossing point. If the train does make a station call within 20 minutes of Central London then a standing allowance, as specified by the DfT in the Green Book, is included in the capacity. Passengers in EXcess of Capacity (PiXC) measures those having to stand beyond those allowed for in the defined capacity. The DfT's aspiration is for no passengers to have to stand for more than 20 minutes and the RUS reflects this in its gap analysis.

4.4.6 The following section presents the overall demand and capacity baseline, and the demand on each route. Capacity utilisation is the passenger demand divided by the capacity supplied. This is presented at a route level.

Figure 4.3 – Central London capacity modelling routes and cordons



4.5 Total Central London passenger demand

4.5.1 In 2008 a typical autumn weekday morning peak saw 570,000 passengers travel into Central London by rail. The busiest hour overall was 08:00 – 08:59 which accounted for 50 per cent of the total morning peak demand. The 'shoulder peaks' – the hours immediately before and after the busiest hour – are less busy than the high peak hour; 28 per cent of passengers arrive between 07:00 – 07:59, and 22 per cent between 09:00 – 09:59

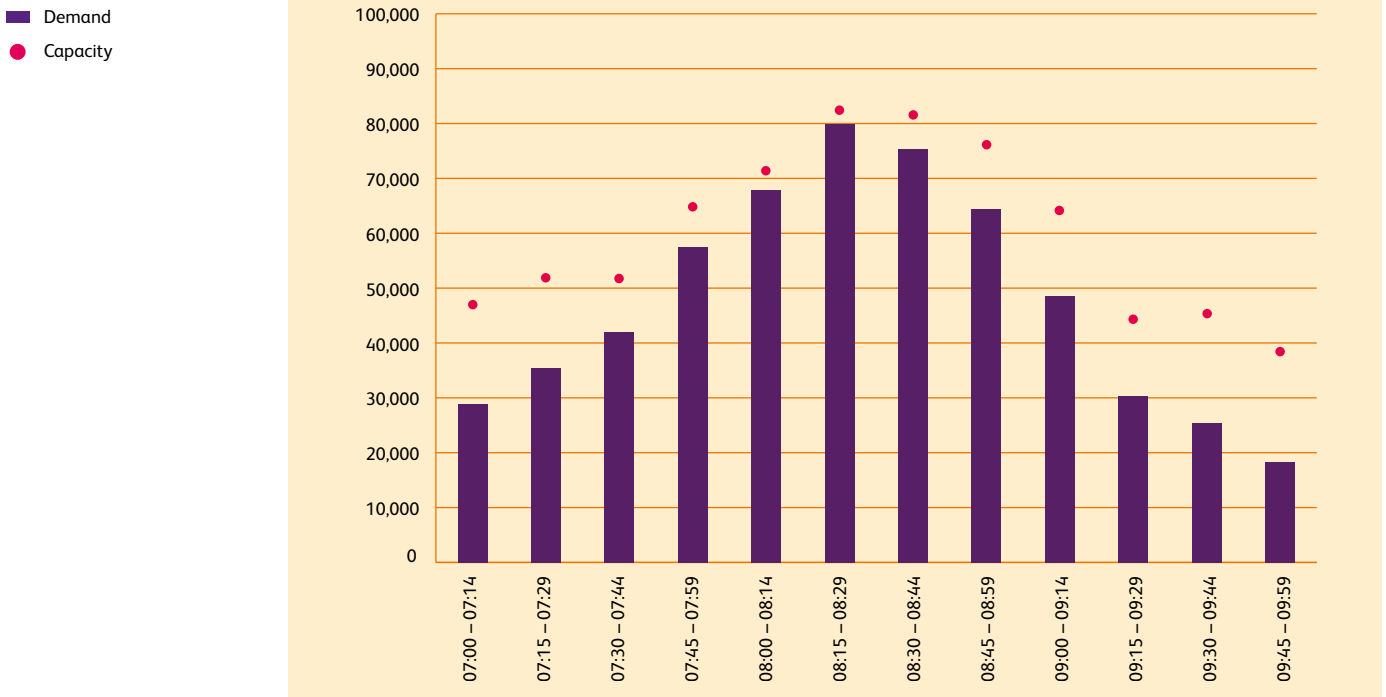
4.5.2 The total capacity supplied into London in the three-hour morning peak period was 720,000. This appears to more than cater for the overall number of passengers as described above; however some trains are inevitably more popular than others, and the profile of capacity is spread more evenly across the morning than the passenger demand profile over the same period. 43 per cent of capacity is supplied in the hour between 08:00 – 08:59; with 30 per cent and 27 per cent in the early and later shoulder peak hours respectively. As a result around 21,000 passengers, 3.7 per cent of the total demand, are recorded as PiXC. The overall profile is shown in **Figure 4.4**.

4.5.3 **Figure 4.5** shows the numbers of passengers arriving on the different service group types: inner suburban services carry the most passengers into London, followed by outer suburban, and then long distance trains. The airport services shown are the Heathrow Express[4] and Gatwick Express.[5] This aligns reasonably with the origins of commuters to London shown in **Figure 4.1**, with roughly equal shares of travellers coming from inner and outer London. Due to interchanging before Central London termini, passengers arriving on inner suburban trains may still have originated from outside Greater London.

4.6 Route-by-route loadings

4.6.1 The breakdown of Central London demand on a route-by-route basis is shown in **Table 4.1**, and illustrated in **Figures 4.6** and **4.7**.

Figure 4.4 – Overall London demand and capacity profile over the morning peak



4 As an open access operator, Heathrow Express does not provide passenger counts for the DfT. Platform counts and MOIRA modelling have therefore been used to estimate passenger usage.

5 Peak Gatwick Express services were subsequently extended to/from Brighton from the December 2008 timetable.

Figure 4.5 – passenger demand into London in the morning peak by service group type (autumn 2008)

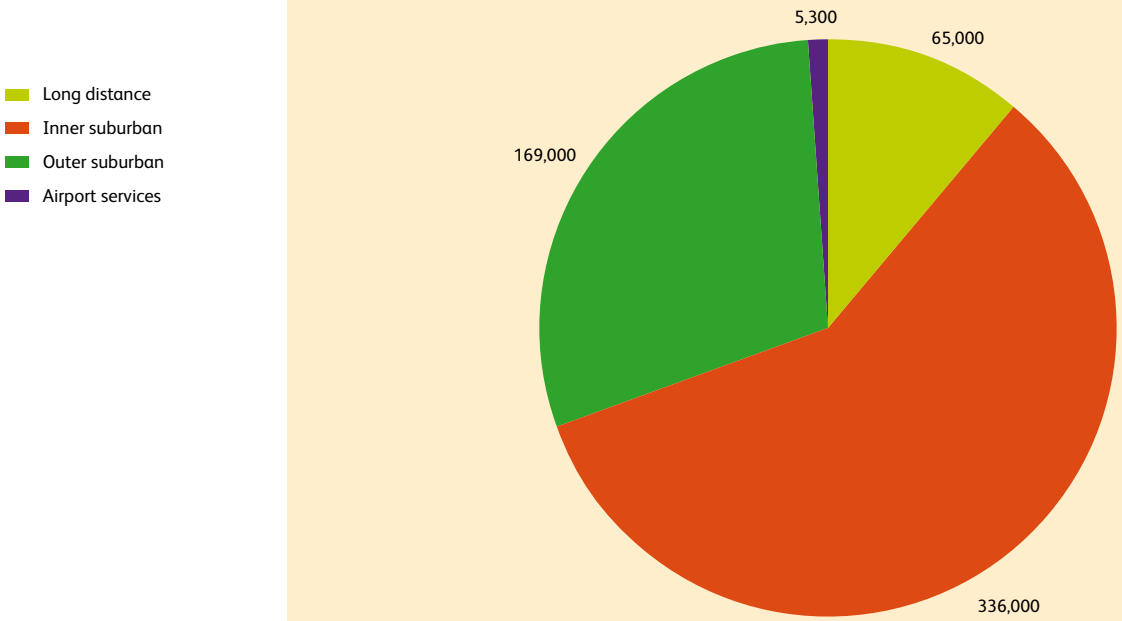


Table 4.1 – morning peak demand by route

Route to	Busiest hour	Busiest hour demand as % of 3 hr peak	2008 morning peak demand (3 hr)	Capacity utilisation in morning peak (3 hr)	Capacity utilisation in busiest hour
London Paddington	07:45 – 08:44	45 %	27,600	80 %	98 %
London Marylebone	07:45 – 08:44	54 %	11,400	84 %	93 %
London Euston	07:45 – 08:44	50 %	23,100	78 %	88 %
London St Pancras International (Midland Main Line)	08:15 – 09:14	51 %	3,000	59 %	70 %
London St Pancras Thameslink cordon	07:45 – 08:44	49 %	20,200	78 %	88 %
London King's Cross	08:00 – 08:59	49 %	21,100	81 %	91 %
Moorgate	08:15 – 09:14	54 %	13,400	82 %	95 %
London Liverpool Street	08:00 – 08:59	49 %	88,300	81 %	95 %
London Fenchurch Street	08:00 – 08:59	52 %	29,800	83 %	94 %
London Bridge cordon (Charing Cross, Cannon Street and London Bridge)	08:00 – 08:59	52 %	144,200	87 %	96 %
London Victoria	08:00 – 08:59	52 %	70,100	80 %	89 %
Elephant & Castle cordon (Thameslink South)	08:00 – 08:59	57 %	20,900	86 %	111 %
London Waterloo	08:00 – 08:59	50 %	101,100	69 %	86 %

Source: DfT Green Book Counts Autumn 2008.

4.7 Busiest hours

4.7.1 As shown in **Table 4.1**, 08:00 – 08:59 is the busiest hour on the majority of routes as most commuters are aiming to arrive at work by the traditional hour of 09:00.

4.7.2 For London Paddington, London Marylebone and the London St Pancras Thameslink cordon the busiest hour on the route is earlier than the typical high-peak hour. This is considered to be because passengers on the route have to continue their onwards journey further beyond the terminus than from other London termini. Supply is also greatest during this busiest hour.

4.7.3 The busiest hour on the Midland Main Line route into London St Pancras International is 08:15 – 09:14, which may be due to the higher proportion of leisure travellers. A similar trend is seen on long distance service groups on some other routes; the East Coast Main Line and West Coast Main Line long distance trains are busiest later than the standard high peak hour.

4.7.4 The Elephant & Castle cordon has the most pronounced high peak hour, with 57 per cent of demand between 08:00 – 08:59. This puts pressure on the route, with 111 per cent utilisation. However, other routes which have above average demand shares in the busiest hour, such as Marylebone, Moorgate and London Bridge (Sussex route) manage to match supply to demand better and have lower PiXC levels.

4.7.5 Flatter demand profiles are seen at London Paddington, the London St Pancras Thameslink cordon, into London Liverpool Street and at London King's Cross. This is influenced by the long distance services; both through fares restricting travel in the peaks, and less frequent services (compared to most suburban services). Therefore many passengers have to travel outside the busiest hour, which spreads the peak demand.

4.8 Critical load points

4.8.1 Many trains are at their busiest at a point before the destination terminus. For example Ealing Broadway for London Paddington, Stratford, Seven Sisters or Tottenham Hale for London Liverpool Street and Clapham Junction for London Victoria and London Waterloo routes. The busiest part of a route, known as the critical load point, tends to be a station with good links to other modes, such as London Underground lines, Dockland Light Rail or other rail routes.

4.9 Passengers in Excess of Capacity

4.9.1 As described in paragraph 4.4.5, where more passengers travel than the rolling stock was designed for PiXC conditions occasionally arise, principally in the morning and evening peaks. PiXC conditions on individual trains tend to occur on the corridors having the highest levels of overall capacity utilisation. Accordingly, the Elephant & Castle cordon, London Paddington, London Liverpool Street (Great Eastern Main Line) and London Bridge (Sussex) routes, which all have high peak hour capacity utilisations of 98 per cent or above have the highest PiXC levels of around 10 per cent of passengers in the busiest hour.

4.9.2 The lowest PiXC levels over the morning peak period, of less than three per cent of passengers, are seen at London St Pancras International (high level), Moorgate, London Victoria (Kent), London Fenchurch Street and London Waterloo. These also correspond to lower capacity utilisation over the three hours.

4.9.3 Analysis of the passenger baseline indicates that PiXC levels begin to breach the industry benchmark on routes where the capacity utilisation over the three-hour morning peak reaches 85 per cent. This reflects the fact that the busiest trains are significantly more heavily loaded than trains at the start and the end of the morning peak. It also illustrates the difficulty in closely matching the supply of capacity in the short term to rapidly changing or fluctuating levels of demand.

4.9.4 In general, there is less spare capacity on the busy trains in the high-peak hour and the utilisation rate at which PiXC levels are breached is often higher than 85 per cent, although this varies by corridor and service type.

4.9.5 Sometimes a low overall utilisation can mask PiXC occurring on selective service groups, such as inner suburban trains having spare capacity, but outer suburban trains being crowded. PiXC numbers also do not record passengers who are standing within capacity but for journey times of over 20 minutes. These issues are recognised by this RUS when identifying gaps in **Chapter 7**.

Figure 4.6 – Morning peak demand by route (07:00 – 09.59) – autumn 2008

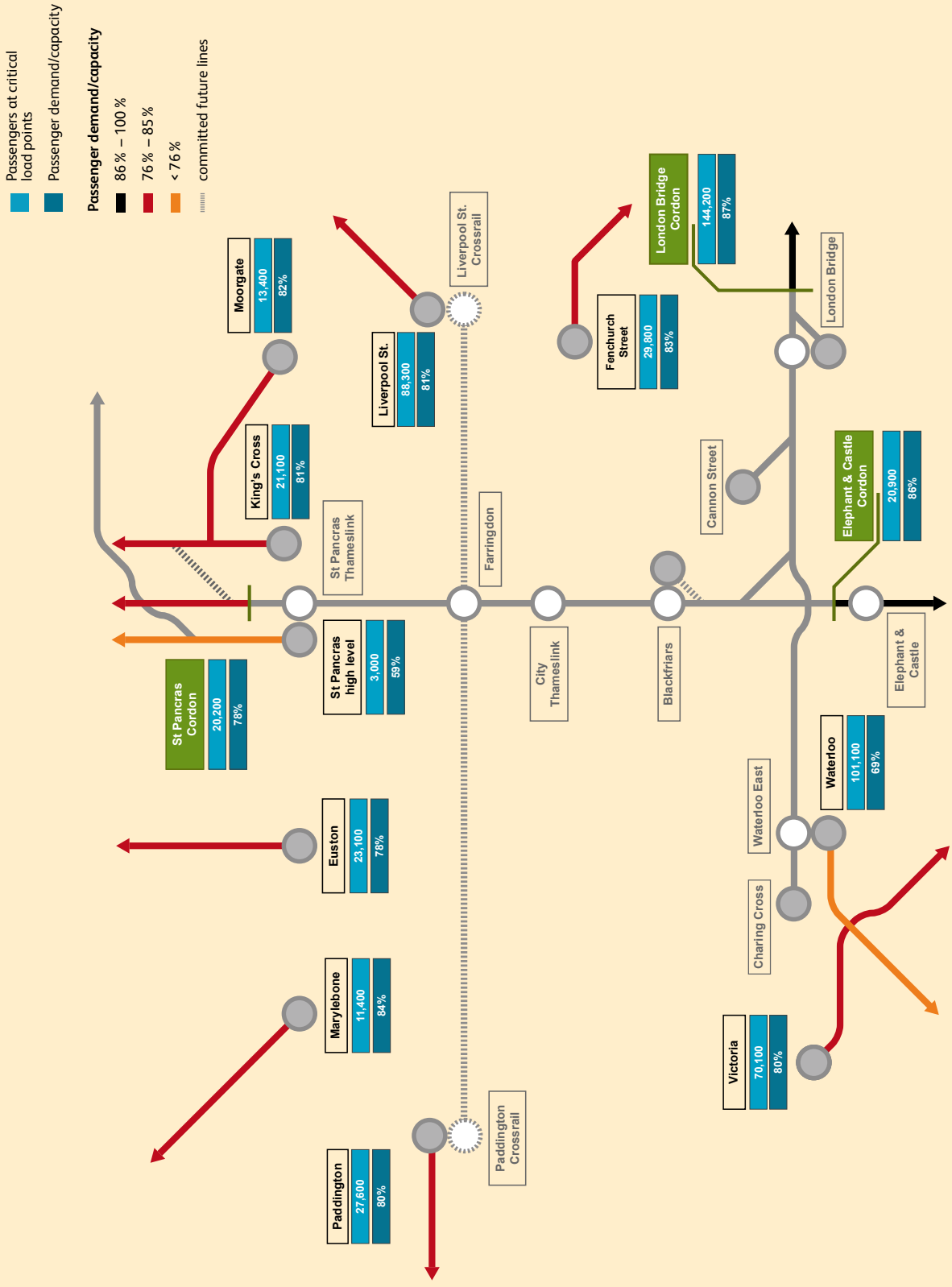
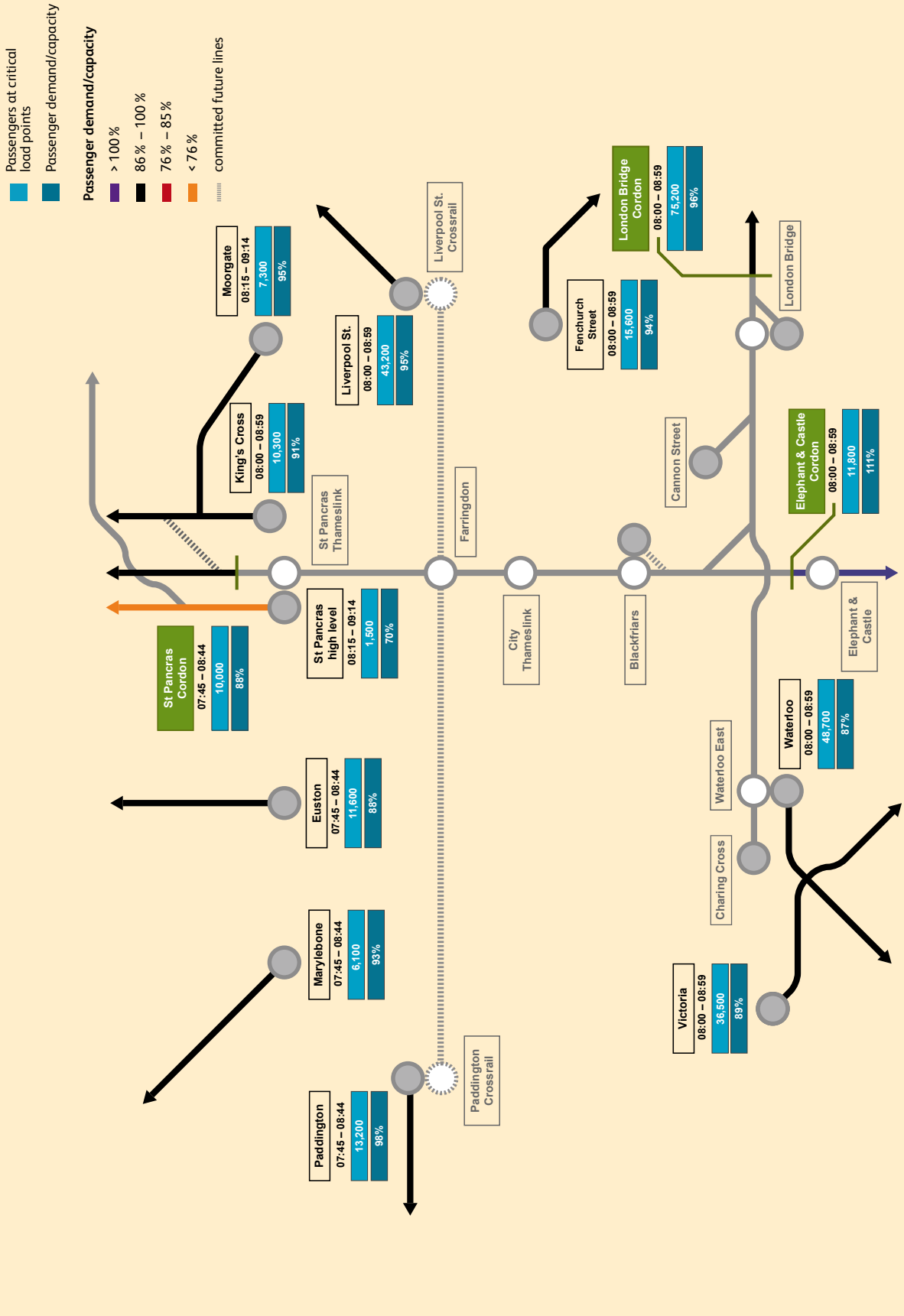


Figure 4.7 – Busiest hour demand by route – autumn 2008



4.10 Service group types

4.10.1 Whilst the overall demand profiles reflect the morning peak market described in this chapter, different routes have widely varying characteristics. The mix of types of passengers by service group varies by London terminal, as each of these have different passenger markets and cover a range of distances.

4.10.2 The majority of the total morning peak passengers into Central London travel on inner suburban trains. **Table 4.6** shows that the busiest routes in terms of peak passenger volumes are those into London Liverpool Street, London Waterloo and London Victoria and to/via London Bridge. It can be seen in **Figure 4.8** that each of these has a high percentage of suburban passengers. There are significantly lower numbers of suburban passengers into termini north and west of London, primarily due to alternative travel options on London Underground lines.

4.10.3 Certain London terminals have relatively high shares of peak longer distance flows: London Paddington, London Marylebone, London St Pancras International, London Euston, London Waterloo and London King's Cross. These are where Britain's main lines terminate, with connections to principal cities. The percentage at London Paddington is particularly high as many commuters from Reading utilise long distance high speed trains from the west of England and Wales, rather than the slower and less well appointed suburban trains. The absolute number at London Waterloo is particularly high, with large numbers of passengers commuting from the Southampton and Portsmouth routes.

4.10.4 As discussed above, sizeable numbers of rail passengers originate from outside of Greater London. The routes having their largest share on outer suburban trains are those to London St Pancras International (low level), London King's Cross and London Euston.

4.10.5 The West London Line is also considered in the London and South East RUS. The baseline comes from count data provided by Southern and London Overground from 2009. This shows that around 2,500 passengers travel on the West London line in the peak busiest hour. Several trains have severe crowding, with loads up to 200 per cent of the seated capacity. Whilst most journeys on this route are short duration in nature and London Overground services have significant standing space this is also recognised as a present day gap.

4.11 Summary

4.11.1 When considering the three-hour peak as a whole it can be seen that the capacity supplied into London in the morning peak is greater than the passenger demand. However, analysis of the baseline capacity utilisation by route shows that due to uneven matching of supply and demand over this period then, with the exception of East Midlands Trains into London St Pancras International, all routes have a capacity gap at present (May 2008 timetable). The crowding plots in **Figures 4.6** and **4.7** and data in **Table 4.1** illustrate this.

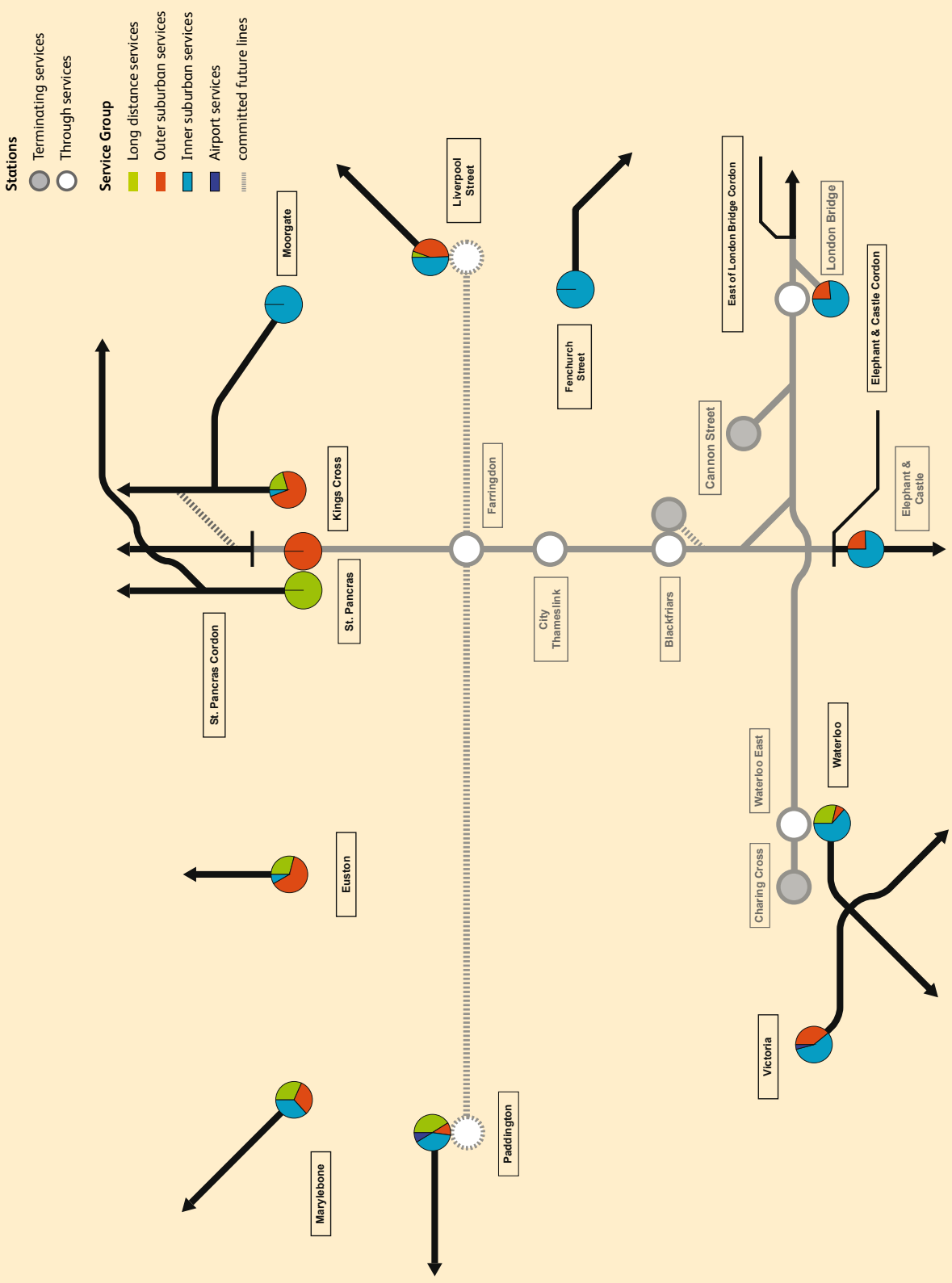
4.11.2 A range of infrastructure interventions are anticipated and rolling stock to increase the capacity into London in the morning peak. Some interventions in early Control Period 4 have already been delivered since the May 2008 base; others will come online in the future. Therefore, if there was no growth the demand observed in the baseline could be accommodated in the future, at more acceptable levels of crowding, with interventions already committed. **Chapter 5** explains these interventions in detail.

4.11.3 However the RUS does not anticipate that demand will remain at today's levels. The demand forecast in **Chapter 6** shows how both exogenous and transport-related factors will drive growth on routes into London over the next 20 years. The growth rates which are forecast are applied to the observed demand from the baseline.

4.11.4 Together, this creates a future picture of supply and demand for each route (disaggregated where needed). The forecast capacity utilisation levels inform where gaps are likely to occur on the network in the future.

4.11.5 The committed interventions are outlined in **Chapter 5**, together with uncommitted interventions recommended by Generation One RUSs. The forecasting methodology and resulting future demand are described in more detail in **Chapter 6**. Forecast peak capacity gaps and options beyond existing strategy are in **Chapter 7**.

Figure 4.8 – Passenger demand share by service group and route



5. Morning peak to London – committed schemes and other existing strategy

5.1 Introduction

5.1.1 This chapter describes existing strategy, as covered in Generation One Route Utilisation Strategies (RUSs) and other relevant planning documents. In general this established strategy is rolled forward as an input into this Generation Two RUS, though updates to previous assumptions are made where appropriate to specific circumstances. The chapter focuses on morning peak passenger capacity to London, so not all existing interventions are described here.

5.1.2 The London and South East RUS assumes that committed schemes will happen as planned and they therefore form part of the baseline, or 'do-minimum' scenario. Similarly the RUS considers that other existing industry strategy will also occur in due course, so this is considered as the 'baseline-plus' scenario for all analysis.

5.1.3 Any further interventions proposed by the RUS (the options described in **Chapter 7**) are therefore assessed against this baseline-plus scenario, rather than the present situation or the do-minimum situation of currently committed schemes only.

5.1.4 The chapter outlines the committed schemes forming the baseline and the uncommitted schemes forming the baseline-plus.

5.2 Committed schemes

5.2.1 Network Rail's Control Period 4 (CP4) Delivery Plan sets out current commitments with respect to infrastructure enhancement for the majority of existing schemes.

5.2.2 Franchise agreements between the Department for Transport (DfT) and train operating companies set out contractual commitments for service improvement, typically using this new infrastructure and additional rolling stock introduced into franchises.

5.2.3 Certain major projects have been subject to recent separate announcements, notably the Thameslink Programme and Crossrail. These are now therefore fully committed, as are their secondary effects such as rolling stock cascades.

5.2.4 In certain cases infrastructure projects are currently committed, but franchise changes are not. Where the necessary rolling stock can be reasonably assumed as resulting from the above future cascades (the full details of which will not be known for some time) the RUS has assumed that franchises will be modified appropriately at some stage in the future. Such capacity is therefore part of the baseline even if it is not currently a franchise commitment for the train operating companies concerned. If the additional carriages for the routes concerned do not become available as a result of these cascades then it is likely to be a recommendation of future RUSs that the rolling stock be procured through an alternative mechanism.

5.2.5 It is recognised that there exists uncertainty with respect to certain elements of erstwhile committed schemes, principally precise details regarding the deployment of new and cascaded rolling stock. The RUS has made assumptions in this area which will be kept under review as the position with respect to rolling stock becomes clearer.

5.2.6 The peak capacity increases assumed by this RUS as resulting from committed schemes are described below.

5.3 Overview of peak capacity to London assumed from committed schemes

5.3.1 The main additional capacity into the capital will result from new rolling stock being procured as a result of the Thameslink Programme and Crossrail. These infrastructure programmes will enable extra and longer trains to run on both the north-south and east-west axes and enhancements elsewhere (principally a major programme of platform lengthening) will enable most other routes to benefit from the resulting rolling stock cascade.

5.3.2 It is important to emphasise that the specific number of additional vehicles operating in the London area following the combination of Crossrail and the Thameslink Programme is not yet fully known, so the RUS baseline is at present developed on the assumption that peak trains on routes into the capital will in general run at the maximum possible length. If rolling stock quantities do not allow this initially then (based on analysis carried out for Generation One RUSs) it would still be a recommendation for later, so the RUS analysis assumes it by 2031 (the year considered in **Chapter 6** for demand forecasting purposes).

5.3.3 Based on this approximation, the baseline includes 250,000 additional seats anticipated in the morning peak into London by 2031. Almost 60,000 of these will be on trains arriving into London in the busiest hour of its respective route. This represents a 50 per cent increase in seats into London over the three hours and a 25 per cent increase in the busiest hour relative to a 2008 base year. However the shoulder peak capacity in particular is heavily dependent on the specific details of rolling stock deployment.

5.3.4 The overall capacity increase (ie including standing space) is anticipated as being a larger percentage than the additional seats, due to the standing space on the new trains likely to be procured, many of which are designed for short distance commuting in the London suburbs. The increase in capacity over the whole morning peak is therefore forecast to be almost 75 per cent and up to 45 per cent in the busiest hour.

5.3.5 The planned capacity increase varies by corridor into London. The Thameslink and Crossrail Programmes in particular will result in a large step change in capacity over some of the routes concerned (though many of the trains running though central London will be alterations to existing services rather than additional train paths into the capital), as will many routes benefitting from the train lengthening programme utilising the cascaded stock.

5.3.6 On orbital routes completion of the upgrade of the London Overground system will provide extra capacity and new journey opportunities. This is already providing increased capacity to growing areas such as the Olympic Park area to the east and Shepherds Bush to the west.

5.3.7 Whilst most routes benefit from anticipated schemes the RUS notes that certain radial routes already have full length trains throughout the busiest part of the peak at present and, given that the maximum practical number of trains is already running, these corridors will see a much lesser capacity increase as a result of committed schemes.

5.3.8 **Figure 5.1** shows the three-hour and one-hour morning peak percentage increases in capacity anticipated over each route by 2031. **Figure 5.2** shows the absolute change in capacity anticipated over the busiest hour of the morning peak of each route.

5.3.9 The following section outlines the schemes that are anticipated to deliver the capacity changes on each route by 2031. The additional capacity expected in the busiest hour is shown.

Figure 5.1 – anticipated percentage change in capacity (seated and standing) by route, 2008 to 2031

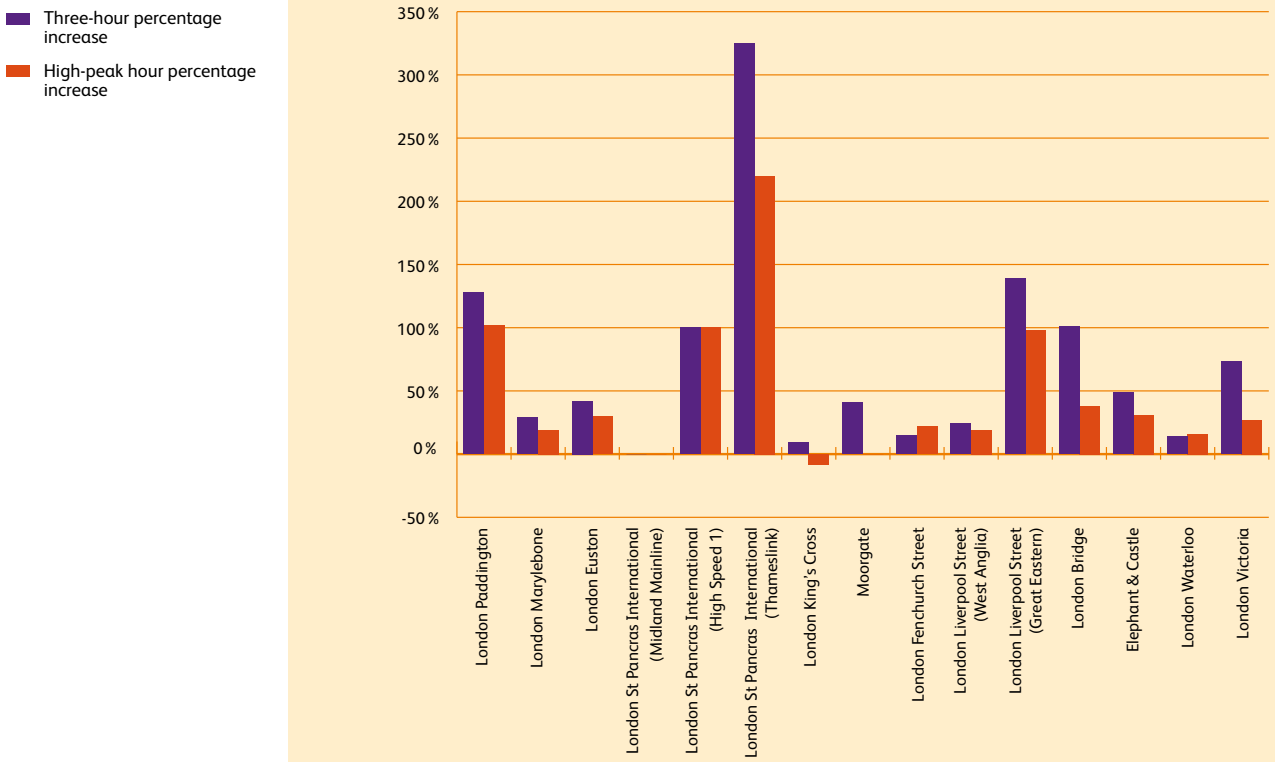
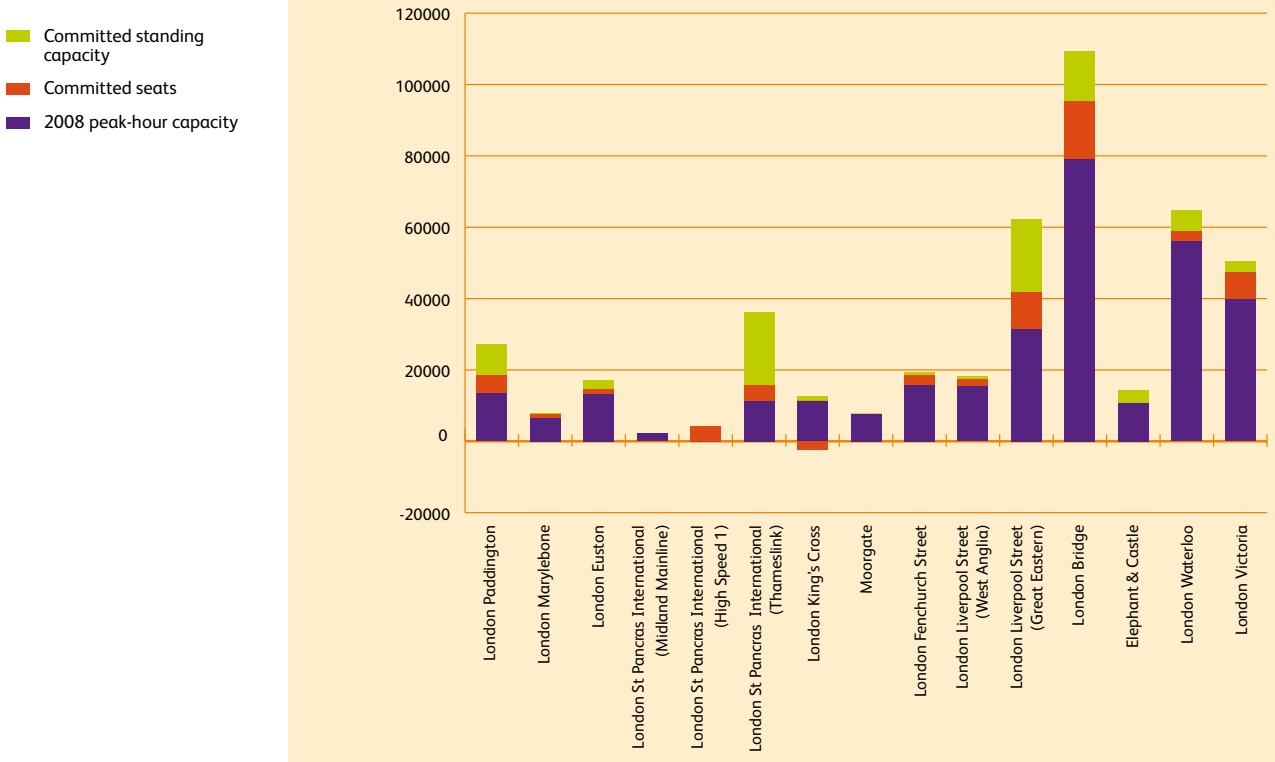


Figure 5.2 – anticipated absolute change in capacity (in the busiest hour) by route, 2008 to 2031



5.4.1 London Paddington routes

- Crossrail will provide a new service linking Maidenhead/Heathrow with Shenfield/Abbey Wood via a new tunnel between London Paddington and Pudding Mill Lane. On the Great Western route there will be ten 10-car Crossrail trains each peak hour, with four trains per hour from Maidenhead, four trains per hour from Heathrow Terminal 4 and two trains per hour from West Drayton. Crossrail services will replace Heathrow Connect and all other relief line services, with the exception of two residual services into London Paddington in each hour from Reading, together with one peak service from each of Bourne End and Henley-on-Thames. Crossrail services will commence in 2018. The scheme also includes electrification of the Great Western Main Line (GWML) between Airport Junction and Maidenhead and various other infrastructure works
- the Reading station area redevelopment is designed to deliver significant performance improvements for GWML, cross-country and freight services as well as passive provision for future main line service increases, a Crossrail extension and the potential BAA Heathrow Airtrack scheme. These works are due for completion in 2016. However it is emphasised that at present the redevelopment alone does not result in additional high peak trains into London Paddington (though it could potentially facilitate them later as discussed in **Chapter 7**)
- electrification of the Great Western Main Line beyond Maidenhead to Oxford and Newbury is now committed. The RUS has assumed this will allow diesel vehicles to be replaced with electric units on a like-for-like basis
- Great Western electrification to Bristol and Swansea, together with new rolling stock (which has been developed under the Intercity Express Programme (IEP)) would increase capacity beyond that currently provided by High Speed Train (HST) services, due to the higher capacity of such trains compared to an HST. As the full extent of the IEP programme is currently under review, this is not viewed as committed
- away from the London and South East RUS area, further schemes on the GWML are planned, for example redoubling of single track sections of the North Cotswold route. Whilst this will enable improved operational robustness over this section it would not enable additional trains on the London approaches
- the changes in capacity into Paddington for the busiest hour 07:45 – 08:44 are shown in **Table 5.1**. It can be seen that no long distance/outer suburban capacity increase has been assumed at present, though the potential impact of IEP is considered later.

Table 5.1 – London Paddington peak capacity – anticipated schemes

Paddington	Committed scheme	2010 capacity	Anticipated increase	2031 capacity
Inner suburban and Crossrail	Replace all relief line services with Crossrail, except for Reading – London Paddington residuals and peak trains from Henley/Bourne End.	3,600	-1,600	17,100
	Crossrail		15,100	
Long distance and outer suburban	No changes	8,200	0	8,200
Heathrow Express	No changes	1,600	0	1,600

5.4.2 London Marylebone routes

- The Evergreen 3 project is the third phase of an investment programme to deliver faster journeys between London Marylebone and Birmingham Moor Street/Snow Hill, and to provide an additional two trains per hour all day service between Oxford and London Marylebone over a new route via Bicester Town. Infrastructure enhancements include remodelling in the South Ruislip area and linespeed improvements. The RUS assumes the Oxford service will be operated utilising four-car Class 168s, with the last stop before London at High Wycombe. In the morning high-peak hour only one new train can be added
- in addition train lengthening is anticipated (of the 20 vehicles in the morning peak, six of which are assumed in the busiest hour)
- the anticipated change in capacity into London Marylebone for the busiest peak hour is shown in **Table 5.2**. Further details can be found in the West Midlands and Chilterns RUS, published as a Draft for Consultation in December 2010.

Table 5.2 – London Marylebone peak capacity – anticipated schemes

London Marylebone	Committed scheme	2010 capacity	Anticipated increase	2031 capacity
All routes	Evergreen 3 and train lengthening	7,100	700	7,800

5.4.3 London Euston routes

Opportunities exist to lengthen long distance trains on this route, and to improve the quality of outer suburban trains. The following are anticipated by this RUS:

- on the long distance services, Network Rail's CP4 Delivery Plan assumes eight Class 390s per hour will be lengthened from 9-car to 11-car providing two additional standard class vehicles. This is not at present a franchise commitment but, given that the rolling stock is on order, the RUS assumes it will proceed in due course
- London Midland has replaced its Class 321 stock with Class 350 vehicles, which are of a higher quality but have a lower overall seating capacity. The operator has proposed further changes to the DfT, including train lengthening to increase suburban capacity. The details are not finalised but eight extra vehicles are assumed, half of which are taken as anticipated for the high-peak hour
- London Overground has recently completed the lengthening of Class 378s from three- to four-car on this line. This capacity is included in the 2010 figure
- the changes in capacity into London Euston for the busiest hour is shown in **Table 5.3**. Further details can be found in the West Coast Main Line RUS, published as a Draft for Consultation in December 2010.

Table 5.3 – London Euston peak capacity – anticipated schemes

London Euston	Committed scheme	2010 capacity	Anticipated increase	2031 capacity
Long distance	Class 390 lengthening	4,500	800	5,300
Suburban	Class 350 rolling stock	11,000	300	11,300

5.4.4 London St Pancras International

- No additional capacity has been considered by the RUS as committed on the Midland Main Line into London St Pancras International
- High Speed 1 domestic services were introduced in 2009 from various destinations in Kent. No further additional capacity on these services is considered as committed by the RUS
- no changes are anticipated at London St Pancras International high level as shown in **Table 5.4.**

Table 5.4 – London St Pancras International high level peak capacity – anticipated schemes

London St Pancras International	Committed scheme	2010 capacity	Anticipated increase	2031 capacity
Midland Main Line	No changes	2,200	0	2,200
High Speed 1	No changes	4,200	0	4,200

5.4.5 Thameslink Programme Key Outputs 1 and 2

- the Thameslink Programme will deliver increased capacity across central London, reducing the need for services to terminate and passengers interchange onto the London Underground system. Thameslink services will traverse the core route between London Bridge, London Blackfriars and London St Pancras International to key destinations on Network Rail's Kent, Sussex, Midland Main Line (MML) and East Coast Main Line (ECML) routes
- work on Key Output 1 is currently in progress and will enable 12-car operations though, as at present, services will not generally be able to run via London Bridge at peak times. Limited 12-car operations are anticipated upon completion of the works. Major improvements to London Blackfriars and Farringdon stations are now both well underway, with the latter also making provision for Crossrail at this location
- Key Output 2 will completely remodel the London Bridge station area, providing nine through platforms and six terminating platforms (all of which will be capable of later extension to 12-car). In the Bermondsey area it will include grade separation of the eastern approaches (to allow high frequency Brighton Main Line to Thameslink route services) and a new western viaduct above Borough Market which is now under construction. It will enable 24 trains per hour to run across central London, including a new link with the ECML
- the capacity that is considered to be committed by this RUS is based on the latest work on the post-Thameslink Programme feasibility timetable, currently under development by Network Rail. This will affect capacity on several routes considered in the modelling for this RUS: the London St Pancras International Thameslink cordon (southbound services in the morning peak from the MML and the ECML; the London King's Cross route; the Moorgate route; the London Bridge cordon and the Elephant & Castle cordon.

5.4.6 London St Pancras International low level cordon (MML and ECML Thameslink services)

- **Table 5.5** shows the Thameslink Programme provides a capacity increase of around 200 per cent in the busiest hour in arrivals at London St Pancras International low level from the north (though a significant portion of this is due to services diverted from London King's Cross or Moorgate). The total quantum arises from a combination of the new route from the ECML to Thameslink, plus the lengthening of most peak MML Thameslink services from eight-car to 12-car
- the RUS baseline includes the following illustrative morning peak train service from the north at London St Pancras International low level station. The anticipated service level includes 16 trains per hour from the MML (a mixture of semi-fast and stopping services) and eight trains per hour from the ECML (a mixture of fast and stopping services). Destinations to be served are not fixed, so these may change in the future:
  - Bedford (MML)
    eight x 12-car Thameslink stock
  - Luton (MML)
    two x eight-car Thameslink stock
    two x 12-car Thameslink stock
  - St Albans (MML)
    four x eight-car Thameslink stock
  - Welwyn Garden City (ECML)
    four x eight-car Thameslink stock
  - Peterborough (ECML)
    two x 12-car Thameslink stock
  - Cambridge (ECML)
    two x 12-car Thameslink stock
- the change in capacity into London St Pancras International low level from the north for the busiest hour is shown in **Table 5.5**.

Table 5.5 – London St Pancras International low level peak capacity – impact of Thameslink Programme Key Output 2

St Pancras Thameslink Cordon	Committed scheme	2010 capacity	Anticipated increase	2031 capacity
Midland Main Line	Train lengthening and new rolling stock under Thameslink Programme	11,300	13,200	24,500
East Coast Main Line	New routeings following the Thameslink Programme	0	11,700	11,700

5.4.7 London King's Cross routes

- First Capital Connect's December 2010 timetable provides increased capacity on the Cambridge line, including additional Class 321 peak operations
- long distance timetables will be improved through the May 2011 timetable and, in the longer term, by major infrastructure enhancements at several locations along the route enabling eight long distance arrivals into London in the 08:00 to 08:59 period
- beyond 2018, the Thameslink Programme will alleviate suburban capacity constraints and improve connectivity, by enabling commuter services to continue through the Thameslink tunnels, rather than needing to terminate at London King's Cross. However no additional peak trains relative to today will be able to run through the critical Welwyn viaduct area, so it is likely that frequency increases in the morning peak will generally be restricted to inner suburban services. These will benefit from a combination of the Thameslink Programme and committed infrastructure enhancements in the Finsbury Park to Alexandra Palace area, with six fully usable tracks planned
- the introduction of the planned ECML Thameslink services results in trains being diverted away from London King's Cross and running through Central London instead. London King's Cross station itself therefore sees a slightly lower level of train service following the Thameslink Programme, but the planned capacity increase at London St. Pancras International low level is significantly greater than this reduction
- following the completion of the Thameslink Programme the following morning peak train service (14 trains per hour) is anticipated as remaining in operation into London King's Cross:
  - Cambridge via Welwyn Garden City
    two x eight-car 365 stock
  - Peterborough fast
    two x 12-car 365 stock
  - Ely/Kings Lynn fast
    two x eight-car 365 stock
  - Long Distance High Speed (LDHS) (Newcastle/Leeds/ Hull/Lincoln/Doncaster/ Edinburgh/West Yorkshire)
    eight x 11-car LDHS stock
- the anticipated changes in capacity into London King's Cross for the busiest hour are shown in **Table 5.6**
- whilst this RUS only considers in detail the London approaches it interfaces with the wider ECML improvements scheme. This includes the construction of a new flyover at Hitchin to remove conflicts between the main ECML and Cambridge line services, additional platforms at Peterborough, remodelling at other major constraints on the route, upgrading of the GN/GE Joint Line route via Lincoln to enable additional freight to utilise that route in preference to the main ECML.

Table 5.6 – London King's Cross peak capacity – impact of Thameslink Key Output 2

London King's Cross	Committed scheme	2010 capacity	Anticipated increase	2031 capacity
Long distance ECML	Timetable changes	2700	1600	4300
Suburban (Great Northern Lines)	Services re-routed away from London King's Cross following the Thameslink Programme	9,700	-3,600	6,100

Table 5.7 – Moorgate peak capacity – anticipated impact

Moorgate	Committed scheme	2010 capacity	Anticipated increase	2031 capacity
Hertford loop	Timetable changes associated with the Thameslink Programme	5,100	1,300	6,400
Welwyn routes	Timetable changes associated with the Thameslink Programme	2,600	-1,300	1,300

5.4.8 Moorgate routes

- Following completion of the Thameslink Programme it is likely that the current peak service into Moorgate will remain 12 trains per hour as today. However, several of the existing Welwyn Garden City to Moorgate/London King's Cross services are anticipated as being re-routed through the Thameslink core. Capacity is therefore freed up on the branch, enabling a frequency increase to 10 trains per hour on the Hertford Loop
- the changes in capacity into Moorgate for the busiest hour is shown in **Table 5.7**. Whilst no additional capacity is shown overall it is emphasised that the Hertford Loop is anticipated as seeing a significant increase, as outlined above.

5.4.9 London Bridge cordon

- delivering additional capacity through London Bridge is one of the key objectives of the Thameslink Programme. This includes re-routeing services currently operating via Elephant & Castle, as well as some additional paths. However the RUS emphasises that no additional train paths overall from Kent routes via London Bridge have been identified, given that constraints such as the Lewisham area and the two-track Orpington – Tonbridge corridor will still apply, as outlined in the Kent RUS. The Thameslink trains are therefore effectively diversions away from London Cannon Street. On Sussex routes some additional train paths have been found, but the East Croydon area represents a major barrier to further growth as outlined in the Sussex RUS
- train lengthening on non-Thameslink services is anticipated as a result of the rolling stock cascade when the new trains are introduced, as described earlier. The RUS assumes that this will eventually lengthen all high-peak suburban trains to London Charing Cross and London Cannon Street to 12-car, Brighton Main Line trains to 12-car and suburban trains via Sydenham to 10-car. By 2031 it is emphasised that delivering the full extent of the capacity increase on the Kent suburban network potentially requires alternative rolling stock to that in use today, given that selective door operation would be necessary at Woolwich Dockyard and if certain platforms at London Charing Cross were used. Maintaining turnaround times at London Charing Cross would require additional drivers
- all services to and via London Bridge will need timetable changes during the Thameslink Programme construction works and after the project is completed. Peak services on the Kent route will need to be recast into a 15/30-minute repeating pattern, rather than the existing 20-minute pattern, to tie into patterns on other Thameslink corridors. This change has potential to affect frequencies at certain stations
- the RUS baseline assumed changes in capacity into and via London Bridge for the busiest hour is shown in **Table 5.8**.

Table 5.8 – London Bridge peak capacity – anticipated impact of committed schemes

London Bridge cordon	Committed scheme	2010 capacity	Anticipated increase	2031 capacity
London Charing Cross	Train lengthening	30,100	2,000	32,100
London Cannon Street	Train lengthening combined with services re-routed away following the Thameslink Programme	24,500	4,400	28,900
Thameslink (Kent)	Thameslink Programme	0	6,900	6,900
Kent total		**54,600**	**13,300**	**67,900**
London Bridge terminators	Train lengthening combined with services re-routed away following the Thameslink Programme	24,500	-5,100	19,400
Thameslink (Sussex)	Thameslink Programme	0	22,000	22,000
Sussex total		**24,500**	**16,900**	**41,400**

5.4.10 Elephant & Castle cordon

- the Thameslink Key Output 2 timetable recast will re-route Brighton Main Line services away from this line and allow new services to operate into the London Blackfriars bay platforms
- current expectations are that services running via Herne Hill will operate into the bay platforms, whilst those via Denmark Hill will operate through the Thameslink core, as outlined in the South London RUS
- the RUS baseline changes in capacity via Elephant & Castle for the busiest hour are shown in **Table 5.9**.

Table 5.9 – Elephant & Castle corridor – anticipated impact of committed schemes

Elephant & Castle Cordon	Committed scheme	2010 capacity	Anticipated increase	2031 capacity
Thameslink route (via Elephant & Castle)	Thameslink Programme	10,700	-3,400	7,300
London Blackfriars terminators	Thameslink Programme	0	6,800	6,800

5.4.11 London Liverpool Street routes

- train lengthening and the planned December 2010 timetable recast will have some significant impacts on the capacity operating on the Great Eastern lines. The RUS assumes that there will be rolling stock changes to the Norwich/ Stowmarket services, two additional trains from Witham, and lengthening of several morning peak services
- from 2018 Crossrail will provide a step change in capacity with 24 trains in the high peak hour through the tunnel, each of 10-car length, 12 of these will run on the Great Eastern Main Line, with the other 12 to/from Abbey Wood. In order to accommodate the Crossrail Great Eastern trains, eight existing trains in the busiest hour which run on electric lines will be displaced (19 over the three-hour peak)
- on West Anglia lines committed platform lengthening will allow 12-car trains on most peak Stansted and Cambridge services, and additional 8-car inner suburban services will be possible with additional rolling stock
- the overall capacity changes assumed by the modelling are shown in **Table 5.10**.

Table 5.10 – Liverpool Street peak capacity – anticipated impact of committed schemes

Liverpool Street	Committed scheme	2010 capacity	Anticipated increase	2031 capacity
Great Eastern inner suburban plus Crossrail	Replace eight electric line services with Crossrail	11,200	-6,900	22,500
	Crossrail Shenfield	0	18,200	
	Crossrail Abbey Wood	0	18,200	18,200
Great Eastern outer suburban	December 2010 timetable	19,300	2,900	22,200
West Anglia Main Line	Train lengthening	14,900	3,300	18,200

5.4.12 London Fenchurch Street routes

- the London Fenchurch Street routes still have substantial scope for train lengthening in the busiest hour. As shown in **Figure 5.1** interventions assumed by the RUS as commited are focused on the high peak, and the percentage increase over this one hour is greater than over the three hours. After this the majority of trains will be at 12-car length, compared with the current position where most trains are of eight-car length
- **Table 5.11** shows the capacity change included in the RUS baseline.

Table 5.11 – Fenchurch Street peak capacity – anticipated impact of committed schemes

Fenchurch Street	Committed scheme	2010 capacity	Anticipated increase	2031 capacity
All	Train lengthening	16,600	3,600	20,200

5.4.13 London Victoria routes

- significant train lengthening to London Victoria is anticipated as a result of 10-car suburban operations on all routes via Balham, 12-car operations on the East Grinstead line and the rolling stock cascade following the Thameslink Programme. Brighton Main Line services to London Victoria are likely to need to be significantly recast to fit into the timetable pattern after the Thameslink Programme, providing the opportunity, for example, for a four trains per hour Redhill corridor to London Victoria service
- committed track layout remodelling works at Gatwick Airport station will enable improved operational flexibility and performance in this area and potentially enable additional trains to call. However given constraints in the London area no additional train paths to the capital will be able to run as a direct result of this scheme
- on Kent routes to London Victoria no platform lengthening is currently planned but some train lengthening is possible with existing infrastructure. Development work on the timetable that will operate upon completion of the Thameslink Programme is seeking to provide secondary benefits to passengers using these routes, by provision of a four trains per hour service from Denmark Hill/Peckham Rye to London Victoria
- the overall capacity changes included in the RUS baseline are shown in **Table 5.12**.

Table 5.12 – London Victoria peak capacity – anticipated impact of committed schemes

Victoria	Committed scheme	2010 capacity	Anticipated increase	2031 capacity
Kent	Train lengthening	13,000	1,200	14,200
Sussex	Train lengthening	27,800	8,100	35,900

Table 5.13 – London Waterloo peak capacity – committed schemes

Route to	Committed scheme	2010 capacity	Anticipated increase	2031 capacity
South West Main Line long distance	No changes	13,200	0	13,200
South West Main Line suburban	10-car operations	27,800	5,600	33,400
Windsor Lines	Train lengthening	15,200	2,100	18,300
	1 tph additional train		1,000	

5.4.14 London Waterloo routes

- bringing the international platforms into use at London Waterloo is a committed scheme as described in Network Rail's CP4 Delivery Plan
- extensive 10-car inner suburban operations are anticipated, both on South West Main Line suburban services (routes via Wimbledon) and on the Windsor lines (routes via Putney)
- services on the Windsor lines are planned to be increased by an extra high-peak train (an increase from 15 to 16 trains) once the platforms at London Waterloo are bought into use, plus an additional train in each shoulder-peak hour
- the overall capacity changes included in the RUS baseline are shown in **Table 5.13**.

5.4.15 Orbital routes

- completion of the upgrade to the London Overground network is currently ongoing. Work, now close to completion, includes provision of an all day four trains per hour service on the West London Line, lengthening of Class 378 services from three-car to four-car and extension of the East London Line to Highbury & Islington
- the East London Line Extension Phase 2, now known as the New South London Line involves a new service linking Clapham Junction to Canada Water and beyond via Denmark Hill. Since capacity does not exist to run both this service and the existing London Bridge – Denmark Hill – London Victoria route at the same time it is planned that the latter will be withdrawn once the New South London Line is in operation. This service is also affected by Thameslink Programme's alterations to London Bridge and High Level Output Specification platform extensions at Battersea Park.

5.4.16 Other committed schemes

- several other schemes of relevance to this London and South East RUS are regarded by this RUS as committed, but do not directly add additional peak passenger capacity into Central London so are not considered in detail in the above. These include station improvement works at locations such as London King's Cross, East Croydon and Clapham Junction, infrastructure upgrades associated with resignalling or other renewal schemes, plus freight schemes (as described in **Chapter 9**)
- full details on Network Rail led schemes can be found in the CP4 Delivery Plan which is available at **www.networkrail.co.uk**.

5.5 Summary of currently uncommitted strategy

5.5.1 Network Rail is nearing the completion of its first generation of RUSs. These provide a comprehensive suite of recommendations, many of which have been implemented or are in the process of being delivered as described in the RUS baseline position in the section above. However, several of the recommendations remain unfunded (or otherwise uncommitted) at present. The majority of these, especially those of relevance to peak capacity, are considered to remain valid. They are therefore the logical next step, which the RUS has considered as the baseline-plus stage before any analysis of new options.

5.5.2 Government and rail industry strategy has also now adopted the development of High Speed 2 (HS2) into its planning framework. The latest position regarding the future construction of HS2 is therefore also included in the baseline-plus for this London and South East RUS, primarily relating to the initial London – Birmingham section.

5.5.3 The following section summarises the key recommendations currently uncommitted from previous RUSs, and carried forward into this London and South East RUS. **Table 5.14** shows the estimated extra high-peak hour capacity provided on each route on implementation of the recommended scheme.

Table 5.14 – uncommitted peak capacity recommendations from existing established strategy carried forward into this London and South East RUS

Route to	Service group	Principal peak capacity recommendations and details (currently uncommitted schemes only)	Extra capacity assumed in busiest morning peak hour	Source of recommendation
London Paddington	LDHS and outer suburban	IEP and electrification to Swansea and Bristol. Replacement of HST train fleet with IEP vehicles, but high-peak frequencies as today.	1,500 seats	Great Western RUS 2010.
London Marylebone	Outer suburban	As described in West Midlands and Chilterns RUS Draft for Consultation.	Under consultation though West Midlands and Chilterns RUS Draft for Consultation.	West Midlands and Chilterns RUS 2010 Draft for Consultation.
London Euston	LDHS	Short term as described in West Coast Main Line RUS Draft for Consultation. Construct high speed rail network (initially London – Birmingham, thence beyond).	At least 10,000 seats per hour on HS2 in the long term. However the RUS assumes that some existing WCML LDHS paths would be reallocated for outer suburban traffic, so a net LDHS capacity increase of 5,000 seats is assumed.	Network Rail New Lines Study 2009 DfT High Speed Rail Command Paper 2010 West Coast Main Line RUS 2010.
London Euston	Outer suburban	Short-term as described in WCML RUS Draft for Consultation. Extra WCML calls at Milton Keynes etc following HS2 as capacity is released on the WCML as fast services are transferred to HS2.	The RUS assumes at least 5000 peak additional outer suburban seats can be provided on WCML post-HS2, as above.	Network Rail New Lines Study 2009 DfT High Speed Rail Command Paper 2010 West Coast Main Line RUS 2010.
London St Pancras (MML)	LDHS	Short-term train lengthening as recommended in the East Midlands RUS. Eventual replacement of HST train fleet with IEP or similar vehicles following electrification, with high peak frequencies as today. Construct HS2 'Y' network to provide long distance capacity.	500 seats (excluding HS2 impact).	East Midlands RUS 2010 Network RUS: Electrification Strategy 2009 DfT High Speed Rail Command Paper 2010.
London St Pancras (Thameslink)	Inner and outer suburban	None	N/A	
London Kings Cross	LDHS and outer suburban	IEP Further outer suburban lengthening to 12-car. Construct HS2 'Y' network to provide long distance capacity.	2600 capacity (excluding HS2 impact).	East Coast Main Line RUS 2009 DfT High Speed Rail Command Paper 2010.
Moorgate	Inner suburban	Improve headways on branch and run two tph extra.	1,300 capacity	East Coast Main Line RUS 2009.
London Liverpool Street (West Anglia)	Inner suburban	Further lengthening to eight-car. Run Cheshunt – Seven Sisters shuttle.	1,700 capacity	Greater Anglia RUS 2007.
London Liverpool Street (West Anglia)	Outer suburban	Lengthen all outer peak trains to 12-car.	300 seats	Greater Anglia RUS 2007.

Table 5.14 – uncommitted peak capacity recommendations from existing established strategy carried forward into this London and South East RUS

Route to	Service group	Principal peak capacity recommendations and details (currently uncommitted schemes only)	Extra capacity assumed in busiest morning peak hour	Source of recommendation
London Liverpool Street (Great Eastern)	Outer suburban	Replace inter-city stock on Norwich services with multiple units for higher capacity. Run one further extra train in high-peak. Lengthen all peak trains to 12-car.	3,000 seats	Greater Anglia RUS 2007.
London Fenchurch Street	Outer suburban	Full 12-car operations using CP4 infrastructure.	1,200 capacity	Greater Anglia RUS 2007.
London St Pancras (HS1)	Outer suburban	Extend Ebbsfleet peak shuttle to Ashford. Extend Rochester peak shuttle to Faversham. Lengthen all peak trains to 12-car.	1,400 seats	Kent RUS 2010.
London Charing Cross and London Cannon Street	Inner and outer suburban	None – full 12-car operations included in baseline for 2031 as described in 5.4.9. However if insufficient rolling stock is available in the short term this would remain a RUS recommendation.	Included in baseline	Kent RUS 2010.
London Victoria (Kent routes)	Inner and outer suburban	None – full length trains included in baseline for 2031 as described in 5.4.13. However if insufficient rolling stock is available in the short term this would remain a RUS recommendation.	Included in baseline	Kent RUS 2010.
London Bridge and Thameslink (Sussex)	Outer suburban	Additional diesel rolling stock for Uckfield line (10-car x 23m).	600 capacity	Sussex RUS 2010.
Elephant & Castle corridor	Inner suburban	None	N/A	South London RUS 2008.
London Victoria (Sussex)	Outer suburban	Insert Clapham Junction calls in certain peak Gatwick Express services to better balance loadings between trains and provide Brighton – Clapham Junction connectivity. Lengthen Caterham and Tattenham trains to 10-car (upon joining at Purley).	700 capacity	Sussex RUS 2010.
London Waterloo (SWML)	Inner suburban	Further 10-car operations using CP4 infrastructure.	300 capacity	South West Main Line RUS 2006.
London Waterloo (SWML)	Outer suburban	Full lengthening to 12-car or 10-car operations.	1,000 capacity	South West Main Line RUS 2006.
London Waterloo (Windsor lines)	Outer suburban	10-car platforms Virginia Water – Earley. Further 10-car operations using CP4 infrastructure.	700 seats	South West Main Line RUS 2006.
West London Line	Inner suburban	N/A		Cross London RUS 2006.

5.6 Further details of key uncommitted schemes from previous strategy

5.6.1 Intercity Express Programme

- This London and South East RUS only covers the immediate approaches to London, but it restates policy regarding IEP from further afield as the project does have significant capacity implications for principal routes into the capital
- the IEP programme would deliver a comprehensive suite of works relating to power supply, platforms, gauge clearance and overhead line equipment on the East Coast Main Line and Great Western Main Line routes. The specific type of IEP rolling stock is currently under review, but the RUS notes that the concept of replacing the current HST fleet with an alternative vehicle will almost certainly be required within its timescale
- timetable development for the IEP on the GWML, covering the morning peak, is based on a 15 minute repeating pattern, delivering 15 IEP trains into Paddington in a high-peak hour with one path left clear as a performance buffer. As there are currently 16 long distance or outer suburban services in the busiest hour, the timetable suggests IEP only delivers a relatively small increase in capacity as shown in **Table 5.14**
- initial IEP deployment on the East Coast Main Line would be more limited, since IEP would operate alongside existing Class 91s and Mark IV trainsets. **Table 5.14** assumes around 200 – 500 extra seats from IEP, with scope for a further five trains to get converted in the busiest hour. Which types of IEP stock would be allocated to which route is not yet fully developed
- given that electrification of the Midland Main Line north of Bedford is a recommendation of the Network RUS: Electrification it is possible that IEP vehicles might see a use on that route in the future. Alternatively, progressive implementation of IEP on the ECML could potentially enable existing ECML rolling stock to be cascaded onto the MML.

5.6.2 Further train lengthening

- It is considered unlikely that the future rolling stock cascade directly associated with the Thameslink and Crossrail Programmes (ie the baseline for this RUS) will provide sufficient additional vehicles to implement all Generation One RUS recommendations for train lengthening in entirety. It is therefore anticipated that further rolling stock beyond that point will be required, and provision of such rolling stock is therefore included within the 'baseline-plus' of this RUS. The exact split between the baseline and baseline-plus has not been calculated at present, since this is dependent on unknown issues including the procurement of two major train fleets and how many vehicles currently in use in the London area might be redeployed elsewhere. The uncertainty regarding specific details of a long-term rolling stock strategy does not materially affect previous RUS recommendations that the train lengthening has a strong economic case
- further train lengthening from Generation One RUSs will require additional platform lengthening beyond current commitments enabling, for example 10-car operations to extend beyond Virginia Water to Reading, beyond Gravesend to the Medway Towns, on semi-fast services to Cambridge from London King's Cross and on the Lea Valley line. Many of these schemes are currently being considered for implementation in Control Period 5
- it is emphasised that many routes have specific restrictions on the types of rolling stock which is suitable for operation over them. For example the Uckfield line requires additional diesel stock which will cannot be assumed to be freed up by a future rolling stock cascade. Operation of longer trains over certain routes is only viable if the stock is equipped with selective door pperation and retrofitting this onto existing trains is generally impractical.

5.6.3 Timetable changes

- Uncommitted timetable changes recommended by previous RUSs are generally carried forward into this RUS. This includes a Cheshunt – Seven Sisters peak shuttle (to provide additional capacity from the Southbury Loop onto the London Underground Victoria Line); additional trains to Moorgate (which, given that this would be addition to the timetable changes anticipated upon the completion of Thameslink as described in 5.4.8 would result in a total of 12 trains per hour on the Hertford Loop): and peak Brighton – Gatwick – London Victoria trains calling at Clapham Junction. These changes are therefore included in the 'baseline-plus' of this RUS.

5.6.4 High Speed 2

- In summer 2008 Network Rail commenced its New Lines Programme study, examining the case for the development of new high speed lines in the UK. The first phase of the New Lines Programme, which was completed in August 2009, established the business case for a new high speed line connecting the main conurbations between London and Glasgow/ Edinburgh currently served by the WCML. The second phase of the study examined the case for a new line to Leeds and the East Midlands and found that there was a case for such a line to be taken forward
- the previous Government's proposed strategy for High Speed Rail was established in a Command Paper presented to Parliament and published in March 2010. The Command Paper sets out the case for a new core British high speed rail network. The core strategy comprises a 335 mile core 'Y'-shaped high speed rail network between London and Birmingham/Manchester/Leeds capable of carrying trains up to 250mph. The Command Paper states that the London to West Midlands HS2 route would be the first stage of the new high speed rail network. The 'day one' service frequency is anticipated as 14 trains per hour peak paths to London, increasing to 18 trains per hour peak paths once a wider network is created. Trains would be 200 metres long (classic-compatible) having 550 seats and 400 metres long (high speed network only) having 1,100 seats
- the current Government is continuing to develop plans for High Speed 2, based on the alignment previously identified. However of particular relevance to the London area is that in addition strategy now includes consideration of a link between High Speed 1 and High Speed 2 and an eventual connection to Heathrow Airport
- a key advantage of the new line is that it is expected to free up capacity on the WCML for further outer suburban trains, serving areas such as Milton Keynes. The London and South East RUS has assumed that this would reallocate around six trains per hour at peak times from LDHS operators to the outer suburban market.

5.6.5 Other

- Generation One RUSs made extensive detailed recommendations, only the most significant of which with respect to on-train peak capacity are summarised above. Full details are available in the relevant RUS which is available at **www.networkrail.co.uk**. Interventions with respect to station capacity are described in **Appendix A**.

6. Morning peak to London – future demand

6.1 Introduction

6.1.1 This chapter summarises the methodology and results of the demand forecasting developed for the London and South East Route Utilisation Strategy (RUS).

6.1.2 A long-term demand scenario has been developed for 2031, which is the year modelled for the RUS. The modelling covers all National Rail corridors into Central London during the morning peak period from 07:00 – 09:59 inclusive, which is the period of greatest demand.

6.1.3 The modelling of 2031 demand together with committed capacity – as described in **Chapter 5** – forms the baseline for this RUS, also known as the 'do-minimum' scenario. This informs the gap identification and development of options in **Chapter 7**.

6.2 Context

6.2.1 A number of large-scale transport schemes are planned to be delivered in the next decade which will significantly enhance the public transport infrastructure in and around Central London.

6.2.2 Some of these schemes will increase the capacity of existing public transport networks, for example train lengthening on South London National Rail routes, or the deployment of new rolling stock on London Underground lines. Other schemes will not only provide additional capacity, but will also improve the connectivity of London's public transport network. Schemes in this category include Crossrail, the Thameslink Programme, and completion of the London Overground orbital railway.

6.2.3 Approximately 90 per cent of commuters arriving in Central London during the morning peak do so using public transport, and many of these use a combination of two or more transport modes to reach their destination.

6.2.4 The London and South East RUS demand forecast therefore reflects the impact of baseline schemes across all modes of transport. Some of these impacts are significant. For example, in the medium term Crossrail will influence the routeing of existing passengers through the public transport network. And in the longer term, Crossrail will redistribute commuting patterns by influencing locational decisions made by households and employers alike.

6.2.5 The London and South East RUS has utilised a combination of methods in developing demand forecasts for 2031. Transport for London's (TfL's) multi-modal models, London Transportation Studies (LTS) and RailPlan have been used as these provide the best available detailed representation of public and private transport networks across Greater London. However, rates of growth for some rail markets have been modified to reflect, in aggregate, rates of growth which would be suggested by an approach based upon the Passenger Demand Forecasting Handbook (PDFH) for consistency with other RUSs.

6.2.6 Network Rail is grateful to TfL for the support it has provided with the deployment of LTS and RailPlan throughout the RUS.

6.3 Drivers of change

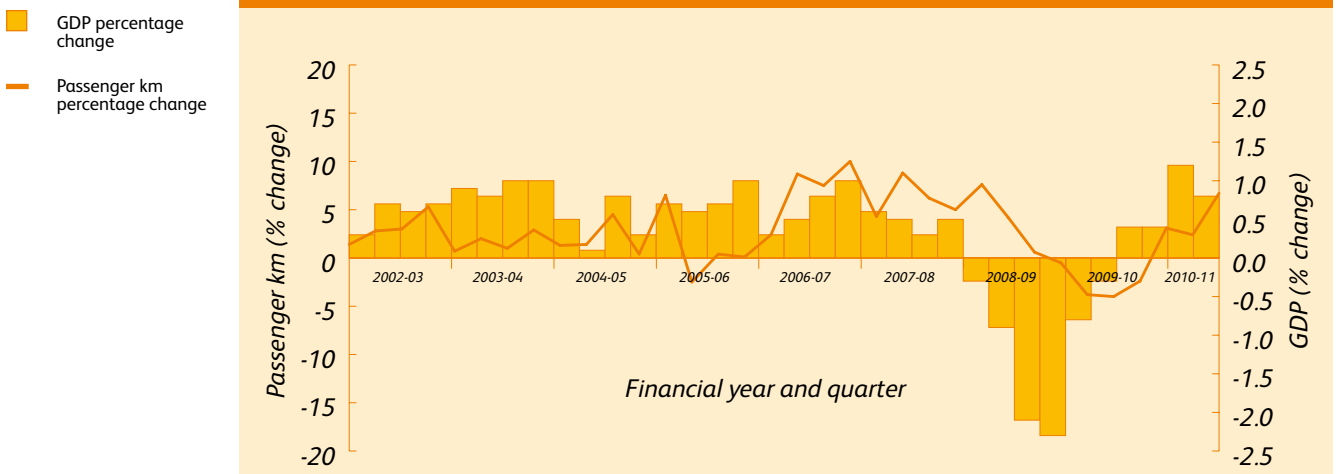
6.3.1 The demand forecast takes account of all key drivers of change in the Central London peak market. These are discussed individually in the following sections.

The recession

6.3.2 In the second quarter of the calendar year 2008 national Gross Domestic Product (GDP) contracted, marking the start of the recent recession. In total, GDP contracted for six consecutive periods with a peak to trough fall in output of over six per cent. Economic growth resumed in the fourth quarter of 2009 for both London and the UK as a whole. The economy has now expanded in each of the succeeding quarters.

6.3.3 The impact of the recession on rail demand is illustrated in **Figure 6.1**. The data refers to passenger km in the London and South East sector as a whole (as defined by the Office of Rail Regulation (ORR) in National Rail Trends), which includes some rail markets outside the scope of the London and South East RUS (for example, off-peak travel to Central London and peak travel to other regional cities in the South East).

Figure 6.1 – rail demand in London and the South East before, during and after the recession



6.3.4 Passenger demand in the London and South East sector contracted over four consecutive quarters, returning to growth in quarter four of the financial year 2009/10. The sector has now grown in each of the last four quarters, with notable growth posted in quarter two of financial year 2010/11. Broadly, passenger numbers have now returned to pre-recesssion levels. The latest set of economic forecasts prepared for the rail industry by Oxford Economics show that the key driver of peak demand, Central London employment, is forecast to resume growth in 2011, expanding by 10 per cent over the next five years.

Employment growth

6.3.5 Four out of every five National Rail passengers arriving in Central London during the morning peak are travelling to their normal place of work. The overall size of the Central and Inner London employment markets is therefore the principal determinant of rail demand.

6.3.6 The Greater London Authority's (GLA) long-run employment projection to 2031, which is reflected in the Mayor's Draft London Plan 2009, indicates that the level of employment in Greater London will grow by 17 per cent, representing an additional 775,000 employees. As shown in **Table 6.1**, this growth will be concentrated on Central and Inner London boroughs, whose employment levels are forecast to grow by 24 per cent over the same period. Growth is projected to be driven primarily by the business services sector.

Table 6.1 – Greater London Authority long-run employment projections

Location	Employment 2007 (millions)	Employment 2031 (millions)	Change (2007 to 2031, millions)	Change (average % per year)
Central and inner London	2.6	3.2	0.6	0.9 %
Outer London	2.0	2.2	0.2	0.3 %
Total	**4.7**	**5.5**	**0.8**	**0.6%**

Economic growth

6.3.7 Most National Rail passengers arriving in Central London during the morning peak are travelling to their normal place of work. However, there is also a significant non-commuting market, typically in excess of 100,000 passenger arrivals every weekday morning, many of whom are making business trips. This non-commuting market is relatively more important to long distance rail services into London Paddington, London Marylebone, London Euston, London St. Pancras International, London King's Cross and London Marylebone.

6.3.8 Growth in this market is generally correlated to overall volume of business activity, as measured by Gross Domestic Product (GDP). For these markets, the London and South East RUS used underlying demand forecasts described in the Network RUS: Scenarios and Long Distance Forecasts.

Population

6.3.9 The principal determinant of the overall size of the Central London commuter market is Central London employment. Unlike other, more discretionary rail markets, population growth plays a smaller part in promoting overall growth in this market.

6.3.10 However, the distribution of the population across London and the South East is an important factor influencing the pattern of commuting into Central London. All other factors being equal, over the longer term we would expect rail corridors serving areas of relatively high population growth to gain an increasing share of the Central London commuter market.

6.3.11 **Figure 6.2** illustrates how the distribution of population across London and the South East is expected to change over the longer term. Areas highlighted by browns and oranges represent the areas of fastest population growth. Areas with relatively low growth forecasts are shown by blues and greens. These forecasts are based on the planning policy of the previous Government, so are subject to change.

6.3.12 **Figure 6.2** also highlights the key population growth areas in and around Milton Keynes, Northamptonshire, Cambridgeshire and the M11 corridor, Inner London, the Thames Gateway and Ashford in Kent. Many of these more northerly growth areas are a considerable distance from Central London, typically at least 50 miles. However, as illustrated by the rail journey times shown, their strategic location on long distance main lines provides for a journey time to London of an hour or less.

Baseline and other schemes

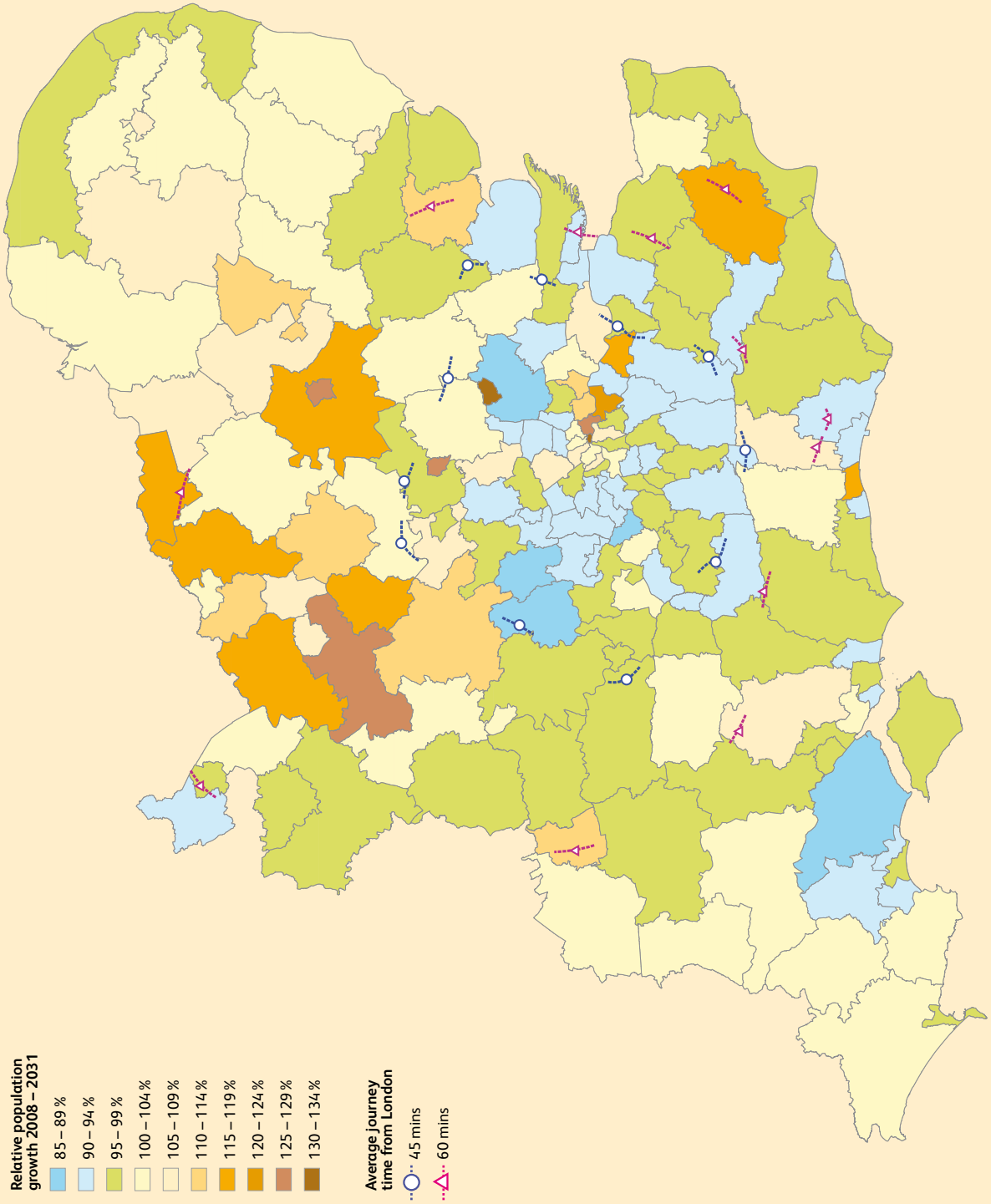
6.3.13 The London and South East RUS demand forecast assumes the rail interventions described as committed in **Chapter 5** will be delivered. The forecast also considers the impact of transport interventions on other modes. **Table 6.2** details the non National Rail significant schemes assumed to be delivered for the forecast.

6.3.14 LTS and RailPlan are multi-modal models where the base year is 'modelled' (and subsequently validated against observed journey patterns). The most up-to-date versions have a 2007 base year. Therefore, some of the schemes included as interventions between the base year and the 2031 forecast have already been delivered.

Table 6.2 – significant schemes included in the demand forecast

London Underground/Docklands Light Railway
London Underground enhancements to 2026, including:
Public Private Partnership (PPP) upgrades and new rolling stock
Piccadilly Line extension to Heathrow Terminal 5
Circle Line extension to Hammersmith
New stations
DLR enhancements to 2026, including:
Bank – Lewisham and Poplar – Stratford three-car upgrades
Woolwich Arsenal and Stratford – Canning Town extensions
London bus network
East London transit
Aggregate eight per cent increase in frequency
Highways
M25 widening of remaining dual three-lane sections to dual four-lane
M1 widening between the M25 and Luton
Improvement to the North Circular (A406) at Bounds Green in North London
Removal of Western Extension of the congestion zone
Two per cent reduction in overall GLA highway capacity to reflect new bus lanes, cycle ways etc.

Figure 6.2 – relative rates of longer-term population growth across London and the South East



Note: Relative growth of 100% equates to the average population growth for the area depicted in the map (120% between 2008 and 2031).

6.3.15 The 'do-minimum' scenario has not modelled uncommitted schemes, for example High Speed 2. It is recognised that such schemes have potential to drive significant growth in the market in their own right, leading to further growth in the rail market.

6.4 Demand forecasts

Passenger rail services

6.4.1 The London and South East RUS forecasts that, in aggregate, passenger demand for National Rail services to Central London during the morning peak will grow by 34 per cent to 2031. This is equivalent to an average rate of 1.3 per cent per year.

6.4.2 This rate is slightly ahead of Central and Inner London employment growth over the same period (0.9 per cent per year), but broadly in line with the average growth rate over the period 1997 to 2008 of 1.2 per cent per year.

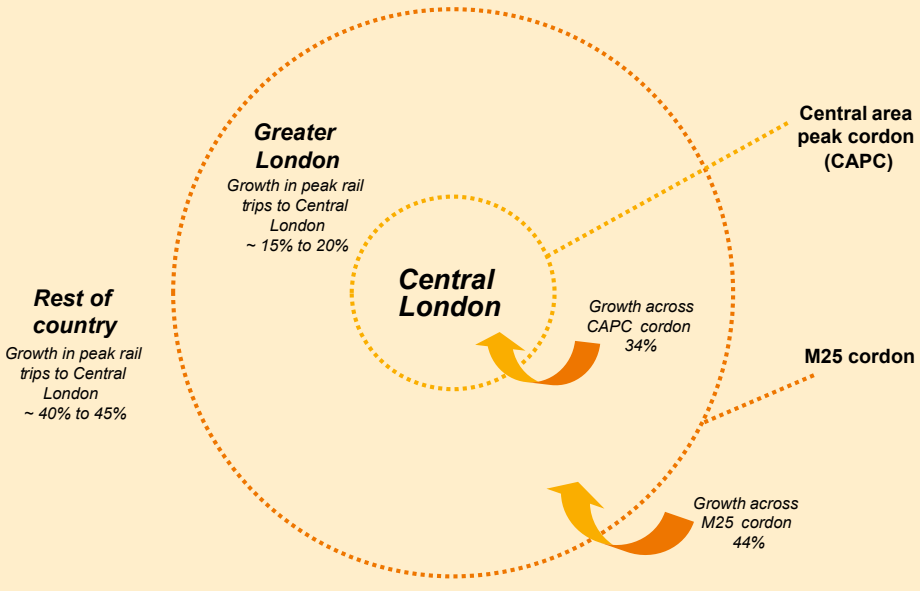
6.4.3 In aggregate, the RUS expects National Rail growth from outside the Greater London area to be higher (1.6 per cent per year on average) relative to growth from within Greater London (1.2 per cent per year on average). One of the reasons for this is the higher proportion of non-commuting trips from outside Greater London during peak hours, which typically grow quite robustly during economic expansion. The cumulative effect of this growth to 2031 across London cordons is shown in **Figure 6.3**.

6.4.4 Rates of demand growth will vary across the rail corridors into central London, as a result of differing levels of population growth, rail network investment, and competition from other transport networks. The growth rate on each route is shown in **Figure 6.4**.

6.4.5 As a second generation RUS, the London and South East RUS has considered central London as a whole, including interaction and abstraction between individual corridors. It includes detailed multimodal modelling of the Crossrail and Thameslink Programmes and interventions on other modes. This approach is desirable, given the purpose of the London and South East RUS forecast is to develop a London-wide picture of demand in 2031, whilst most of the first generation RUSs looked in detail to 2019 and focused on an individual corridor of interest. Therefore the London and South East RUS forecast is not directly comparable to the preceding first generation RUS forecasts. Overall, the London and South East RUS forecast endorses existing RUS strategy as described in **Chapter 5**.

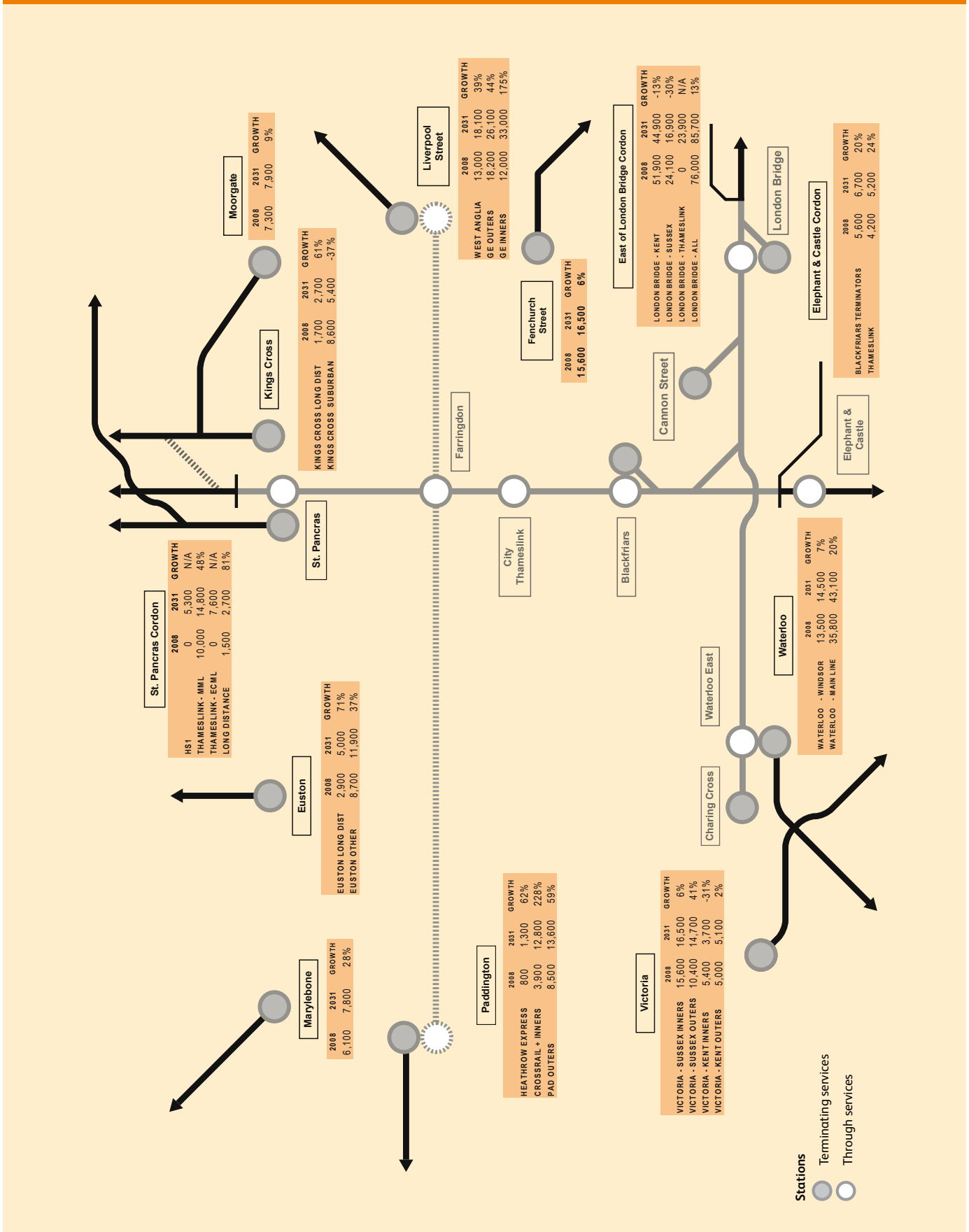
6.4.6 Subsequent to producing the forecast, the Government has announced that the upper threshold for regulated fares is to rise to Retail Price Index (RPI) plus three per cent for three years from 2012, returning to RPI plus one per cent from 2015. The commuting element of the morning peak market (80 per cent of rail demand into Central London) is less responsive to fare increases as there are fewer alternatives available for passengers. The increase to regulated rail fares for this market is expected to result in a small reduction in the rate of growth over these three years, such that the forecast demand for 2031 may not be achieved until a year later. The impact on the long distance market is more difficult to judge, not least because only a relatively small percentage of fares are regulated. Given recent strong growth in this market[1], the fares announcement is unlikely to have a material impact on the RUS strategy.

Figure 6.3 – forecast peak rail demand growth into central London to 2031



1 Nationally, passenger journeys in the long distance market grew at 7 per cent over the last year.

Figure 6.4 – diagram showing disaggregated rates of growth



6.5 Capacity utilisation

6.5.1 Capacity utilisation is the number of passengers divided by the capacity supplied (seated capacity plus a standing allowance if the train stops within 20 minutes of Central London). High utilisation is indicative of crowding, so utilisation is used to identify gaps.

6.5.2 The London and South East RUS defines a capacity gap where capacity utilisation in the high-peak hour exceeds 85 per cent. As can be seen from **Figure 4.7** in **Chapter 4**, this represents a significant improvement over current capacity utilisation levels. On all rail corridors into London, gaps are identified at the location where loads are typically highest. This is not always at the London terminus, as for example trains arriving at Finsbury Park are more heavily loaded than upon arrival at London King's Cross.

6.5.3 The forecast passenger numbers are obtained by applying the forecast growth in **Figure 6.4** to the busiest hour demand baseline in **Chapter 4**. The future capacity is described in **Chapter 5**.

6.5.4 **Figure 6.5** shows the average capacity utilisation on trains in 2031 with committed interventions only. The utilisation rate relates to the busiest hour on each route; generally services arriving in Central London between 08:00–08:59.

6.5.5 **Figure 6.6** shows the impact of additional capacity associated with previous RUS recommendations and other existing strategy.

Figure 6.5 – capacity utilisation in 2031 (committed schemes only) – busiest hour of the morning peak

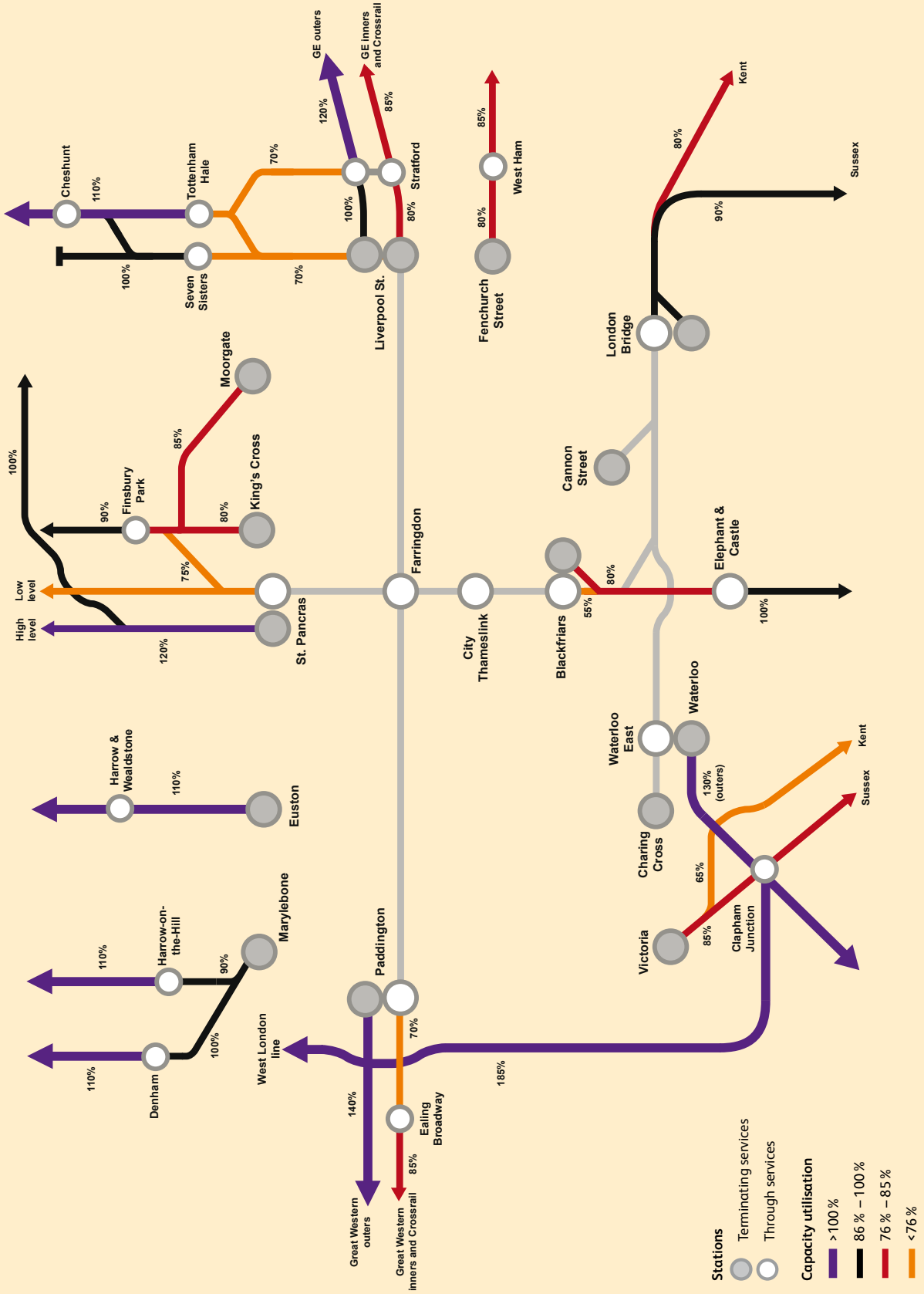
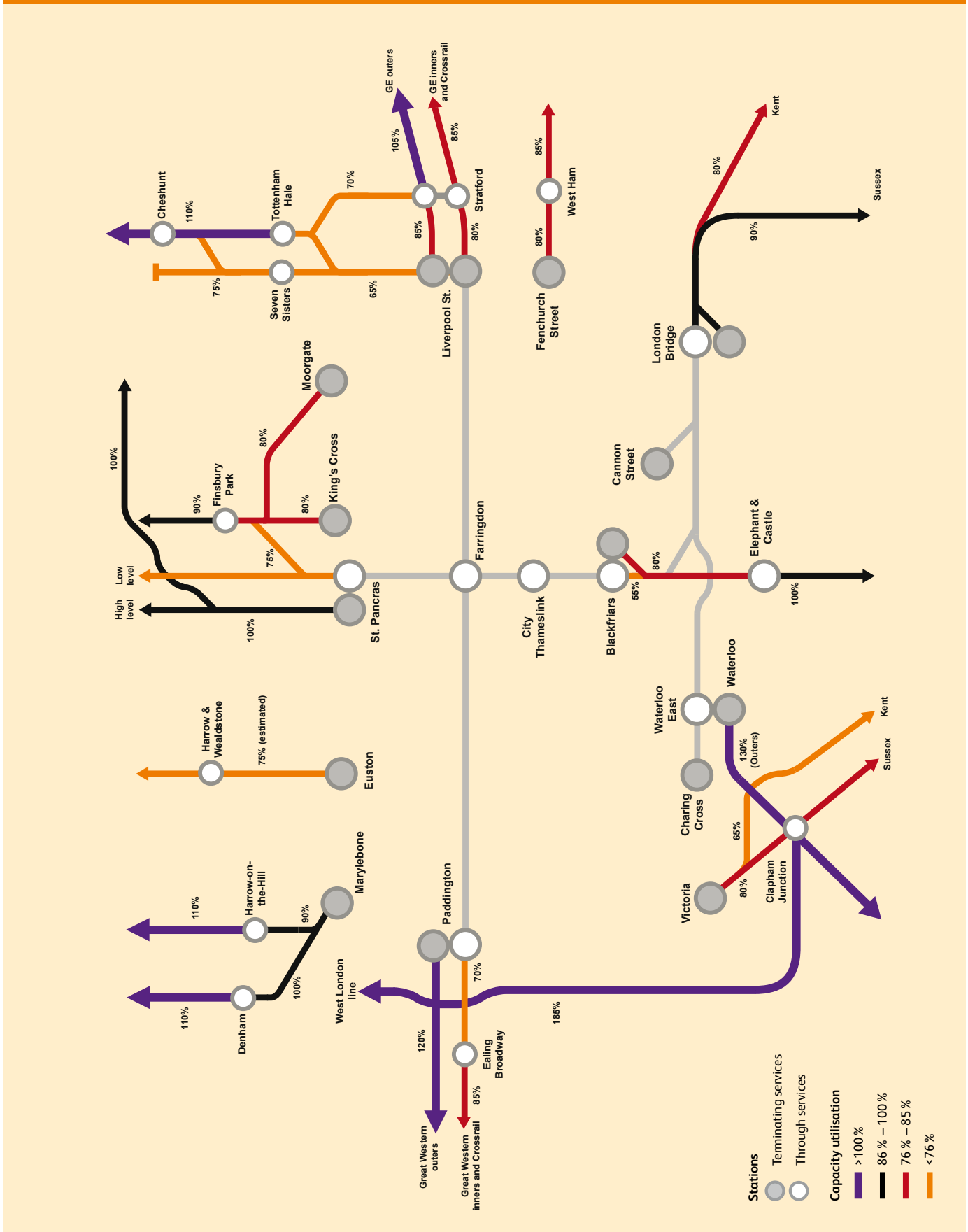


Figure 6.6 – capacity utilisation in 2031 with existing recommended strategy – busiest hour of the morning peak



7. Capacity gaps and options beyond existing strategy

7.1 Introduction

7.1.1 This chapter describes the approach taken by this Route Utilisation Strategy (RUS) to develop options so that services to/from Central London have sufficient peak capacity to cater for the future demand which is forecast in **Chapter 6**.

7.1.2 The starting point is the quantification of gaps (between committed capacity and forecast demand) for each route corridor. This is followed by consideration of the impacts of implementing existing uncommitted strategy, as described in **Chapter 5**. The London and South East RUS then identifies corridors where the existing strategy is insufficient to bridge the gap, and develops new options to address this where possible.

7.1.3 At this draft stage of the RUS, many options are in a state of development and require further analysis to establish operational and economic viability. All options considered so far are presented below to facilitate debate and highlight gaps that currently remain unresolved.

7.2 Process for quantification of gaps

7.2.1 As described in **Chapter 6**, London Transportation Studies (LTS) and RailPlan modelling has been used to forecast future peak on-train loadings, based on currently anticipated capacity (including assumptions made regarding rolling stock cascades following the Thameslink and Crossrail Programmes). The results indicate that morning and evening peak crowding on the busiest corridors into and out of Central London will remain an issue – and will worsen on several routes – even after currently committed schemes are implemented. This is therefore a significant gap for this RUS.

7.2.2 Specifically, peak period crowding in 2031 is forecast to be a particular concern on the route corridors shown in **Table 7.1**, unless further interventions (beyond those already funded) take place to make up the capacity shortfall shown. The forecast capacity gap with committed schemes only is shown in the column headed A. The size of the gap shown in this column is an approximation of the capacity which would need to be provided in addition to commited schemes, in the busiest morning peak hour, in order to reduce the levels of Passengers in eXcess of Capacity (PiXC) to industry benchmark levels on the corridor concerned.

7.2.3 As described in **Chapter 5** where a crowding gap is forecast to remain (following the completion of all currently funded schemes) the logical step is to then consider the additional interventions previously appraised as delivering value for money by Generation One RUSs and other similar studies. Recommendations in this category remain uncommitted at present but would help address these gaps, so the strong case for them is re-affirmed in this RUS, though it is emphasised that the business cases for the Intercity Express Programme (IEP) and High Speed 2 are held elsewhere. The principal such recommendations carried forward into this London and South East RUS were summarised in **Table 5.14** in **Chapter 5** and are repeated for routes with a peak capacity gap following committed schemes in the column headed B in **Table 7.1**. Further details of these recommendations were discussed in **Chapter 5** and more information can also be found for many of the schemes in the specific RUSs concerned, available on Network Rail's website.

7.2.4 Column C in **Table 7.1** shows the reduced gap following implementation of previous recommendations carried forward into this RUS, in addition to currently committed schemes. It can therefore be seen that several of the peak capacity gaps in column A can be resolved by existing strategy without new schemes from the London and South East RUS being required. For example the forecast growth in rail usage between London and the Midlands/North of England/Scotland would be handled by construction of High Speed 2 and other services on the West Coast Main Line (WCML) would benefit from the capacity freed up by that scheme. Similarly previously recommended train lengthening and timetable modifications would reduce or resolve gaps on several routes.

7.2.5 However **Table 7.1** demonstrates that not all gaps are forecast to be resolvable to 2031 by Generation One RUS strategy. For example whilst extra capacity would be provided on the Great Western Main Line (GWML) and Great Eastern Main Line (GEML) routes through new intercity-type rolling stock, this would not be enough to address the gap. The remainder of this chapter therefore considers options that seek to respond to the capacity shortfall as shown in column C in **Table 7.1**.

Table 7.1 – forecast capacity shortfall in busiest morning peak hour in 2031: currently anticipated schemes only/previous RUS recommendations

Route to	Service group	Anticipated capacity shortfall with committed schemes (A)	Generation One RUS (or equivalent other strategy) recommendations carried forward into this RUS (B)	Anticipated capacity shortfall with previous RUS recommended schemes (C)	Shortfall basis (seats/standing)
London Paddington	Long distance high speed (LDHS)	6,700	IEP	5,200	Seats
London Paddington	Outer suburban		IEP		Seats (standing capacity included for Slough passengers).
London Marylebone	Outer suburban	1,200	As described in West Midlands and Chilterns RUS (published as a Draft for Consultation in December 2010).	Dependent on options recommended in final RUS	Seats (standing capacity included for Harrow-on-the-Hill passengers).
London Euston	LDHS	500	Construct HS2 (initially London – Birmingham, thence 'Y' network beyond).	0	Seats
London Euston	Outer suburban	2,500	Extra WCML fast line calls at Milton Keynes etc following HS2 opening.	0	Seats (Standing capacity included for Watford Junction passengers).
London St Pancras International	LDHS	800	Lengthen long distance trains. New rolling stock following electrification.	300	Seats
London King's Cross (GN/Thameslink)	Outer suburban	300	12-car outer suburban operations (including Thameslink)/IEP on Ely/Kings Lynn services.	0	Seats
London King's Cross (ECML)	LDHS	None in morning high-peak. Evening peak and all day LDHS loadings not covered by RUS methodology.	IEP.	None in morning high-peak. Evening peak and all day LDHS loadings not covered by London and South East RUS methodology.	N/A
Moorgate	Inner suburban	1,400	Improve headways on branch and reduce turn around times at Moorgate to run two additional tph.	0[1]	Seats + standing
London Liverpool Street (West Anglia)	Inner suburban	2,100	Run all peak inner services as eight-car. Run Cheshunt to Seven Sisters shuttle.	800 on Tottenham Hale branch	Seats + standing

1 Modelling suggests that the extra capacity provided by the additional two tph abstracts from the LU services, so a high load factor may remain between Harringay and Finsbury Park (dependent on calling pattern).

Table 7.1 – forecast capacity shortfall in busiest morning peak hour in 2031: currently anticipated schemes only/previous RUS recommendations

Route to	Service group	Anticipated capacity shortfall with committed schemes (A)	Generation One RUS (or equivalent other strategy) recommendations carried forward into this L&SE RUS (B)	Anticipated capacity shortfall with previous RUS recommended schemes (C)	Shortfall basis (seats/standing)
London Liverpool Street (West Anglia)	Outer suburban	400	Lengthen all peak trains to 12-car.	0	Seats (standing capacity included Broxbourne to Tottenham Hale).
London Liverpool Street (Great Eastern)	Outer suburban	7,200	Replace inter-city stock on Norwich services with multiple units for higher capacity. Run one further extra train in high-peak. Lengthen all peak trains to 12-car.	4,200	Seats (standing capacity included Shenfield to Stratford).
London Bridge & Thameslink (Sussex)	Outer suburban	1,200	Additional diesel rolling stock for Uckfield line (10-car x 23m).	1,200 (600)[2]	Seats (standing capacity included for East Croydon passengers).
London Victoria (Sussex)	Outer suburban	400	Insert Clapham Junction calls in certain peak Gatwick Express services. Lengthen Caterham and Tattenham trains to 10-car (upon joining at Purley).	400 (0)[3]	Seats (standing capacity included for East Croydon passengers).
London Victoria (Sussex)	Inner suburban	300	Further 10-car operations using CP4 infrastructure.	0	Seats + standing.
London Blackfriars (via Herne Hill)	Inner suburban	900	N/A	900	Seats + standing.
London Waterloo (SWML)	Outer suburban/ main line	7,100	Lengthen all peak trains to 12-car (or 10-car x 23m).	6,100	Seats (standing capacity included for Surbiton passengers).
London Waterloo (Windsors)	Outer suburban	700	10-car platforms Virginia Water – Earley. Further 10-car operations using CP4 infrastructure.	700[4]	Seats (standing capacity included Richmond to Clapham Junction).
West London Line	Inner suburban	2,500	N/A	2,500	Seats + standing.

2 Gap remains at 1,200 from Sussex to East Croydon; reducing to 600 between East Croydon and London
3 Gap remains at 400 from Sussex to East Croydon, but is resolved between East Croydon and London.
4 Modelling suggests that the added capacity will abstract passengers from the less crowded inner suburban services so the gap remains unchanged.

7.3 Corridors not fully addressed by Generation One RUS strategy

7.3.1 From column C it can be seen that, even if all elements of existing RUS strategy are funded, the modelling approach used forecasts that the following routes will still have peak capacity problems in 2031:

- GWML services between London Paddington and the South Wales/the West Country. Significant crowding problems are therefore anticipated with Reading area to London Paddington commuters in particular unless further capacity is provided. Note that this conclusion is only marginally affected by a decision on IEP, since additional trains into London Paddington in the high-peak over the fast lines are not viable regardless of train type
- GEML services, with no track capacity available between Shenfield and London to run further trains. Significant crowding problems are therefore anticipated from the Colchester area inwards unless further capacity is provided
- outer services on the South West Main Line (SWML). Significant crowding problems are therefore anticipated inwards of Basingstoke/ Guildford on these trains. It should be noted that this conclusion applies regardless of what works are undertaken at London Waterloo station, since the remodelling works currently planned there are only designed to facilitate lengthening of the London suburban services
- the West Anglia corridor. The main growth anticipated on this route is now on inner suburban services, rather than those to Stansted airport and only parts of the Greater Anglia RUS strategy have therefore been carried forward as shown in **Table 7.1** if these are implemented. The key crowding problem is then anticipated to be the capacity (and frequency) of inner services on the Lea Valley corridor, since the Cheshunt to Seven Sisters peak shuttle recommended in the Greater Anglia RUS would resolve the gap on the Southbury Loop
- the West London Line, with peak trains crowded towards Shepherds Bush from both the north and south directions. In addition there will also be significant crowding at other times, for example during Christmas shopping at Shepherds Bush, events at Earls Court or football matches in Chelsea. The RUS also notes that demand on the West London Line could be expected to increase significantly in the event of a new interchange station being provided to the High Speed 2 route and Crossrail in the Old Oak Common area
- the Herne Hill/Elephant & Castle corridor, with trains restricted to eight-car, significant physical obstructions preventing platform lengthening and no spare capacity at key locations for additional trains
- the Brighton Main Line, principally on the London Bridge corridor. Whilst significant lengthening of certain service groups is possible it is noted that there is already peak standing from locations such as Haywards Heath on existing 12-car trains and lengthening of services from Uckfield; Caterham or Tattenham corner can only indirectly respond to this issue
- outer suburban services on the Windsor Lines into London Waterloo, on which increasing levels of crowding are anticipated within the RUS timescales, even with the planned increase from 8-car to 10-car capability for most services using this route.

7.3.2 Further to the above the RUS also considers it prudent to investigate whether anything beyond existing RUS strategy can be recommended for the London approaches on the East Coast Main Line (ECML), as being considered through the East Coast Main Line 2016 Capacity Review. Whilst no morning peak capacity gap is shown in **Table 7.1** column C – due to the extra capacity provided by the combination of the Thameslink Programme and IEP – off-peak and evening peak travel patterns have not been modelled and these issues are more pertinent on this corridor. Furthermore whilst passengers to London from the East Midlands, Yorkshire and North East England will potentially benefit from a future High Speed 2 'Y' network this is unlikely to be for many years and even then with 18 peak train paths per hour eventually available on the High Speed 2 southern section, it is at present unclear how many of these would operate on a north eastern spur.

7.3.3 **Sections 7.4** to **7.11** consider interventions by line of route, based on those corridors where peak capacity gaps still remain as described above.

7.4 Gap A: Reading/outer Thames Valley

7.4.1 **Table 7.1** forecasts that capacity will need to be found for a further 5200 people in the high peak, primarily commuters between the outer Thames Valley area and London. This figure is after the implementation of IEP and Crossrail (to Maidenhead). A number of options are currently in development to address this gap.

7.4.2 The first test undertaken has been to identify whether the extension of Crossrail services to Reading would resolve the gap, utilising the additional track capacity planned at Reading in the committed CP4 scheme and building on the anticipated electrification of the GWML.

Assessment of Option A1 – extend Crossrail services beyond Maidenhead to Reading	
Concept	This option would extend the Crossrail network from Maidenhead to Reading. The resulting peak Crossrail service pattern is therefore assumed to be: • four tph Heathrow Airport Terminal 4 (stopping) • four tph Reading (stopping) • two tph West Drayton (stopping).
Operational analysis	Following the committed remodelling of the Reading station area capacity will exist there to allow a four tph Crossrail service. The removal of the separate London Paddington to Reading relief lines all day service which would otherwise be necessary is likely to simplify operations. This would free up relief line capacity and platform capacity (albeit short platforms) at London Paddington. If this option were implemented the only non-Crossrail passenger trains needing to operate on the relief lines are then envisaged as one peak direction train to/from each of Bourne End and Henley-on-Thames, though it is conceivable that alternatively these might be replaced by self-contained all day shuttles on the two branches.
Infrastructure required	None additional, other than GWML electrification beyond Maidenhead and the committed remodelling of Reading. However there would be a potential infrastructure saving in that the following committed infrastructure enhancement schemes would not appear to be required: • signalling changes in Platform 4 at Maidenhead • reversing sidings west of Maidenhead station; • the west-facing bay at Slough station; • the stabling and servicing facilities at Maidenhead (though alternatives would need to be provided at Reading).
Passenger impact	Passengers from Reading and Twyford for destinations beyond London Paddington would benefit as the need to change would be removed. However since Reading to Crossrail services would run on the relief lines and call at all stations they would have journey times of 25 – 30 minutes longer than main line trains to Paddington, so would not be attractive to the majority of Reading to London commuters. Whilst this could theoretically be resolved by removing Reading calls from alternative services such an approach is not considered economically attractive. As a result Option A1 does not resolve the peak capacity gap from the Reading area.
Freight impact	None.
Financial and economic analysis	Economic analysis is currently in progress.
Link to other options	Whilst this option is viable in isolation, it would also be needed as a facilitator to Option A6 as described later.
Conclusion	Recommended for further development, subject to business case, to simplify operations and as a facilitator to Option A6 as described later. However in isolation this option does not resolve the peak capacity gap for Reading area commuters so further interventions are required.

7.4.3 Since **Option A1** above does not resolve the gap the next test has been to increase the IEP service from the currently anticipated 15 trains per hour to 16 trains per hour in the high peak, providing one extra long train into London Paddington at the busiest times. This is considered in **Option A2**. It should be noted that the current main line service level is 16 trains per hour as described in section 5.6.1, so this option effectively maintains today's service levels, albeit with higher capacity IEP trains on all services.

Assessment of Option A2 – increase peak IEP service from 15tph to 16tph	
Concept	This option would involve 20 tph running on the main lines into London Paddington in the high peak. The resulting peak service pattern is assumed to be: • four tph Heathrow Express • eight tph fast trains from beyond Reading • four tph running fast from Maidenhead • two tph running fast from Slough • two tph running fast from Twyford.
Operational analysis	The post-IEP peak timetable structure is based on a 20 tph structure (including the four tph Heathrow Express service). Services repeating every 15 minutes. Increasing from 15 IEP trains to 16 IEP trains in the high peak is therefore theoretically practical, utilising the path not currently planned to be used. However platform workings at London Paddington could not be accommodated so additional infrastructure would be required. Even then some current planning assumptions regarding IEP would need to be changed: principally the need for separate sub-fleets of 'electric' and 'bi-mode' sets which affects turnaround times at London Paddington.
Infrastructure required	This would require provision of a total of 12 long platforms at London Paddington (rather than 11 today) by; • creating one long platform in the space currently occupied by platforms 12 and 13 • making some revisions to signal positions on other platforms to increase their usable length. However it is possible that these changes may be required to implement IEP in any case.
Passenger impact	The additional train would improve frequencies and reduce peak crowding to a certain extent. However it would not be sufficient to bridge the forecast capacity gap.
Freight impact	None identified
Financial and economic analysis	No detailed economic analysis undertaken. The key issue is that this option potentially requires infrastructure and significant rolling stock strategy changes to facilitate a single extra service. It is unclear at present if this would be economically effective.
Link to other options	Assessment of the following options has assumed 16 tph high peak IEP paths into London Paddington. However the analysis would still be valid in the event of a 15 tph service.
Conclusion	Further development is recommended, but this option in isolation does not provide sufficient capacity to close the gap.

Assessment of Option A3 – lengthening of peak IEP trains	
Concept	In the event of IEP proceeding there is anticipated to be a range of train lengths (mostly eight-car to 10-car) arriving into London Paddington in the morning peak. Main line trains from the principal locations of Swansea and Bristol Temple Meads are planned to be eight-car, whilst outer suburban trains from locations such as Oxford would be 10-car. This option would involve lengthening all trains to a standard 10-car length.
Operational analysis	Development of the GWML timetable following IEP is complicated by the need for different sub-fleets for main line and outer suburban, fully electric and self-powered capability. Whilst having all trains of a standard length might have potential to simplify operations, full flexibility in train fleet deployment would only be achieved if suburban and main line trains were configured identically, and if the entire GWML route was fully electrified. These issues would create major complications so have not been investigated further. Hence no direct impact on operations of IEP lengthening has been identified.
Infrastructure required	This option potentially requires additional platform extensions on the GWML route. It may also require modifications to depots and sidings.
Passenger impact	Approximately 10 – 12 additional vehicles into London might be achievable in the peak hour, beyond current plans. This would alleviate crowding from the Reading area, but not to a sufficient degree to resolve the gap.
Freight impact	None identified
Financial and economic analysis	No detailed economic analysis has been undertaken. The key issue is that this option requires lengthening of morning peak main line trains originating from Swansea and Bristol Temple Meads, just to meet the commuter peak from Reading inwards. It is unclear at present if this would be economically effective.
Link to other options	None
Conclusion	Further development is recommended, but this option in isolation does not provide sufficient capacity to close the gap.

7.4.4 The next test has been to increase the length of certain morning peak IEP services into London Paddington.

7.4.5 Since the above options cannot resolve the gap fully, the concept of a fast, frequent outer Thames Valley – London Paddington service at peak times has been developed. This would maximise the benefits resulting from the additional track capacity scheme now underway at Reading.

7.4.6 The initial test has been whether this fast service could operate as an overlay on the current train plan, or that anticipated to be in operation following IEP. As detailed in the appraisal table for Option A4, this was shown not to be operationally viable.

7.4.7 The RUS has therefore considered changes to other services which may enable the fast Thames Valley shuttle service to run. The only fast line service group not contributing to capacity from the Thames Valley area is the four trains per hour Heathrow Express service. The RUS has therefore sought to consider whether changes to the airport services might make the concept of a fast Thames Valley to London Paddington service workable, given that changes to any other fast line service group would most likely increase the size of the capacity gap at Reading.

7.4.8 **Option A5** and **Option A6** therefore seek to incorporate Heathrow Express into the Crossrail network to free up space on the London Paddington approaches for additional main line services, enabling the desired outer Thames Valley – London Paddington fast peak services to operate. It is recognised that implementation would require significant changes to current track access rights and additional Crossrail-compatible rolling stock.

Assessment of Option A4 – new 12-car four tph outer Thames Valley/Reading to London Paddington peak shuttle (implement as an overlay on other services)	
Concept	This option would involve running a new four tph peak outer suburban shuttle service, to reduce the need for GWML long distance trains to cater for Reading commuters. Some South Wales/ West Country services would potentially be sped up as a result by omitting a Reading call. The new service would be operated by electric multiple units of 12-car length, with high seating capacity. An indicative main line service specification would be: • four tph Heathrow Express • eight tph fast trains from beyond Reading • four tph fast Reading or outer Thames Valley shuttle • four tph running fast from Maidenhead • two tph running fast from Slough • two tph running fast from Twyford.
Operational analysis	This would increase the peak main line service on the London Paddington approaches from 20 tph to 24 tph. Current signalling headway is two and a half minutes between London Paddington and Airport Junction and three minutes between Airport Junction and Reading. Timetable development indicates that a reduction in line headway to two minutes throughout would be required to achieve this option. Even if this were resolved the track layout from Ladbroke Grove to London Paddington and the platforms at London Paddington could not accommodate the increased service frequency of 24tph on the main lines. Again 20 tph is considered the maximum achievable in this area. As a result of these constraints this option is not considered operationally viable. The Reading station area will not be a constraint as this will be resolved by the planned remodelling scheme.
Infrastructure required	Reduction of headways to two minutes has not been proven to be technically viable between Ladbroke Grove and Airport Junction. If not viable then provision of six tracks between these two locations would be necessary as an alternative. In addition more long platforms at London Paddington would be required. Resolving the combination of these two issues would involve major further changes to the infrastructure between Ladbroke Grove and London Paddington, including new grade separated junctions and/or major remodelling works. Whilst this approach could potentially resolve the problem the RUS has not considered it in detail as the high cost and disruption associated with it could be avoided by options A5/A6 which follow.
Passenger impact	Option not proven to be viable, so not applicable.
Freight impact	Option not proven to be viable, so not applicable.
Financial and economic analysis	Option not proven to be viable, so not applicable.
Link to other options	Option not proven to be viable, so not applicable.
Conclusion	This option would require very high cost infrastructure works or changes to other services to make it viable.

Assessment of Option A5 – new 12-car four tph outer Thames Valley/Reading to London Paddington peak shuttle (with Heathrow Express incorporated into Crossrail and continuing to run on the fast/main lines at all times)	
Concept	As with option A4, this also involves running a new four tph peak outer suburban shuttle service, to reduce the need for GWML long distance trains to cater for Reading commuters. The new service would be operated by 125mph electric multiple units of 12-car length, with high seating capacity. The existing Heathrow Express service would be modified to a Heathrow Airport to Crossrail service, crossing from the main lines towards the Crossrail tunnel just outside London Paddington. An indicative main line service specification would be: • four tph Heathrow Express to Crossrail • eight tph fast trains from beyond Reading • four tph fast Reading or outer Thames Valley shuttle • four tph running fast from Maidenhead • two tph running fast from Slough • two tph running fast from Twyford. Building on the implementation of Option A1 (Crossrail extension to Reading) the resulting Crossrail service pattern is then assumed to be: • four tph Heathrow Terminal 5 (fast) • four tph Heathrow Terminal 4 (stopping) • four tph Reading (stopping) • two tph West Drayton (stopping). The number of Crossrail services terminating in the Westbourne Park area from the east would be reduced from 14 tph to 10 tph.
Operational analysis	Following the committed remodelling of the Reading station area, capacity will exist there to allow four tph additional fast services to London Paddington. The diversion of the Heathrow Express service to Crossrail would free up the necessary platform capacity at Paddington (two long platforms) for use by a Reading area or beyond – London Paddington peak shuttle. Planned infrastructure between Ladbroke Grove Junction and Westbourne Park would enable Heathrow Express to run directly from the main lines onto the relief lines, in turn leading to the Crossrail tunnels. However, parallel moves between up and down services would be needed at this location to make this workable and this would be difficult to achieve at peak times. As with Option A4 this option would also require an increase of four tph at peak times over the main lines between Airport Junction and Ladbroke Grove (from 20 tph to 24 tph). This would therefore create the same issues as identified in Option A4. As a result of the need for reduced signalling headways on the congested London approaches this option is not operationally viable at peak times.
Infrastructure required	Reduction of headways to two minutes has not been proven to be technically viable between Ladbroke Grove and Airport Junction.
Passenger impact	Option not proven to be viable, so not applicable.
Freight impact	Option not proven to be viable, so not applicable.
Financial and economic analysis	Option not proven to be viable, so not applicable.
Link to other options	Option not proven to be viable, so not applicable.
Conclusion	This option is not operationally viable in the morning and evening weekday peak periods, due to insufficient signalling headway on the main lines. It does not therefore enable operation of a peak outer Thames Valley/Reading to Paddington shuttle, so further changes are required as discussed in Option A6.

Assessment of Option A6 – new 12-car four tph Reading/outer Thames Valley to London Paddington peak shuttle (with Heathrow Express incorporated into Crossrail and running on the relief lines at least at peak times)	
Concept	As with option A4/A5, this also involves running a new four tph peak outer suburban shuttle service, to reduce the need for GWML long distance trains to cater for Reading commuters. The new service would be operated by 125mph electric multiple units of 12-car length, with high seating capacity. The existing Heathrow Express service would be modified to a Heathrow to Crossrail service and running, at least at peak times, on the relief lines. An indicative peak main line service specification would be: • eight tph fast trains from beyond Reading • four tph fast Reading or outer Thames Valley shuttle • four tph running fast from Maidenhead • two tph running fast from Slough • two tph running fast from Twyford. Building on the implementation of Option A1 (Crossrail extension to Reading) the resulting peak Crossrail service pattern is then assumed to be: • four tph Heathrow Airport Terminal 5 (running fast on the relief lines) • four tph Heathrow Airport Terminal 4 (stopping) • four tph Reading (stopping) • two tph West Drayton (stopping). The number of Crossrail services terminating in the Westbourne Park area from the east would be reduced from 14 tph to 10 tph.
Operational analysis	Following the committed remodelling of the Reading station area capacity will exist there to allow four tph additional fast services to London Paddington. The diversion of the Heathrow Express service to Crossrail would free up the necessary platform capacity at London Paddington (two long platforms) for use by a Reading area or beyond – London Paddington peak shuttle. With respect to the section between London Paddington and Reading it is considered that the removal of Heathrow Express from the main (fast) lines, together with resolving the platform constraints as identified above, would free up the capacity necessary to run a four tph fast shuttle service between these locations at peak times. Operation of Heathrow Express on the relief lines at peak times requires removal of the planned residual (non-Crossrail) Reading – London Paddington relief line service. This could be achieved by implementation of Option A1. Further consideration of the means of serving the Bourne End and Henley-on-Thames branches with a peak service to London would be required. In addition further work is required regarding the operation of the extended Heathrow Express service in the off-peak. This will need to take into account capacity requirements on the relief lines for freight paths and the desire to minimise the London – Heathrow Airport journey time.
Infrastructure required	None identified. However it may be possible for relief line passing loops to be provided to allow Heathrow Express to overtake stopping services.
Passenger impact	The peak Reading to London Paddington fast shuttle would provide significant extra capacity, removing most of the standing which is otherwise anticipated from the outer Thames Valley. In addition some peak main line trains to/from South Wales and the West Country would no longer need to call at Reading, reducing journey times. However it is recognised that some calls would need to be retained to keep connectivity to Reading from the west. Running the Heathrow Express service on the relief lines at peak times would add up to six minutes to journey times for users to/from London Paddington. However this would be balanced by improved connectivity from beyond London Paddington in Central London, doubling the planned Crossrail service to Heathrow from four tph to eight tph and serving all terminals.
Freight impact	The option has implications for freight paths on the GWML, in the event of the modified Heathrow Express services running on the relief lines other than in the high peak. Resolving this will therefore be a requirement in developing this option further.
Financial and economic analysis	Economic analysis is currently in progress.
Link to other options	This option interacts with the RUS assumptions that a new interchange station will be provided at Old Oak Common following High Speed 2 as described under section 8.5 later. It appears to require significantly less infrastructure for Heathrow Express to serve this station if this service was on the relief lines, though this is dependant on whether other Great Western Main Line trains call at this station.
Conclusion	This option is recommended for further development.

7.4.9 From the above analysis the emerging conclusion for GWML capacity is the potential desirability of a peak Thames Valley – London Paddington shuttle, using rolling stock configured for commuters rather than long distance travellers. In order to create space for this on the fast line approaches to London Paddington, the RUS considers that the existing Heathrow Express service would need to be incorporated into Crossrail. For this to be operationally viable all the airport services would need to run on the relief lines, at least at peak times. Initial analysis suggests that a fast airport service could potentially remain on the fast/main lines at off-peak times, though this requires parallel moves between east and westbound services immediately outside London Paddington. The peak relief line capacity to implement this option is dependent on removal of the residual Reading – London Paddington service, which could be facilitated by the potential extension of Crossrail services to Reading.

7.4.10 The RUS considers that the need to respond to otherwise severe overcrowding from the Reading area will outweigh relatively minor journey time disbenefits for London Paddington – Heathrow Airport travellers for a few hours each day. These disbenefits are in any case potentially outweighed by the improved connectivity associated with incorporating Heathrow Express into Crossrail, enabling more direct trains between the airport and Central London and through services from both the Canary Wharf and Stratford eastern branches.

7.4.11 The RUS also notes that the planned London Marylebone to Oxford service has some potential to reduce the GWML capacity gap, though only to a very limited degree. Whilst these services are currently anticipated to be four-car they could be lengthened to six-car without further infrastructure work.

7.4.12 The RUS is also mindful of the ongoing review of the strategy for IEP on the GWML and optimisation of infrastructure designs associated with Crossrail. The RUS therefore recommends further detailed timetable development relating to both the medium and long-term elements of this strategy, focusing on issues such as:

- a funding decision regarding IEP and electrification
- the integration of IEP and Crossrail timetables
- the strategy for outer-suburban IEP (or equivalent), including work on optimising calling patterns for Slough, Maidenhead and Twyford, given that these would utilise significant capacity by either requiring main line station calls or crossing services between the main and relief lines
- whether any further infrastructure enhancement (in addition to committed Crossrail-funded interventions) on the section of line between Westbourne Park and Old Oak Common West/Acton East is required, as well as at London Paddington to receive longer trains on the suburban side of the station
- longer-term considerations from this RUS such as the Crossrail extension to Reading, incorporation of Heathrow Express into the Crossrail network, peak Thames Valley to Paddington commuter shuttles and serving the High Speed 2 station at Old Oak Common.

7.4.13 The RUS will continue to develop the above options further during the consultation period, through a working group focused on the GWML.

7.5 Gap B: East Coast Main Line – London approaches

7.5.1 The East Coast Main Line 2016 Capacity Review, published as a Draft for Consultation in December 2010, considers capacity and future timetable structures on the ECML in general. It interfaces with this London and South East RUS on the London approaches, which are particularly congested in the two-track Welwyn Viaduct area and inwards thereof.

7.5.2 Replacement of HST trains with IEP is assumed in the base-plus case for this RUS, as described in **Chapter 5** existing Class 91 locomotives and Mark IV coaches are anticipated as remaining in use in this base-plus case.

7.5.3 **Table 7.1** indicates that morning peak capacity on the ECML into London has not been found by the modelling to be a quantified gap in this RUS. This is due to the additional capacity provided by the new First Capital Connect (FCC) timetable starting in December 2010 and the new East Coast timetable planned for May 2011, together with further FCC improvements – mainly increasing train lengths – later in CP4. Beyond that the Thameslink Programme and IEP are expected to accommodate the growth in morning peak demand. The eventual connection of the high speed rail network is also relevant, given that this could be expected to move flows such as London – Leeds and London – Scotland away from the ECML.

7.5.4 However, as described in section 7.3.2 the RUS recognises that there are significant industry aspirations to run additional trains on the ECML, and the London approaches potentially represent a barrier to doing so at present. The gap on the ECML is spread through the day rather than being confined to the recognised morning and evening commuter peaks as on many London and South East routes. This arises partly from the diversity of markets served but also from the current fares policy and yield management techniques used by long distance high speed operators. It is also notable that the evening peak potentially presents more of a challenge than the morning, given that commuters and long distance travellers tend to leave London at similar times, whereas long distance travellers generally arrive towards the end of or after the morning commuter peak. The RUS therefore considers it prudent to explore longer-term options on the London approaches. These would build upon those described in the East Coast Main Line 2016 Capacity Review.

7.5.5 The initial options considered seek to increase capacity on the London approaches by making further rolling stock changes, beyond the anticipated impacts of IEP on this route.

Assessment of Option B1 – reconfigure ECML electric trains to allow the busiest services to be formed of a Class 91, 10 Mark IV coaches and a Driving Van Trailer (DVT)	
Concept	This option would involve reconfiguring the current ECML Mark IV fleet from all 2+2-car to a mixture of 2+8-car and 2+10-car. The 2+10-car sets could then be deployed on the busiest services. The concept does not apply to ECML HST sets which are 2+9-car maximum.
Operational analysis	A mixed fleet would create increased complexity in timetabling and has the potential for small increases in journey times caused by slower acceleration of longer trains.
Infrastructure required	None anticipated.
Passenger impact	An extra passenger vehicle would be provided on the busiest trains. However a similar number of quieter trains would need to run with shorter formations than today. However no additional trains into London would run, so this does not meet industry aspirations for additional paths on the London approaches.
Freight impact	No impact anticipated.
Financial and economic analysis	No appraisal undertaken.
Link to other options	None.
Conclusion	This option requires further investigation.

Assessment of Option B2 – ECML rolling stock replacement (beyond replacing HST sets with IEP)	
Concept	This option would involve replacing the current ECML Mark IV trainsets with IEP vehicles or similar, creating additional capacity by utilising the front and rear vehicles for carrying passengers. In addition other short formation services on the ECML could be extended by utilising longer rolling stock (potentially splitting and joining on route if necessary).
Operational analysis	Limited impact anticipated. Any longer services formed by splitting/joining on the main ECML route would require specific timetable investigation.
Infrastructure required	No impact anticipated.
Passenger impact	An extra two passenger vehicles would be provided on all trains currently utilising a Class 91 locomotive, nine Mark IV carriages and a DVT. This potentially represents an increase in seats of around 20 per cent per train. Lengthening of other services would also provide significant extra capacity. However no additional trains into London would run, so this does not meet industry aspirations for additional paths on the London approaches.
Freight impact	No impact anticipated.
Financial and economic analysis	No appraisal undertaken.
Link to other options	None.
Conclusion	This option requires further investigation.

7.5.6 **Options B1** or **B2** potentially provide additional capacity for long distance services, enabling more passengers to use each train. However the RUS is also aware of extensive stakeholder aspirations to run additional long distance trains on ECML if the paths could be found which, given infrastructure constraints on the London approaches, is only considered worth investigating in any detail in the off-peak. If viable this would be likely to generate additional demand and economic activity.

7.5.7 **Option B3** therefore describes the latest thinking regarding whether it is practical to run additional trains into London using existing infrastructure, building beyond the eight trains per hour peak and six trains per hour off-peak (excluding the Cambridge line) planned under anticipated schemes.

Assessment of Option B3 – run seven tph long distance services in alternate off-peak hours on ECML	
Concept	This option builds on the approach described in the East Coast Main Line 2016 Capacity Review, running seven tph in alternate off-peak hours on long services on the ECML. A key aspiration is for the additional path to run fast London – Newcastle – Edinburgh.
Operational analysis	Initial capacity assessment has indicated that seven LDHS services in one hour along with the required level of suburban, inter-regional and freight can be achieved. To achieve this level of service the timetable specification/structure would need to be modified – for example there is an opportunity to reduce the journey time of key flows by adding stops to other services. Some turnaround times at King's Cross may need to be reduced.
Infrastructure required	None (other than CP4 commitments).
Passenger impact	An extra off-peak train would be provided. This would increase capacity and potentially reduce London – Scotland journey times however the disbenefit would be the removal of some existing direct journey opportunities.
Freight impact	After committed CP4 schemes are taken into account, the key constraint will be between Huntingdon and Fletton Junction. A standard freight path needs to be included over this section in the timetable design and it is noted that accomodating freight services in the southbound direction on this section is challenging.
Financial and economic analysis	No appraisal undertaken.
Link to other options	None.
Conclusion	Further development is recommended, subject to business case and optimisation of the option.

7.5.8 Whilst **Option B3** has potential to provide significant service improvements on the ECML it is recognised that not all industry aspirations for additional trains on this corridor will have been met. **Options B4** and **B5** therefore test upgrading the ECML infrastructure on the London approaches to increase the overall number of train paths available. However it is emphasised that there are also other major constraints on the ECML and the London approaches are not the only consideration.

Assessment of Option B4 – implement advanced signalling (European Rail Traffic Management System (ERTMS)) on ECML to create additional train paths	
Concept	This option would utilise the anticipated installation of ERTMS such that additional LDHS trains could run into London on the ECML at peak times and throughout the day.
Operational analysis	New signalling would enable trains to run closer together. However all other existing capacity constraints would still apply, for example platform capacity at Kings Cross and two-track sections such as through the Welwyn area, including Welwyn North station. This means that the additional capacity released by ERTMS is currently considered to be minimal unless changes are made to the timetable structure, rationalising the number of distinct stopping patterns into a smaller number of service groups. Normalisation of journey times reduces instances of faster trains catching slower trains in the timetable and using up capacity.
Infrastructure required	Installation of ERTMS equipment, both on the infrastructure and on passenger and freight locomotives using the route.
Passenger impact	Limited extra long distance train paths would be provided, potentially up to two tph in the peak on the assumption that the headway can be reduced to 2.5 minutes with necessary timetable structure changes (journey time normalisation) on the longer sections. Additional off-peak capacity will be similar depending on the compromise selected between journey times and capacity. The greater passenger impact from ERTMS is likely to come from journey time improvements as signal sighting constraints will be removed, raising the prospect of higher line speeds, benefitting both LDHS and suburban services. Previous analysis has shown a journey time benefit of up to five minutes between London King's Cross and Edinburgh if all 125mph sections of line were raised to 140mph.
Freight impact	Freight locomotives using the ECML would need to be ERTMS equipped.
Financial and economic analysis	No appraisal undertaken.
Link to other options	None.
Conclusion	This option is unlikely to be a solution to capacity issues on the ECML, given the limited additional paths it would facilitate. However there are wider grounds for ERTMS, including operating costs, journey times and maintainability, which are likely to make the case for this scheme stronger in coming years.

Assessment of Option B5 – four tracking throughout the Welwyn North area to create additional train paths	
Concept	This option would involve providing two additional tracks from Digswell to Woolmer Green junctions via Welwyn North, alleviating the only existing two-track section at the south end of the ECML.
Operational analysis	Significant extra capacity would be provided in the Welwyn North area. However other existing capacity constraints would still apply and would restrict the overall extra capacity benefit to two additional LDHS services per hour. The reason the benefit is limited is because of the overall capacity of the London approaches, due to the number of trains and variety of different service speeds, with varying stopping patterns. Capacity is therefore used up as fast trains trail slower trains and by the overall quantum on the route.
Infrastructure required	Major construction works involving new Welwyn tunnels (approx one mile) and a new Welwyn viaduct. Welwyn North station would be relocated onto the new slow lines.
Passenger impact	Limited extra long distance train paths would be provided, potentially two tph in the peak and two tph in the off-peak.
Freight impact	No impact anticipated, freight traffic would continue to operate via Hertford North.
Financial and economic analysis	No appraisal undertaken.
Link to other options	None.
Conclusion	This option cannot be recommended at present due to very high cost and insufficient evidence that it is required. However protection is recommended regarding the land concerned so that it is not impractical later.

7.5.9 From the above **Options B1** to **B5** the emerging conclusion is to run as many trains as practical using currently committed infrastructure, at maximum length. LDHS operators on this route rely heavily on the use of a train-by-train pricing policy (for advance tickets), encouraging significant numbers of people to use trains at quieter times of the day rather than those trains that are the busiest. The continued use of such a policy will enable overall LDHS loadings to be spread across services throughout the day, with eight LDHS trains in high peak hours and six/seven alternately in other hours.

7.5.10 The above strategy should avoid the need for additional trains at peak times being needed over the Welwyn viaduct once the post-Thameslink Programme timetable structure is in place. In the longer term the degree to which the proposed implementation of ERTMS on the ECML, linked to the renewal of signalling equipment, could alleviate the capacity constraint at Welwyn has yet to be fully explored but current thinking suggests this to be limited. As a result four-tracking at Welwyn is possibly required in the very long term. However abstraction of LDHS demand from ECML to the high speed rail network appears to reduce the case for intrusive works to increase capacity in this area.

7.6 Gap C: Lea Valley corridor

7.6.1 **Table 7.1** indicates that, in the absence of additional trains, overcrowding will be a concern on the Lea Valley main line section of the West Anglia route, with a capacity shortfall of some 800 passengers in the busiest peak hour. The RUS has not automatically carried forward the recommendation from the Greater Anglia RUS for a Lea Valley four-tracking scheme, given that Stansted Airport growth is now forecast at much lower levels than previously. However potential interventions up to and including that scheme are now treated as options by this RUS.

7.6.2 The following options therefore seek to respond to the gap. This includes investigation of what can be achieved with current infrastructure, consideration of more limited partial infrastructure upgrades on the Lea Valley route and reappraisal of the Greater Anglia RUS Lea Valley full four-tracking scheme (but without the previously assumed growth at Stansted Airport).

7.6.3 All the options considered would increase peak capacity, improve train frequencies and have potential to reduce certain journey times. Connectivity to Stratford and the Olympic Park area is a key feature of the options considered. It is recognised that improvements to the service frequency at poorly served (but currently lightly used) stations in the Lea Valley is likely to stimulate significant additional demand and assist the regeneration of the area, moving towards Transport for London's (TfL's) aim of four trains per hour services across the London network.

Assessment of Option C1 – run two tph extra on the West Anglia route, utilising existing infrastructure in the Lea Valley	
Concept	This option seeks to test increasing service frequencies without requiring additional infrastructure.
Operational analysis	No additional services to London Liverpool Street have been identified as operationally viable. However committed track layout changes at Stratford will allow up to four tph to operate to/from that location. At present a two tph peak service is in operation (one tph off-peak). Timetable analysis has identified that two tph extra Broxbourne to Stratford is viable, at least one of which would need to start back from Hertford East due to capacity limitations at Broxbourne. To accommodate these additional trains, changes would need to be made to the stopping patterns of some existing Stratford – Stansted Airport and London Liverpool Street – Hertford East services.
Infrastructure required	None, other than committed changes at Stratford.
Passenger impact	Extra trains between Hertford East/Broxbourne and Stratford would improve connectivity to the Olympic Park area and Docklands. The increased frequency north of Tottenham Hale would provide extra capacity to the critical load point and alleviate the peak crowding gap.
Freight impact	Existing freight paths would be maintained.
Financial and economic analysis	No detailed economic analysis undertaken. However given that this option would allow additional trains to run without requiring Lea Valley infrastructure changes it is likely to have a strong economic case.
Link to other options	None
Conclusion	Likely to be recommended, subject to business case.

Assessment of Option C2 – four-tracking of the entire Lea Valley route and additional trains	
Concept	This option proposes four tracking of the Lea Valley route between Broxbourne and Coppermill Junction, together with additional trains on the route.
Operational analysis	In addition to the additional two tph in Option C1, four-tracking would then enable up to four tph extra to operate, by providing separate tracks for fast and stopping trains. Since no extra capacity would be provided over the Coppermill Junction to London Liverpool Street section all of these additional trains would need to run to Stratford.
Infrastructure required	Four-tracking Broxbourne junction – Coppermill junction, together with additional platform faces at Tottenham Hale. Works to the level crossings would be required, together with an upgrade to the power supply. In addition committed changes at Stratford would be required as described in Option C1.
Passenger impact	This scheme would provide sufficient capacity to alleviate peak crowding on this corridor, with extra capacity provided from the north to Tottenham Hale, where many passengers change onto LUL Victoria Line services. The increased quantum of trains would improve journey opportunities, including on local stations on the Lea Valley route where service levels and patronage are currently poor. The significantly increased frequency to Stratford would improve journey opportunities to the Olympic Park area and provide onward links to Crossrail, Docklands (via DLR) and Kent (and potentially Europe in future) via High Speed 1.
Freight impact	Existing freight paths would be maintained.
Financial and economic analysis	Economic analysis is currently in progress.
Link to other options	This option builds on option C1.
Conclusion	Recommended for further development, to confirm if a business case exists.

7.6.4 Given the probable high cost of the above and current affordability constraints a range of potential lesser schemes were tested for the short term. These would involve significantly lower infrastructure cost but facilitate fewer additional services.

Assessment of Option C3 – Additional infrastructure in the Tottenham Hale to Coppermill Junction area, with additional trains beyond those recommended in Option C1	
Concept	This option proposes additional tracks over a short section of the Lea Valley route between Tottenham Hale and Coppermill Junction, together with additional trains on the route.
Operational analysis	In addition to the additional two tph in Option C1, limited infrastructure enhancements would then enable a further one to two tph Tottenham Hale to Stratford shuttle to operate. However timetable analysis has shown that this scheme does not tackle the most critical constraint, which is in the Broxbourne area. As a result no additional trains directly resulting from this scheme could run further north than Tottenham Hale.
Infrastructure required	Additional tracks in the Tottenham Hale – Coppermill Junction area, together with an additional platform face at Tottenham Hale.
Passenger impact	This would improve service frequency between Tottenham Hale and Stratford, providing a four trains per hour service between these locations.
Freight impact	Any additional tracks in the Tottenham Hale area would potentially increase timetable opportunities for freight using the Lea Valley route.
Financial and economic analysis	No analysis undertaken.
Link to other options	Requires further investigation. However this option builds on option C1.
Conclusion	Requires further investigation. However, at present insufficient evidence of benefits has been identified to enable this option to be recommended, since it does not resolve the main capacity restrictions on the West Anglia route which are in the Broxbourne area.

Assessment of Option C4 – additional infrastructure between Tottenham Hale and Angel Road to extend the Tottenham Hale to Stratford shuttle considered in Option C3 to Angel Road	
Concept	This option proposes infrastructure enhancements between Tottenham Hale and Northumberland Park, allowing additional services to operate at Northumberland Park and Angel Road.
Operational analysis	In addition to the additional two tph in Option C1, infrastructure enhancements would allow the further one to two tph Tottenham Hale to Stratford shuttle to be extended to Angel Road via Northumberland Park. However timetable analysis has shown that this scheme does not tackle the most critical constraint, which is in the Broxbourne area. As no additional trains directly resulting from this scheme could run further north than Angel Road.
Infrastructure required	In addition to the additional tracks in the Tottenham Hale – Coppermill Junction area, extend a third track from Tottenham Hale northwards to Northumberland Park, together with additional platform faces at Tottenham Hale, Angel Road and Northumberland Park.
Passenger impact	This scheme would provide sufficient capacity to alleviate peak crowding on this corridor, with extra capacity provided from the north to Tottenham Hale, where many passengers change onto London Underground Victoria Line services. The increased quantum of trains would improve journey opportunities, including on local stations on the Lea Valley route where service levels and patronage are currently poor. The significantly increased frequency to Stratford would improve journey opportunities to the Olympic Park area and provide onward links to Crossrail, Docklands (via DLR) and Kent (and potentially Europe in future) via HS1.
Freight impact	Any additional tracks in the Tottenham Hale area would potentially increase timetable opportunities for freight using the Lea Valley route.
Financial and economic analysis	No analysis undertaken.
Link to other options	This option builds on Options C1 and C3.
Conclusion	Requires further investigation. However, at present insufficient evidence of benefits has been identified to enable this option to be recommended, since it does not resolve the main capacity restrictions on the West Anglia route which are in the Broxbourne area.

Assessment of Option C5 – infrastructure enhancements in the Broxbourne area, with additional trains beyond those recommended in Option C1	
Concept	This option proposes infrastructure enhancements in the Broxbourne area, together with additional trains on the route.
Operational analysis	This approach would alleviate the existing capacity restrictions at Broxbourne, for which a range of options are available. As a result the two tph Stratford – Tottenham Hale service described in Option C3 is likely to be able to originate from Broxbourne or beyond.
Infrastructure required	Operational analysis has identified various potential alternative schemes to add capacity: • the ideal layout at Broxbourne would have the through lines on the outside (Platforms 1 and 4), with Platforms 2 and 3 used for terminating trains and stopping trains waiting to be overtaken. All platforms would be 12-car capable • four-tracking between Broxbourne Junction and south of Cheshunt would allow Stansted Express trains to overtake stopping trains with out the latter being held for excess time in the platform at Broxbourne • smaller scale alternatives could involve a turnback siding at Broxbourne or turnback facilities at Harlow Town. Further analysis is required to determine the most appropriate solution from the above.
Passenger impact	This scheme would alleviate peak crowding on this corridor, with extra capacity provided from the north to Tottenham Hale, where many passengers change onto London Underground Victoria Line services. The increased quantum of trains would improve journey opportunities, including on local stations on the Lea Valley route where service levels and patronage are currently poor. The significantly increased frequency to Stratford would improve journey opportunities to the Olympic Park area and provide onward links to Crossrail, Docklands (via DLR) and Kent (and potentially Europe in future) via HS1.
Freight impact	The passing loops would potentially increase timetable opportunities for freight using the Lea Valley route.
Financial and economic analysis	Economic analysis is required when an optimised infrastructure scheme has been identified.
Link to other options	This option builds on Option C1.
Conclusion	Recommended for further development, subject to business case.

7.6.5 In the event that further development of **Option C2** or **C5** does not enable additional capacity to be provided from the Broxbourne/ Cheshunt area and beyond then additional train lengthening is likely to be required instead in response to the gap. The main opportunity relates to the Hertford East line, as described in **Option C6**.

7.6.6 Given that none of the above options have identified additional trains to London Liverpool Street from the West Anglia route, the RUS has also tested running the additional Stratford trains in **Options C1** to **C5** through to London Liverpool Street, utilising platform capacity freed up following the Crossrail scheme.

Assessment of Option C6 – Lengthen Hertford East peak services from 8-car to 12-car	
Concept	This option proposes lengthening to 12-car of the only remaining main line service group which is currently anticipated to be shorter than this.
Operational analysis	No impacts identified, as long as all platforms lengthened. However the calling pattern is likely to be dependent on whether any additional tracks are provided by other options.
Infrastructure required	Dependent on calling pattern. Selective door opening would be required if trains were to call at certain stations.
Passenger impact	Additional capacity would be provided in response to the forecast gap.
Freight impact	None identified.
Financial and economic analysis	Not undertaken.
Link to other options	Infrastructure is dependant on calling pattern, linked to other options for this corridor.
Conclusion	Potentially required if other options for increasing frequency not implemented.

Assessment of Option C7 – extend West Anglia to Stratford services through to London Liverpool Street	
Concept	This option seeks to test extending services beyond Stratford to London Liverpool Street, utilising GEML capacity released following Crossrail.
Operational analysis	This would involve: • extended West Anglia via Stratford services operating over the Temple Mills lines as far as Bow Junction where they would then be re-routed onto the current main lines. At Stratford these trains would generally need to use Platform 12, to avoid conflicting with the down GEML stopping trains through Platform 10A • some current GEML trains being re-routed onto the electric lines in the Bow Junction area to the west of the planned Crossrail tunnel portal • most existing Electric line trains being re-routed into the Crossrail tunnels • the remaining residual six tph peak service from the Electric Lines to London Liverpool Street would be restricted to using eight-car Platforms 16, 17 and 18 at London Liverpool Street. Further detailed analysis would be needed to confirm the viability of this option and that it does not prevent resolution of Gap D.
Infrastructure required	Probable track layout and associated signalling changes in the Bow Junction area and in the London Liverpool Street throat.
Passenger impact	This option would improve the frequency from the West Anglia route to London Liverpool Street, with some services routed via Hackney Downs and other services routed via Stratford. Peak trains routed via Stratford would then be extended beyond four-car, providing extra capacity and enabling train loadings to be spread more evenly between services. However Lea Valley – London Liverpool Street journey times are likely to be longer than the more direct route via Hackney Downs.
Freight impact	Dependent on timetable solution and wider freight routeing strategy as described in Chapter 9.
Financial and economic analysis	Economic analysis is required once an infrastructure solution has been identified.
Link to other options	Linked to Options C1 – C5, which would determine the quantum of trains operating from the Lea Valley to Stratford, subject to business case and not preventing resolution of Gap D.
Conclusion	Recommended for further development, subject to business case and not preventing resolution of Gap D.

7.6.7 From the above the RUS emerging strategy for the Lea Valley line is to incrementally increase service frequencies to Stratford. This would initially be utilising existing infrastructure, then building on this with enhancements in the Broxbourne area and potentially the Tottenham Hale area, for both of which further analysis is required. The ultimate solution for this corridor remains the Lea Valley four-tracking scheme, potentially with works in the Bow Junction area to enable as many trains as possible to continue to London Liverpool Street.

7.6.8 The RUS recognises that aspirations also exist to increase service frequencies on the Chingford corridor and potentially from Enfield Town. At present the demand modelling suggests that the main Lea Valley corridor is a higher priority, so frequency increases on other routes should not be at the expense of potential improvements to the main line. It is also recognised that aspirations exist to increase frequencies at less well-served stations in inner east London.

7.6.9 Options to address the capacity, frequency and journey time issues on the Lea Valley line will be developed further by the industry over the coming months.

7.7 Gap D: Great Eastern Main Line

7.7.1 **Table 7.1** forecasts a significant crowding problem on GEML outer services, even when the Greater Anglia RUS recommendations (to replace the current Anglia Intercity rolling stock with EMUs and run an additional train in the high-peak) are included. A shortfall of 4,200 seats in the busiest peak hour is therefore forecast in 2031 by the modelling. This would be spread between the main corridor via Chelmsford and the Southend Victoria route.

7.7.2 The following section includes initial analysis regarding how to respond to this gap. However it is emphasised that, once full 12-car operations are in operation, with as many trains in operation on the route as possible and rolling stock with high density seating (all of which have already been allowed for in the above), no simple interventions remain utilising the standard RUS toolkit of longer or additional trains utilising existing infrastructure or with minor modifications. More complex changes are therefore likely to be necessary, which the RUS is still seeking to identify at time of publication.

7.7.3 The first test is to identify whether any capacity at London Liverpool Street freed up by the implementation of the Crossrail Programme can be utilised for additional outer services.

Assessment of Option D1 – run additional GEML outer services into London Liverpool Street, using capacity freed up following the implementation of the Crossrail Programme	
Concept	This option considers utilising platform capacity at London Liverpool Street freed up by the implementation of the Crossrail Programme for additional fast line services from the Chelmsford area or beyond.
Operational analysis	Following the diversion of most Great Easterm slow line services into Crossrail platform capacity at London Liverpool Street is unlikely to be a particular barrier in running any additional trains. It should be noted that Platforms 16,17 and 18 are restricted to eight-car length and will be required for the all-stations services which will continue to operate into London Liverpool Street after the implementation of the Crossrail Programme at peak times. However this option would require an increase in the number of trains over the fast lines between Shenfield and London Liverpool Street, including at Stratford station where it is anticipated that all trains will call. Without additional infrastructure this is not considered viable.
Infrastructure required	No infrastructure solution identified to date.
Passenger impact	Option not viable, so not applicable.
Freight impact	Option not viable, so not applicable.
Financial and economic analysis	Option not viable, so not applicable.
Link to other options	This option potentially interacts with Option C7, given that both seek to run additional trains to London Liverpool Street.
Conclusion	This option is not believed to be operationally viable without additional infrastructure.

Assessment of Option D2 – implement ERTMS on GEML to create additional train paths	
Concept	This option considers installing European Rail Traffic Management System (ERTMS) such that additional trains could run on the GEML fast lines at peak times.
Operational analysis	The current capacity is delivered using two-minute signalling headways which is at the limit of what colour-light signalling can deliver at mainline speeds and with manual train control. Servce increases which could be delivered with ERTMS are not currently proven. The existing signalling already provides headways closely matched to the capabilities of the rolling stock and other contraints, such as platform occupation at Stratford and Shenfield. In order to deliver greater train frequency ERTMS would need to be combined with a form of Automatic Train Control to remove human variability from the train control process and other contraints would also need to be resolved. Operational viability of ERTMS and Automatic Train Control combined delivering a sub two-minute headway on a mixed use railway is not yet proven.
Infrastructure required	Installation of ERTMS and Automatic Train Control equipment, both on the infrastructure and on passenger and freight locomotives using the route. Contraints at Stratford and elsewhere would also need to be resolved.
Passenger impact	The number of extra train paths that can be delivered will depend on the capability of the technical solution chosen. It is not currently proven that sub two-minute headways can be robustly delivered on a mixed-use railway and as such this option is not considered viable.
Freight impact	Freight locomotives using the GEML would need to be ERTMS equipped.
Financial and economic analysis	No analysis undertaken.
Link to other options	None.
Conclusion	This option is has not been shown to resolve the gap.

Assessment of Option D3 – run three tph additional main line trains into London Liverpool Street	
Concept	This option would involve running additional mainline trains into London Liverpool Street during the busiest peak hour from locations east of Shenfield to be determined. The option would increase the GEML peak service from 24 tph to 27 tph.
Operational analysis	Additional trains cannot be accommodated on the current infrastructure even after capacity is released by the diversion of suburban services into Crossrail. The key constraints are accessing the platform capacity at London Liverpool Street, platform layout at Stratford and Shenfield and appropriate facilities for origin of services at the country end. These would need to be resolved to make the option workable.
Infrastructure required	To increase the number of services on the mainline, a combination of the following infrastructure solutions would be required: • additional infrastructure at the origin to allow for the extra services to start there such as a bay platform or extra loop • alterations to the approaches to London Liverpool Street to allow use of Platform 15 which is 12-car in length and vacated by the suburban services following the implementation of the Crossrail Programme • layout alterations at both Stratford and Shenfield to allow for the platform capacity to cope with the increase in frequency • potential further infrastructure changes to mitigate the performance risk of running this high frequency of service.
Passenger impact	An additional 2,500 seats would be provided by the three additional 12-car trains. Whilst this option would not, in isolation, fully resolve the gap it would provide a significant step towards this and reduce standing distances.
Freight impact	No impact anticipated as freight does not generally run in the peak.
Financial and economic analysis	Detailed appraisal required once a specific infastructure solution has been identified.
Link to other options	The option of extending West Anglia services currently terminating at Stratford through to London Liverpool Street (Option C7) would be impacted by this change in service frequency. This is because both service groups would have to run on the main lines for a distance and there is unlikely to be capacity.
Conclusion	This option is recommended for further development to identify the level of infrastructure it would require. However it is likely to be a high cost solution and detailed analysis will be needed to determine if there is a business case.

7.7.4 From the above the principal finding in this RUS Draft for Consultation is that no simple solution has yet been identified to provide desired significant extra capacity on the Great Eastern Main Line, beyond current commitments. Further analysis is required in this area and extensive additional infrastructure is likely to be required.

7.7.5 As an alternative it is also noted that no capacity gap has been forecast with respect to GE inner stopping services (given the committed Crossrail network to Shenfield), so it is possible that some use of the 'electric' (stopping) tracks for outer suburban trains might be worth exploring. Whilst this might be a possibility it is emphasised that mixing fast and slow services on any pair of tracks reduces the number of trains which can run overall and no specific solution has been considered to date.

7.7.6 Options to address the peak capacity gap on this route will be explored further by the industry over the coming months. Capacity on the Stratford – London Liverpool Street approaches will be considered holistically, with priority being given to any solution identified for GEML capacity rather than the West Anglia route in this section, given the relative sizes of the two gaps. Development will also take into account freight issues in the Forest Gate Junction – Stratford section, as discussed in **Chapter 9**.

7.8 Gap E: Brighton Main Line

7.8.1 **Table 7.1** forecasts crowding on Sussex route outer services (primarily to London Bridge), even following completion of the Thameslink Programme, all practical train lengthening recommended by previous RUSs and inserting of Clapham Junction stops into peak Gatwick Express services to London Victoria. Detailed analysis of the forecasts suggests that standing on some Brighton Main Line services is likely to continue to occur from Haywards Heath and other locations over 20 minutes outside of London.

7.8.2 The size of the gap being forecast is dependent on the current assumption that the Thameslink Programme rolling stock has fewer seats and greater standing capacity compared to conventional rolling stock. Should the Thameslink Programme trains be provided with more seats than the RUS has assumed, the overall size of the capacity gap would increase since there would be less standing space, although the distance over which standing occurs would be less.

7.8.3 The following options seek to respond to this gap:

Assessment of Option E1 – increase envisaged post-Thameslink Programme service level by running additional trains to London Bridge	
Concept	The current post-Thameslink Progamme service specification calls for a total 20 tph high peak service into the low level terminating platforms at London Bridge, in addition to 14 tph through services to the Thameslink corridor. This option would involve running additional trains beyond this level.
Operational analysis	Detailed timetable development work has identified the maximum level of Brighton Main line (BML) service which can be robustly delivered. At London Bridge this timetable currently has the following from the Sussex route at peak times: • eight tph Tulse Hill line • six tph Sydenham line • six tph Brighton Main Line/Coastway • four tph Redhill line • four tph East Grinstead/Uckfield lines • four tph Caterham/Tattenham Corner lines • two tph Wallington line. The RUS has not been able to robustly timetable any additional trains, with key contraints identified including the East Croydon area, and London Bridge platforms.
Infrastructure required	None assumed.
Passenger impact	Not operationally viable so not relevant.
Freight impact	Not operationally viable so not relevant.
Financial and economic analysis	Not operationally viable so not relevant.
Link to other options	None.
Conclusion	Further trains without additional infrastructure are not operationally viable.

Assessment of Option E2 – implement ERTMS on Brighton Main Line to create additional train paths	
Concept	This option considers installing ERTMS such that additional BML trains could run, including on the fast lines north of Croydon, at peak times.
Operational analysis	The current capacity is delivered using two minute signalling headways which is at the limit of what colour-light signalling can deliver at mainline speeds and with manual train control. Service increases which could be delivered with ERTMS are not currently proven. The existing signalling already provides headways closely matched to the capabilities of the rolling stock and other contraints exist, such as platform occupation at East Croydon and at London Terminals. In order to deliver greater train frequency ERTMS would need to be combined with a form of Automatic Train Control to remove human variability from the train control process and other contraints would need to be resolved. Operational viability of ERTMS and Automatic Train Control combined delivering a sub two-minute headway on a mixed use railway is not yet proven.
Infrastructure required	Installation of ERTMS and automatic train control equipment, both on the infrastructure and on passenger and freight locomotives using the route. Contraints in the East Croydon area would also need to be resolved.
Passenger impact	The number of extra train paths that can be delivered will depend on the capability of the technical solution chosen. It is not currently proven that sub two-minute headways can be delivered on a mixed-use railway and as such this option is not considered viable.
Freight impact	Freight locomotives using the Brighton Main Line would need to be ERTMS equipped.
Financial and economic analysis	No analysis undertaken.
Link to other options	None.
Conclusion	This option has not been shown to resolve the gap.

Assessment of Option E3 – construct new tunnel from outer London to create additional train paths on Brighton Main Line	
Concept	The Sussex RUS described a potential long-term option for a new tunnel from the Stoats Nest Junction area inwards towards central London. This option seeks to identify whether this warrants further consideration.
Operational analysis	By providing a new route that does not involve the congested East Croydon corridor this option would enable additional services to run.
Infrastructure required	A new tunnelled railway from south of Purley to Central London. Additional Central London platform capacity would also be needed.
Passenger impact	Dependent on detailed solution.
Freight impact	No impact identified.
Financial and economic analysis	No appraisal undertaken, however given the relatively small size of the gap in relation to other routes it is likely that this scheme would provide poor value for money.
Link to other options	None.
Conclusion	Whilst no appraisal has been carried out it is unlikely this option would be affordable or represent good value for money in the time period concerned. However this conclusion should be kept under review, since it might become necessary in a high growth scenario.

Assessment of Option E4 – construct new BML2 avoiding Gatwick Airport and East Croydon	
Concept	Given the high cost of the long tunnel in Option E3 this possible alternative option is based on the following: • reinstating Lewes – Uckfield, electrifying and fully double-tracking the Uckfield Line • running extra trains over the corridor through Crowborough, Oxted and Sanderstead • reinstating a heavy rail alignment Selsdon – Elmers End, sharing a formation with the existing Tramlink system • running extra trains over the Elmers End – Ladywell corridor • running extra trains over the Ladywell – London Bridge – Charing Cross route. This analysis seeks to identify whether this warrants further consideration.
Operational analysis	There will be no spare capacity (following the Thameslink Programme) over the Ladywell – London Bridge – Charing Cross route. This option is therefore not operationally viable without additional tracks in this area and additional platforms in Central London.
Infrastructure required	Extensive, including resolving the issue above.
Passenger impact	This option misses out the key demand drivers of Haywards Heath, Gatwick Airport and East Croydon, so does not respond to the passenger demand based gap. Journey times for other passengers would be longer than the existing route via East Croydon.
Freight impact	No impact identified.
Financial and economic analysis	Option does not appear to be a viable solution to the gap, so not applicable.
Link to other options	None.
Conclusion	This option is not recommended due to high cost, disbenefits created, not solving the capacity problem and not serving the key demand drivers.

7.8.4 From the above, the long-term RUS recommendation for the Sussex route remains an eventual scheme for a tunnel from the outer London suburbs towards Central London, as described in the Sussex RUS. Whilst this scheme would be very high capital cost no alternative approach has been identified which would enable additional trains to run.

7.8.5 However, whilst the capacity gap on the BML is not forecast to be fully resolved by existing strategy, other than the above, it is significantly smaller than the as yet unresolved gaps on the GEML or SWML in particular so this London and South East RUS considers that these routes must be regarded as a higher priority.

7.8.6 Further work will be required by operators to optimise service patterns to minimise the numbers of standing passengers and the duration of such standing on a train-by-train basis. Implementing the Sussex RUS recommendation of certain peak Gatwick Express services (originating from Brighton) calling at Clapham Junction, as shown in **Table 5.14** in **Chapter 5**, is re-affirmed here.

7.8.7 In addition the RUS emphasises that significant levels of spare capacity could potentially exist during shoulder peak times, especially given that Thameslink rolling stock is anticipated as fixed-formation units. Utilising the shoulder peak capacity effectively is likely to be a key consideration in the future, when faced with alternative options – that require significant capital cost infrastructure interventions.

7.9 Gap F: South West Main Line

7.9.1 **Table 7.1** forecasts significant peak crowding on South West Main Line (SWML) outer trains, with a capacity shortfall of over 6,000 passengers in the high-peak hour even if every main line train is full length.

7.9.2 The RUS has not automatically carried forward the recommendation from the SWML RUS for 12-car inner suburban operations, given that this scheme is now considered to be very high capital cost and the modelled gap is on outer suburban rather than inner suburban services. This option is, however, reappraised below, based on current circumstances.

Assessment of Option F1 – implement 12-car SWML inner suburban operations	
Concept	This option would involve 12-car trains, generally with extended platforms, moving beyond the 10-car lengthening planned in CP4.
Operational analysis	12-car trains may involve longer turnrounds at terminal stations and increased junction margin times. Increased turnround times may increase the number of platforms required for suburban services at London Waterloo, with a likely impact on main line platform arrangements.
Infrastructure required	Platform extensions from 10-car to 12-car would be required throughout the SWML suburban network. However selective door opening may be utilised at certain difficult sites. London Waterloo station would need to be completely rebuilt. This would be an extremely complex, disruptive and expensive scheme.
Passenger impact	Significant capacity for extra passengers would be provided in the high-peak on inner services. However if stopping services via Wimbledon were lengthened no extra capacity would be provided for outer suburban passengers which is where the gap lies. Lengthening those outer suburban trains which run fast from Surbiton is therefore a higher priority.
Freight impact	None anticipated.
Financial and economic analysis	Not undertaken. However given the envisaged high cost and no evidence of a gap this is likely to be poor value for money.
Link to other options	None.
Conclusion	Not recommended since the forecast capacity gap is on outer services so this would not solve the problem. It is emphasised that 12-car inner suburban capability at London Waterloo is complex and high cost. However this conclusion should be kept under review.

7.9.3 The following options seek to respond to the gap on SWML outer suburban services:

Assessment of Option F2 – run double-deck trains on SWML outer services	
Concept	This option would involve running double-deck trains, perhaps on the Southampton – London Waterloo corridor.
Operational analysis	Double-deck trains are likely to require increased station dwell times, hence a potential impact on route capacity. Calling patterns would need to be determined with this in mind.
Infrastructure required	Extensive gauging works would be required, including through all the tunnels on the route. This would be extremely disruptive and expensive.
Passenger impact	Extra on-train capacity would potentially be provided in the high-peak on outer services. However careful design would needed in the design of any double-deck unit to avoid dis-benefits. This would include factors such as access for the disabled and personal security issues (given the reduced sightlines through the train).
Freight impact	Gauging works for double-deck vehicles are likely to have synergies with enabling higher and wider freight containers to operate.
Financial and economic analysis	No appraisal has been carried out.
Link to other options	None.
Conclusion	Not recommended due to insufficient evidence that the gap would be resolved. In addition the high cost of this scheme is such that there is unlikely to be a robust business case.

Assessment of Option F3 – run 16-car trains on SWML outer suburban services into Lonfon Waterloo International	
Concept	This option would involve running 16-car trains into London Waterloo International from SWML destinations. Trains would be formed of two eight-car trains joining at a location such as Woking or Basingstoke from separate origin points.
Operational analysis	A flat crossing move into London Waterloo International would be impractical from the SWML, since the 16-car platforms are only readily accessible from the Windsor lines. The option therefore requires additional grade separation. Splitting and joining would increase operational complexity and potentially reduce the number of trains which could run overall. Junction margins would also increase in the station throat due to the low speeds and the length of a 16-car train, reducing train frequency.
Infrastructure required	This would require a new two-track flyover in the Clapham Junction area to take the SWML tracks across to the north side of the railway corridor. Major remodelling at Queenstown Road would also be required. In addition 16-car platforms would be required at a location such as Woking or Basingstoke. This would involve extensive signalling and track layout changes.
Passenger impact	Capacity for extra passengers would be provided by the longer trains. However this would need to be balanced against impacts of the necessary timetable change, for example additional journey times due to the splitting and joining.
Freight impact	Dependent on infrastructure solution.
Financial and economic analysis	No appraisal has been carried out.
Link to other options	None.
Conclusion	Potentially needed in the longer term if other options cannot be identified.

Assessment of Option F4 – run four tph additional main line trains into London Waterloo	
Concept	This option would involve running additional trains in the busiest peak hour into London Waterloo from Basingstoke which option would increase the SWML peak service from 24 tph to 28 tph.
Operational analysis	Additional trains can not be accommodated on the current infrastructure due to capacity constraints at London Waterloo (station throat and platform lengths), Queenstown Road, Woking Junction and Basingstoke. Queenstown Road constrains the removal of mainline empty stock from London Waterloo during the morning peak so any increase in frequency of the mainline services will require removal of this constraint at Queenstown Road. These constraints would need to be resolved in order to run this level of service. Operating this level of service will have a negative effect on performance without further mitigation works. Signalling headways inwards of Surbiton are not, in theory, a constraint to this option but would require detailed investigation.
Infrastructure required	To increase the number of services on the mainline, a combination of the following infrastructure solutions would be required: • remodelling of London Waterloo station throat and approaches, increasing the number of parallel movements and 12-car capable platforms • alterations to the layout at Queenstown Road and re-introduction of Platform 1 • as mitigation for the removal of firebreak paths from the timetable, the lines from Clapham Junction to London Waterloo could be reconfigured to allow for a reversible Main Fast line in addition to the two current main fast lines, improving the robustness of Waterloo operations • grade seperation of Woking junction • infrastructure to allow services to start at Basingstoke.
Passenger impact	An extra 3,200 seats would be provided by the extra four 12-car trains. Whilst this option would not, in isolation, fully resolve the gap it would provide a significant step towards this and reduce standing distances.
Freight impact	No impact anticipated as freight does not generally run in the peak.
Financial and economic analysis	Detailed appraisal required.
Link to other options	The alterations to Queenstown Road required for this option will also be required for Option G2 (increasing the service level on the Windsor lines to 18 tph).
Conclusion	This option is recommended for further development to identify the level of infrastructure it would require. However it is likely to be a high cost solution and detailed analysis will be needed to determine if there is a business case.

7.9.4 From the above the RUS concludes that there is no simple solution to SWML route capacity beyond train lengthening, which primarily benefits inner suburban services. The size of the gap suggests that all outer suburban trains will need to run at full length, including the Salisbury route (which would require additional diesel stock unless electrified) and those services from Guildford via Cobham which run fast from Surbiton. Beyond this longer trains or double-deck trains are both potential options in the longer term but each of these would be high cost and have major technical challenges.

7.9.5 The key to solving SWML route capacity is the need to run more trains between London Waterloo and the route beyond Woking. **Option F4** uses this approach but this would require major infrastructure works, including grade separation of the junctions and remodelling at Queenstown Road, Basingstoke and the London Waterloo approaches. Any additional trains would put significant pressures on train performance on this route.

7.9.6 Further development of options for the SWML outer services is planned by the industry over the coming months.

7.10 Gap G: Windsor lines

7.10.1 **Table 7.1** identified a peak capacity gap of around 700 passengers on the Windsor lines. This includes the additional train planned under the High Level Output Specification (increasing from today's 15 trains per hour to 16 trains per hour), and further 10-car operations throughout the route to Reading. This additional capacity primarily alleviates existing suppressed demand and modelling suggests that demand is likely to fill up quickly, with a peak capacity challenge still then remaining.

Assessment of Option G1 – run 17 tph at peak times on the Windsor lines	
Concept	This option seeks to test further increasing service frequency to allow the operation of 17 tph service at peak times.
Operational analysis	The additional platform capacity at London Waterloo, following reopening of the international platforms, would enable SWML main line trains to be held at London Waterloo until after the peak, before proceeding to Clapham Yard. Given that these currently make this move via the Windsor lines in the main part of the peak. This facilitates a service increase on the Windsor lines. Detailed timetable development work through the BAA Heathrow Airtrack scheme has concluded that two additional trains per hour would be operationally viable once the disused platforms at Waterloo have been bought back into use as anticipated. Under the specific timetable considered two tph from Heathrow would run in the peak hour, but with one post-High Level Output Specification train moved out of the high peak hour into the shoulder-peak as a result. This therefore represents a net increase of one service in the 08:00 – 08:59 arrival period at London Waterloo, making 17 trains in total.
Infrastructure required	This requires the disused International platforms at London Waterloo to be recommissioned, as planned in CP4. Additional infrastructure enhancements may be beneficial to mitigate the impacts of longer road closure times at level crossings on the Windsor lines west of Clapham Junction.
Passenger impact	This option would provide a further 10-car additional train to central London, alleviating congestion on the route. However additional demand would be created by the increased frequency so this is unlikely to resolve the gap in isolation, especially if any trains have a Heathrow origin point. As the Barnes – Twickenham two-track section constrains capacity, increasing the number of trains over this section is likely to result in journey time impacts for fast services (of up to four minutes additional time). Service options via Hounslow also exist.
Freight impact	Whilst freight does not generally run in the peak additional trains at off-peak times would reduce opportunities for freight paths, including those from Kent to the route via Acton Central (principally those destined for the Midland Main Line)
Financial and economic analysis	A detailed business case for this level of service is being developed as part of the Airtrack development process. However it is likely that a Windsor lines service level of at least 17 tph would be recommended to resolve the crowding gap on this corridor, even without a Heathrow Airport origin point.
Link to other options	None.
Conclusion	Likely to be recommended, subject to business case.

Assessment of Option G2 – run 18 tph at peak times on the Windsor lines	
Concept	This option seeks to test further increasing service frequency to allow the operation of 18 tph service at peak times which would require additional infrastructure at Queenstown Road.
Operational analysis	As with Option G1 the additional platform capacity at London Waterloo would enable trains to be held at London Waterloo until after the peak, before proceeding to Clapham Yard. This facilitates a service increase on the Windsor lines. However this option would also require providing additional capacity in the Queenstown Road area, to enable further a additional high peak train to run.
Infrastructure required	As with Option G1 this requires the disused International platforms at London Waterloo to be re-commissioned, as planned in CP4. In addition at Queenstown Road the following changes would also be required: • Platform 1 reopened • track layout changes to enable both Platforms 2 and 3 to be used in the down direction in the morning peak. As with Option G1 additional infrastructure enhancements may be beneficial to mitigate the impacts of longer road closure times at level crossings.
Passenger impact	This option would provide a further 10-car train to central London, alleviating congestion on the route. The increase from today's 15 tph to 18 tph, plus extensive 10 car operations is likely to resolve the gap, though it is recognised that any trains from Heathrow Airport would increase demand. As the Barnes – Twickenham two-track section constrains capacity, increasing the number of trains over this section is likely to result in journey time impacts for fast services over this section beyond that identified for Option G1. Service options via Hounslow also exist.
Freight impact	Whilst freight does not generally run in the peak additional trains at off-peak times would reduce opportunities for freight paths, including those from Kent to the route via Acton Central (principally those destined for the Midland Main Line).
Financial and economic analysis	Detailed economic analysis is required.
Link to other options	None.
Conclusion	Likely to be recommended, subject to business case.

7.10.2 At first glance this does not represent a major challenge in comparison to some other routes, given the much lower level of train service into the Windsor side of London Waterloo than on the SWML side. However there are significant operational constraints, including limited track capacity in the Queenstown Road area, critical flat junctions at Barnes and Feltham, a mix of fast and stopping services over two-track corridors and wider constraints such as numerous level crossings. The gap interacts significantly with the potential BAA Heathrow Airtrack scheme, as described later in **Chapter 8**. This would involve an additional two trains per hour service from Heathrow Airport Terminal 5 to London Waterloo, together with services from Heathrow to Reading and Guildford.

7.10.3 **Option G1** considers running further additional trains to London Waterloo, based on committed infrastructure. No specific origin point has been assumed at present as this does not affect the analysis.

7.10.4 It is likely that implementation of **Options G1** and **G2** would provide sufficient capacity to resolve the gap for some years. Detailed consideration of the mix of services on these routes, including the balance between the main Richmond corridor and the Hounslow loop is needed, together with consideration of level crossing downtimes. Beyond this point given that both the extra trains and the Heathrow Airport origin point have significant potential in the longer term to release demand which is currently suppressed by lack of supply, there may also be a case for going further, as discussed in **Option G3**.

7.10.5 A further factor to consider in a future decision regarding **Option G3** is that increasing train frequency generally offers more benefits than train lengthening, **Option G4** therefore tests, as an alternative to **G3**, running additional trains on the Windsor lines beyond the 18 trains per hour which would be provided by **Option G2**. This would involve major reconfiguration of the London approaches from Barnes Junction inwards, at the time of London Waterloo resignalling.

Assessment of Option G3 – implement 12-car operations on Windsor lines	
Concept	This option would involve running 12-car trains, generally with extended platforms, moving beyond the 10-car lengthening mostly planned in CP4.
Operational analysis	12-car trains may involve longer turnarounds at terminal stations and increased junction margin times. Certain routes would not be able to be lengthened, for the following reasons: • Heathrow Airtrack trains could not be extended beyond 10-car due to platform lengths at Heathrow Airport Terminal 5 • Kingston loop trains could not be extended beyond 10-car due to platform lengths on the Wimbledon corridor, unless Option F1 was also implemented.
Infrastructure required	Platform extensions from 10-car to 12-car would be required throughout the route. However selective door opening could potentially be utilised at a small number of difficult sites. However this would not be a solution for the two routes described above.
Passenger impact	Capacity for 20 per cent extra passengers would be provided on the lengthened trains, alleviating crowding.
Freight impact	None anticipated.
Financial and economic analysis	No analysis undertaken at present, given that Option G1 or potentially Option G2 appear to resolve the gap.
Link to other options	None.
Conclusion	This option does not appear to be required to bridge the gap under current forecasts, but this conclusion should be kept under review.

Assessment of Option G4 – Reconfigure London Waterloo to Barnes Junction and run additional trains	
Concept	This longer-term option would involve major works to completely remove the existing capacity constraints between London Waterloo and Barnes Junction. Four tracks would be provided over this whole section, requiring removal of the disused Nine Elms flyover at Queenstown Road.
Operational analysis	Over this partial route section at least eight trains per peak hour extra would be viable, with the constraint in this area moved from Queenstown Road area throughput to Vauxhall platform capacity. However due to other constraints on the route it has not been demonstrated that any extra trains would be operable beyond those identified in Option G2. The principal constraints would then be: • the mix of fast and slow trains over the Barnes – Twickenham corridor • the capacity of Feltham junction. Changes would therefore be required on the Richmond and/or Brentford routes to accommodate more trains.
Infrastructure required	This option would involve reinstating four Windsor line tracks between London Waterloo and Clapham Junction. The analysis has assumed that London Waterloo – Barnes Junction would be reconfigured with four tracks nominally paired by direction (Richmond and Brentford) rather than an up pair and a down pair. The Queenstown Road area would be four-tracked, with platform faces on at least two lines. The Nine Elms Flyover, currently connecting the Kent lines to the London Waterloo approaches, would be removed.
Passenger impact	Option not currently proven as viable so no impact identified.
Freight impact	No impact identified.
Financial and economic analysis	No analysis undertaken as no specific option identified to date.
Link to other options	None.
Conclusion	Given the potential to provide significant extra capacity on the London approaches this option should be considered at time of London Waterloo resignalling.

7.10.6 From the above the principal RUS recommendation is to run additional trains, subject to business case, either as part of a revised timetable upon implementation of the BAA Heathrow Airtrack scheme or as a standalone timetable change when demand requires. It is noted that additional capacity at Queenstown Road would be required to increase services to 18 trains per hour at peak times. To run 17 trains per hour it is not strictly necessary under timetable planning rules to enhance the infrastructure at this location, though it would assist significantly with robust delivery of performance given the increased numbers of trains through this critical location.

7.10.7 The RUS recognises that running additional trains on this corridor potentially impacts on level crossing downtimes to road traffic in the Richmond area and further work may be required on this issue, which is not affected by whether the trains concerned have a Heathrow origin point. Alternative routeing options via Hounslow also exist for the additional services.

7.10.8 Beyond the above changes a longer-term scheme could be 12-car operations (on most Windsor Line services) and/or reconfiguring of the London Waterloo to Barnes Junction corridor; removing the disused Nine Elms flyover and completely removing the constraint at Queenstown Road. The combination of this work would most likely be undertaken at the time of London Waterloo resignalling, but further as yet unidentified major service or infrastructure changes would also be needed elsewhere on the route to facilitate any additional trains, potentially linked with the resignalling of the Feltham area. Only then would the potential capacity of the disused platforms at London Waterloo International be able to be fully exploited. Further development would be needed on the specific details of such a scheme.

7.11 Gap H: Elephant & Castle corridor

7.11.1 **Table 7.1** identified that there will be a significant peak capacity gap on the Elephant & Castle corridor, principally on services running via Herne Hill.

7.11.2 The following option seeks to bridge this gap.

Assessment of Option H1 – implement 9, 10 or 12-car operations on the Wimbledon Loop	
Concept	Following completion of the Thameslink Programme the RUS anticipates the following service: • four tph from the Streatham corridor to the Blackfriars bay platforms via Tulse Hill • six tph from the Streatham corridor to London Bridge via Tulse Hill. At least two tph of these would be combined as circular services running via St Helier. This service pattern reflects the operational constraints identified in the South London RUS, with crossing moves from the Herne Hill lines to the Thameslink tracks in the Elephant & Castle area not considered viable. This option would involve lengthening these trains to provide additional capacity.
Operational analysis	Limited impact identified although longer trains may involve longer turnarounds at terminal stations and increased junction margin times.
Infrastructure required	Platform extensions across the route would be required. The principal difficulties include the need for major works at Tulse Hill, Herne Hill and Elephant & Castle. Whilst in theory selective door operation could be utilised, it is unlikely to be operationally practical to implement selective door operation at all of these, given the train loadings so close to central London. This scheme therefore requires complex additional infrastructure.
Passenger impact	Significant extra capacity would be provided in response to the gap.
Freight impact	No impact identified.
Financial and economic analysis	No economic analysis undertaken, however given the envisaged high cost and other ways of responding to the gap this is likely to be poor value for money.
Link to other options	None.
Conclusion	This option cannot be recommended at present due to the significant complexity (and therefore cost) involved in extending platforms beyond eight-car. However this conclusion should be kept under review.

7.11.3 The conclusion from the above is that the Elephant & Castle corridor potentially requires a complex infrastructure scheme to provide additional seats on trains using the route. However, such a scheme would be disruptive to implement and it is unclear at present if it would have a viable business case. As an alternative the use of higher density rolling stock, similar to that used by London Overground, may be more appropriate given the relatively short duration of journeys involved. However it is possible that this may lead to passengers standing for longer periods than the 20 minutes currently considered acceptable, so further consideration is required.

7.11.4 In addition the RUS is also mindful that TfL have a long-term aspiration for a southern extension to the London Underground Bakerloo Line, extending this route via Camberwell into south east London. Given the extra capacity such a scheme would create to the area concerned it is possible that this would reduce the capacity gap on National Rail lines. The RUS therefore supports further development of this scheme.

7.12 Gap I: Orbital routes

7.12.1 **Table 7.1** identified that, without further interventions, there will continue to be a significant and increasing peak capacity gap on the West London Line (WLL), with an ongoing increase in demand on this key orbital route. The capacity gap applies to both London Overground and Southern services, though options identified have at present been restricted to Southern services only, since high capacity Class 378 vehicles have recently been introduced on the Overground and any changes to these would also create significant complications on the North London Line. Whilst rail usage on this corridor mostly comprises local flows on the WLL itself it is also important that many through journeys to this line are made from the Watford Junction and Balham routes immediately beyond.

7.12.2 One of the more immediate capacity challenges at present appears to be the service between the WCML and WLL in the morning peak, given that this very limited service forms the only link between Watford Junction and Kensington Olympia corridors. **Option I1** considers timetable changes in response to this issue.

7.12.3 The approach in **Option I1** would mitigate an immediate issue, but would not add significantly to capacity overall or resolve the significant crowding issues at the Clapham Junction end of the route. **Option I2** therefore considers the next step.

Assessment of Option I1 – increase West London Line – Watford Junction (or beyond) peak service to two tph	
Concept	This option would increase the present service from the Watford Junction route to the WLL to a train every 30 minutes. In the short- term a high priority variant of this option appears to be to optimise the timings of the existing morning high peak trains, given that there is currently a 73-minute gap in an otherwise hourly service.
Operational analysis	The main consideration is timings on the WCML, including ensuring that turnbacks at Watford Junction and/or Milton Keynes are operationally viable. Analysis is currently ongoing but the RUS considers that minor improvements are likely to be operationally viable. However no solution for a two tph peak service has been identified at present.
Infrastructure required	None required.
Passenger impact	The Watford Junction – Kensington Olympia route suffers from lengthy gaps in frequency at present, including a gap in departures from (for example) Wembley Central between 07:49 and 09:05 which leads to severe overcrowding. This option would reduce the gap to 30 minutes which would significantly reduce crowding. Any reduction in the duration of the gap would also be a major improvement.
Freight impact	No impact identified.
Financial and economic analysis	Not undertaken.
Link to other options	None identified.
Conclusion	Recommended for further development to identify an operationally viable solution. The short-term emphasis should be on reducing the gap to no more than 60 minutes, with 30 minutes in the longer term.

Assessment of Option I2 – lengthen Southern WLL services to 8-car	
Concept	This option would length Southern services on the WLL from four-car to eight-car. These services operate Croydon/Clapham Junction – Shepherd's Bush/Milton Keynes.
Operational analysis	No impact identified south of London or on the WLL itself. On the WCML the bay platform (2A) at Milton Keynes is only four-car in length. Certain WLL services in the evening utilise this platform and cannot readily be re-platformed due to London Midland services using Platform 2. Further work would therefore be required to identify an alternative turnback location for these services unless this platform is extended.
Infrastructure required	Platform extensions at Clapham Junction, Imperial Wharf, West Brompton and Shepherds Bush.
Passenger impact	Additional capacity through lengthened services would be provided. This would help with peak commuter capacity and other peak loadings on the route, for example such as Christmas shopping at Westfield, Chelsea football matches and events in the Earls Court area.
Freight impact	No impact anticipated.
Financial and economic analysis	The following table outlines the appraisal results. The capital costs shown include platform lengthening at all stations other than Milton Keynes, for which an operational solution is assumed, but has not been included in the economic analysis.

30-year appraisal	**£million (2002 PV)**
Costs (present value)	
Investment cost	19.4
Operating cost	62.1
Revenue	-37.8
Other Government impacts	7.6
Total Costs	**51.3**
Benefits (present value)	
Rail users benefits	168.1
Non users benefits	45.6
Total quantified benefits	**213.7**
NPV	**162.4**
Quantified BCR	**4.2**

Note: All figures are presented in 2002 market prices
This option represents very good value for money.

Link to other options	None.
Conclusion	This option is recommended as soon as the rolling stock becomes available. Given the need for dual voltage rolling stock for any services north of Shepherd's Bush this is likely to be linked to the introduction of new Thameslink rolling stock.

7.12.4 The conclusion from the above options is that in the short term, timetable changes are recommended for investigation, focusing on reducing the peak frequency gap from the WCML to the WLL to no more than 60 minutes. The next step, potentially in Control Period 5, would be eight-car Southern operations on the WLL, which would provide a step-change in capacity and respond to demand generators such as the redevelopment of the Earls Court area. Provision of a 30-minute peak service from the WCML to the WLL is also recognised as desirable, but at present the RUS has not been able to identify an operationally viable means of achieving this.

7.12.5 On orbital routes generally the RUS also notes significant ongoing demand growth. On the North London Line and East London Line in particular it is possible that further train lengthening and frequency increases might be required and this will be considered further over the coming months.

7.12.6 In the longer term it is likely that a new interchange station being provided to the High Speed 2 route and Crossrail in the Old Oak Common area would further increase demand on the WLL and North London Line. This would especially be the case in the event of any temporary terminus, prior to the completion of a tunnelled section to London Euston. Under these circumstances dispersal of a proportion of High Speed 2 and Crossrail passengers via predominantly four-car London Overground services would be a major challenge. The RUS therefore recommends further demand forecasting analysis focusing on access to Old Oak Common in general, as discussed in **Chapter 8**.

7.13 Summary

7.13.1 This chapter has developed a strategy for providing sufficient peak capacity for each of the routes into London. Based on current demand forecasts it has identified that most gaps are capable of being resolved at a route corridor level, though this conclusion would change significantly in a high demand scenario and the RUS has not considered individual train loadings.

7.13.2 The strategy includes the following stages:

- implementing currently committed schemes. This includes the Thameslink and Crossrail Programmes, a significant train lengthening programme in the London suburbs and a small number of additional services
- implementing uncommitted recommendations from previous RUSs and similar studies. This includes further train lengthening, additional trains on some routes and timetable changes such as inserting Clapham Junction calls in peak Gatwick Express services. Beyond this the strategy includes the Intercity Express Programme (or similar) and the construction of a new High Speed 2 line to the north
- new interventions from this London and South East RUS, including further train lengthening on routes such as the WLL. In addition extensive changes are recommended for further development on the GWML; extending Crossrail services to Reading, a new Thames Valley to Paddington peak shuttle and incorporating the Heathrow Express service to run as part of Crossrail. Further interventions being considered include additional trains on the Windsor Lines (linked to the BAA Heathrow Airtrack scheme) and an updated development plan for the West Anglia route
- significantly more complex schemes to resolve the most significant remaining peak capacity gaps on the SWML and GEML. These would involve major infrastructure upgrades, and specific details have not been identified at present.

7.13.3 Further detailed work is planned following the consultation period prior to publication of the final RUS, taking into account stakeholder views where possible.

8. Network connectivity

8.1 Introduction

8.1.1 **Chapter 7** developed a strategy for alleviating future crowding on the existing rail network, by providing additional on-train capacity for central London commuters in the morning and evening weekday peak periods.

8.1.2 This chapter moves beyond merely responding to the demand being forecast on the existing network, by looking at where additional connectivity might be provided to/from key demand drivers which are not currently well served by train services. This approach has potential to alleviate congestion on other transport modes, by encouraging a shift from road to rail-based travel. Such an outcome would be consistent with current Department for Transport (DfT) planning policy and the Mayor of London's strategy.

8.1.3 Improving rail connectivity is a key aspiration of industry stakeholders. For example Transport for London's (TfL's) recommended standard for stations within Greater London is a four trains per hour frequency from first to last train, enabling a turn-up-and-go service. Beyond this new rail, Underground, Docklands Light Rail (DLR) and tram routes have been provided in recent years to improve travel options to some areas of the capital (for example Docklands and more recently the Olympic Park area), encouraging their redevelopment. Other areas covered by this Route Utilisation Strategy (RUS), especially within the capital, have further potential for new rail links, and the key gaps and opportunities with respect to the major generators of demand in this category are described below.

8.2 Gap J – access to Heathrow Airport

8.2.1 The first gap identified has been access by rail to the UK's busiest airport at Heathrow Airport. Based on the existing network and committed schemes only, the airport will be accessible directly by rail by means of the following:

- four trains per hour Heathrow Express non-stop service from London Paddington
- four trains per hour Crossrail stopping service via Central London by 2018
- London Underground Piccadilly Line service via Central London.

8.2.2 In addition to the above there are extensive bus services from Heathrow Airport. Many of these are local in nature but several are of strategic importance to rail passengers. The main ones of relevance to this RUS are:

- RailAir coach link from Reading, providing connections to Great West Main Line (GWML) services
- RailAir coach link from Woking, providing connections to South West Main Line (SWML) services
- local bus to stations served by GWML–stopping trains, including Maidenhead, Slough and Hayes & Harlington
- bus links from Watford, providing connections to West Coast Main Line (WCML) services, though few long distance trains currently call at this location
- local bus from Feltham, providing connections to services via Richmond and providing an alternative to travel via Central London from much of South London
- bus links from High Wycombe, providing connections to the Chiltern route.

8.2.3 For longer distance passengers there is currently an extensive coach network between Heathrow Airport and towns and cities throughout the country. The extensive nature of this network is almost certainly at least in part due to the difficulty in accessing the airport by rail from certain directions.

8.2.4 However it is recognised that buses are low capacity and relatively unpopular with passengers to and from airports, especially where they form part of a journey principally made by rail. For this reason the RUS considers the following to be strategic level connectivity gaps at Heathrow Airport:

- lack of rail connectivity between Heathrow Airport and the SWML from Woking and beyond
- lack of rail connectivity between Heathrow Airport and the GWML from the west, principally at Reading but also including stations such as Slough and Maidenhead
- lack of rail connectivity between Heathrow Airport and the Windsor lines, especially from the Richmond/Clapham Junction direction
- lack of rail connectivity between Heathrow Airport and cities in the Midlands, northern England and Scotland.

Table 8.1 – potential Heathrow connectivity options

Option	Scheme	Service and demand issues	Status
A6 (in Chapter 7)	Heathrow Express extension into Crossrail	Incorporate Heathrow Express into Crossrail, running on the relief lines at least at peak times (for further detail refer to **Chapter 7**). This option would improve connectivity to Heathrow Airport, by increasing the central London Crossrail to Heathrow Airport frequency and by allowing direct Heathrow Airport trains from both the Abbey Wood and Shenfield eastern branches.	Recommended for further development, subject to business case, to resolve GWML peak capacity issues as described earlier. Also responds to this Heathrow Airport connectivity gap.
J1	British Airports Authority (BAA) Heathrow Airtrack scheme	New two tph Waterloo – Staines – Heathrow Airport T5 service.	Currently under development through the Transport and Works Act process.
		New two tph Reading – Ascot – Heathrow Airport T5 service.	
		New two tph Guildford – Woking – Heathrow Airport T5 service (one tph at peak times).	
		Extension of two tph of the existing Heathrow Express service to Staines.	
J2	Heathrow Airport Western connection	Enables direct local or longer distance services to run to Heathrow via Slough.	Potentially requires further investigation.
J3	New High Speed Rail station complex serving Heathrow Airport directly	Construction of HS2 spur from the north to enable some services to run to Heathrow Airport.	The Government's proposed high speed rail strategy includes a new station at Heathrow Airport, to be provided when the HSR network includes Manchester and Leeds.
K1 (in Table 8.2)	Increasing connectivity to Old Oak Common from WCML South	See Crossrail option in section 8.3. Passengers from WCML South for Heathrow Airport would have a single change at Old Oak Common.	Requires further investigation.

8.2.5 **Table 8.1** summarises options in response to these Heathrow Airport connectivity gaps:

8.2.6 **Option A6** was recommended in **Chapter 7** for further development since it responds to the future gap relating to Thames Valley to London peak commuter capacity (it would facilitate a new four trains per hour Thames Valley peak commuter shuttle). It would also increase connectivity to Heathrow Airport, enabling the airport to be served by eight trains per hour from Crossrail central London stations rather than four trains per hour. Both eastern branches of Crossrail would see direct trains to Heathrow Airport, enabling both Canary Wharf and Stratford to see such trains rather than a choice needing to be made between these two as alternatives. All terminals at Heathrow Airport would be served by Crossrail, rather than a choice needing to be made between the Terminal 4 and Terminal 5 routes.

8.2.7 **Options J1 and J2** represent long-standing aspirations to improve local connectivity to Heathrow Airport, with the principal aim of increasing the public transport modal share to the airport. Various service options exist for **Option J2**, though the RUS notes that direct Reading – Heathrow Airport trains (albeit only to/from T5) are likely to already have been provided by **Option J1** at this stage.

8.2.8 The RUS is aware that **Option J3** has significant stakeholder support, but detailed analysis suggests that, if included from the outset, it would substantially increase the costs and reduce the benefits of the initial London – Birmingham phase of the HS2 scheme. It is therefore only recommended at a subsequent later stage when a wider national high speed rail network is in place.

8.2.9 **Option K1** is described in the analysis below.

8.2.10 No economic analysis has been undertaken by the RUS in connection with any of the above. Stakeholder feedback is therefore sought during the consultation phase to influence further development of options before publication of a final strategy.

8.3 Gap K – maximising the benefits of Crossrail

8.3.1 The Crossrail Programme will provide a major increment to connectivity across London on an east-west axis, with a high frequency service across Central London at peak times. New travel opportunities will be created and journey times reduced. As indicated in **Chapter 5** this level of service is forecast to provide sufficient capacity on this corridor.

8.3.2 However the London and South East RUS scoping document noted the following as a potential gap for this RUS:
"Mismatch between a) the presently planned Crossrail capacity, service patterns and routeings at both western and eastern ends, and b) the predicted future demand; and the associated impact on non-Crossrail services".

8.3.3 The primary issue is associated with the western end of Crossrail, since in the base position over half of services running westbound through the Central London tunnel will not carry passengers beyond London Paddington. The trains turning at this location will be:

- 14 of 24 trains per hour in the peak
- eight of 16 trains per hour in the off-peak.

The RUS does not consider this consistent with maximising the economic benefits of the Crossrail tunnels in the longer term.

8.3.4 In addition it is noted that the following factors now also apply:

- as described above **Chapter 7** (**Option A6**) recommended further development, subject to business case, of the concept of incorporating the four trains per hour Heathrow Express service into the Crossrail network. This would principally be to free up capacity to enable the anticipated growth in Thames Valley commuters to be accommodated. If implemented it would reduce the number of Crossrail trains terminating from the east at Paddington to 10 trains per hour peak/four trains per hour off-peak. Some of the Heathrow Airport trains could potentially originate at Staines, consistent with the BAA Heathrow Airtrack proposals shown in **Option J1** in **Figure 8.1**
- the Government's High Speed 2 strategy includes a new station at Old Oak Common, to which all Crossrail services would be extended.

8.3.5 Based on the above the RUS works on the basis that at least 10 trains per hour Crossrail services from the east will need to terminate at a new Old Oak Common High Speed 2 interchange station at peak times. The RUS considers that extension of these trains westwards would enable significant benefits, in the event that such an extension was physically, operationally and economically viable. It might also reduce the infrastructure requirements for turnback moves at the new station.

8.3.6 In considering potential extensions it is noted that increasing services on the GWML relief lines would not be consistent with freight requirements and is unlikely in any case to be justified by demand. The RUS has therefore considered other potential lines of route for extension of these trains. Given the geography of the area the physically practical options appear to be as follows:

- extension via Wembley Central, taking over the DC lines to Watford Junction
- extension via Wembley Central, taking over the WCML slow lines
- extension via the Chilterns line towards High Wycombe
- extension via South Acton towards Brentford and beyond
- extension via South Acton towards Richmond and beyond.

8.3.7 All of the above potential options require significant infrastructure changes. In considering choices between them the RUS highlights that the following factors would need to be considered:

- the WCML Crossrail extension options appear to be highly relevant to the implementation of High Speed 2, both during the construction phase and following its completion. WCML Crossrail options have potential to reduce both train and passenger numbers at London Euston, assisting with the construction phase and after implementation. This would also apply to passengers at Euston Underground station and on the London Underground Northern Line (both branches) and Victoria Line
- routes having high demand would be prioritised above those having low demand. The ideal solution would be a route requiring 10 trains per hour peak/4 trains per hour off-peak (assuming the Heathrow Express changes described) since this would remove the need for planned turnback moves in central London during normal operations
- all of the route extension possibilities described in 8.3.6 would involve major infrastructure works, with new-build sections of railway in an urban area and grade-separated junctions. No detailed assessment has been carried out by the RUS
- in the absence of other major issues routes having infrastructure characteristics (platform lengths, electrification) closest to those of other Crossrail branches would be the easiest to connect to. However given the other considerations above this is unlikely to be a deciding factor.

8.3.8 The RUS also considered two additional peak-only options on the GWML, linking into peak capacity recommendations from **Chapter 7**. These were:

- inclusion of two additional high-peak trains from the GWML relief lines into Crossrail, one from each of Henley-on-Thames and Bourne End. This is a small-scale possibility, running these across London through to the Great Eastern or Abbey Wood route, rather than into London Paddington. However the RUS has not considered this further given the small numbers of trains involved and the need for electrification and 200-metre length capability of the branches
- London Paddington peak shuttle, as recommended by **Chapter 7**, into Crossrail. However the RUS has not considered this further since the rolling stock likely to operate such a service would be unlikely to be internally configured for Crossrail-type operations and there are likely to be major operational problems in crossing at peak times from the fast lines outside London Paddington into the Crossrail tunnels.

8.3.9 **Table 8.2** describes the key features associated with each of the options described in 8.3.6.

Table 8.2 – options reviewed for a possible additional Crossrail western branch

Ref	Route	Infrastructure issues	Other comments
K1	WCML slow lines	Requires new connection in Old Oak Common area.	Would free up platform capacity at London Euston, and abstracts passengers from London Euston station itself, which is likely to be of considerable benefit to the dispersal of passengers from HS2. This would therefore be of assistance during the construction of HS2 and afterwards. Potential four tph stopping service to Tring/Milton Keynes with six tph peak additionals. Milton Keynes/ Northampton flows transferred to WCML fast lines into Euston following HS2.
K2	WCML DC lines	Requires new connection in Old Oak Common area.	Capacity freed up at London Euston would be much more limited than the above. Alternative options also potentially exist for these services, for example extending Bakerloo Line services to Watford Junction and/or introducing a Stratford – Watford service via Primrose Hill.
K3	Chiltern route to High Wycombe via Ruislip	Requires new connection in Old Oak Common area since existing connecting route would be utilised by HS2.	Unlikely to be capacity available for new services following the Evergreen 3 project. Demand growth on this corridor is for longer distance journeys than any likely Crossrail service. Would also require electrification of the Chilterns route.
K4	Brentford and beyond via South Action	Requires new connection in Old Oak Common area.	Capacity unlikely to be available without removing services to London Waterloo.
K5	Richmond or beyond via South Action	Requires new connection in Old Oak Common area.	Capacity unlikely to be available beyond Richmond without removing services to London Waterloo. This option was dismissed by the Crossrail Review, led by Sir Adrian Montague.

8.3.10 It is recommended by this RUS that the industry undertake further work on the merits of such an extension, initially with the aim of identifying a route alignment for safeguarding from development. On initial inspection of the above **Option K1** appears to represent the most promising case.

8.3.11 To expand further on this emerging conclusion, a Crossrail extension to the WCML South slow lines appears to enable the following:

- providing direct trains from this corridor to the West End, City of London and locations such as Canary Wharf and beyond, avoiding the need to change onto the London Underground system at London Euston
- freeing up capacity on the London Underground system, both at Euston station and on the Northern and Victoria Lines, for passengers from High Speed 2
- reducing the number of trains and passengers needing to be accommodated at London Euston during High Speed 2 construction works
- potentially making it easier for High Speed 2 to reach London Euston, by removing most if not all passenger trains from one of the pairs of tracks on the existing tunnelled approaches to the terminus
- enabling full benefit to be made of the Central London Crossrail tunnels, with 24 trains per peak hour arriving from key corridors to the west and none needing to start at Old Oak Common/ Westbourne Park
- improving access to Heathrow Airport, by providing much of Hertfordshire and Buckinghamshire with access to Heathrow with a single change at Old Oak Common.

For the above reasons the RUS recommends further development work on such a scheme, including identification of potential alignment options in the Old Oak Common area for the tracks concerned

8.3.12 In addition to the above the RUS re-states for the longer term, subject to a business case becoming justified, the potential future Crossrail extension to Gravesend, as highlighted in the Kent RUS. This route is currently safeguarded and passive provision is now made in the design of works at Abbey Wood for the necessary infrastructure to be provided in the future. This is likely to involve two new crossovers between the Crossrail and North Kent Line tracks at Abbey Wood, plus additional turnback infrastructure at Crayford and/or Barnehurst to avoid increasing the quantum of trains though Dartford.

8.3.13 Further development of the concept of extending Crossrail to Reading was recommended under **Option A1** in **Chapter 7**. This would involve extending services currently planned to terminate at Maidenhead.

8.3.14 **Figure 8.1** illustrates the recommended potential future Crossrail extensions for further consideration.

8.4 Gap L – future Crossrail 2 (Chelsea – Hackney line)

8.4.1 A potential future Chelsea – Hackney line (Crossrail 2) alignment is currently protected by the planning process. Given that this would have major connectivity and capacity implications for the central London area, and potentially beyond, it is referenced in this RUS.

8.4.2 The protected Central London corridor would provide the following benefits:

- direct journeys from additional areas in the London suburbs to Central London, avoiding the need to change onto the London Underground network
- reducing journey times across Central London
- reducing demand on some of the most congested sections of the Underground, including the Victoria and Central Lines
- reducing demand on certain intensively operated bus corridors
- regeneration of several parts of the capital.

8.4.3 The RUS has considered whether the protected alignment would provide a means of resolving the outstanding peak capacity gaps from **Chapter 7**, principally on the Great Eastern or South West Main Lines. However the alignment does not appear to benefit the outer suburban service groups directly. Consideration has been given as to whether the route could be used indirectly to enable additional trains on these lines. At present a viable way forward has not been identified. However further work is recommended by this RUS to optimise the safeguarded proposal and to identify service patterns.

8.4.4 The RUS recognises that the scheme is not affordable at present but recommends that consideration should be given as to whether it, or a variation, will become necessary once current major projects in the London area (principally the Thameslink Programme, Crossrail 1 and London Underground upgrades) have been completed.

8.4.5 Analysis suggests that re-routing the safeguarded alignment via London Euston to serve High Speed 1 should be considered, consistent with the issues outlined in Gap M.

8.4.6 **Figure 8.2** illustrates the potential future Chelsea – Hackney line (Crossrail 2) protected allignment and future possible extensions.

Figure 8.1 – emerging conclusions for potential future Crossrail extensions

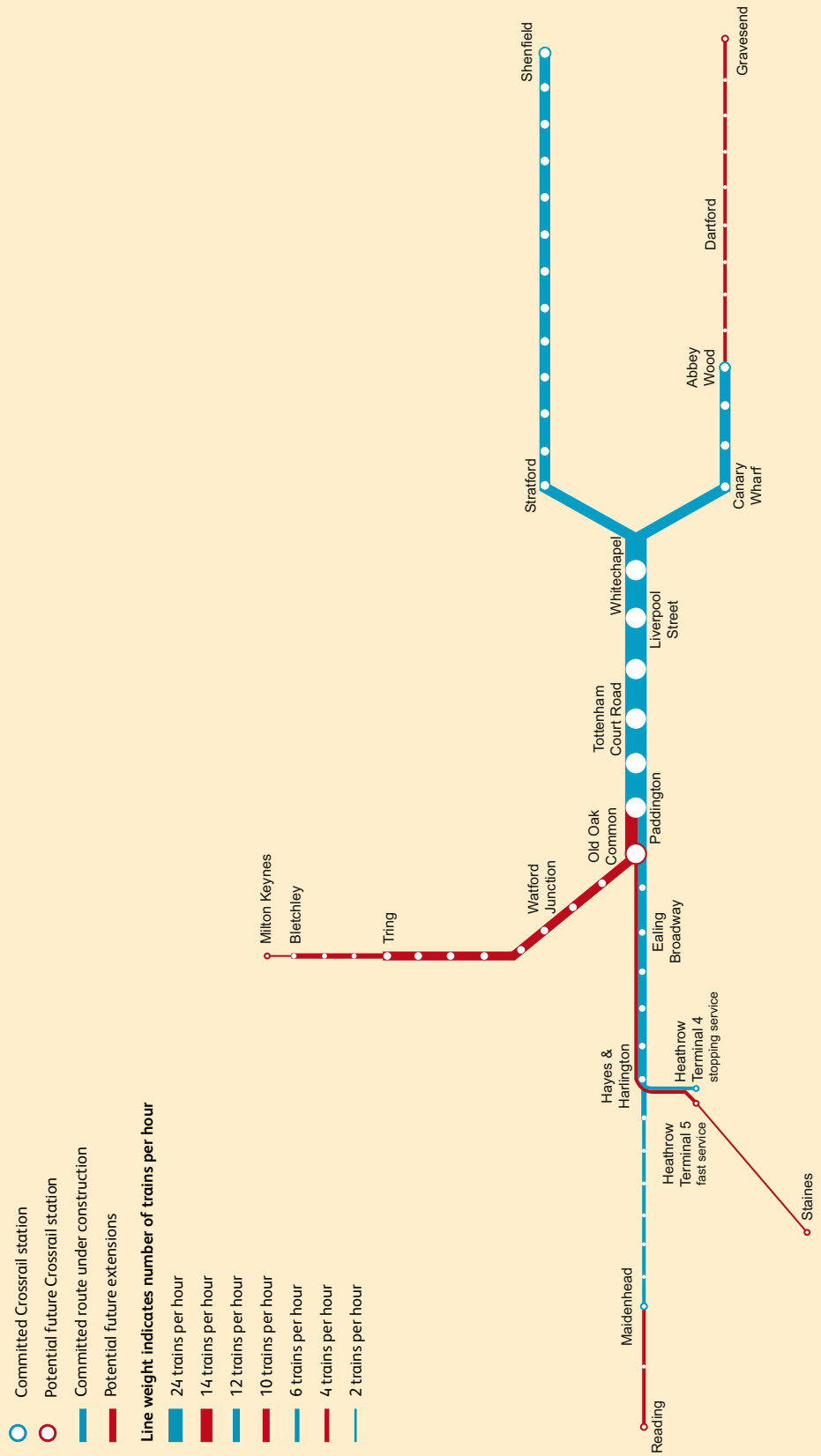
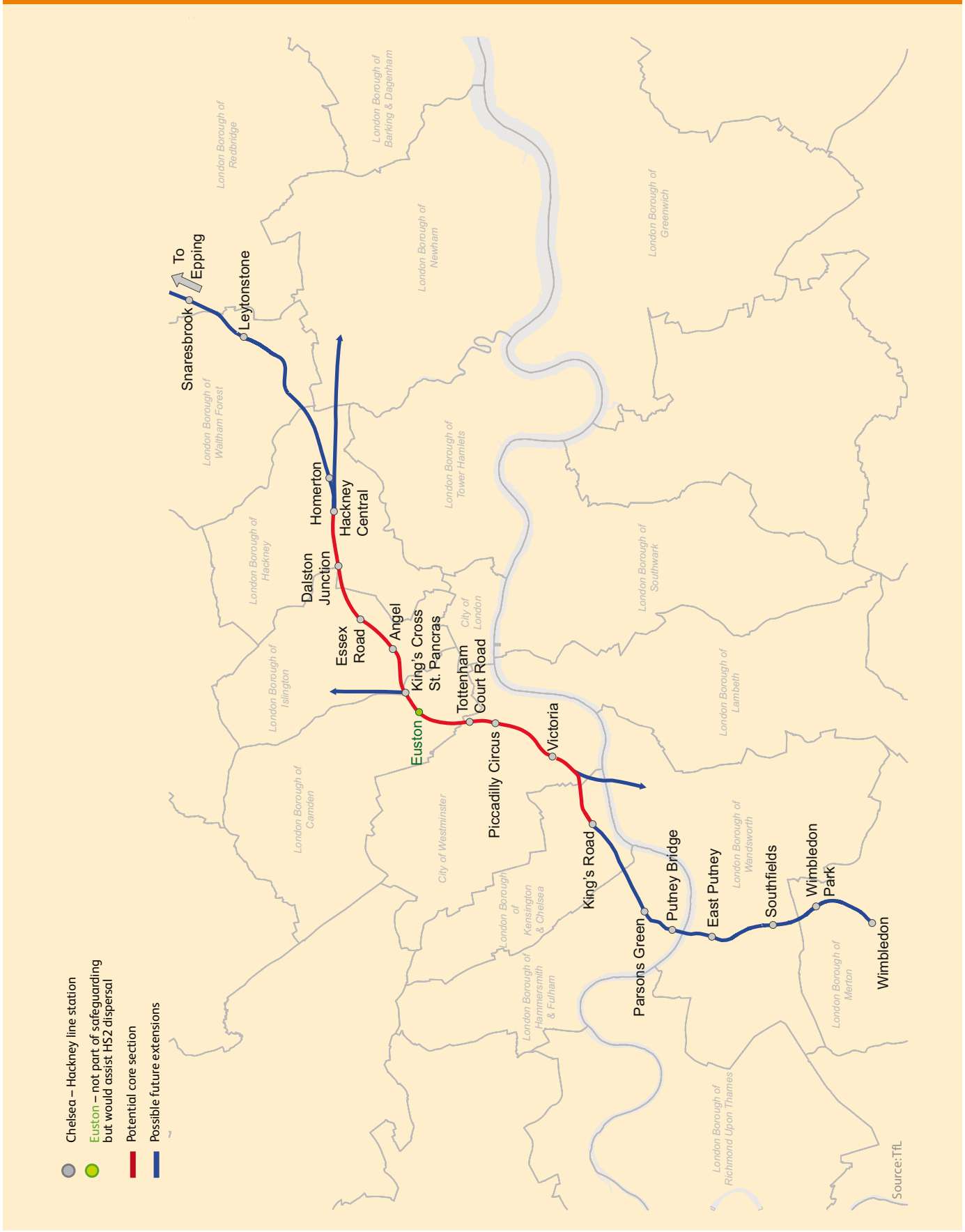


Figure 8.2 – possible future Chelsea – Hackney line (Crossrail 2)



8.5 Gap M – implications of High Speed 2 on the London area

8.5.1 This London and South East RUS strategy is based on a post-High Speed 2 scenario. This is because it would not be possible for the rail industry to resolve the future capacity gap on the south end of the WCML effectively in any other way, given the forecast demand growth. Development of a High Speed Rail network is also current Government policy, for both economic and environmental reasons.

8.5.2 The High Speed 2 route, together with new stations in the London area at Old Oak Common and London Euston, would be designed to cater for the ultimate capacity of the new train service in operation. The RUS therefore confidently assumes that there would be no capacity gaps directly associated with High Speed 2 itself, though there would be implications for the services used for the dispersal of High Speed 2 passengers.

8.5.3 The RUS notes that the opening of High Speed 2 would be a significant driver for wider changes to local travel patterns in parts of central and west London. In particular the following would apply:

- demand for travel from across London and the wider South East to Euston would increase
- significant new demand would materialise from across London and the wider South East to the new station at Old Oak Common.

8.5.4 The above appears to have the most significant implications for the following:

- the London Underground Victoria and Northern Lines (both branches), which serve London Euston
- Euston Underground station itself
- the London Underground sub-surface network, which serves nearby Euston Square station
- the GWML, which would have a new station at Old Oak Common, to be served by Crossrail services. However the RUS does not consider it likely that Great Western long distance services would generally call, given the time penalty this would impose on London – West Country/ South Wales journey times. Further work is recommended regarding which, if any, longer distance GWML trains should call
- the North London Line (NLL), which passes close by the High Speed 2 station at a site where an interchange is anticipated to be provided given that Gap I identified a capacity gap on the NLL even with out High Speed 2
- the West London Line (WLL), which passes close by the High Speed 2 station at a site where an interchange is anticipated to be provided given that Gap I identified a capacity gap on the WLL even without High Speed 2.

8.5.5 The RUS advises that further development of the strategy for accommodating High Speed 2 local flows between London, the wider South East and both London Euston and Old Oak Common stations is required.

8.6 Gap N – capacity implications of the proposed link from High Speed 2 to High Speed 1

8.6.1 The construction of a high speed rail network is forecast to result in major growth in the rail market for travel between London and the north of England/ Scotland, with one aim being to reduce the need for domestic flights within the UK. In addition to this Government policy favours a direct link between High Speed 2 and the existing High Speed 1 route, facilitating direct trains on future potential routes such as Manchester or Birmingham to Paris, further reducing the need for short-haul aviation. Such trains would avoid the need for passengers to change in London, ie making their way between London Euston and London St Pancras International stations. The RUS assumes that such direct trains would require passport control facilities at a location such as the proposed new station in central Birmingham, but other options may exist. The RUS also assumes that such trains could potentially make a London call at Stratford International, but that this would be to pick up/set down only.

8.6.2 The Government recently requested that the High Speed 2 planning team identify a viable railway route through Central London to facilitate trains to travel between High Speed 1 and High Speed 2[1]. Whilst the specific details of such an alignment are not at present known the RUS assumes that the connection is unlikely to be located in the existing High Speed 1 London tunnels (due to the high cost and physical changes involved in constructing such a link), so appears likely to be in the London King's Cross/London St Pancras International area. Given the limited space available this implies international passenger trains potentially operating over, or in close proximity to, a section of the existing NLL at some stage in the future. Depending on the level of service envisaged it is likely that such a strategy would have a significant interface on the NLL, with trains from Europe potentially routed via Primrose Hill towards the tunnels outside London Euston station.

8.6.3 The RUS therefore recommends that a strategy for connecting High Speed 1 to High Speed 2 is considered early in the High Speed 2 infrastructure design. This would need to identify a way forward consistent with the future strategy for both local passenger and longer distance freight services using the NLL in the Camden Road/ Primrose Hill area.

8.6.4 The RUS also notes that if such a connection were to be implemented the opportunities for running freight traffic between High Speed 1 and High Speed 2 could also be considered if appropriate.

1 This would also allow trains between HS1 and a potential future station at Heathrow Airport.

8.7 Gap 0 – other connectivity schemes

8.7.1 The existing railway network has certain gaps in connectivity between routes, with passengers sometimes needing to travel via London to make journeys indirectly.

8.7.2 One potential scheme responding to gaps in this category is the East – West Rail proposal, as referred to in **Chapter 9** given its potential usefulness for rail freight. This would involve reopening of a currently disused rail route southwest of Bletchley. For passengers the scheme would provide direct links on the Oxford/Aylesbury – Milton Keynes Central/Bedford axis. East – West Rail is also referred to in the West Midland and Chilterns RUS Draft for Consultation. In the longer term it could potentially be extended towards Cambridge, though this would be significantly more complex.

8.7.3 A further connectivity scheme is the Croxley Link as promoted by Hertfordshire County Council, which would enable passengers to access Watford Junction from the London Underground Metropolitan Line. The Croxley Link is currently contained within DfT's Pre-Qualification Pool of local major transport schemes. This list of schemes was published in October 2010 and describe projects for which value for money is not clear, but where preliminary assessment is on-going.

8.7.4 Various other potential rail, light rail and bus-based schemes exist in response to this gap, many of which are promoted by local stakeholders. In the event of such schemes becoming committed their impact would be considered in future updates to this RUS.

8.8 Summary

8.8.1 This chapter has considered connectivity gaps and options in the railway network around the capital. This has included the high level of demand for surface access to Heathrow Airport which is only partially provided for by the railway network at present, options for the potential future development of the Crossrail 1 network and thinking ahead towards Crossrail 2 and the implications of High Speed 2 on the London area. It has also noted that there are also many other smaller-scale schemes possible which are not described herein.

8.8.2 Given the early stage of development of many of the schemes in this category limited economic appraisal has been carried out at this stage. Further detailed development is therefore recommended by this RUS.

9. Freight in South East England

9.1 Introduction

9.1.1 This chapter develops a strategy to provide sufficient capacity and route capability across South East England to allow for the future development of rail freight, consistent with current forecasts. The requirement to provide freight capacity, capability and economic attractiveness to operators is emphasised as necessary to support the economic development and environmental needs of the country as a whole.

9.1.2 The analysis follows on from the national Freight Route Utilisation Strategy (RUS), established in 2007. This section develops this further, taking into account the currently emerging view from the industry's Strategic Freight Network (SFN) workstream. This RUS builds upon this with respect to the South East England area.

9.1.3 The RUS baseline includes several currently committed freight upgrade schemes, as part of the SFN. Some of the key schemes of most relevance to this RUS, many of which are physically located outside of the South East of England, are:

- loading gauge clearance to W10 between Felixstowe and the West Midlands via Bury St Edmunds, with completion due by 2011
- loading gauge clearance to W10 between Southampton and the West Midlands via Basingstoke and Oxford, with completion due by 2011
- the Nuneaton North Chord, to enable trains from Felixstowe via Bury St Edmunds to access the West Coast Main Line (WCML) without crossing all tracks on the flat, with completion due by 2013
- capacity and capability schemes on the southern end of the East Coast Main Line (ECML) and between Peterborough and Doncaster
- schemes in the West Midlands.

9.1.4 The remainder of this chapter considers the overall allocation of capacity, focusing how best to manage the interaction between freight and passenger services at a time of rising demand for both.

9.2 Future gaps

9.2.1 Freight demand forecasts were developed nationally to 2019 and 2030 for the SFN. The forecasts were developed using the Great Britain Freight Model (GBFM) to assess the aggregate level of demand. The GBFM is designed to forecast freight to be moved within Great Britain, including to and from the ports and the Channel Tunnel. It covers all modes (such as rail and road) and produces a matrix of all future freight flows. For certain commodities, the GBFM forecasts were modified to reflect operators' understanding of developments in their markets. The final forecasts, while subject to a large degree of uncertainty, aim to represent an industry consensus of a plausible level of traffic on which to base future plans.

9.2.2 These traffic forecasts indicate that the most relevant rail freight issue affecting South East England will be an ongoing increase in international shipping imports into the UK from the rest of the world. The key issue this creates for the rail freight industry is the need to move increased numbers of intermodal freight containers between the south east ports and inland terminals, generally located in the Midlands, northern England and Scotland. The rail freight increase arises from a combination of both the increased shipping levels and a greater future rail modal share for this traffic.

9.2.3 Due to the locations of the major distribution centres only relatively small volumes of rail freight are forecast to serve the London area itself. Moving traffic from the national distribution centres to the next stage in the supply chain is dependent on customers having rail-connected facilities, and onward journeys from distribution centres are generally by road at present. Therefore, in addition to growth from ports there is potential for high levels of growth in domestic container movements by rail, though volumes in this area are highly sensitive to the development of suitable terminal sites.

9.2.4 The SFN forecasts for the growth required in rail freight to 2030, to/from the principal demand generators in the London area, is shown in **Table 9.1**.

Table 9.1 – key freight growth origin points of relevance to this RUS		
	2010 average daily trains each way	**2030 total daily train paths required each way**
Southampton	20	51
Channel Tunnel	6	35
Felixstowe/Bathside Bay	28	58
Essex Thamesside (London Gateway etc)	8	50
Kent Thamesside (Isle of Grain, Howbury Park, Medway etc)	9	24

Notes: Paths shown are in both directions, with trains operating six days per week.
2030 path forecasts assume 640-metre trains, except for Channel Tunnel traffic for which 775-metre is assumed.
Paths shown are for all freight traffic not just intermodal traffic.

9.2.5 The RUS notes that growth forecast from ports in **Table 9.1** is predicated upon their owners and operators' plans to increase capacity – for both quayside activity and rail handling. The inland terminals for these freight flows are likely to remain distribution centres in the Midlands, Northern England and Scotland, though the RUS notes that a degree of flexibility is needed rather than constraining operations around specific locations. The level of growth in domestic freight is dependant on new terminal construction.

9.2.6 In order to meet the growth required in **Table 9.1** for certain types of freight additional flows could be accommodated by running trains in existing but unused freight opportunities in the working timetable. This particularly applies to Channel Tunnel traffic, where the 35 paths required are currently protected by international agreement and from the Kent Thamesside, where standard hour timetable opportunities exist to increase traffic if this becomes necessary as forecast. However this approach is far less practical with respect to the key intermodal traffic flows from the container ports, to/from which at present there is a very low level of unused freight paths.

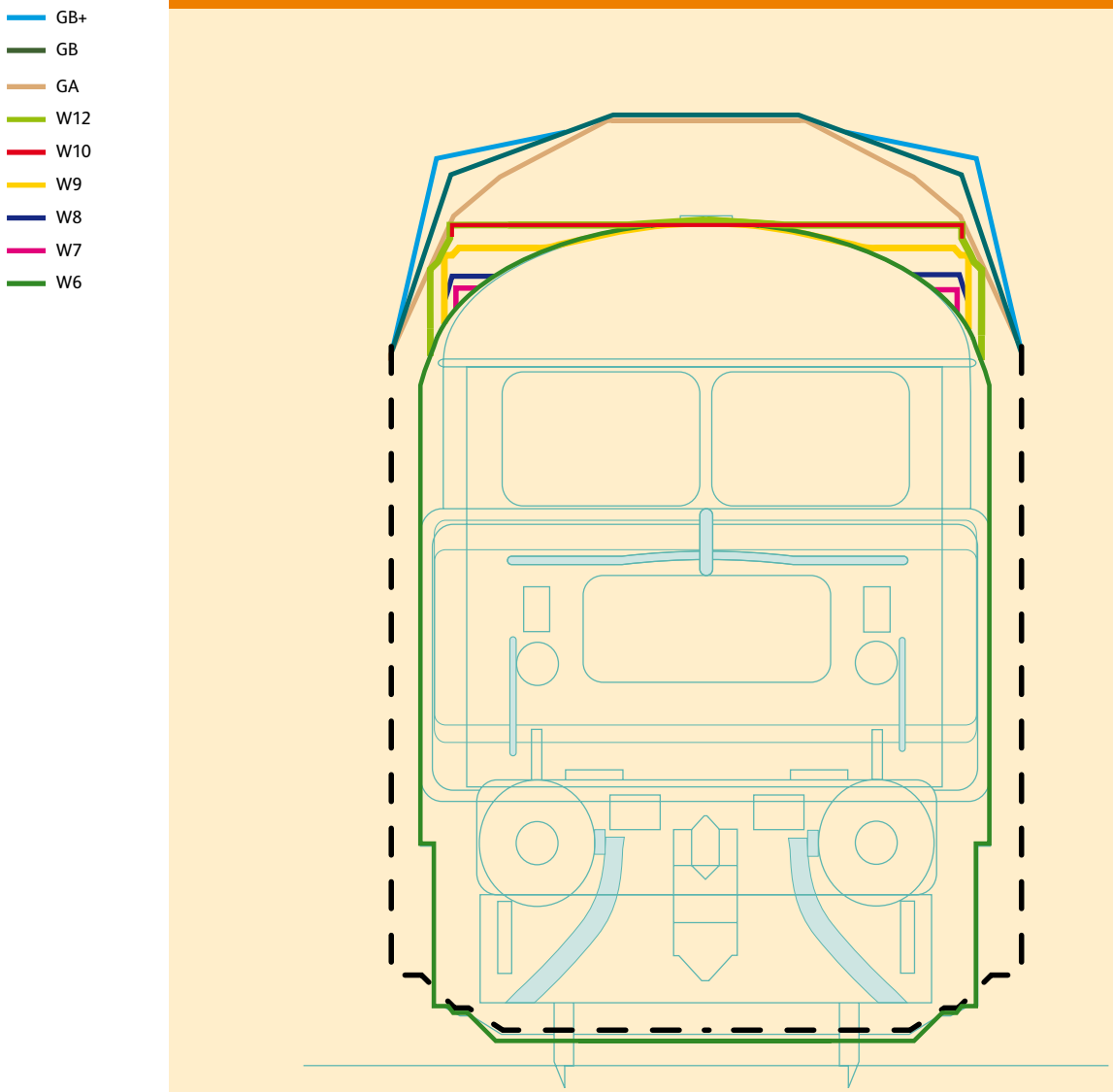
9.2.7 It can be concluded that significant additional freight paths will be required in future from the key ports of Southampton, Felixstowe/Bathside Bay and the London Gateway area in particular if the forecasts in **Table 9.1** are broadly correct. This leads to the need for the RUS to focus on how to increase rail freight capacity from these areas.

9.2.8 It is emphasised that, to remain competitive with road haulage and to improve modal share, freight trains in future will need to be longer, have quicker end-to-end journey times and need to be able to carry 9'6" international shipping containers on standard wagons from the busier ports. The SFN workstream expands on this with the core trunk network requirement as shown in **Table 9.2**. These features have particular importance when considering routeing options as described later.

9.2.9 The various loading gauges for rail freight are shown in **Figure 9.1**.

Table 9.2 – Strategic Freight Network – future core trunk network requirements
Sufficient capacity for growth.
Limited conflicts between passenger and freight traffic (eg by utilising/avoiding lines, grade separation).
Minimise freight movements via London if a better alternative route can be made available (unless the ultimate origin or destination of the freight is in London).
Provide for longer trains.
Provide for appropriate axle loads.
Appropriate loading gauge for the traffic that needs to use it.
Include defined diversionary routes for each core route to ensure availability whenever operators wish to use the network.
Reduced journey times to compete with road transport.

Figure 9.1 – Loading gauge envelopes and container sizes



9.3 Routeing recommendations

9.3.1 Given the increased demand for both passenger and freight it is important to consider routeing options. Whilst passenger services are servicing the capital itself, and cannot therefore be routed away, there may be some opportunities to re-route some freight services, as long as this does not result in uncompetitive increases in operational costs or journey times. However with limited alternative routeing options available this may have significant implications for these other routes, some of which may need to be further upgraded (beyond currently committed schemes) to ensure they have sufficient capacity and capability to accommodate the trains concerned.

9.3.2 The RUS emphasises that such upgrades should in general be an opportunity to increase overall freight capacity and capability, as well as improving journey times, rather than merely used to re-route away from the capital. It is particularly emphasised by the rail freight industry that any alternative routeings to those in use today must not impose increased operating costs or other inefficiencies on the freight operators.

9.3.3 The following sections consider various routeing options to accommodate the forecast freight growth, assisting rail to compete with road transport.

9.4 Port of Southampton traffic

9.4.1 Growth from the major international shipping facility on the south coast is anticipated due to increasing imports of container-based goods and increasing rail modal share in moving such imports. **Table 9.3** shows the 2030 from Southampton average freight trains per day forecast split by inland origin/destination region.

Table 9.3 – Southampton 2030 average freight trains per day	
Yorkshire	7.5
North West	12.8
Scotland	3.5
West Midlands (inc Daventry)	6.9
East Midlands	6.0
West	0.7
London	5.1
North East	1.1
Other	7.3
Total	**51.0**

Notes: Paths shown are in both directions, with trains operating six days per week.
Paths shown assume 640-metre trains.
Paths shown are for all freight traffic not just intermodal traffic.

9.4.2 It can be seen from **Table 9.3** that whilst a small proportion of this traffic will need to serve London directly the majority of container traffic at Southampton will be destined for the Midlands or north of England. The rail route of first choice to these destinations is therefore the most direct route, running via Basingstoke, Reading and Oxford.

9.4.3 At present a particular problem in growing freight volumes using this route is the need to cross the main lines to the west of the Reading station area – a major capacity constraint involving interaction with fast passenger trains to and from London Paddington. However this issue will be removed in Control Period 5 (CP5) following the completion of the Reading remodelling scheme during which a grade-separated connection will be provided.

9.4.4 A further problem at present is that the route is not W10 loading gauge cleared, so standard 9'6" international shipping containers cannot be carried on standard wagons. However this issue will be resolved with the ongoing funded Control Period 4 (CP4) loading gauge clearance scheme for Southampton to the West Midlands, a project which also covers the partial diversionary route to Basingstoke via Andover.

9.4.5 Whilst the Reading remodelling scheme will alleviate the main north-south capacity constraint the following other limitations south of Oxford will still be relevant following its completion. This list is not necessarily exhaustive.

- capacity in the Southampton area
- capacity at Basingstoke, where southbound freight services need to cross the entire layout on the flat to reach the South West Main Line (SWML) down lines. There are also potential opportunities for a passing loop in the station area, though this would primarily improve timetabling opportunities for northbound traffic
- capacity over the Didcot to Oxford section, which is shared between freight and six passenger trains (four of which are fast) in each standard hour
- the absence of a W10 loading gauge diversionary route avoiding the whole of this line.

At present, the timetable permits two standard freight paths per hour in the off-peak between Southampton and the Midlands. Significant growth from Southampton may require interventions to overcome the constraints preventing this quantum being raised to three or four freight paths per standard hour.

9.4.6 None of the above is felt to be an insurmountable barrier to future freight growth. However further consideration of development of a W10 loading gauge diversionary routes is recommended, focusing on:

- avoiding closures on the Southampton – Basingstoke – Didcot corridor, possibly re-routeing via Melksham (as an alternative to the Andover route as described in **9.4.4**)
- avoiding closures on the Reading/Didcot – Oxford – West Midlands corridor, most likely via Kew and the WCML, but possibly alternatively utilising additional infrastructure when the Oxford area is resignalled.

9.4.7 Beyond Oxford freight services currently all continue northwards via Leamington Spa, mostly then running via Solihull towards Landor Street Junction (located adjacent to the Birmingham Freightliner terminal). From this point routeings exist via Walsall to other terminals in the West Midlands or join the West Coast Main Line (WCML) at Stafford, also via Water Orton towards Derby for Yorkshire and North East England. However all of these routeings include operation over parts of the busy West Midlands rail network, potentially constraining future growth.

9.4.8 In addition to the above, a route to the WCML exists from Leamington Spa via Coventry, joining the WCML at Nuneaton. However this route is capacity constrained by single track sections between Coventry and Leamington Spa as well as a flat crossing move through Coventry station. For freights from the north bound towards Southampton there is also a flat crossing move across the WCML at Nuneaton. Whilst this route is heavily used, including for diversionary purposes, these constraints make it potentially unsuitable for accommodating future growth at busy times without infrastructure enhancements, especially as there are local aspirations for more passenger services. Partial re-doubling, between Milverton Junction and Kenilworth, is currently under investigation as described in the West Midlands & Chilterns RUS Draft for Consultation. However the Coventry and Nuneaton areas represent more significant challenges on this corridor.

9.4.9 Capacity in the West Midlands and over the Leamington Spa – Nuneaton corridor therefore appear to be potential barriers to future freight growth from Southampton. Options to address this gap may therefore be required.

9.4.10 One way of resolving the issue might be for some Southampton traffic to run via London, then onwards to the north via the WCML, Midland Main Line (MML) or East Coast Main Line (ECML). However this would increase congestion on busy routes in the capital so this approach is not recommended. It would also conflict with freight demand growth from other origins using the southern end of the WCML. The RUS therefore seeks an option which both avoids London (for traffic not serving that area) and the West Midlands (for traffic not serving that area).

9.4.11 One potential approach would be to reopen the currently closed route from Bletchley towards Bicester (at Claydon Junction), as part of the east-west Rail Link. This has synergy with passenger connectivity options described in **Chapter 8**. Reopening of this line would enable new routeing options for Southampton freight flows, linking in to forecast demand (from **Table 9.3**) to Daventry in the West Midlands, the North West via the WCML or the East Midlands/Yorkshire via the Midland Main Line (MML). The main new routeing options would be:

- Southampton – Oxford – Bletchley – WCML (for the Northwest)
- Southampton – Oxford – Bletchley – Bedford – Midlands Main Line (for the East Midlands, Yorkshire and the Northeast)
- Southampton – Oxford – Bletchley – Daventry.

In all cases the London area, the Birmingham area and the Leamington – Nuneaton route would be capable of being avoided (for traffic not needing to be on these routes).

9.4.12 With regard to the second bullet in **9.4.11** above it is noted that loading gauge clearance of the MML north of Bedford could have synergies with any structural works required for electrification. However even though this option does not rely on freight growth south of Bedford some capacity works would still potentially be required on a number of sections north thereof.

9.4.13 **Table 9.4** summarises some of the key issues associated with each of the main potential future routeing options north of Oxford.

Table 9.4 – routeing options north of Oxford for Southampton traffic

Route	Major operational constraints	Principal freight terminals likely to use the route
Oxford – Leamington Spa – Solihull – Landor Street Junction – Lawley Street or beyond	Busy local rail network in West Midlands.	Terminals in the West Midlands.
Oxford – Leamington Spa – Solihull – Landor Street Junction – Water Orton – Derby – MML North	Busy local rail network in West Midlands.	Terminals in Yorkshire and the North East.
Oxford – Leamington Spa – Solihull – Landor Street Junction – Walsall – WCML North	Busy local rail network in West Midlands.	Terminals in northern England and Scotland.
Oxford – Leamington Spa – Coventry – Nuneaton – WCML North	Capacity on the Leamington Spa – Coventry route and at Coventry station, southbound flat crossing move across WCML.	Terminals in northern England and Scotland.
Oxford – Bletchley – Rugby – WCML North	Oxford – Bletchley route not currently operational Claydon – Bletchley Limited capacity at south end of WCML.	Daventry. Terminals in northern England and Scotland.
Oxford – Bletchley – Bedford – MML North	Requires operation over MML North.	Terminals in Yorkshire and North East England.

9.4.14 The following high level conclusions can be drawn from **Table 9.4**:

- based on current infrastructure, future growth in container traffic from Southampton will potentially be impacted by capacity constraints in the West Midlands
- this could potentially be avoided if growth from Southampton not headed for the West Midlands were routed to avoid the area. However this is not considered a simple solution given that the only currently existing alternative route (Leamington Spa to Nuneaton) would require significant infrastructure enhancements (including further grade separation at Nuneaton) as described in Gap 8 of the Freight RUS
- an alternative solution could potentially involve reopening the Oxford – Bletchley – Bedford route. This would enable Southampton growth to reach destinations in Northern England and Scotland, subject to path availability on the WCML, without needing to travel via the West Midlands. A more direct route between Southampton and the East Midlands would also be provided, together with a route avoiding London from Southampton to Daventry.

9.4.15 These emerging conclusions with respect to preferred routeings are summarised in the box below.

Freight from Southampton – emerging conclusions

Freight growth from Southampton will in general be accommodated on the route via Reading and Oxford, either travelling to terminals in the West Midlands or through this area to terminals beyond. The committed Reading remodelling and W10 loading gauge enhancement schemes will encourage traffic growth. Additional double track sections between Leamington Spa and Coventry are being considered, though trains from the WCML would still need to cross all tracks on the flat at Nuneaton and run through the congested Coventry station area if routed this way rather than through central Birmingham.

Given the constraints in the West Midlands the RUS considers that the East – West Rail (EWR) scheme is potentially a useful route to accommodate future growth in freight traffic from Southampton, enabling trains for Northern England to avoid the congested West Midlands area and trains for Daventry to avoid London. However it is recognised that the south end of the WCML is capacity constrained at present, though this can be expected to be less of an issue following the construction of HS2. The RUS recommends further consideration of freight on the route as part of the wider business case for the EWR scheme. It is however, approximately 20 miles longer than the direct route for most freight via Lemington Spa, so journey times would need to be minimised to avoid increasing operating costs.

If the EWR scheme proceeded some Southampton traffic may be able to head onto the MML at Bedford, though infrastructure enhancements on the northern section of the MML may then be required. This could provide a new routeing option to Yorkshire and the North East and could potentially be loading gauge cleared to W10 as part of any MML electrification scheme.

Further development of diversionary routes from Southampton is likely to be required, to enable freight to continue running in the event of track closures for contingencies or planned engineering works.

9.5 Essex Thamesside (London Gateway) traffic

9.5.1 This area includes the existing Tilbury terminal and the development currently under construction at London Gateway port. Rail freight growth from the area is forecast due to the new port development, together with increasing imports from international shipping and the increasing rail modal share in moving such imports. **Table 9.5** shows the 2030 Essex Thamesside average freight trains per day forecast split by inland origin/destination region.

Table 9.5 – Essex Thamesside 2030 average freight trains per day

Yorkshire	8.6
NW England	5.4
Scotland	3.2
West Midlands (inc Daventry)	9.0
East Midlands	8.0
West	7.2
London	6.9
Northeast	0.0
Other	1.8
Total	**50.0**

Notes: Paths shown are in both directions, with trains operating six days per week.
Paths shown assume 640-metre container trains.
Paths shown are for all freight traffic not just intermodal traffic.

9.5.2 Whilst the new facilities are located on the outskirts of Greater London only a small proportion of the rail freight from them is forecast (in **Table 9.5**) as serving the capital itself directly, since such short distance traffic would generally be carried by road and those flows that do exist by rail are unlikely to be intermodal traffic. For the remaining flows it is clearly impractical to avoid the capital entirely, given the location and rail network geography. Freight trains from London Gateway heading for the Midlands, the north of England and the West Country must therefore travel on busy routes around East and North London at the start/end of their journey.

9.5.3 As a result the RUS emphasises that capacity issues in north and east London will heavily influence the choice of main line routeing beyond London for these trains. It is also noted that resolving infrastructure constraints in the London area is likely to be highly constrained by the availability of physical space for additional tracks etc, a factor much less likely to apply once radial routes away from the capital are reached.

9.5.4 **Table 9.6** summarises the principal key issues for the cross-London routeing associated with each of the main potential future routeing options for London Gateway traffic.

Table 9.6 – routeing options north of London for Essex Thamesside traffic

Route to North	Route across London	Major operational constraints
ECML	Dagenham – Barking – Forest Gate – Stratford – Dalston – Drayton Park – Hertford North – Peterborough.	Need for flat crossing move across Great Eastern Main Line (GEML)/ Crossrail at Stratford. Interaction with increasing passenger services over part of the North London Line (NLL) (Stratford – Highbury & Islington). Interaction with increasing passenger services over the Finsbury Park – Hertford route. Requires operation over 2/3 track section of ECML between Huntington and Peterborough. Involves extra distance to principal markets, especially those in the West Midlands.
ECML via West Anglia	Dagenham – Barking – Leytonstone High Road – Seven Sisters – Cheshunt – Ely – Peterborough.	Interaction between fast and slow trains over the Cheshunt – Cambridge route. Gospel Oak – Barking route and Ely to Peterborough not electrified. Involves extra distance to principal markets, especially those in the West Midlands.
	Dagenham – Barking – Forest Gate – Stratford – Seven Sisters or Tottenham Hale – Cheshunt – Ely – Peterborough.	Need for flat crossing move across GEML/Crossrail at Stratford. Interaction between fast and slow trains over the Lea Valley line and route to Cambridge. Restrictions on loading gauge. Ely to Peterborough not electrified. Involves extra distance to principal markets, especially those in the West Midlands.
WCML	Dagenham – Barking – Leytonstone High Road – Upper Holloway – Gospel Oak – Hampstead Heath – Willesden Junction.	Interaction with increasing passenger services over part of the NLL (Gospel Oak – Willesden Junction). Gospel Oak – Barking route not electrified.
	Dagenham – Barking – Forest Gate – Stratford – Dalston – Primrose Hill.	Need for flat crossing move across GEML/Crossrail at Stratford. Interaction with increasing passenger services over part of the NLL (Stratford – Camden Road).
	Dagenham – Barking – Forest Gate – Stratford – Dalston – Gospel Oak – Hampstead Heath – Willesden Junction.	Need for flat crossing move across GEML/Crossrail at Stratford. Interaction with increasing passenger services over the whole of the NLL (Stratford – Willesden Junction).
MML	Dagenham – Barking – Leytonstone High Road – Upper Holloway – Carlton Road Junction.	Interaction with intensive Thameslink service in the Carlton Road junction area on MML. Restrictions on loading gauge. Gospel Oak – Barking route and north of Bedford not electrified.
	Dagenham – Barking – Forest Gate – Stratford – Upper Holloway – Carlton Road Junction.	Need for flat crossing move across GEML/Crossrail at Stratford. Interaction with intensive Thameslink service in the Carlton Road junction area on MML. Restrictions on loading gauge. North of Bedford not electrified.
MML via WCML	As WCML options then Bletchley – Bedford.	As WCML options plus: Not electrified Bletchley – Bedford Restrictions on loading gauge.
MML via ECML	As ECML options then Peterborough – Leicester.	As ECML options plus: Not electrified from Peterborough.
WCML via ECML	As ECML options then Peterborough – Leicester – Nuneaton.	As ECML options plus: Not electrified Peterborough – Nuneaton.
WCML via MML	As MML options then Leicester – Nuneaton.	As MML options.

9.5.5 It can be seen from **Table 9.6** that a flat crossing move across the Great Eastern Main Line (GEML)/Crossrail tracks at Stratford/Forest Gate is a feature of several potential routeings from the London Gateway port. Operational analysis suggests that existing crossing moves at this location are a severe constraint in maximising the overall numbers of trains which can run. Given the GEML peak passenger capacity gap and the intensive planned Crossrail service on tracks at this location the RUS does not consider that such a routeing for freight growth would be a robust strategy.

9.5.6 The RUS has reviewed the implications of removing such conflicts at Stratford/Forest Gate by means of an infrastructure scheme, creating a grade-separated route from Barking towards Hackney that does not interact with the GEML/Crossrail. However given the densely built-up nature of this part of inner London and the amount of property acquisition which would be necessary the RUS is of the view that such a scheme could only be considered if it were the only option available. The RUS therefore recommends that this particular major conflict is avoided via an alternative routeing. **Table 9.7** therefore lists only those routeings from **Table 9.6** which do not involve a flat crossing move in the Stratford area.

9.5.7 It can be seen from **Table 9.7** that the initial routeing options away from the capital for London Gateway traffic – assuming that crossing moves at Forest Gate/Stratford are best avoided – are as below:

- operating via the West Anglia route to the ECML at Peterborough, generally involving extra distance (except for the relatively small proportion of traffic to Yorkshire and the Northeast) and involving significant interaction with passenger traffic north of Cheshunt
- operating via the MML, involving significant interaction with the intensive Thameslink service in the Carlton Road Junction area
- operating via the WCML, joining at Willesden.

Of the above only the WCML option avoids major issues in terms of interaction with passenger services in the London area, so this route is likely to be the preferred choice for future strategy.

9.5.8 In addition to the cross-London route towards the WCML being less capacity constrained than the limited other cross-London alternatives an important further factor to consider is that only the WCML is currently W10 loading gauge cleared. Use of the southern end of an alternative route would involve significant infrastructure enhancement costs to enable efficient carrying of 9'6" international shipping containers.

Table 9.7 – routeing options north of London for Essex Thamesside traffic – excluding those involving a flat crossing of the GEML

Route to North	Route across London	Major operational constraints
ECML via West Anglia	Dagenham – Barking – Leytonstone High Road – Seven Sisters – Cheshunt – Ely – Peterborough.	Interaction between fast and slow trains over the Cheshunt – Cambridge route. Gospel Oak – Barking route and Ely to Peterborough not electrified. Involves extra distance to principal markets, especially those in the West Midlands.
WCML	Dagenham – Barking – Leytonstone High Road – Upper Holloway – Gospel Oak – Hampstead Heath – Willesden Junction.	Interaction with increasing passenger services over part of the NLL (Gospel Oak – Willesden Junction). Gospel Oak – Barking route not electrified.
MML	Dagenham – Barking – Leytonstone High Road – Upper Holloway – Carlton Road Junction.	Interaction with intensive Thameslink service in the Carlton Road junction area on MML. Restrictions on loading gauge. Gospel Oak – Barking route and north of Bedford not electrified.
MML via WCML	As WCML then Bletchley – Bedford.	As WCML option plus: Not electrified Bletchley – Bedford Restrictions on loading gauge.
MML via ECML	As ECML then Peterborough – Leicester.	As ECML option plus: Not electrified from Peterborough.
WCML via ECML	As ECML then Peterborough – Leicester – Nuneaton.	As ECML option plus: Not electrified Peterborough – Nuneaton.
WCML via MML	As MML then Leicester – Nuneaton.	As MML option plus: Not electrified Leicester – Nuneaton.

9.5.9 Finally whilst it is recognised that freight paths on the WCML are currently scarce, construction of High Speed 2 can be expected to alleviate this issue, with passenger demand from locations such as Northampton and Milton Keynes Central generally then being catered for on the fast lines, in turn freeing up slow line paths for freight traffic.

9.5.10 The emerging conclusion is therefore that the most effective option for future growth in freight traffic from London Gateway will be via the Gospel Oak – Barking and south end of WCML. The Gospel Oak – Barking route and associated connections are currently un electrified, but the recommendation of the Network RUS: Electrification Strategy for electrification to be provided on this line is re-emphasised here. Between Gospel Oak and Willesden Junction further consideration is required regarding freight/ passenger interaction, given that both types of traffic are likely to increase over this section.

9.5.11 Any London Gateway traffic heading to terminals in the West Midlands will generally need to leave the WCML at Nuneaton, then running via Water Orton. This avoids the congested Birmingham – Coventry corridor and provides access to West Midlands rail terminals.

9.5.12 Notwithstanding the general strategy of using the WCML some opportunities for using the MML South section (Carlton Road Junction – Bedford) will continue to be available following the completion of the Thameslink Programme, with two trains per hour freight paths anticipated by the RUS in each off-peak standard hour. However many of these paths are likely to be taken by existing domestic traffic (for example aggregates), so options for London Gateway growth would be extremely limited, even if this were the preferred routeing to the north. The RUS particularly emphasises that the Carlton Road Junction/Kentish Town area is severely constrained due to being located in a narrow deep cutting with tunnels at each end. Given the densely built-up nature of this part of inner London and the amount of property demolition which would be necessary for grade separation the RUS is of the view that such a scheme could only be considered if it were the only option available. Whilst there are potentially smaller scale opportunities to provide additional or higher speed crossovers to reduce to a limited degree the interaction between MML freight and Thameslink services this is not sufficient to change the conclusion that an alternative routeing strategy, generally involving the WCML, is preferred.

9.5.13 Whilst most traffic from London Gateway would be suitable for a WCML routeing strategy as described above some traffic would be more directly routed to its destination via the ECML. Use of the Gospel Oak – Barking route presents difficulties in this respect since there is no direct connection onto the ECML and the only route available is via Seven Sisters and Bishops Stortford to the ECML at Peterborough, a longer distance and involving interaction with fast passenger trains such as Stansted Express, aspirations from other operators to increase services to Stansted Airport and the need to increase capacity of the Ely – Peterborough route for Felixstowe traffic as described in section 9.6 below.

9.5.14 For London Gateway – ECML traffic the only direct connection onto the ECML is from the North London Line (NLL) rather than the Gospel Oak – Barking route, so requiring the flat crossing move at Forest Gate. One way considered of avoiding this issue would be to improve the run-round facility at Upper Holloway, but this would only assist northbound traffic given that there is no connection from the ECML to the Gospel Oak – Barking route in the southbound direction. A further solution would be to continue to Wembley then reverse via Primrose Hill and Camden Road for the ECML, but this involves extra mileage and increases the interaction with passenger traffic. None of these options is ideal and given the relatively small number of trains involved (referring to the destination split from London Gateway as shown in **Table 9.5**) further work is required to understand the timing at which crossing moves at Forest Gate/Stratford become a strategic concern.

9.5.15 These emerging conclusions are summarised in the box below.

Freight from Essex Thamesside – emerging conclusions

Growth from this port will generally need to be accommodated on the Barking – Leytonstone High Road – Gospel Oak – Willesden Junction – WCML route. This avoids conflicts with the GEML and much of the NLL is cleared to W10 loading gauge and represents the most direct route to the majority of terminals. Electrification of the Gospel Oak – Barking route and its associated connections was recommended in the Network RUS: Electrification Strategy.

Paths on the WCML will become scarce, but additional freight paths can be expected to be released following the completion of High Speed 2. The main freight route from the WCML to terminals in the West Midlands leaves the WCML at Nuneaton, then runs via Water Orton, avoiding the congested corridor via Coventry.

Opportunities for use of the southern end of the MML are extremely limited, even though it connects directly with the Gospel Oak – Barking route. Significant freight growth on this corridor is difficult due to the interaction with increased off-peak Thameslink services (especially in the Carlton Road junction area), the MML not being loading gauge cleared to W9/W10 and other freight traffic requirements. Some traffic might be able to join further north at Bedford from the Bletchley route, but this is more relevant to traffic from Southampton than from London Gateway.

Further consideration is required regarding the most viable routeing for London Gateway – ECML traffic in the London area, given that there is no suitable route from Gospel Oak – Barking route to the ECML.

Further consideration is also required regarding freight/passenger interaction between Gospel Oak and Willesden Junction, given the likely increase in both types of traffic over this section of the NLL.

9.6 Haven Ports (Felixstowe and Bathside Bay) traffic

9.6.1 Growth is forecast from the existing major international shipping facility of Felixstowe, and at Bathside Bay near Harwich once this planned new facility is built. The forecast growth comes from increasing imports of intermodal traffic and increasing rail modal share in moving such imports. **Figure 9.8** shows the 2030 average freight trains per day forecast split by inland origin/destination region from this area.

Table 9.8 – Felixstowe/Bathside Bay 2030 average freight trains per day

Yorkshire	6.9
North West	14.2
Scotland	2.9
West Midlands (inc Daventry)	10.6
East Midlands	10.4
West	5.6
London	5.6
North East	1.1
Other	0.6
Total	**58.0**

Notes: Paths shown are in both directions, with trains operating six days per week.
Paths shown assume 640-metre trains.
Paths shown are for all freight traffic not just intermodal traffic.

9.6.2 **Table 9.8** indicates that, whilst a small proportion of this traffic will be serving London directly, most of the rail freight from the Haven Ports will be heading to the Midlands and north of England. The most direct rail route to such locations is therefore via Bury St Edmunds, Peterborough (for the ECML), Leicester (for the MML) and Nuneaton (for the West Midlands and the WCML). However as this 'cross-country' route has limited capacity and is not electrified the majority of traffic currently operates via London (utilising the GEML and NLL, joining the WCML at Camden Junction).

9.6.3 Ongoing enhancement schemes (capacity and loading gauge) will enable an increasing proportion of this traffic to operate via the cross-country route rather than via London. This is consistent with the strategy in this RUS of freight not serving London being routed to avoid the capital.

9.6.4 However even when the schemes currently committed are completed there will still be some significant barriers to using the cross-country route for all traffic to the Midlands or north. The principal ones are:

- capacity restrictions in the Leicester area, through which significant north-south and east-west passenger movements are also necessary with limited tracks available
- capacity constraints at Ely
- the Ely – Soham single line
- Haughley junction, near Ipswich, which is a single-lead junction at present
- the cross-country route being non-electrified
- the cross-country route having sections of low capacity absolute block signalling.

9.6.5 Based on the above it is recommended that further development of the Felixstowe – Nuneaton cross-country route is likely to be required in the future, focusing on further infrastructure upgrade schemes to eliminate key capacity constraints and improve capability on this route.

9.6.6 It is emphasised that any freight paths freed up on the GEML in the Stratford area (by diverting existing Haven Ports traffic to the cross-country route) could potentially be available for London Gateway – ECML traffic, given that section 9.5 did not identify an obvious alternative for such flows.

9.6.7 Even if the capacity restrictions and economic issues associated with the cross-country route were resolved a W10 loading gauge-cleared diversionary route via the GEML and London would still be required. However traffic diversions would generally be overnight or at weekends when passenger numbers are lower. Other growing flows such as freight between Felixstowe and the West Country will continue to need to run via London as their preferred route.

9.6.8 These emerging conclusions are summarised in the box below.

Freight from Haven Ports – emerging conclusions

Longer term growth from these ports will need to be accommodated on the cross-country Ipswich – Bury St Edmunds – Peterborough – Leicester – Nuneaton route, building on the committed capacity and loading gauge enhancements on this corridor. In the shorter term growth will tend to use remaining capacity on the GEML as sufficient paths are unlikely to be available cross-country.

Removing all freight to the north from the GEML and London area would require additional infrastructure enhancements which are not currently funded. Capacity in the Leicester area in particular (and potentially elsewhere), together with a lack of electrification present a barrier to fully utilising the cross-country route. In any event traffic growth between Felixstowe and areas such as Bristol will need to continue to be routed via London.

Any Haven Ports freight re-routed away from the Stratford area to the cross-country route potentially frees up paths across the GEML, which could in turn be used by London Gateway – ECML flows.

9.7 Channel Tunnel/Kent Thames Gateway traffic

9.7.1 To the south east of London rail freight growth is forecast from the Channel Tunnel in particular, leading to the eventual take up of all 35 paths at present protected by international agreement. High levels of growth are also forecast from the Kent side of the Thames Gateway.

9.7.2 **Table 9.9** shows the 2030 average freight trains per day forcast split by inland origin/destination region from these areas.

Table 9.9 – routeing options north of Oxford for Southampton traffic

	Channel Tunnel	Kent Thames Gateway (Isle of Grain, Howbury Park, Medway etc)
Yorkshire	2.6	0.6
North West	3.9	0.8
Scotland	2.0	0.1
West Midlands (inc Daventry)	7.2	0.9
East Midlands	9.0	1.3
West	3.4	2.5
London	7.2	16.0
North East	0.1	0.0
Other	0.0	1.3
Total	**35.0**	**24.0**

Notes: Paths shown are in both directions, with trains operating six days per week.
Paths shown assume 775-metre trains for Channel Tunnel, 640-metre trains elsewhere.
Paths shown are for all freight traffic not just intermodal traffic.

9.7.3 As with the shipping ports only a small proportion of Channel Tunnel traffic is forecast as serving the London area directly. The following three main potential future routes are available for Channel Tunnel traffic to beyond the capital:

- via the existing route (generally Maidstone East and Catford), then operating via the West London Line to join to WCML at Willesden.
- via High Speed 1 to the Dagenham area, with traffic heading further north then having the same routeing options as traffic from London Gateway
- via Tonbridge, Redhill, Guildford, Reading and Oxford, then utilising routes as per traffic from Southampton.

In addition there are also various diversionary routes associated with the classic network options.

9.7.4 The potential for Channel Tunnel traffic growth is accepted in this RUS. However, the history of the business and current provision for growth are of note. From its opening, the Channel Tunnel attracted new business which reached a peak of 3.2 million tonnes p.a. around 10 years ago. Services were suspended in 2001/02 as a result of the actions of illegal migrants in France. Recovery has been slow – a little over one million tonnes of traffic per annum is passing currently – equivalent to five to six trains per day. Set against this level of actual demand, a minimum of 35 specified paths/day in each direction between the Channel Tunnel and Wembley Freight Operating Centre have been protected by Network Rail for the duration of the Channel Tunnel/Railways Usage Contract up to 2052.

9.7.5 The RUS notes that the use of High Speed 1 for freight is unlikely to be a direct replacement for existing flows on the classic network. High Speed 1 provides opportunities for time-sensitive goods and/or those requiring European loading gauge operation, these represent new markets for the UK rail industry. The key issue is that such freight will require terminals in the London Riverside area serving High Speed 1; the Mayor for London's policy documents support this.

9.7.6 Beyond the London Riverside area opportunities for High Speed 1 freight are much more limited, given that a circuitous journey around north London would still be required (with relatively minor gains over the existing West London Line route) and the higher costs likely to be involved. It is therefore likely that High Speed 1 will be principally utilised for new freight flows from Europe serving the London area directly as above, rather than for re-routeing existing traffic from the Channel Tunnel to the north.

9.7.7 The RUS has also considered the potential of developing the Tonbridge – Redhill – Reading route for freight traffic. However this route suffers from the following major problems:

- the majority of Channel Tunnel freight trains are expected to be destined for the Midlands and North of England, rather than the West Country or Wales. A routeing via Reading therefore involves significant additional mileage
- extremely expensive infrastructure enhancements would be required, including a potential grade separation and avoiding line south of Redhill and new tunnels in the Guildford area
- large sections of the route are not electrified
- it would add to traffic over the capacity-constrained Reading – Oxford route, which was identified in section 9.5 as the route for accommodating future Southampton traffic growth.

For the above reasons the RUS recommends that this option is not pursued.

9.7.8 Based on the above the RUS recommends that the existing freight routes to the north from the Channel Tunnel remain the main routeing for such traffic in the future. The post-Thameslink Programme timetable structure includes two freight paths via the Catford Loop and Maidstone East in each off-peak standard hour, and these will need to remain for the foreseeable future. The Ashford International – Tonbridge – Redhill – Clapham Junction line will remain a diversionary route, with investigations ongoing at present into enabling electric haulage on this line when the preferred Maidstone East line is closed.

9.7.9 The West London Line (WLL)is a particular constraint associated with the current routeings. The key issues are:

- passenger services on this route have increased significantly in recent years, and **Chapter 7** forecast a capacity gap associated with future passenger demand growth
- there is only limited capability for southbound trains to be held whilst awaiting a path through Kent or northbound trains to be held whilst awaiting a path on WCML. Freight trains must in general therefore be kept moving to avoid delaying the following passenger traffic. The planned commencement of London Overground services to Clapham Junction can be expected to increase this existing issue, given that these passenger trains will use sections of currently freight-only line
- the West London Line only has a direct connection onto the WCML for services for the north of London. Freight for the MML must use the Kew and Dudding Hill route, interacting significantly with South West Main Line (SWML) services via Barnes. Freight for the ECML must run via a large section of the North London Line
- whilst the Kew route is a diversionary route for the WCML, parts of this are not electrified.

9.7.10 Issues on the WCML identified for London Gateway port are equally relevant to Channel Tunnel traffic. These are:

- availability of freight paths on the WCML will be constrained until such time as High Speed 2 opens, freeing up slow line capacity
- development of the Bletchley – Bedford route could provide a route for Channel Tunnel traffic to Yorkshire and the Northeast, whilst avoiding the busiest southern section of the MML; however, infrastructure enhancements on the MML section north of Bedford might be required.

9.7.11 Traffic from the Kent Thames Gateway is forecast to have significantly lower growth levels, but is also generally routed via the West London Line so has many issues in common with Channel Tunnel traffic as above.

Channel Tunnel freight – emerging conclusions

The existing route via Maidstone East, the Catford Loop, the WLL and the WCML (along with existing diversionary routes) is recommended to remain the key route for Channel Tunnel freight to the Midlands and North of England.

Paths on the WCML are scarce, but additional freight paths can be expected to be released following the completion of High Speed 2. The main freight route from the WCML to terminals in the West Midlands leaves the WCML at Nuneaton, then runs via Water Orton, avoiding the congested corridor via Coventry.

Development of freight services on High Speed 1 is likely, but is expected to involve new flows serving the London area directly.

Development of an alternative route between the Channel Tunnel and the North via Redhill and Reading is not recommended due to the extra mileage involved to key terminals and a very high level of infrastructure enhancement costs.

Development of the Bletchley – Bedford route would potentially enable use of the less constrained northern end of the MML and would provide a viable route to Yorkshire and the Northeast. Depending on the level of traffic, infrastructure enhancements on section of the MML concerned (north of Bedford) may be required.

9.8 Domestic freight growth

9.8.1 In addition to growth from ports significant levels of domestic traffic are also forecast, including around the capital. **Tables 9.10** and **9.11** show the 2030 average freight trains per day forecast with respect to such traffic.

Table 9.10 – 2030 average freight trains per day between UK terminals to/from London (including domestic intermodal)	
Yorkshire	5.5
North West	9.0
Scotland	9.0
West Midlands (inc Daventry)	4.0
East Midlands	9.3
West	14.5
North East	4.0
Other	1.8

Notes: Paths shown are in both directions, with trains operating six days per week.
Paths shown assume 640-metre trains.
Paths shown include all freight traffic not just intermodal traffic.

Table 9.11 – 2030 average freight trains per day between non-London terminals where the shortest route is via London	
Bristol – Peterborough	2.0
Northern England – Kent/Essex	0.6
East Midlands – Berkshire	1.0
Mendips – Sussex/Kent/Essex	4.7

Notes: Paths shown are in both directions, with trains operating six days per week.
Paths shown assume 640-metre trains.
Paths shown include all freight traffic not just intermodal traffic.

9.8.2 With respect to the London area most of the growth in domestic traffic is expected to be in trains to and from strategic rail freight interchanges – that is, terminals with modern intermodal rail facilities serving significant concentrations of distribution and logistics industries.

9.8.3 The overall contribution of the domestic intermodal sector to freight growth is expected to be considerable over time and it will be important for network planning purposes to continue to track its development. However, current appraisal of the prospective strategic rail freight interchanges developments in the South East suggests that they do not appear to affect significantly the conclusions emerging up this point with respect to traffic from the ports.

9.8.4 **Table 9.12** indicates the rail freight interchange developments in the South East which the RUS is aware of.

Table 9.12 – potential rail freight interchanges in South East England

Location	Developer/promoter	Progress with development	Implications for RUS
Alconbury	Urban and Civic	Renewal of planning permission being sought.	Train services likely to fit within appraised options for Haven Ports and Channel Tunnel demand.
London Riverside (Barking area)	Transport for London	Mayoral policy supports freight terminals serving HS1 and Transport for London (TfL) is working to safeguard suitable sites.	Enables HS1 freight to serve a London destination. Also enables domestic intermodal freight from this area.
Borough Green	Cemex	Early stage of plan development.	Pending developer's view of train numbers/flows.
Cricklewood	Hammerson	Master plan being progressed.	Rail Freight Interchange (RFI) size expected to be below 'strategic' level. Potential capacity issues on MML following the Thameslink Programme.
Howbury Park	Prologis	Planning permission granted.	Requires paths through the congested South London area and interacts with Slade Green depot. Two tph standard off-peak paths to locations in Thames Gateway (South) planned in post-Thameslink timetable which should be sufficient for demand at this site.
Kemsley Fields	Gazeley	Initial proposals being developed with Kilbride, Morrisons and Knauf to assess scope to create new rail freight interchange nearby on former Knauf sidings.	RFI size expected to be below strategic level.
Kent International Gateway	DMI/Axa	Planning permission refused.	Not now expected to proceed.
Northfleet	South East England Development Agency	Initial proposals being developed with Gravesham Borough Council, Lafarge, Crossrail and Kimberly-Clark for multimodal industrial/ distribution development.	Requires paths through the congested South London area. Two tph standard off-peak paths to locations in Thames Gateway (South) planned in post-Thameslink timetable which should be sufficient to cater for demand at this site. Could be used in short term to receive up to five spoil trains per day from Crossrail project, other third-party prospects unlikely to exceed two – four trains per day.
Radlett	Helioslough	Second Appeal resulted in Planning Inspector recommending consent, over-ruled by Secretary of State, developer has lodged a request for a judicial review on the decision, anticipated early 2011.	Pending outcome of judicial review. Potential capacity issues on MML following Thameslink.
SIFE (Colnbrook)	Goodman	Planning permission being sought.	Strategic Rail Freight Interchange will be close to existing Channel Tunnel/ West Coast Main Line routes. No significant additional routeing issues.
Sundon (Luton)	Prologis	Early stage of development.	Pending developer's view of train numbers/flows.
London Gateway	DP World	Planning permission granted and construction under way.	Significant train paths anticipated once terminal opens, as described in section 9.5 earlier. Potential domestic intermodel flows in addition.

9.9 Summary

9.9.1 This chapter has considered the key growth challenges impacting on freight in Southeast England in the future, based on the latest SFN demand forecasts. This work has been developed in close collaboration between the SFN Steering Group and the London and South East RUS Stakeholder Management Group.

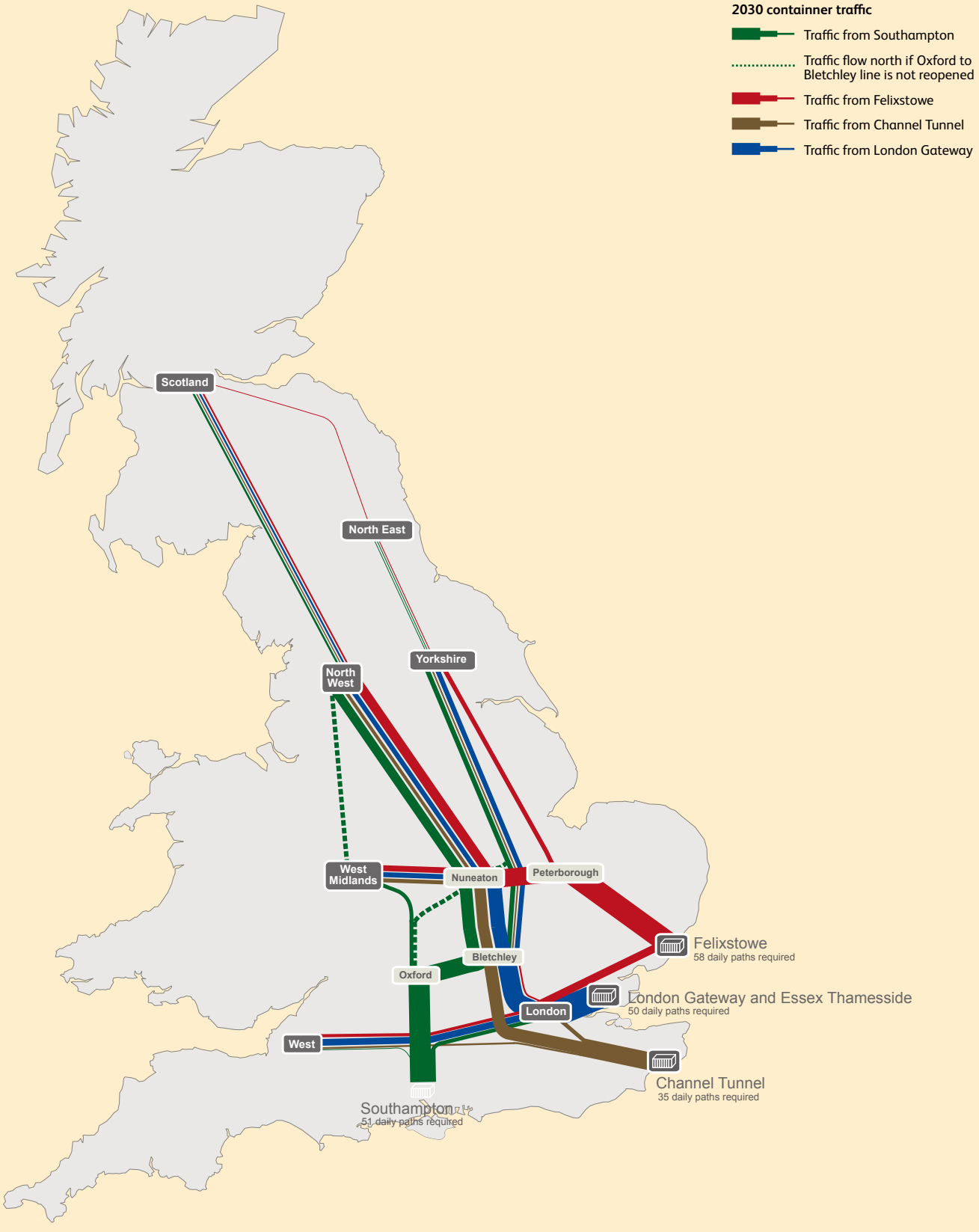
9.9.2 The principal conclusions from this chapter are as follows:

- the majority of growth will be intermodal container traffic entering the UK from ports at Southampton, London Gateway, the Haven Ports (Felixstowe and Bathside Bay, Harwich) and via the Channel Tunnel
- wherever acceptable, freight traffic not serving London should be routed to avoid the capital though this must not impact on the competitive position of rail freight in relation to road haulage. Where not practical to avoid London the routeings should be based on avoiding key infrastructure constraints, unless such constraints are realistically resolvable
- avoiding key constraints in the West Midlands is also relevant. However the extent to which this will apply depends on traffic changes associated with other types of freight flow not considered by this RUS
- growth for Southampton traffic should be via Oxford, potentially using the future east-west rail corridor for some traffic to reach the WCML and north end of the MLL
- growth for London Gateway traffic should in general be via the Gospel Oak – Barking route and the WCML, since this avoids conflicts with the GEML, represents the most direct route to the majority of terminals and is W10 loading gauge cleared. Further consideration is required regarding traffic from this port to the ECML, focusing on how best to minimise passenger/ freight interaction at Forest Gate/Stratford
- growth for Haven Ports traffic should be encouraged to use the cross-country route via Bury St Edmunds. However additional infrastructure enhancements beyond current commitments would be needed to allow all such freight to run this way
- growth for Channel Tunnel traffic should be on existing routes to the WCML, though use of High Speed 1 for new flows serving London is also likely
- increasing domestic intermodal traffic in the London area is anticipated. This is consistent with the RUS strategy and would be assisted by freight not serving London having alternative routeings. However this requires development of appropriate additional terminal locations in South East England
- freight paths on the WCML will become increasingly scarce as freight traffic builds. This could be alleviated to some extent if all Southampton and Felixstowe traffic were to avoid the London area (except those trains serving the capital directly). However the longer term solution would be through the construction of High Speed 2
- analysis remains ongoing to fully determine the relevant infrastructure enhancements for inclusion in this strategy.

9.9.3 **Figure 9.2** illustrates graphically the routeings above.

9.9.4 Further development of this strategy will now occur, building on feedback received during the RUS consultation period, together with ongoing analysis by the rail freight industry through the SFN workstream.

Figure 9.2 – 2030 preferred freight routeings from key international import locations in the South East



10. Solent and South Hampshire

10.1 Introduction

10.1.1 The South West Main Line Route Utilisation Strategy (RUS) (Network Rail, March 2006) investigated future demand from Waterloo to Portsmouth, Southampton, Bournemouth, Weymouth, Salisbury, Exeter and Reading. The London and South East RUS Stakeholder Management Group (SMG) decided to re-examine the Solent and South Hampshire areas which forms the basis of this chapter.

10.2 Dimensions

10.2.1 Geographical scope

10.2.1.1 The geographical scope, by lines of route, is defined as:

- South West Main Line (SWML): Basingstoke to Southampton Central (and beyond to Weymouth)
- Netley line: Fareham to Southampton Central via Netley
- Botley line: Fareham to Eastleigh via Botley
- Test Valley line: Redbridge to Salisbury
- Marchwood branch: Totton to Fawley
- Chandler's Ford line: Eastleigh to Romsey
- Cosham line: Cosham to Fareham
- Bedhampton line: Havant to Bedhampton
- Portsmouth direct: Woking to Portsmouth via Guildford*
- Alton line: Ash Vale to Alton*.

The Solent and South Hampshire area is shown by line of route in Figure 10.3

10.2.1.2 Key stations are Winchester, Eastleigh, Southampton Airport Parkway, Southampton Central, Fareham, Havant, Portsmouth & Southsea and Portsmouth Harbour.

10.2.1.3 Freight Yards are located at Eastleigh, Southampton, Botley, Fareham, Marchwood, Fawley and Fratton.

10.2.2 Time horizon

10.2.2.1 The RUS examines in detail a time period of 10 years to 2021. However, the RUS also identifies longer-term challenges beyond this point, highlighting further options and opportunities that may arise.

10.2.3 Planning context – Department for Transport

10.2.3.1 The Government's High Level Output Specification (HLOS) identifying requirements for the rail network in Control Period 4 (CP4) (2009/14) was published in 2007, after the publication of the SWML RUS. Alongside this, the Government also published its Statement of Funds Available (SOFA), identifying the funding which would be made available to the rail industry. This was followed by Network Rail's publication of its Strategic Business Plan (SBP) for CP4, in response to the above. The Office of Rail Regulation (ORR) reviewed the SBP and SOFA and allocated funds accordingly. Network Rail and its industry partners are in the early stages of preparing the Control Period 5 (CP5) (2014/19) submissions.

10.2.3.2 On a local level, the Department for Transport (DFT) published its Southern Regional Planning Assessment (RPA) in January 2007, which highlights some gaps and options within the RUS area.

10.2.3.3 The DfT was the specifier for the current South Central franchise which commenced in September 2009, details of the other franchises can be found in paragraph 10.3.1.2.

10.2.4 Planning context – South East England Regional Assembly and South East England Development Agency

10.2.4.1 Although disbanded by the Coalition Government, South East England Regional Assembly (SEERA) and South East England Development Agency (SEEDA) developed the South East Plan, published May 2009, to set out a vision for the South East to 2026. Whilst there is uncertainty about the future role of the Plan, it is included here as many local authorities are following through with the workstreams started by it.

10.2.5 Planning context – Transport for South Hampshire

10.2.5.1 Transport for South Hampshire (TfSH) are a delivery agency for Hampshire County Council, Southampton and Portsmouth Unitary Authorities together with transport operators, business interests and government agencies.

10.2.5.2 TfSH is currently delivering a number of schemes including the South Hampshire Bus Rapid Transit system which is under construction.

* These two lines of route technically fall outside the scope area but have been looked at for journey time improvements only.

10.2.5.3 Originally planned as a light rail system, this has been transformed into a non-guided busway utilising the alignment of the former Fareham to Gosport railway line. This will interchange with National Rail at Fareham station.

10.2.5.4 TfSH has a long-term aspiration to convert the St Denys – Fareham (Netley line) into a light rail system, more information will appear later in this chapter.

10.2.6 Planning context – local authorities

10.2.6.1 Within the context provided by the national and regional planning authorities, other local authorities have produced/are producing spatial development and implementation plans which also cover transport issues. These authorities include counties, unitary authorities, districts and boroughs.

10.2.6.2 The following local authorities are particularly relevant to the geographic scope of the Solent and South Hampshire section of this RUS:

- Hampshire County Council
- Southampton City Council
- Surrey County Council
- West Sussex County Council
- Portsmouth City Council
- Basingstoke & Deane Borough Council
- Rushmoor Borough Council
- Waverley Borough Council
- Woking Borough Council
- Guildford Borough Council
- Havant Borough Council
- Gosport Borough Council
- Fareham Borough Council
- Test Valley Borough Council
- Winchester City Council
- New Forest District Council
- East Hampshire District Council
- Chichester District Council.

10.2.7 Links to other RUSs

10.2.7.1 The Solent and South Hampshire section of this RUS interfaces with other parts of the railway network through the following geographic RUSs:

- Sussex RUS (Network Rail, January 2010) which interfaces at Havant, with regard to the West Coastway route
- Great Western RUS (Network Rail, March 2010) which interfaces at Salisbury for services to Portsmouth Harbour/Brighton from Cardiff and the West.

10.2.7.2 This section of the London and South East RUS builds on the findings of the South West Main Line RUS (Network Rail, March 2006) which looked at the timeframe between 2007 and 2017 (the length of the current South Western franchise).

10.2.7.3 This RUS interfaces with various national elements of the RUS programme:

- the Freight RUS (Network Rail, March 2007), which made recommendations on the key strategic Gaps for freight across the network as a whole and provided freight demand forecasts to 2014/15
- the Network RUS which is developing a number of key workstreams at a national level:
  - Scenarios and Long Distance Forecasts (Network Rail, June 2009, established by the ORR)
  - Stations – currently being developed
  - Rolling Stock and Depots – currently being developed
  - Electrification Strategy (Network Rail, October 2009, established by the ORR).

10.2.8 Assumptions about committed schemes

10.2.8.1 In preparing the base case (or do-minimum) demand forecasts for future years, it has been assumed that only schemes contained in Network Rail's March 2010 Route Plan (Route C) will be delivered. Those schemes are:

- provision of W10 freight gauge between Southampton and the West Coast Main Line (WCML) by 2012
- provision of W10 freight gauge between Southampton and the WCML on diversionary route via Andover in 2013.

10.2.9 Assumptions about future funding

10.2.9.1 The RUS assumes that all of the schemes detailed in 10.2.8 are funded, or part funded, under the CP4 settlement. Any further recommendation made by this RUS for infrastructure schemes that could be implemented in CP4 is made with a stated caveat that they would have to be funded either through the Network Rail Discretionary Fund (NRDF) and/or a third party source.

10.2.9.2 For schemes proposed beyond CP4, specific funding sources are not identified as it is envisaged these would be proposed by Network Rail for funding in CP5. Further development of these schemes may in some cases be through the CP5 development fund allocated by the ORR to Network Rail.

10.3. Current demand, capability and delivery

10.3.1 Introduction

10.3.1.1 This section considers the present day function and capability of the rail network in the Solent and South Hampshire area. Profiles are provided of passenger operations and freight movements, as well as information about current demand patterns, infrastructure, how the railway performs and how it is maintained.

10.3.1.2 At present, four franchised passenger train operating companies (TOCs) run scheduled services over the line covered by the study area.

- Stagecoach South West Trains (trading as South West Trains), the largest operator within the area with trains on all routes. Franchise dates: February 2007 – February 2017. This TOC will be referred to as SWT
- New Southern Railway (trading as Southern) operates services from London Victoria and Brighton along the coast to Portsmouth and Southampton. Franchise dates: September 2009 – September 2015. This TOC will be referred to as Southern
- First Great Western operates trains from Wales and the West Country to Portsmouth and Brighton. Also operates services from Reading to Redhill and Gatwick Airport via Guildford. Franchise dates: April 2006 – April 2016. This TOC will be referred to as FGW
- CrossCountry, provide trains from Manchester to Bournemouth and Newcastle to Southampton. Franchise dates: November 2007 – April 2016.

10.3.1.3 There are currently no daily timetabled open access passenger train operators although charter trains such as the British Pullman and the Cruise Saver Express (Glasgow/Edinburgh to Southampton Docks), operated by DB Schenker Rail (UK), regularly operate in this area.

10.3.1.4 Freight operators are:

- DB Schenker
- Freightliner
- GB Railfreight
- Colas Rail
- Direct Rail Services.

10.3.2 Profile of the passenger market

10.3.2.1 **Figure 10.1** shows that the Solent and South Hampshire area passenger market is dominated by journeys to and from London and within the area itself. This is closely followed by other medium distance journeys to and from the South East and South West regions. Most of the travel to the South West region is local journeys just over the border into Dorset or Wiltshire, with longer distance journeys to the rest of the country comprising only a small proportion of the demand from the passenger market.

10.3.2.2 The most significant flows are to Southampton and Portsmouth city centres, followed by flows to London. Significant numbers of passengers pass through this area.

10.3.2.3 Significant numbers of passengers arrive on trains to connect into flights from Southampton Airport and ferries from Southampton and Portsmouth to the Isle of Wight and the continent.

10.3.2.4 **Figure 10.2** shows robust growth in journeys to and from the Solent and South Hampshire area in all segments of the passenger market, averaging about 4.7 per cent per annum.

10.3.2.5 There are several main roads in this area that both feed and compete with passenger rail demand.

10.3.2.6 The M27, M3 and A31 feed significant traffic into Southampton Airport Parkway from a wide area of South Hampshire reducing the use of other stations for journeys to London.

10.3.2.7 The A3 impacts journeys between South Hampshire and destinations towards London such as Guildford, while the A34 provides a fast road route to the West Midlands. The new Hindhead Tunnel on the A3 will unblock a constraint on this road although the stretch through Guildford will still be constrained.

10.3.2.8 These roads provide significant competition for passengers on the parallel rail routes between Southampton/Portsmouth and Sussex, between Southampton, Winchester and destinations towards London and to Bournemouth, Poole and Dorset.

10.3.2.9 Bus operations in the Portsmouth and Southampton area generate a significant number of local passengers and for local journeys are often better options for passengers rather than rail, especially between Southampton and communities in the Woolston and Netley areas. Luxury coaches from Portsmouth, Bournemouth and Southampton to London are competing for the price-sensitive market.

10.3.3 Passenger train services

10.3.3.1 Passenger services are detailed below by line of route:

10.3.3.2 South West Main Line –

- direct fast and semi-fast services to London Waterloo from Weymouth, Wareham, Poole, Bournemouth, Southampton Central, Eastleigh and Winchester
- direct semi-fast trains from Portsmouth to London Waterloo via Fareham and the Botley line
- direct trains from Bournemouth, Southampton Central, Southampton Airport Parkway and Winchester to Reading, the Midlands and North
- trains predominantly on other routes as detailed in the following text.

Figure 10.1 – rail demand by destination/origin

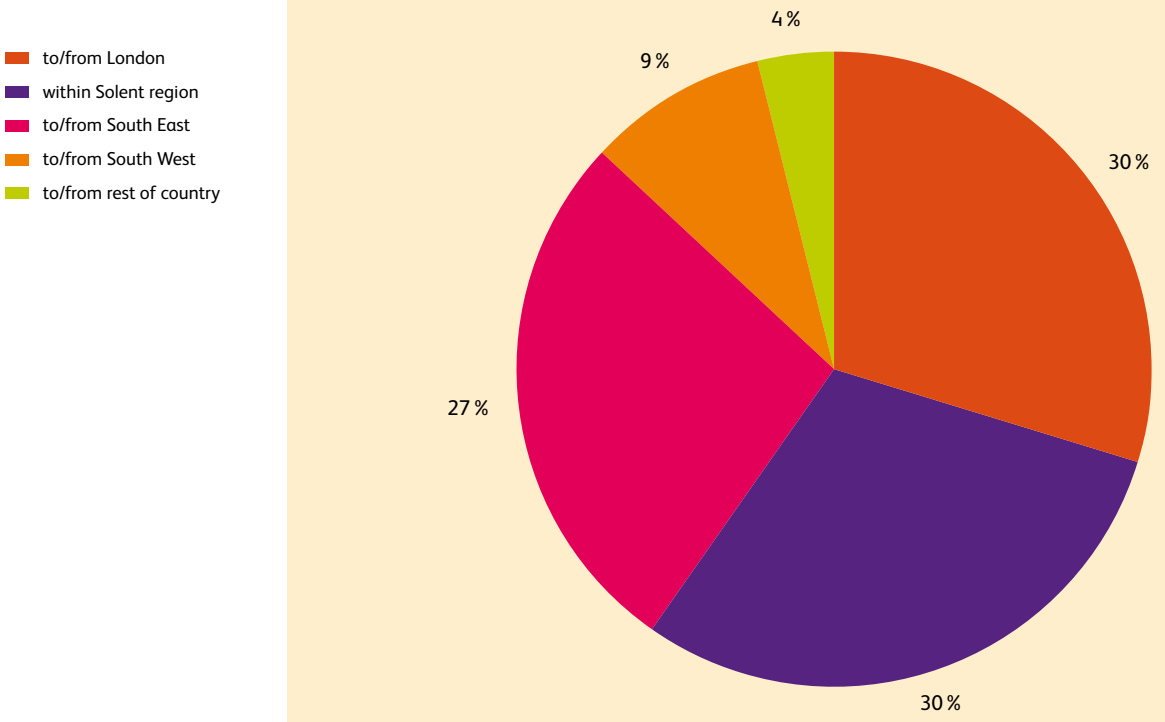


Figure 10.2 – growth in passenger journeys within the Solent and South Hampshire region

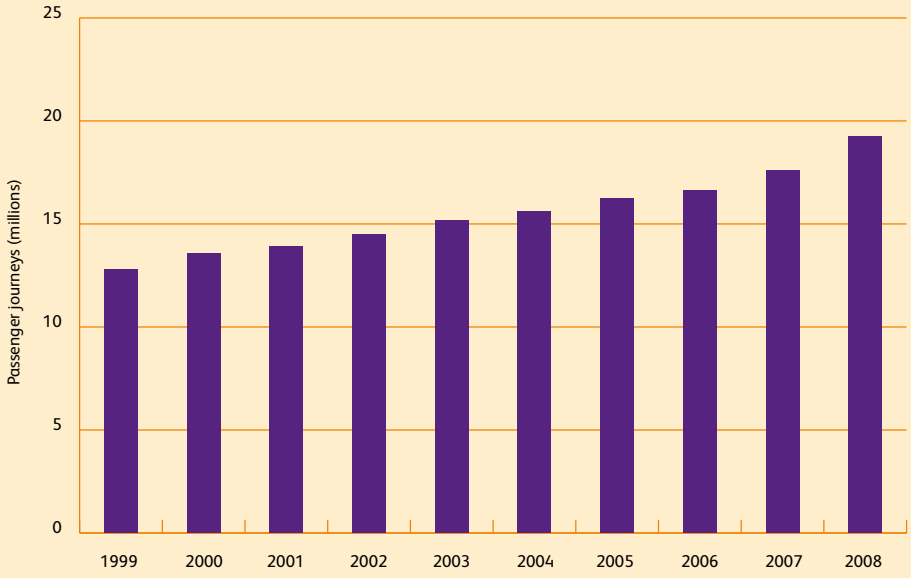


Figure 10.3 – Solent and South Hampshire

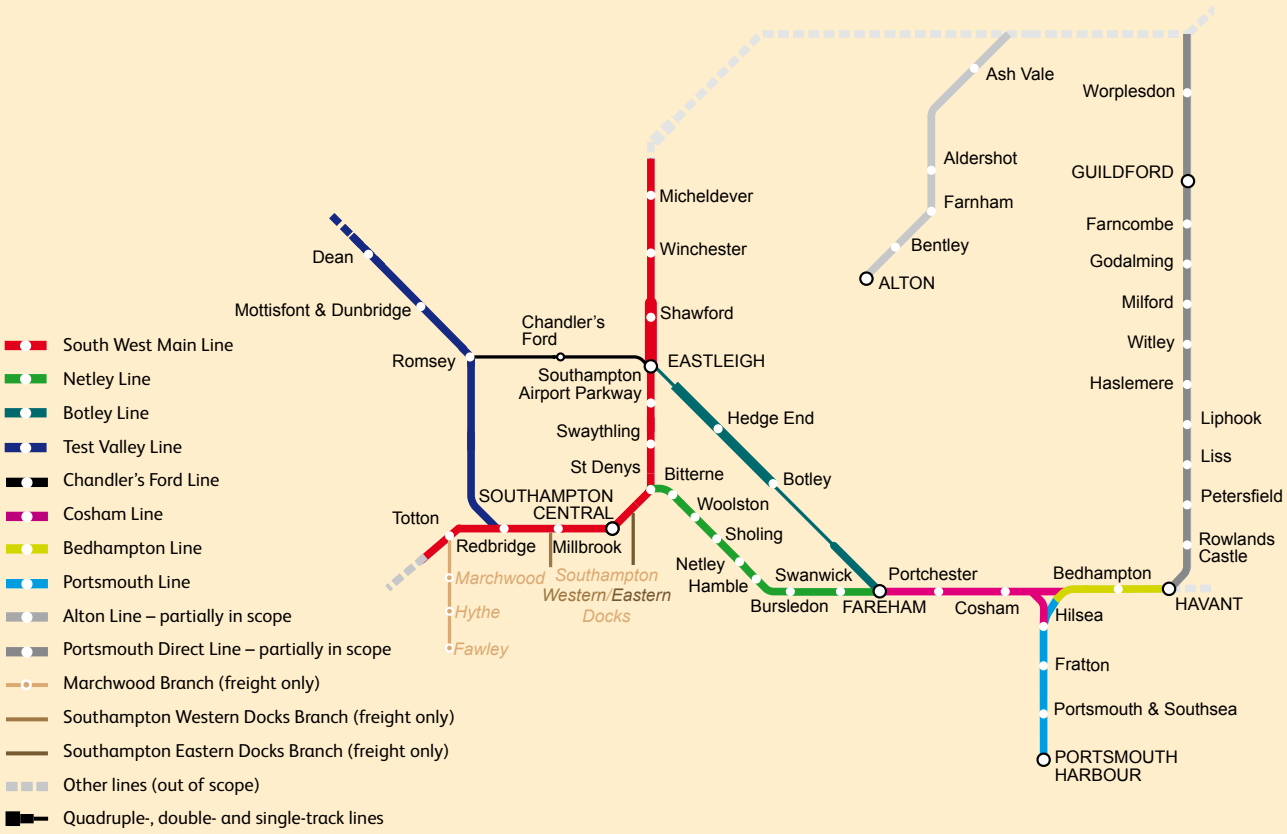


Figure 10.4 – existing staion usage

Source: Office of Rail Regulation/Delta Rail – Station usage data 2008/09

10.3.3.3 Portsmouth and Bedhampton Lines (also Portsmouth Direct, partially in scope)

- direct fast and semi-fast services from Portsmouth and Havant to London Waterloo
- direct semi-fast trains from Portsmouth and Havant to Chichester which alternate beyond to Brighton or Gatwick Airport and London Victoria
- direct stopping services between Portsmouth and Havant to Chichester and Littlehampton
- direct fast services between Portsmouth, Fareham, Southampton Central and Bristol and South Wales
- direct semi-fast trains between Portsmouth, Fareham, Eastleigh and London Waterloo
- direct stopping service between Portsmouth and Southampton.

10.3.3.4 Netley, Botley and Cosham lines

- direct fast services Southampton to Fareham, Havant and Chichester, alternately continuing to Brighton or Gatwick Airport and London Victoria
- direct fast trains to Fareham and Portsmouth from Salisbury, Bristol and South Wales
- direct stopping service between Southampton and Portsmouth
- direct semi-fast trains Portsmouth, Fareham, Eastleigh to London Waterloo.

10.3.3.5 Test Valley and Chandler's Ford lines

- fast services from South Wales, Bristol, Salisbury, Romsey to Southampton Central and Portsmouth
- stopping services from Salisbury to Romsey via Southampton Central, Southampton Airport Parkway, Eastleigh and Chandler's Ford (and vice-versa).

10.3.3.8 Alton line (partially in scope)

- direct fast and semi-fast trains from Alton, Farnham and Aldershot to London Waterloo.

10.3.3.9 Non-London trains on the Alton and Portsmouth Direct lines are out of scope.

10.3.3.10 There is some overcrowding on certain peak services, particularly those formed of two, three or four-car units although this was not identified as a gap by the SMG as interventions have already been proposed by earlier RUSs.

10.3.4 Stations and station usage

10.3.4.1 Station usage statistics are shown in **Figure 10.4**. There is a large variance in patronage between stations within the study area reflecting not only the size of the community the station serves but the provision of car parking, other facilities and local bus services. The interchange figures are rail-to-rail only and do not cover other modes of transport.

10.3.4.2 Station facilities are shown in **Figure 10.5**.

10.3.4.3 Key rail-to-rail interchange stations are Southampton Central, Eastleigh, Winchester, Fareham, Fratton and Havant. Some of these stations are for cross-platform or same platform interchange between faster and slower services, whilst others are for alternative routes/destinations.

10.3.4.4 Southampton Airport Parkway is the interchange station for airport passengers.

10.3.4.5 Other modes of transport also interchange at many of the stations – motorists are attracted to the park and ride facilities at Southampton Airport Parkway, whilst many other stations have an interchange with local buses. A number of connecting and through ticketing arrangements have been made with bus operators across the area under the PLUSBUS branding. **Figure 10.5** shows the locations where such facilities exist.

10.3.4.6 Parkway stations can cause problems as they attract large numbers of motorists to use the local road network to access the parkway station rather than using their local station, often resulting in greater congestion on the local roads and reducing the patronage of their local station, this is also known as railheading.

10.3.4.7 Railheading also occurs at other non-parkway stations and also results in car parks becoming full earlier than would normally be expected.

10.3.4.8 Southampton Central station is the interchange for Isle of Wight ferries and cruise liners, via the local bus services or taxis. Unlike air passengers, cruise passengers have no luggage limits and often take advantage of this. A new rail service from Scotland has been introduced to serve certain cruise sailings and runs directly to the dock avoiding Southampton Central.

10.3.4.9 A variety of cycle storage facilities exist at stations, from Sheffield stands to lockers, with or without Closed Cicuit Television (CCTV) coverage. Some stations have very limited cycle storage which makes mode shift from car to cycle and train harder to achieve as most train operators do not allow non-folding cycle carriage on trains in the peak periods.

10.3.5 Freight train operators

10.3.5.1 Of the current licensed freight operating companies (FOCs) the following operate services in the Solent and South Hampshire area:

- DB Schenker (DBS), which is the largest freight operator in Great Britain and is part of the German national railway company Deutsche Bahn AG. DBS runs trains for a large range of markets and is organised into three market-based groups: Logistics (door-to-door deliveries with or without rail haulage), Construction (aggregates, construction, waste and rail industry flows) and Industrial (movement of heavy raw materials such as coal, metal and petroleum products)

Figure 10.5 – station facilities map

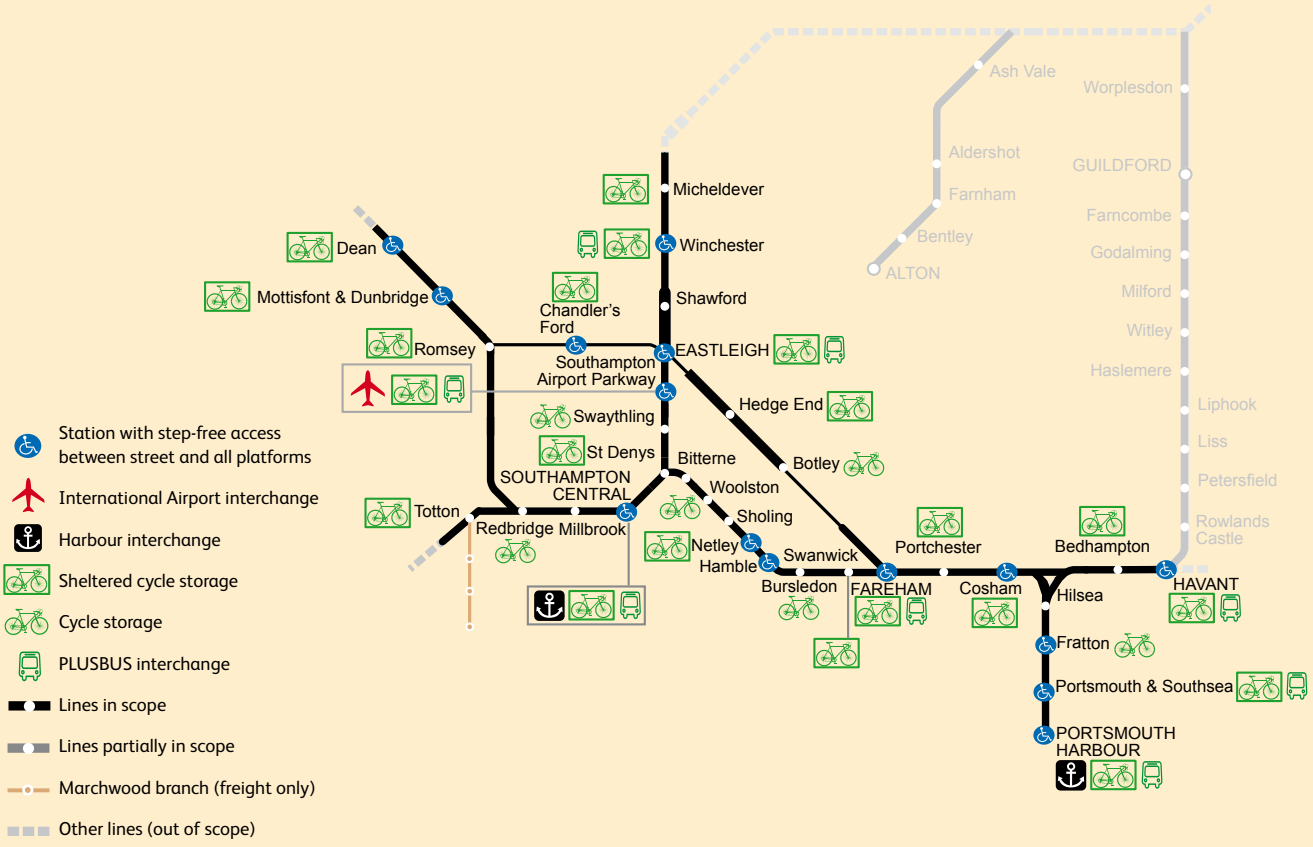


Figure 10.6 – freight terminals

- Freightliner has two divisions: Freightliner Limited is the largest haulier of containerised traffic, predominantly in the deep sea market and Freightliner Heavy Haul which is a significant conveyor of bulk goods (especially coal, construction materials and petroleum). It also operates rail infrastructure services
- GB Railfreight (GBRf), part of Eurotunnel's Europorte rail freight business, operates in the following markets: Coal, Bulk Commodities (such as dry goods for the construction industry), Rail Services (rail industry movements), Intermodal (containers etc) and Infrastructure (trains for engineering works (infrastructure), de-icing, etc)
- Colas Rail, a subsidiary of a large French infrastructure company. Nationally Colas operates a number of services including timber, flyash, steel and Channel Tunnel intermodal flows
- Direct Rail Services (DRS) is a subsidiary company of the Nuclear Decommissioning Authority. The freight operations are split into the following sectors: Specialist Freight, Domestic Intermodal Freight (container traffic), Maintenance Services (locomotive and rolling stock maintenance), Rail Infrastructure Support Services (such as infrastructure, weed-spraying and snow clearance trains).

10.3.6 Profile of the freight market

10.3.6.1 The area covered by the Solent and South Hampshire area is predominantly a passenger railway, however, there are a number of freight terminals within the area, as shown in **Figure 10.6**.

10.3.6.2 The main freight flows are containers to/from Southampton Docks. Most DBS services run via Eastleigh East Yard whilst some DBS and all Freightliner services change crew in the platform at Eastleigh. Container traffic is a leading commodity but containers have developed considerably since the original standard shipping container was introduced, various lengths and heights have resulted in the requirement for specialist wagons, for example, to carry the tallest container, to ensure the load remains within the network's loading gauge. The direct route from the West Coast Main Line to Southampton Docks is currently being upgraded to enable the tallest containers to be carried without the specialist wagons. Containerised traffic is intermodal – easily swapped from ship to train and then to truck. This is most profitable where a long distance is to be covered by rail. **Figure 10.7** shows the loading gauge of routes with the area.

10.3.6.3 Infrastructure trains, for engineering works, are loaded and marshalled at Eastleigh East Yard. New ballast is loaded into trains here and old ballast is unloaded and recycled at an adjacent facility. Long welded rail trains are loaded using specialist equipment and unloaded on site by the train but it is vital that the train arrives on site the correct way round so these trains sometimes have to be turned by running around the outside of Eastleigh Works.

10.3.6.4 Oil trains operate to and from Fawley and Holybourne. This traffic takes tanker traffic off the roads and transports it by rail directly terminal to terminal.

10.3.6.5 Aggregates traffic operates to Eastleigh, Botley and Fareham. Rail is particularly suited to the transportation of this commodity for both economic and environmental reasons. Aggregates products tend to have a relatively low unit value, as a result of which transportation costs comprise a large proportion of the end price. With a typical payload of at least 1,000 tonnes per train, rail can carry large volumes reliably and economically.

10.3.6.6 Aside from freight operations, FOCs are also involved in the movement of rolling stock in/out of storage/maintenance, on-track plant operations, thunderbird[1] locomotives, rail head treatment trains[2] and de-icer[3] operations etc.

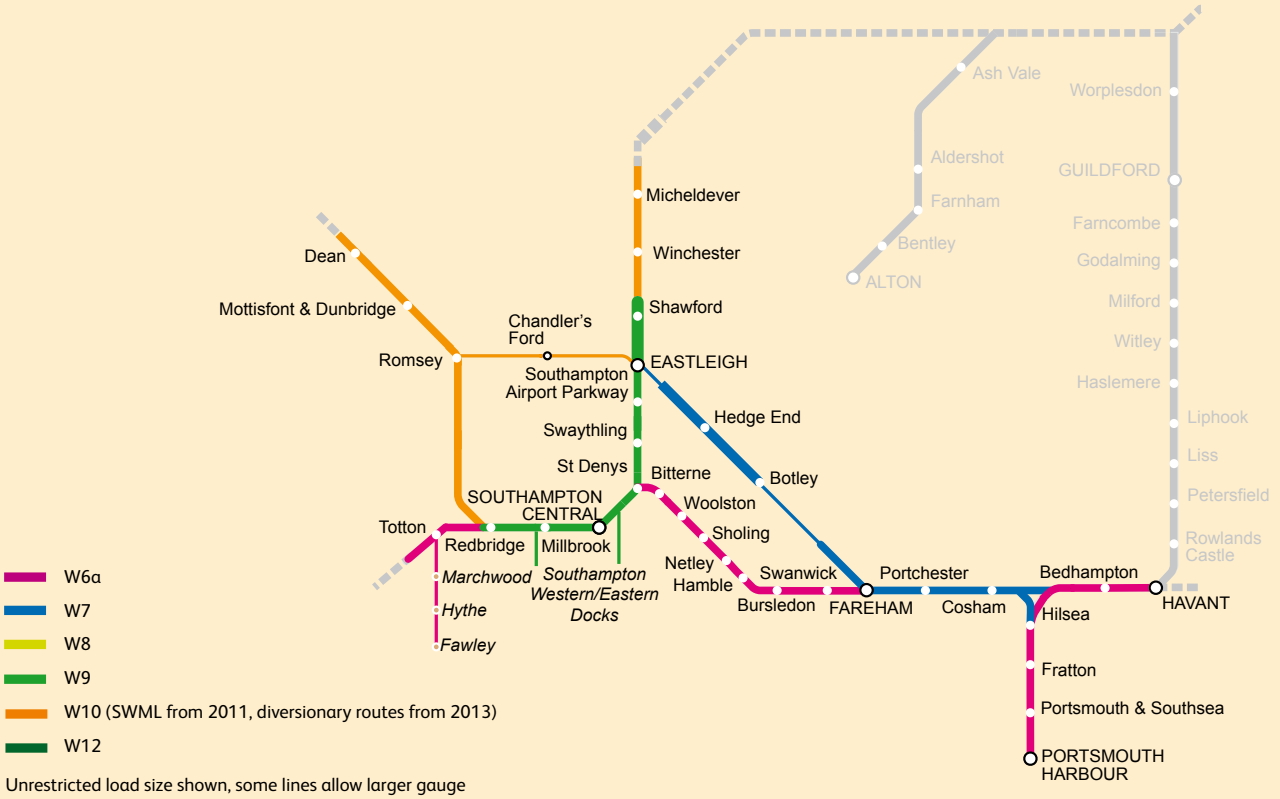
10.3.7 Freight-specific infrastructure

10.3.7.1 The loading gauges within the Solent and South Hampshire area are shown in **Figure 10.7** and a graphic illustrating the various gauges is shown in **Figure 9.1**. Loading gauge defines the maximum width and height of vehicles and their loads that can be safely accommodated without fouling structures such as bridges and platforms.

10.3.7.2 Route Availability (RA) is a system for determining which types of locomotive and rolling stock can travel over any given section of route and is normally a function of the strength of underline bridges in relation to axle load and speed. A locomotive rated as RA8, for example, would not normally be permitted on a route rated as RA6. **Figure 10.8** shows the RA for the study area.

1 Thunderbird locomotives are standby locomotives which can be called upon to rescue/assist a broken down train.
2 Rail head treatment trains are operated during the autumn period to apply a sand mixture to the railhead to aid adhesion – these trains are either locomotive-hauled or MPV (multi-purpose vehicle) operated.
3 De-icer trains operate over the third-rail network to spray de-icing fluid onto the conductor rail

Figure 10.7 – loading gauge



Unrestricted load size shown, some lines allow larger gauge vehicles under restriction.

Figure 10.8 – route availability

The higher the route availability, the higher the axle loads that are permitted to run.

10.3.8 General infrastructure

10.3.8.1 This section describes more general aspects of the infrastructure in the Solent and South Hampshire area, including:

- linespeeds
- signalling
- electrification
- platform lengths.

10.3.8.2 **Figure 10.9** shows the existing linespeeds within the study area. Most of the network has maximum plain line speeds of between 60 mph and 100 mph. However, there are some sections of track where high speeds cannot be attained due to factors such as gradient, track curvature and level crossings, thus limiting capacity and adversely affecting journey times.

10.3.8.3 **Figure 10.10** shows the four Area Signalling Centres (ASCs) and signal boxes and their boundaries within the Solent and South Hampshire area. There are two main types of signalling control system – absolute block and track circuit block – however track circuit block is the main control system in the Solent and South Hampshire Area. Absolute block signalling is generally associated with traditional lever frame, mechanical interlocking signalling but forms the foundations of all following systems – one train in a section at any time with generally long section running times or headways.

10.3.8.4 Track circuit block signalling is a more modern system which, in its simplest form, breaks the track into sections through which a low voltage current provides a circuit which is shorted out by the wheels of a train. This then breaks the circuit to show the track circuit section as occupied. More trains can be operated as the signaller knows where each train is – by occupation of the track circuit section – but the fundamental rule of 'one train in section' is maintained.

10.3.8.5 Multiple aspect signals are the modern colour light signals of two, three or four-aspects rather than the old semaphore signals with their moving arm and lamp behind the signal lenses. Network Rail is planning over time to replace Multiple aspect signals lamps with LED signal heads which enable a single head to show up to three different colours as required for the signal. An additional head may be provided for 'double yellow' signals (for advanced warning of caution signals).

10.3.8.6 Signalling headways are shown in **Figure 10.11**.

10.3.8.7 The 40 level crossings of six different types are shown in **Figure 10.12** and a breakdown of these can be found in **Table 10.1**.

10.3.8.8 Whilst some level crossings affect public roads, there are a number of user-worked crossings providing access to bridleways or private roads. CCTV and manned level crossings are controlled by a signal box or crossing box. CCTV crossings consist of full barriers to protect the railway line and are remotely operated. This style of crossing is protected by a signal so the signaller has to lower the barrier early enough to allow the train to pass without being slowed by restrictive signals. This often means the barriers are down for several minutes, whereas Automatic Half Barrier level crossings are activated by the approaching train a relatively short time period before passing over it. These are generally only provided in rural areas.

10.3.8.9 Most of the area has third rail 750V DC electrification. However, the Salisbury to Eastleigh/ Redbridge lines are not electrified so the service is presently provided by Class 153, 158 and 159 diesel units.

10.3.8.10 Some services that run in the RUS area are also operated by diesel units by virtue of the fact that they originate on non-electrified routes outside the scope area of the Sussex RUS. The main examples are the CrossCountry services from Manchester to Bournemouth and Newcastle to Southampton Central, the FGW services between Cardiff and Portsmouth and SWT's Salisbury to Romsey service via Southampton and Chandler's Ford.

10.3.8.11 Existing platform lengths are shown in **Figure 10.13**.

10.3.8.12 Eastleigh Works is currently leased by Bruce Knights Rail Services and is used for storage, maintenance and refurbishment of trains. To the south of the Works there are numerous sidings operated by DBS and regularly used for storing locomotives and rolling stock. The entire site is just north of Southampton Airport's runway, the runway end safety area crossing many of the sidings.

Figure 10.9 – linespeeds

Highest maximum permitted speed shown – may be applicable to one line only.

Figure 10.10 – signal boxes and Area Signalling Centres

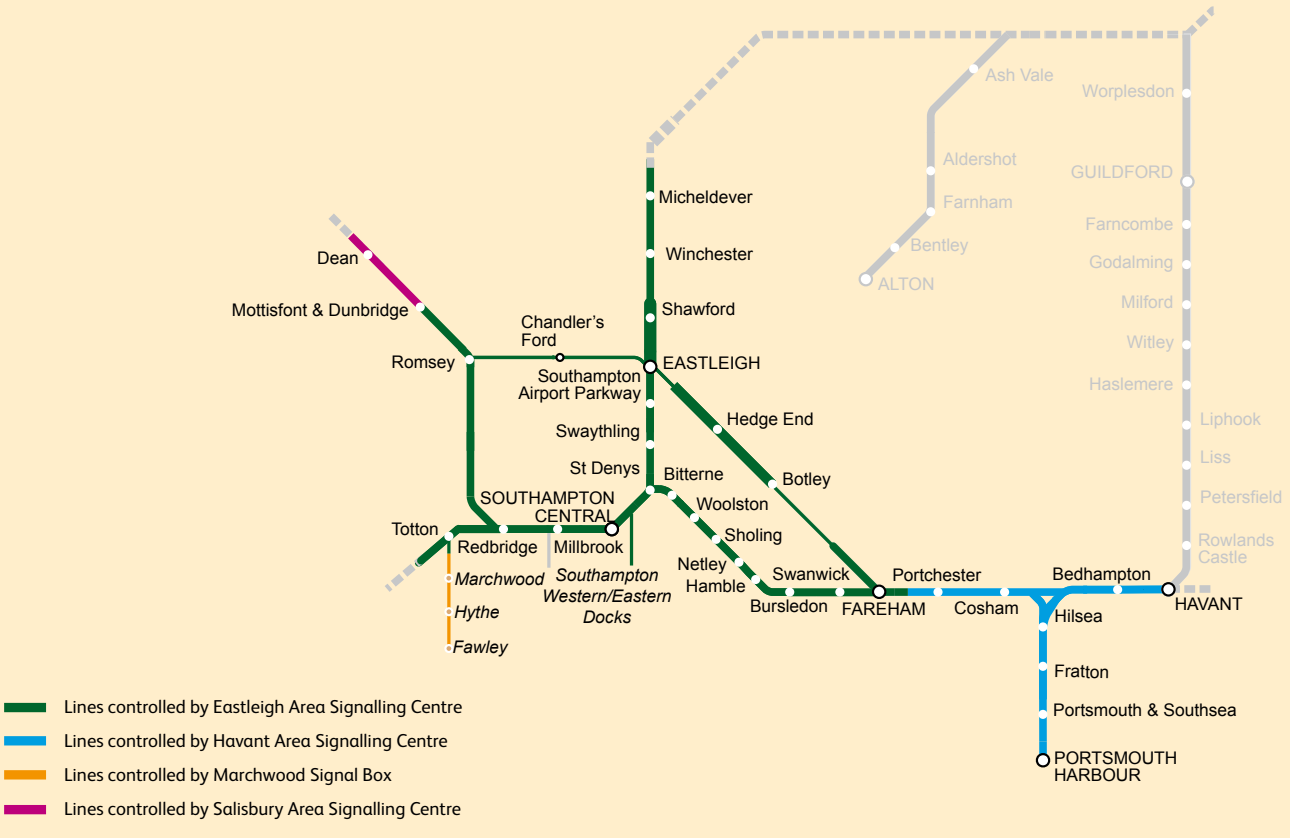
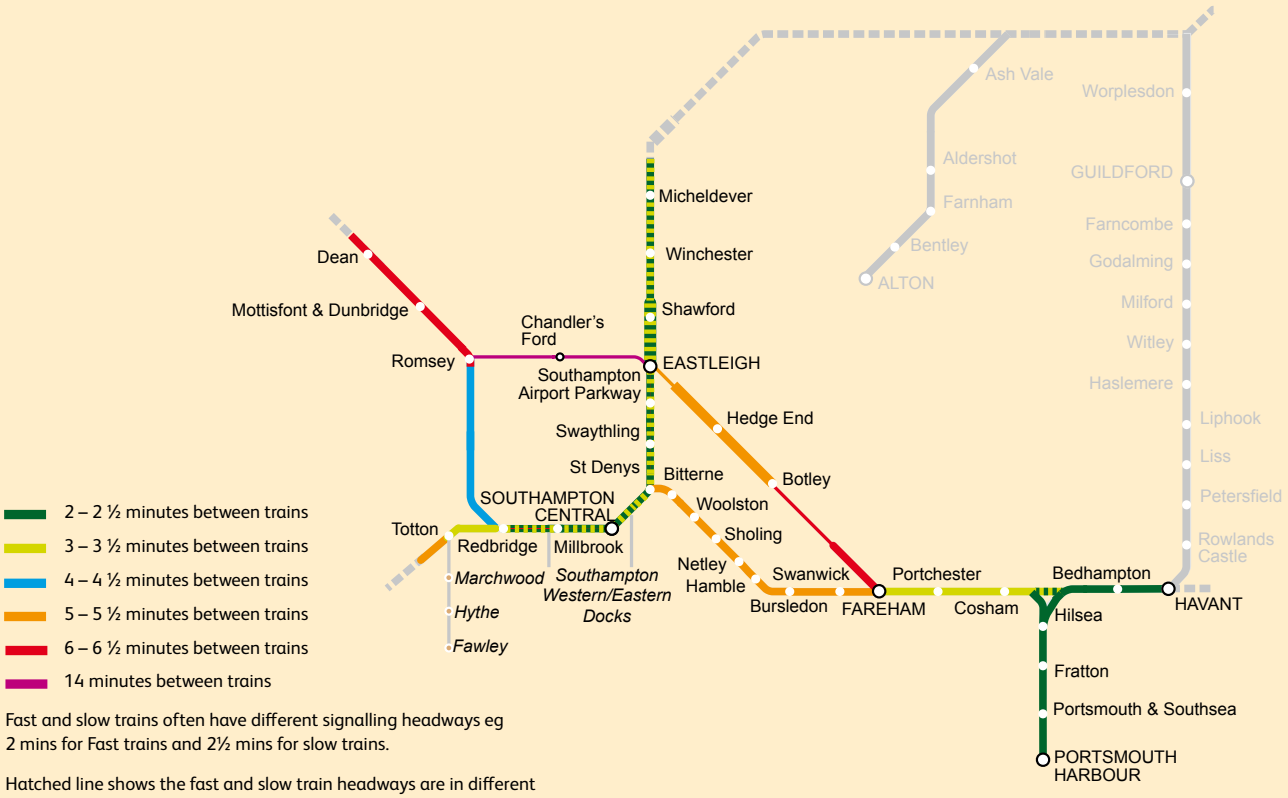


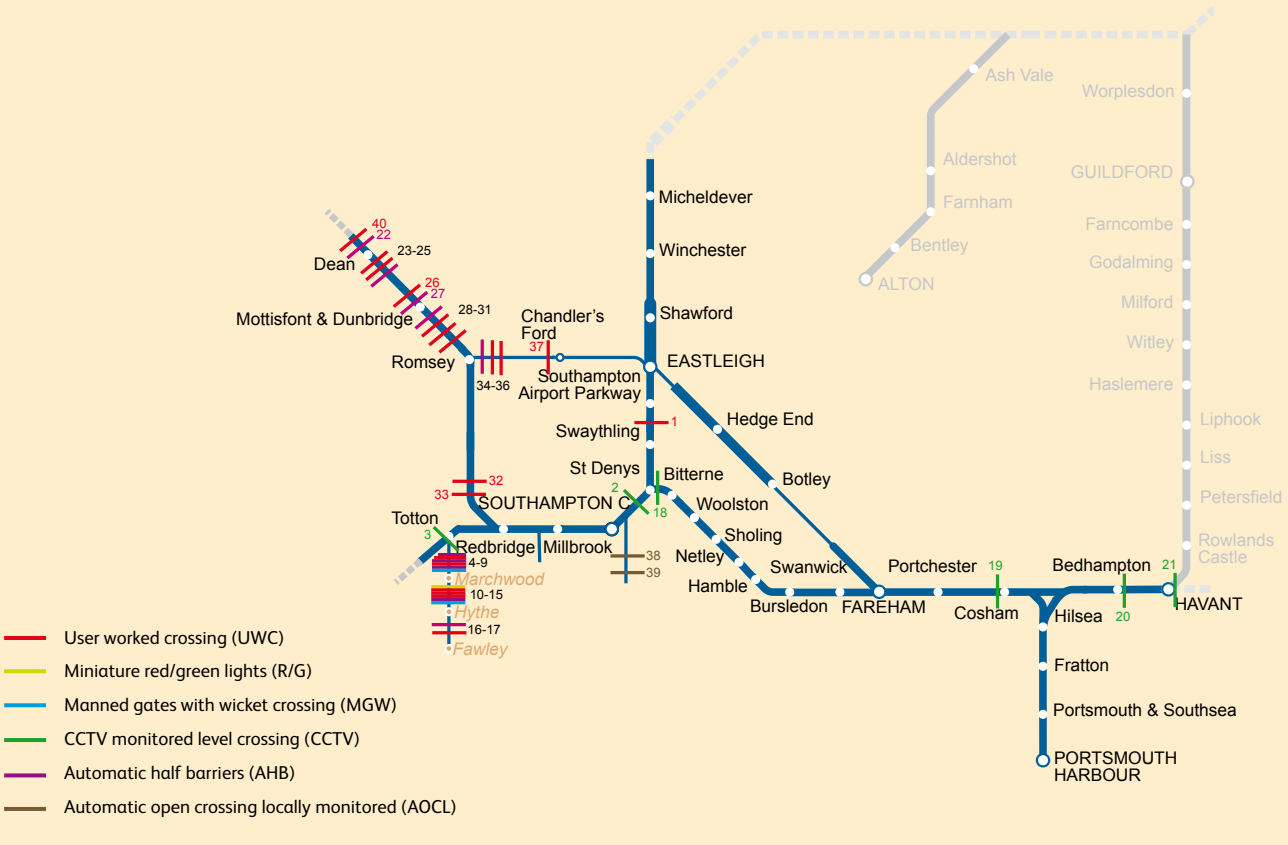
Figure 10.11 – signalling headways



Fast and slow trains often have different signalling headways eg 2 mins for Fast trains and 2½ mins for slow trains.

Hatched line shows the fast and slow train headways are in different time bands as shown above.

Figure 10.12 – level crossings



10. Solent and South Hampshire

Table 10.1 – level crossings			
No.	**Name**	**Type of crossing**	**Controlling signal box**
1	Swaythling	User worked crossing	
2	Mount Pleasant	CCTV	Eastleigh ASC
3	Totton (Junction Road)	CCTV	Eastleigh ASC
4	Jacob's Gutter Lane	Automatic half barriers	
5	White's	User worked crossing	
6	Trott's Lane	Automatic half barriers	
7	Howell's	User worked crossing	
8	Tavell's Lane	Automatic half barriers	
9	Marchwood	Manned gates with wicket crossing	Marchwood signal box
10	Pumpfield Farm	Miniature red/green lights	
11	Mc Gee No.2	User worked crossing	
12	Mc Gee No.3	User worked crossing	
13	Mc Gee No.4	User worked crossing	
14	West Street	Automatic half barriers	
15	School Road	Manned gates with wicket crossing	School Road crossing box
16	Frost Lane	Automatic half barriers	
17	Devel. Co. No.3	User worked crossing	
18	Adelaide Road	CCTV	Eastleigh ASC
19	Cosham	CCTV	Havant ASC
20	Bedhampton (69)	CCTV	Havant ASC
21	Havant New Lane (66)	CCTV	Havant ASC
22	Dean	Automatic half barriers	
23	East Dean	User worked crossing	
24	Bishops	User worked crossing	
25	Dean Hill	Automatic half barriers	
26	Dunbridge	User worked crossing	
27	Mottisfont & Dunbridge	Automatic half barriers	
28	Kimbridge	Automatic half barriers	
29	Butler's	User worked crossing	
30	Thurstons	User worked crossing	
31	Terrys	User worked crossing	
32	Banks	User worked crossing	
33	Chandlers	User worked crossing	
34	Halterworth	Automatic half barriers	
35	Crampmoor	User worked crossing	
36	Crawford	User worked crossing	
37	Chandler's Ford	User worked crossing	
38	Chapel Road	Automatic open crossing locally monitored	
39	Canute Road	Automatic open crossing locally monitored	
40	West Grimstead	User worked crossing	

Figure 10.13 – platform lengths

10.4. Committed service changes and associated schemes

10.4.1 Introduction

10.4.1.1 This section describes the planned train service changes, together with the committed (funded) infrastructure enhancement schemes due for implementation during the early years of the London and South East RUS to 2015.

10.4.1.2 The RUS assumes that committed service changes and associated schemes will happen as planned and they therefore form part of the baseline. Any interventions proposed by the RUS are assessed against this 'do-minimum' scenario, rather than the present situation.

10.4.2 December 2010 timetable change

10.4.2.1 CrossCountry's hourly Newcastle to Reading service was extended to Southampton Central on a two-hourly basis from 12 December 2010. This provides an additional service between Reading and Southampton Central calling at Basingstoke, Winchester, Southampton Airport Parkway and Southampton Central.

10.4.3 Southampton to West Coast Main Line freight upgrade

10.4.3.1 As mentioned in 10.3.6.2, shipping containers have evolved to be longer and higher than originally designed. To meet these changes, specialist lower chassis and pocket wagons have been developed. The taller 9' 6" containers are becoming increasingly popular by shippers but require the specialist wagons for transportation on the current network.

10.4.3.2 This project will expand the gauge to W10 between Southampton Central and the WCML via Winchester and is scheduled for completion in 2011.

10.4.4 Southampton to West Coast Main Line freight upgrade – diversionary routes

10.4.4.1 This is a follow-on project to the one detailed above. It will deliver W10 gauge between Southampton and the WCML but via diversionary routes for when the preferred route is unavailable by June 2013.

10.4.4.2 In the Solent and South Hampshire area, this is the Southampton to WCML via Andover diversionary route which uses the Test Valley or Chandler's Ford lines.

10.4.5 Buriton Tunnel linespeed improvement

10.4.5.1 The linespeed through Buriton Tunnel, between Guildford and Havant, is due to be increased in early 2011, following some track improvement work.

10.5. Future planning context

10.5.1 Introduction

10.5.1.1 Planning for the transport system needs to recognise that today's travel patterns will be influenced by demographic trends, employment opportunities, land use changes and many other factors affecting society as a whole. Transportation issues are therefore intrinsically linked to the wider planning process.

10.5.1.2 The strategy recommended by this RUS needs to be consistent with wider intentions of the relevant planning authorities for the area which it covers. It must also be consistent with government policies (as specified by the DfT) regarding transportation issues.

10.5.1.3 A specific regional context for the planning process is set by the relevant regional governmental bodies, by means of plans known as Regional Spatial Strategies. The key document being referred to in developing the London and South East RUS is the South East Plan, published by the Government Office for the South East in May 2009.

10.5.1.4 However, following the abolition of the Government Office for the South East by the Coalition Government, it is uncertain how local authorities will deal with future growth.

10.5.1.5 Working in accordance with the relevant regional spatial strategy, local authorities (such as County Councils and District Councils) also prepare their own local transport plans, local development frameworks or local implementation plans. These can also be of relevance to the RUS. Many of these are currently being updated.

10.5.1.6 As well as being informed by current regional and local planning policies, the RUS will also inform future policy-making within its geographic scope. It can, for example, influence planning decisions regarding the location of major proposed developments, since most local policies require that these should be located in areas with adequate transport links.

10.5.1.7 A specific planning context for the railway is set by the DfT. The following are the DfT's most significant documents of relevance for the Solent and South Hampshire study area of the London and South East RUS:

- 'Delivering a Sustainable Railway', a White Paper published in 2007
- 'The Southern Regional Planning Assessment for the Railways', published in 2007
- 'The Eddington Transport Study', published in 2006.

10.6. Future passenger demand

10.6.1 The RUS has developed a high level forecast for the Solent and South Hampshire area. This forecast considers the future demand that can be expected due to drivers external to the rail industry, such as changes in population and employment distribution.

10.6.2 It is important to note that rail service improvements can also drive increases in demand, especially where such improvements encourage a shift to rail from other modes.

10.6.3 Growth of air traffic volumes at Southampton Airport also has the potential to generate significant additional rail journeys. The airport's throughput has been linked with additional traffic volume in the region.

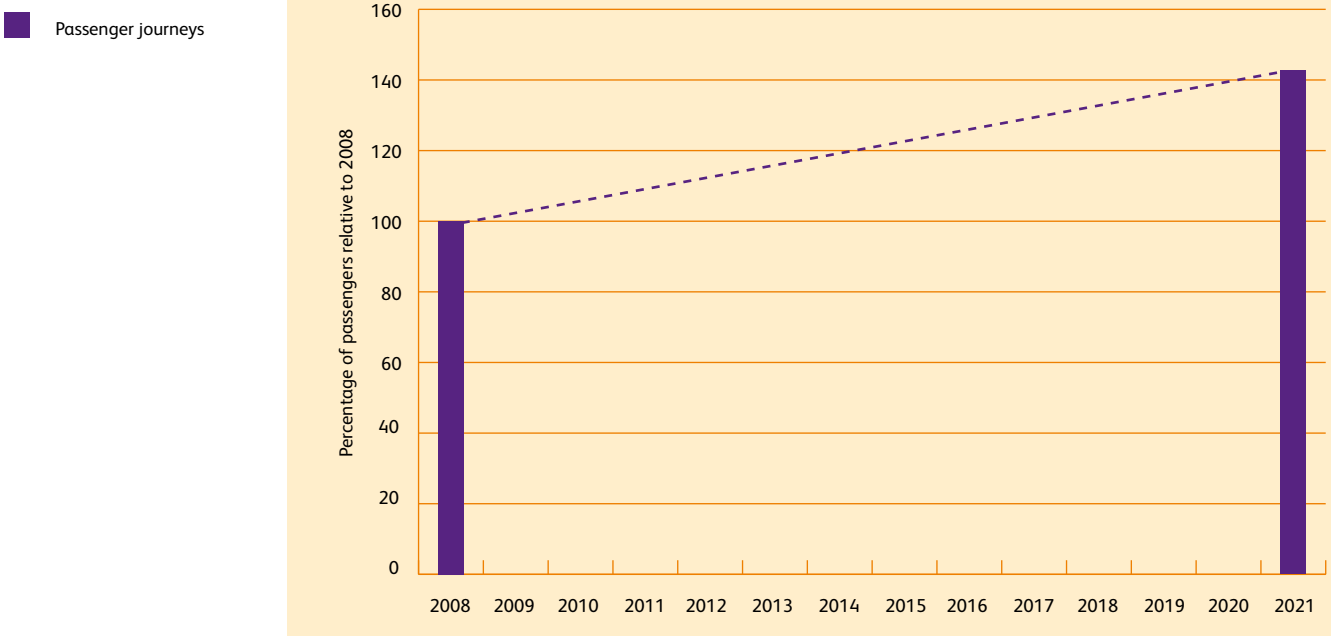
10.6.4 The forecast has been developed using Passenger Demand Forecasting Handbook (PDFH) methodology. The PDFH is the industry standard tool for developing rail passenger demand forecasts. The data sources for the main demand drivers considered in the forecast are listed in **Table 10.2**.

Table 10.2 – external drivers of demand

PDFH exogenous demand drivers	Source
Fares	standard DfT assumptions
Gross Value Added (GVA) per capita	Oxford Economics Forecast Update for Passenger Demand Forecasting Council (PDFC) Members, January 2010
Employment	Oxford Economics Forecast Update for Passenger Demand Forecasting Council (PDFC) Members, January 2010
Population	TEMPRO
Car ownership	TEMPRO
Fuel cost	standard DfT assumptions, webTAG Guidance

10.6.5 An exercise comparing the level of growth PDFH methodology would have predicted against actual growth over the past 10 years showed that the PDFH methodology would, on average, have under-represented historic growth in the Solent region by about one per cent per annum. As a direct result of this exercise, the final version of the forecast has been uplifted to better reflect historic growth, see **Figure 10.14**.

Figure 10.14 – all day passenger demand (normalised to 2008 levels)



10.6.6 Total passenger demand in the Solent and South Hampshire area is expected to grow at roundly three per cent per annum between 2010 and 2021, due to external factors alone.

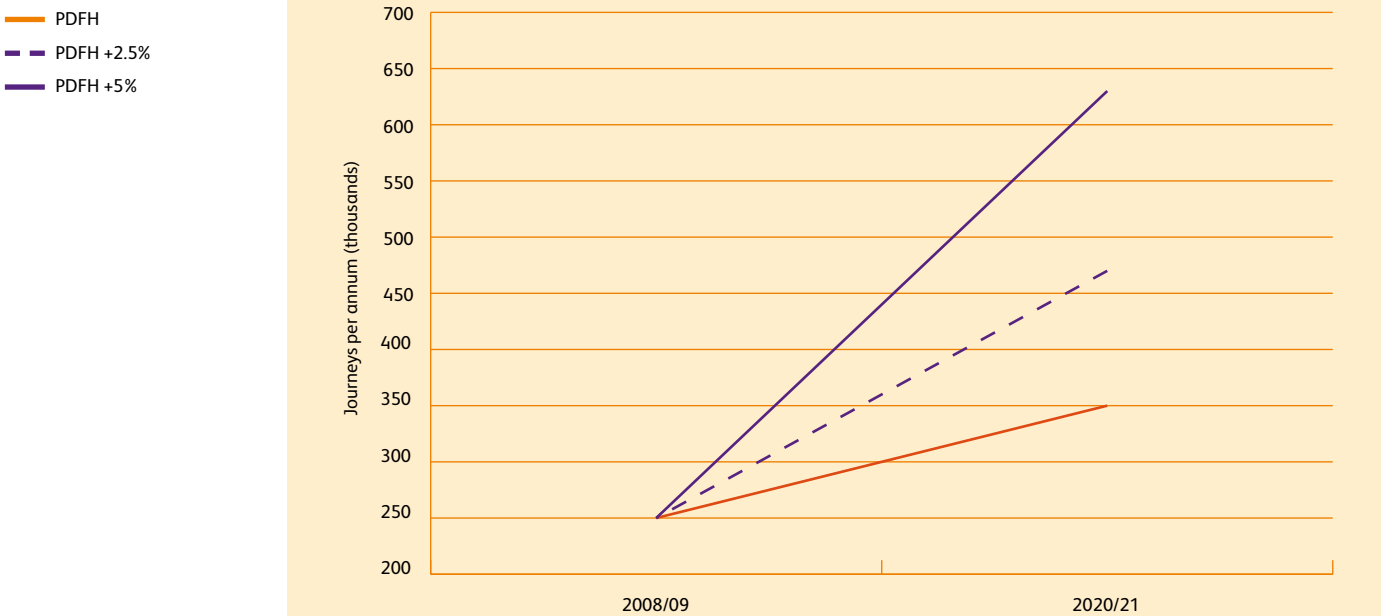
10.6.7 Southampton Airport

10.6.7.1 The back-casting exercise described above showed significantly higher demand growth than the PDFH would have predicted. This primarily reflects growth in market share driven by improvements to the frequency of rail services to the airport.

10.6.7.2 The demand forecast for Southampton Airport Parkway has therefore taken into account the potential to further grow the rail market at the airport. The PDFH forecast, with no increase in market share, represents the 'low growth' scenario for this station. **Figure 10.15** shows the low, medium and high scenarios. All option appraisal has used the medium growth scenario for airport passengers, with high growth as a sensitivity.

Figure 10.15 – future growth scenarios at Southampton Airport Parkway

Future growth scenarios		Implied annual growth rate to 2021	
Low	External growth only, no change in market share	3.0%	PDFH
Medium	External growth and 5% rail market share increase	5.5%	PDFH + 2.5% pa
High	External growth and 10% rail market share increase	8.0%	PDFH + 5% pa



10.7 Gaps

10.7.1 Introduction

10.7.1.1 The role of the RUS is to consider where the current or future railway system does not or will not meet the requirements that will be placed upon it, unless intervening action is taken. In other words, to identify gaps.

10.7.1.2 Within the RUS process, in order for a gap to be considered appropriate for study it should generally conform to the following criteria:

- supply and demand are mismatched now
- supply and demand predicted to be mismatched in the future
- proposed by funders and consistent with funds that are or are likely to be available.

10.7.1.3 The process of gap identification for the Solent and South Hampshire section of the London and South East RUS has therefore been completed as follows:

- review of existing mismatches between supply and demand – as detailed in section 10.3
- review of likely future demand – section 10.6 – and any further gaps driven by it
- review by the London and South East RUS SMG and the Solent and Hampshire working group of identified gaps and consideration of any further gaps that meet RUS criteria but are not immediately apparent from comparison of modelled demand and supply.

10.7.1.4 During the RUS process we have investigated a number of gaps and options that cover the RUS area, these have been grouped into the main gaps, detailed below:

10.7.2 Gap S1 – Direct connectivity and frequency of services to Southampton Central and Southampton Airport Parkway

10.7.2.1 This gap examines the services to and through Southampton Airport Parkway and Southampton Central, focusing on the lack of direct services to the Airport from the east, direct services between Southampton Central and Portsmouth and connectivity from the west.

10.7.3 Gap S2 – Reopening of the Marchwood line to passenger traffic

10.7.3.1 This gap investigates the possible reopening of the Marchwood freight-only line to passenger traffic.

10.7.4 Gap S3 – Car park provision at stations

10.7.4.1 This gap highlights that several car parks in the Solent and South Hampshire area are currently full, too small or require improvements, this leads to the risk of passengers railheading – driving to a bigger car park to catch the train rather than using their local station.

10.7.5 Gap S4 – Improve journey times on the Portsmouth Direct and Alton line

10.7.5.1 The SMG decided to look to reduce the journey times on the Portsmouth Direct and Alton Line, this will involve a line of route linespeed review which is scheduled for early 2011 – the results of which will be published in the final RUS.

10.7.6 Gap S5 – Freight growth and other issues

10.7.5.2 With the busy Eastleigh Yard and docks terminals around Southampton it is understandable that freight has been identified as a gap – freight demand is expected to rise significantly by 2030 with extra pathways being required to cope with the demand. The possible new container terminal at Dibden Bay is also considered in this gap, as is the current problem of freight services changing crew at Eastleigh.

10.8 Options

10.8.1 Introduction

10.8.1.1 This section describes the options which the Solent and South Hampshire working group of the London and South East RUS is currently considering to bridge the gaps identified in the previous section, together with the analysis which has been carried out to date on these options.

10.8.1.2 For each gap identified in section 10.7, a range of options were considered and sifted at the RUS SMG and Solent and South Hampshire working group meetings. Those options likely to meet the key RUS criteria of being practical, fundable within the timescale considered by the RUS and likely to address the gap outlined were progressed to appraisal.

10.8.1.3 The options that have been developed have been subject to an economic appraisal which is compliant to the Department for Transport's Transport Analysis Guidance (webTAG). All figures in the appraisals are presented in 2002 market prices. Where appropriate, Benefit Cost Ratios (BCRs) are reported, which indicate the value for money of the scheme. DfT funding criteria permits recommendation for funding through the RUS process if the BCR is at 1.5, which is indicative of medium value for money. However, schemes involving infrastructure investment are typically required to offer high value for money indicated by a BCR of at least 2.0.

10.8.1.4 For others, there appears to be a weak case for implementing the option as described, so the RUS will not be able to provide a recommendation unless additional information becomes available during the consultation period.

10.8.2 Options responding to Gap S1 – Direct connectivity and frequency of services to Southampton Central and/or Southampton Airport Parkway

10.8.2.1 The development of this RUS looked at each route to Southampton Central and Southampton Airport Parkway individually and at a higher level. Given the Airport's aspiration for higher rail share than at present, the complete lack of direct services from the east is likely to reduce this market because of the requirement to change trains at Southampton Central or Eastleigh.

10.8.2.2 The approaches to Southampton from the East are from the Havant and Portsmouth lines which combine at Cosham and split again, at Fareham, into the Netley line (which follows the coast to St Denys and Southampton Central) and the Botley line (which heads north-west to Eastleigh).

10.8.2.3 Both routes were resignalled when fewer trains operated over these routes, the Botley line has one track between Fareham and Botley with six-minute headways for fast trains and 6½ minute headways for stopping trains over this stretch. The remainder of the Botley line and all of the Netley line (Fareham to St Denys) has five and 5½ minute headways. In comparison, the SWML between Eastleigh and Redbridge benefits from two and 2½ minute headways.

10.8.2.4 The Netley line has eight stations between Fareham and Southampton Central, **Figure 10.4** shows the passenger footfall of the stations in this area. The current train service of four trains per hour along this route only has one train that stops at all stations. A further two trains call at Swanwick. Passengers have to change at Southampton Central for services to Southampton Airport Parkway.

10.8.2.5 The Botley line has two stations between Fareham and Eastleigh. The current service is the hourly Portsmouth Harbour to London Waterloo via Eastleigh. Passengers from Botley and Hedge End have to change trains at either Eastleigh or Fareham for trains to Southampton Central or Eastleigh for trains to Southampton Airport Parkway. **Figure 10.4** shows the footfall for these stations.

10.8.2.6 It is to be noted that the footfall at the intermediate stations on both lines are quite low. Swanwick has the highest footfall on the Netley line, followed by St Denys and Woolston. Hedge End and Botley have relatively high passenger numbers but this is mostly due to the direct service to London Waterloo.

10.8.2.7 The passenger numbers in the area are quite low so the RUS has looked at the hourly train service against the local bus services. Both lines are only served by hourly stopping services whereas the local bus service is an extensive and frequent network of routes to both Southampton Central station and the city centre. It is therefore unlikely that heavy rail can compete, by running an hourly stopping service, with the local bus service, with a frequency of two to six buses per hour.

10.8.2.8 There is a relatively infrequent rail service between Portsmouth with Southampton – there is an hourly fast service (FGW's two- or three-car Portsmouth Harbour to Cardiff Central service) and a stopping service (SWT's four-car Portsmouth Harbour to Southampton Central service). These trains take 41 and 60 minutes respectively. This is not competitive with the roads on which the journey should take 31 minutes.

10.8.2.9 From the north, on the SWML, the line between Basingstoke and Shawford is double-track with a passing loop at Waller's Ash, then four-track through Eastleigh (where the Botley and Chandler's Ford lines converge with the SWML) where it reverts back to double-track to St Denys (where the Netley line joins the SWML). **Figure 10.16** shows the stopping patterns (for trains between 12:00 and 12:59 on a weekday), as can be seen, all trains call at Winchester and Southampton Airport Parkway but only a few call at Eastleigh. All electric trains calling at Southampton Airport Parkway are subject to a 90-second dwell time against the usual 30 or 60 second stops. Diesel services formed of two- or three-car units have a dwell time of 60 seconds.

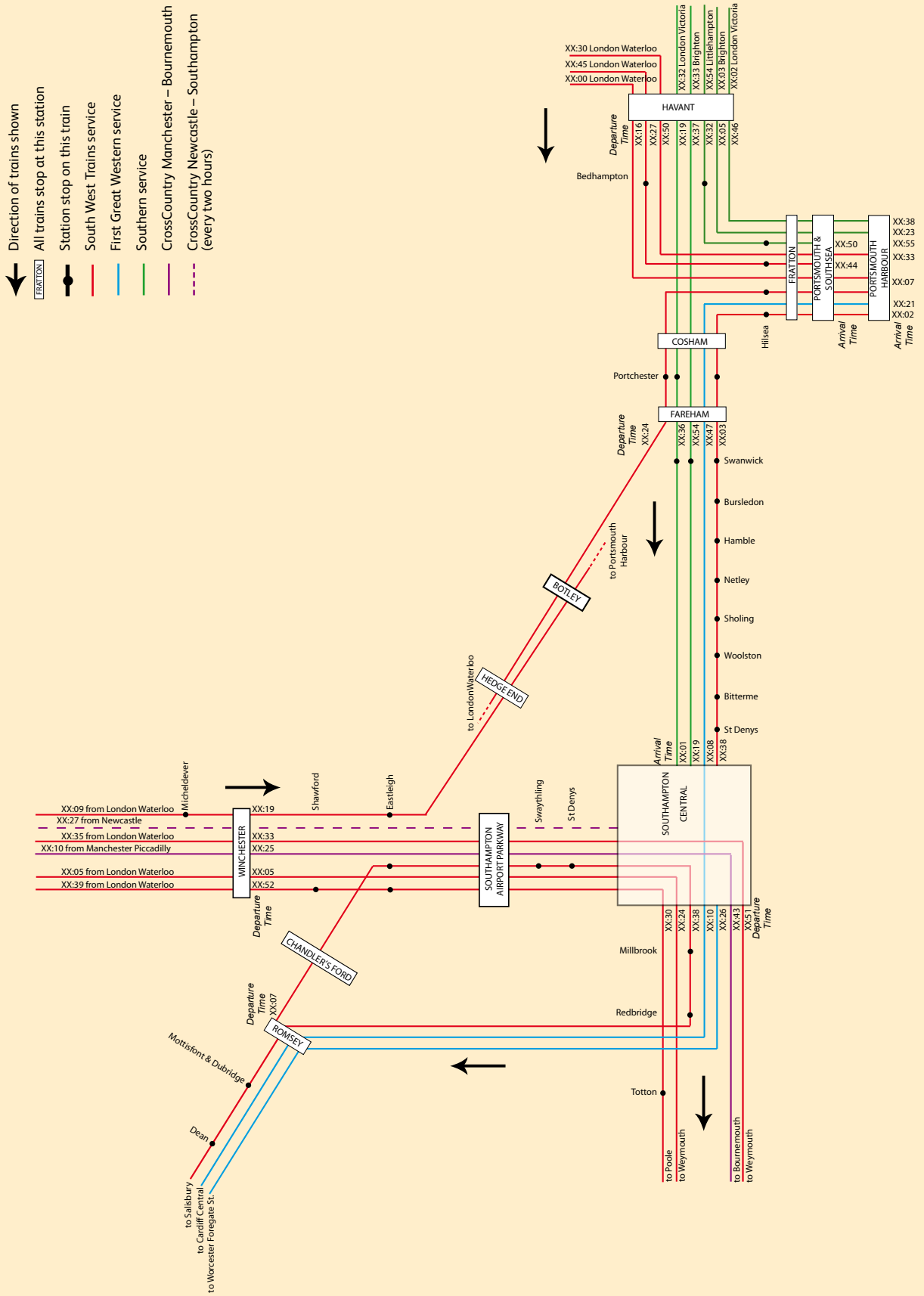
10.8.2.10 Southampton Central is served by stations to the north-west from Salisbury and Romsey via either the Test Valley line to Redbridge, the direct route, or via Chandler's Ford and Eastleigh, which has the benefit of a Southampton Airport stop. Trains also run directly to Southampton Central from Weymouth, Bournemouth and Brockenhurst.

10.8.2.11 Train operator Southern has a franchise commitment to re-route the off-peak Brighton to Southampton Central service via Eastleigh to provide a direct connection to Southampton Airport Parkway from the east. Due to operational constraints, this service could not be included in the December 2010 timetable due to the CrossCountry hourly Newcastle to Reading service being extended to Southampton Central on a two-hourly basis as recommended in the Great Western RUS.

10.8.2.12 Timetable analysis has been carried out and confirms that a pathway can be accommodated without any additional infrastructure and the economic analysis shows it to be financially positive, see **Option S1.1**. Running the return trip via Eastleigh (this is not part of the franchise commitment which operates in one direction only) does not produce a financially positive business case as it requires an additional train and crew, however, does produce a BCR of 9.0 which represents good value for money as shown in **Option S1.2**. Infrastructure options are detailed separately, in **Table 10.3**, however, some timetable and economic analysis has been carried out to test the validity and affordability of these schemes.

Assessment of Option S1.1 – diversion of Southern's Brighton to Southampton Central service via Eastleigh and Southampton Airport Parkway (in this direction only)		
Concept	Southern's Brighton to Southampton Central service (in this direction only) to run via Botley calling additionally at Eastleigh and Southampton Airport Parkway and not calling at Swanwick. This is already a franchise commitment.	
Operational analysis	Timetable analysis shows that this is possible if the SWT 'Figure 6' service from Salisbury to Romsey via Southampton service is slightly retimed.	
Infrastructure required	No additional infrastructure required.	
Passenger impact	Extended journey times between Fareham and Southampton Central and not stopping at Swanwick, however, introduces a direct service from the East to Southampton Airport Parkway and provides an additional service between Eastleigh and Southampton Airport/Central. Only operates in one direction so passengers to Fareham and the East would have to board the service and remain on board whilst the crew changed ends at Southampton Central.	
Freight impact	None.	
Financial and economic analysis	**60-year appraisal**	**Present value £m**
	Costs (present value)	
	Investment cost	0.0
	Operating cost	0.0
	Revenue	-6.9
	Other Government impacts	1.4
	Total costs	**-5.5**
	Benefits (present value)	
	Rail users benefits	7.8
	Non users benefits	3.2
	Total quantified benefits	**11.0**
	NPV	**16.5**
	Quantified BCR	**Financially positive**
Link to other options	S1.2 diverts this train in both directions.	
Conclusion	Recommended subject to further timetabling work for implementation at the earliest opportunity.	

Figure 10.16 – current service pattern in the Solent and South Hampshire area



Assessment of Option S1.2 – diversion of Southern's Brighton to Southampton Central service via Eastleigh and Southampton Airport Parkway (in both directions)		
Concept	Southern's Brighton to Southampton Central service (in both directions) to run via Botley calling additionally at Eastleigh and Southampton Airport Parkway and not calling at Swanwick. This is already a franchise commitment.	
Operational analysis	Timetable analysis shows that this is possible although further work is required.	
Infrastructure required	No additional infrastructure required.	
Passenger impact	Extended journey times between Fareham and Southampton Central and not stopping at Swanwick, however, introduces a direct service from the East to Southampton Airport Parkway and provides an additional service between Eastleigh and Southampton Airport/ Central, also provides a direct return journey.	
Freight impact	Possible conflict with freight train crew changes at Eastleigh.	
Financial and economic analysis	**60-year appraisal**	**Present value £m**
	Costs (present value)	
	Investment cost	0.0
	Operating cost	10.2
	Revenue	-11.2
	Other Government impacts	2.2
	Total costs	**1.2**
	Benefits (present value)	
	Rail users benefits	6.1
	Non users benefits	4.8
	Total quantified benefits	**10.9**
	NPV	**9.7**
	Quantified BCR	**9.0**
Link to other options	S1.1 diverts this train in one direction.	
Conclusion	Recommended subject to further timetabling work.	

10.8.2.13 In addition to the diversion of the Brighton to Southampton Central service, the diversion of other Netley line services to the Botley line to provide a half-hourly service on this route was examined:

- FGW's Portsmouth Harbour to Cardiff Central – excessive journey time disbenefit for existing users as this service currently runs fast between Fareham and Southampton Central, see **Option S1.3** which looks at running this instead of the Southern service
- Southern's London Victoria to Southampton Central – excessive journey time disbenefit for existing users
- SWT's Portsmouth Harbour to Southampton Central stopping service – would not be able to call at seven of the 14 stations due to timetable issues.

Assessment of Option S1.3 – diversion of First Great Western's Portsmouth Harbour to Cardiff Central service via Eastleigh and Southampton Airport Parkway (in both directions) instead of Southern service in Options S1.1 and S1.2		
Concept	FGW's Portsmouth Harbour to Cardiff Central service (in both directions) to run via Botley calling additionally at Eastleigh and Southampton Airport Parkway.	
Operational analysis	Difficult to timetable as it would affect the timings of the train on such a long journey.	
Infrastructure required	No additional infrastructure required.	
Passenger impact	Extended journey times between Fareham and Southampton Central.	
Freight impact	Possible conflict with freight train crew changes at Eastleigh.	
Financial and economic analysis	**60-year appraisal**	**Present value £m**
	Costs (present value)	
	Investment cost	0.0
	Operating cost	0.0
	Revenue	2.6
	Other Government impacts	-1.0
	Total costs	**1.5**
	Benefits (present value)	
	Rail users benefits	-24.1
	Non users benefits	-12.9
	Total quantified benefits	**-36.9**
	NPV	**-38.5**
	Quantified BCR	**-24.0**
Link to other options	None identified.	
Conclusion	Not recommended due to excessive journey time disbenefit and poor BCR.	

10.8.2.14 An additional service was then examined, to provide a half-hourly service between Cosham/ Fareham and Southampton Central via Eastleigh, starting from Portsmouth & Southsea. Timetable analysis shows that whilst this service would be possible to operate between Fareham and Eastleigh South Junction, the Portsmouth Single line between the junction and the station and platform capacity is insufficient to operate this additional train. Modelling was carried out with an estimation of around £10 million to redouble the line and construct a new Platform 4 at Eastleigh, **Option S1.4**, although the benefits were outweighed by the costs the quantified BCR 0.7 is still short of the 2.0 required for a scheme to be developed. Paragraph 10.8.6.4 looks at the impact of the extra platform to freight services.

10.8.2.15 Looking at the Netley line, the diversion of the Brighton to Southampton Central service via the Botley line has reduced the number of trains using this line to three, as detailed in paragraph 10.8.2.13 above. Timetable analysis shows that the theoretical maximum number of trains it is possible to run along this route is much higher than the current four trains, however, the stopping service extends the journey times for the faster services as the signals are located quite far apart, see **Figure 10.11**, which severely restricts capacity by extending signalling headways.

10.8.2.16 To replace the Brighton to Southampton Central service, an additional Portsmouth to Southampton Central service has been modelled, but whilst this service provides extra journey opportunities between the two cities and replaces the missing train, the journey time means that the rolling stock and crew costs outweigh the benefits, **Option S1.5** details this.

Assessment of Option S1.4 – introduction of a new service to between Southampton and Portsmouth & Southsea via the Botley Line with the redoubling of the Portsmouth Single and a new platform at Eastleigh		
Concept	A new service between Southampton and Portsmouth & Southsea via the Botley Line.	
Operational analysis	Feasible with current layout but would be more robust with the infrastructure detailed below.	
Infrastructure required	Redoubling of the Portsmouth Single and a new Platform 4 at Eastleigh.	
Passenger impact	New direct service from Portsmouth & Southsea to Southampton Central via Eastleigh. New journey opportunities to Southampton Airport Parkway.	
Freight impact	Without the infrastructure detailed above, it would be difficult for freight services to change crew at Eastleigh in the down direction.	
Financial and economic analysis	**60-year appraisal**	**Present value £m**
	Costs (present value)	
	Investment cost	10.9
	Operating cost	47.4
	Revenue	-19.7
	Other Government impacts	4.0
	Total costs	**42.5**
	Benefits (present value)	
	Rail users benefits	19.7
	Non users benefits	8.9
	Total quantified benefits	**28.6**
	NPV	**-14.0**
	Quantified BCR	**0.7**
Link to other options	None identified.	
Conclusion	Not recommended due to cost.	

Assessment of Option S1.5 – introduction of a new service to between Southampton and Portsmouth & Southsea via the Netley Line		
Concept	Provide a new service between Southampton Central via Netley to Fareham and the East.	
Operational analysis	Provides an additional service between Southampton Central and Fareham (and beyond).	
Infrastructure required	None.	
Passenger impact	Extra service between Southampton Central and Fareham (and beyond).	
Freight impact	None.	
Financial and economic analysis	**60-year appraisal**	**Present value £m**
	Costs (present value)	
	Investment cost	0.0
	Operating cost	47.4
	Revenue	-21.5
	Other Government impacts	4.4
	Total costs	**30.3**
	Benefits (Present Value)	
	Rail users benefits	28.6
	Non users benefits	11.8
	Total quantified benefits	**40.4**
	NPV	**10.1**
	Quantified BCR	**1.3**
Link to other options	S1.1 and S1.2 which divert a service via the Botley line.	
Conclusion	Not recommended at this stage further timetabling work required, also subject to timetable slots at the Portsmouth end.	

10.8.2.17 The current mix of fast, semi-fast and stopping service patterns between Portsmouth and Southampton Central will not support extra (or even the replacement) services. As mentioned in paragraph 10.8.2.8, the current journey time for a stopping service is 60 minutes city to city, which does not compete with road. The high frequency bus service and road system, detailed in **Appendix B**, is causing passengers to generally travel by alternative modes leaving rail with a small minority of passengers preferring to catch the train.

10.8.2.18 Timetable analysis has shown that, theoretically, skip-stop operation may be a solution, see **Figure 10.17**. It is possible to get from any station on the Netley line to any other on the Netley line without having to change service, however the journey time improvement is insufficient to reduce the operating costs – which would require the journey from Portsmouth to Southampton Central to be operated in around 50 minutes rather than the 56 minutes caused by skip-stops.

● = Stopping

● = Passing

Figure 10.17 – calling patterns of three alternating services

Station	Service 1	Service 2	Service 3
Fareham	●	●	●
Swanwick	●	●	●
Bursledon	●	●	●
Hamble	●	●	●
Netley	●	●	●
Sholing	●	●	●
Woolston	●	●	●
Bitterne	●	●	●
St. Deny's	●	●	●

10.8.2.19 The working group will examine stopping patterns across this route, however it may be beneficial to adopt a skip-stopping pattern or as most journeys on these flows are made by the frequent fast bus service, more passengers may benefit by providing a more frequent fast train services for the majority of passengers by serving the light used stations only in the peak.

10.8.2.20 As part of the consultation process, we would be interested to hear local users views of replacing the current off-peak train service with a frequent, fast non-stop service, limited stop trains or a skip-stop service.

10.8.2.21 Transport for South Hampshire has an aspiration to operate light rail or bus rapid transit on the line but, as an industry, we would prefer to keep the line for heavy rail as it is a diversionary route for when the SWML is closed between Southampton and Basingstoke. This enables trains to and from Weymouth and the West to continue to operate rather than forcing passengers to change into a replacement bus service for part of the journey. **Table 10.4** contains more information on the tram-train, light rail, guided bus or bus rapid transit solutions.

10.8.2.22 As described in 10.8.2.10, Southampton Central is also served by trains from Salisbury and the West Country. These services are:

- FGW's hourly Cardiff to Portsmouth Harbour service which runs fast from Salisbury to Romsey then fast to Southampton Central via the Test Valley line
- SWT's hourly Salisbury to Romsey 'Figure 6'[4] service which calls at all stations via the Test Valley and returns to Romsey via the SWML and Chandler's Ford lines.

10.8.2.23 The SWT service departs Salisbury 16 minutes after the FGW service but only takes about 10 minutes longer to get to Southampton Central. Consideration was given to diverting the FGW service via Chandler's Ford to Southampton Central to provide an additional Salisbury (and the west) connection with Southampton Airport Parkway. The train crew would have to change ends at Southampton Central before the journey could continue to Portsmouth, however, this would cause excessive journey time disbenefit to existing users, see **Option S1.6**.

Assessment of Option S1.6 – diversion of the First Great Western Cardiff Central to Portsmouth Harbour service via Chandler's Ford

Concept	Divert the Cardiff Central to Portsmouth Harbour service via Chandler's Ford .
Operational analysis	Restrictive pathways over single line.
Infrastructure required	Redoubling of the Chandler's Ford Line.
Passenger impact	Extended journey times between Romsey or Fareham and Southampton Central but new journey opportunities between Salisbury/Chandler's Ford/Eastleigh and Southampton Airport Parkway/Portsmouth.
Freight impact	None.
Financial and economic analysis	N/A.
Link to other options	None identified.
Conclusion	Not recommended due to excessive journey time disbenefit.

4 The SWT service that calls Salisbury – Romsey – Southampton Central – Eastleigh – Chandler's Ford – Romsey.

10.8.2.24 An alternative was to look at the 'Figure 6' service to see if returning to Salisbury, **Option S1.7**, would improve the connections between Salisbury and Southampton Airport Parkway by giving a new journey opportunity via Chandler's Ford. The extension may require the whole service being retimed but this may be beneficial as it could change the interval of trains departing Salisbury for Southampton so that they do not closely follow the FGW service but run on the opposite half hour. SWT is looking to retime the train from Salisbury in May 2011. Extending the train back to Salisbury may require redoubling the Chandler's Ford branch, see **Option S1.8**. Further timetable work is required and will be reported in the final London and South East RUS.

Assessment of Option S1.7 – extension of the South West Trains 'Figure 6' service back to Salisbury	
Concept	Extend the 'Figure 6' service back to Salisbury.
Operational analysis	May require further work on platforming at Salisbury and unit/crew diagrams.
Infrastructure required	None, although the redoubling of the Chandler's Ford line would help.
Passenger impact	Reduce the Chandler's Ford to Salisbury journey time by 16 minutes, introduce a quicker direct route to Salisbury.
Freight impact	Will reduce pathways on the Chandler's Ford line, unless it is redoubled.
Financial and economic analysis	N/A.
Link to other options	None identified.
Conclusion	Not recommended at this stage further timetabling work required to show unit/crew/platform diagrams work.

Assessment of Option S1.8 – Chandler's Ford Branch redoubling	
Concept	Redouble the Chandler's Ford branch to increase the capacity of the route.
Operational analysis	Would enable extra trains to operate without the pathing issues caused by the single line.
Infrastructure required	Approx. five miles of additional track to redouble the Salisbury single and an additional platform (or refurbishment of existing redundant platform) and footbridge at Chandler's Ford station.
Passenger impact	Improved service provision at Chandler's Ford.
Freight impact	Increased pathways on this route.
Financial and economic analysis	TBA.
Link to other options	None identified.
Conclusion	Further work being carried out to cost this scheme and will be reported in the final London and South East RUS document.

10.8.2.25 The SMG decided that the service on the SWML from the West to Southampton Central had been adequately covered by the South West Main Line RUS and no gaps were identified.

10.8.2.26 Further timetabling work will be carried out during the consultation period to confirm the maximum number of pathways between Basingstoke and Southampton and between Havant/Fareham and Portsmouth Harbour.

Table 10.3 – infrastructure Options for trains between the Botley line and Southampton Central

Network Rail and Transport for South Hampshire have been looking at infrastructure options to enable the diversion of services from the Netley line to the Botley line. TfSH has an aspiration to take over the Netley line, requiring all four trains per hour in each direction to be diverted via Botley. Various reports have been produced and they are summarised below:

a) Fareham to Botley Redoubling – the Knowle single line is a particular problem as it would not be simple or cheap to redouble as a second bore would be required adjacent to Tapnage Tunnel. There are various sub-options for the tunnelling (includes redoubling):

- cut and cover – £52.2 million
- single bore – £128.3 million[5]
- two new bores – £110 million[6]

b) Fareham to Botley partial redoubling –

- redouble the lines on either side of Tapnage Tunnel but leave the tunnel as single line – £38.5 million[5]
- redouble the lines on either side of the tunnels but not the tunnels – £65 million[6].

c) Eastleigh South Junction to Eastleigh station redoubling (with or without an additional platform) – redouble the Portsmouth Single line to increase capacity as trains arriving at Eastleigh from the Botley line would be able to sit outside the station until a platform becomes free. If this is tied in with a new platform, increased flexibility and capacity could see improved platform use and reduce arrival and departure times:

- it is estimated to cost in the region of £10m in today's prices with the platform.

d) Eastleigh Chord – there are various versions of this scheme, it is a new line that avoids Eastleigh and saves journey time because the crew do not have to change ends at Eastleigh before heading south to Southampton Airport Parkway. The greatest problem is the main reason for its requirement – Southampton Airport. Airports have runway end safety areas, Southampton's extends to 240 metres beyond the end of the runway which would prevent the construction of the Eastleigh chord running around the southern perimeter of the Eastleigh Works site at grade, therefore, the line would have to be underground at the site of the runway end safety areas. A further version was looked at where a short, slow speed chord is constructed just south of Eastleigh station but involved very complicated track work at the throat of Eastleigh Works. Brief details are detailed below:

- chord with at grade junctions – at grade junction on the Botley line, south of Eastleigh works, to an at grade junction north of Southampton Airport Parkway. Two alignments were identified with differing linespeeds:
  - 30mph chord – £88.7 million[5]
  - 50mph chord – £103.7 million[5]
  - 30mph chord which does not avoid the runway end safety areas – £15 million[6]
- chord with grade separated junction north of Southampton Airport Parkway and at grade junction on the Botley line
  - 30 mph chord – £116.9 million[5]
  - 50 mph chord – £131.4 million[5]
- tunnel chord – a 30 mph chord which diverges from the Botley line at around Eastleigh South Junction but then runs in a tunnel under the works to a grade separated junction north of Southampton Airport Parkway
  - £255.6 million[5]
- at grade chord – a very slow speed chord just south of Eastleigh station, crossing the works site and joining the SWML in the vicinity of Campbell Road bridge:
  - Less than 30mph chord – £10 million[6].

e) Three or four-tracking between Eastleigh and Southampton Airport Parkway – construction of an additional parallel line either from Eastleigh station or the Eastleigh Chord to Southampton Airport Parkway, allows two trains to serve the station in the same direction simultaneously, this is particularly relevant here as all trains have a 90-second dwell time so one train could be preparing to depart whilst another arrives. Three-tracking would require a reversible middle line to allow for tidal flows in busy periods. The station would require significant reconstruction to both platforms and may need some staggering to allow the wider formation to close back to two-tracks south of the station.

f) Three- or four-tracking between Southampton Airport Parkway and St Denys Junction – this would only be carried out if the Eastleigh to Southampton Airport Parkway section is tripled or quadrupled and would enable parallel operation, overtaking moves and holding back of freight trains without stopping all trains in that direction. Extremely expensive solution as it would require the complete reconstruction of Swaythling and St Denys stations:

- no costs have been identified for these schemes at this time.

5 Atkins/Hampshire County Council 2004 report – 2003 prices
6 Network Rail 2008 prices

Table 10.4 – bus rapid transit, guided busway, light rail and tram-train systems
TfSH have been investigating a number of alternatives to heavy rail (National Rail services) on the Netley line and the Marchwood Branch, below is an explanation of these terms with their benefits and disbenefits:
i. Bus rapid transit – high-capacity uban public transport system with its own dedicated roads and longer stop spacing than traditional bus routes. TfSH is already investing heavily in this technology by converting the old Fareham to Gosport branch line into a bus rapid transit system which will see fast buses using a dedicated road with defined bus stops. Benefits: buses are able to overtake each other, buses can use ordinary roads, buses require no modification, quite a flexible system. Disbenefits: removes the rail system, possibility of bus exclusivity being eroded by future administrations and becoming a normal road, poor public perception of buses.
ii. Guided busway – these systems use kerb guided buses on dedicated routes. This is used by the Fastway bus system. Benefits: lower cost than trams, buses are also able to use normal roads. Disbenefits: higher cost as buses and roadway need to be converted for use to the system (the roadway system is usually a continuous concrete roadway), inability to overtake, poor public perception of buses.
iii. Light rail – this is the modern evolution of the tram system, often utilising converted heavy rail lines to operate dedicated lines and street running of articulated vehicles, generally electric vehicles though not exclusively, with rapid acceleration and braking capabilities. Tramlink in Croydon and Metrolink in Manchester operate over a mix of converted heavy rail and street running routes which may be cheaper than converting existing heavy rail routes to concrete roadways for bus rapid transit or guided bus systems. Benefits: improved acceleration and deceleration to shorten point-to-point times, electrification to reduce CO_2 emissions (particularly in an urban environment), good public perception, articulated vehicles capable of carry large numbers of passengers. Disbenefits: high start up costs, inability to overtake, restricted to dedicated tracks.
iv. Tram-train – this is a development of the light rail system where heavy rail routes are shared by heavy rail trains and light rail vehicles. The advantage is that low-floored trams would be able to stop at low level extensions to National Rail stations and take advantage of the higher speed of the heavy rail route, rather than continuous street running. Possible to diverge away from the heavy rail line to make stops at the front of stations before rejoining the heavy rail line, enabling heavy rail services to pass. Benefits: all the benefits of light rail but with the use of heavy rail routes too, may be possible to fit vehicles with retractable third rail power collection system. Disbenefits: as light rail but also vehicles must be fitted with heavy rail safety systems and qualified drivers (light rail systems can use drivers who are colour blind, for example, whereas heavy rail drivers cannot so impaired).
The Network RUS may examine this further but generally speaking, these solutions are best used in and between urban areas.

10.8.3 Options responding to Gap S2 – Reopening the Marchwood Line to passenger traffic

10.8.3.1 Another aspiration of TfSH is the reopening of the Marchwood Line to passenger traffic. This line is currently a freight only line between the yard at Totton and Fawley Oil Terminal. Despite the current freight service of around one train a day, its importance should not be overlooked.

10.8.3.2 The line branches away from the SWML at Totton, the next station west of Redbridge, and runs through Totton Yard and onto the single line to Marchwood. The old station is still in-situ at Marchwood but is a private residence, the signal box is still staffed and controls the rest of the line (sharing control of the Totton-end with Eastleigh Area Signalling Centre). There are manual rail gates protecting the level crossing here, which are operated by the signaller. The line is double-tracked through the old station and even retains both platforms, this is the passing point for the line.

10.8.3.3 The single line continues the former Hythe station and onto Fawley Oil Terminal. The proposed Dibden Bay container terminal would also branch off this section line.

10.8.3.4 Timetable analysis shows that it would be possible to run two passenger trains per hour in each direction and one freight train in a single direction between Totton and Marchwood. Beyond Marchwood and with minimum headways, it would be possible to run an hourly passenger service in both directions and up to three freight trains in the same direction.

10.8.3.5 This assumes that the existing infrastructure is capable of handling passenger services and that the platforms at Marchwood and Hythe have been returned to operational use (in accordance with Disability Discrimination Act (DDA)), this in itself is not confirmed as good value for money.

10.8.3.6 Additional infrastructure would be required for two passenger trains per hour between Marchwood and Hythe, possibly the reopening the other platform at Marchwood, which would require a DDA-compliant footbridge.

10.8.3.7 It is not just a case of upgrading the infrastructure to passenger use – a decision would have to be made whether to employ a one- or two-car diesel unit. A shuttle service could be introduced if the bay platform at the Weymouth end of Southampton Central is brought back into use. SWT do not currently have any one-car (Class 153) units in their fleet and are unlikely to be able to source a spare Class 158 two-car unit for this service so additional units would have to be hired in. Failing that, the line could be electrified and an existing service extended to terminate at Marchwood/Hythe.

10.8.3.8 However, Bluestar buses currently operate a high frequency bus service between Southampton City Centre, Central Station and Hythe, calling at the main housing estates on the way, see **Appendix B**. Three buses per hour operate most of the day and an hourly service runs until 3am on Friday and Saturday nights. Given this high frequency service and relatively low fares, rail cannot compete with the bus alternative.

10.8.3.9 It is not just the buses in competition with rail, there is the Hythe Ferry which runs a half-hourly service across Southampton Water to Town Quay where a free bus is waiting to take passengers into the city centre and to Southampton Central station.

10.8.3.10 Therefore, the RUS is not going to recommend the conversion of the Marchwood Branch for passenger use. It may be looked at in the future for possible use as part of a tram-train system but the bus will be able to drop passengers at a stop closer to where they live than the train.

10.8.4 Options responding to Gap S3 – Car park provision at stations

10.8.4.1 **Figure 10.5** shows the current car parking provision and usage at stations across the Solent and South Hampshire study area.

10.8.4.2 Network Rail and the TOCs are working with local stakeholders on a range of car parking capacity schemes across the RUS area.

10.8.4.3 Additional capacity is planned or under consideration at a number of congested locations. **Table 10.5** sets out the full range of locations where schemes are currently under development with the TOCs.

Table 10.5 – stations under consideration for additional car parking capacity

Station	Number of new spaces
Southampton Airport Parkway	378*
Swanwick	58
Eastleigh	6
Netley	30
Shawford	28

*The car park has been rebuilt so this figure represents the new car park as a whole.

10.8.4.4 Southampton Airport Parkway station is having its car park enlarged by adding an additional storey, this car park is intended for rail passengers rather than airport users as there are National Car Parking (NCP) parking facilities opposite the terminal building.

10.8.4.5 One of the key themes from the Solent and South Hampshire Study Area is that an extensive network of frequent bus services are available to get rail passengers to the nearest or best station for their journey. Many of these bus services start early in the morning for commuters and have extra services in the peaks.

10.8.4.6 The RUS will not be recommending a particular scheme but would encourage the current level of cooperation between Network Rail, the TOCs and local stakeholders to look at targeted expansion where possible, without encouraging rail heading.

10.8.5 Options responding to Gap S4 – Improve journey times on the Portsmouth Direct and Alton Line

10.8.5.1 Separately to the RUS programme, Network Rail has been reviewing the Permanent Speed Restrictions and maximum permissible linespeeds around the South East.

10.8.5.2 This workstream has identified a number of locations where current speed limits may be changed to improve journey times, some of the speeds will be raised as part of the rolling programme of maintenance and renewals and others will be the focus of a line of route review scheme. The Portsmouth Direct line falls into the latter category.

10.8.5.3 The Portsmouth Direct line diverges from the SWML at Woking and heads south to Havant, via Guildford; the two-track railway is sinuous and steeply graded. This line will be subject to a detailed review in early 2011 for further consideration by the RUS.

10.8.5.4 Level crossings (both foot and road) can be a cause of reduced speed to ensure the safety of the users, however, in recent years, safety standards have evolved and higher speeds may be possible with a small amount of level crossing improvement work.

10.8.5.5 On the Alton line, some line speeds may be improved but the biggest constraint is the single line section between Farnham and Alton, despite the passing loop at Bentley. This section is subject to a resignalling or interlocking scheme but at the time of the draft publication, the final details of any scheme are not finalised. The final RUS will detail this scheme if the outputs are identified by then.

10.8.6 Options responding to Gap S5 – Freight growth and other issues

10.8.6.1 Freight traffic is expected to rise significantly by 2030, requiring up to three pathways an hour between Basingstoke and Southampton for access to the port.

10.8.6.2 Eastleigh is an important yard for DB Schenker and the National Delivery Service. The National Delivery Service moves new and waste materials for rail maintenance and renewal schemes across the UK. Eastleigh is key in the South East as it provides ballast and spoil trains, recycling facilities, long welded rail trains and pre-assembled equipment.

10.8.6.3 As a result of the above and SWT's clock face timetable[7], a timetable study will be carried out, to report in the final version of the RUS, to investigate whether it would be possible for three (**Option S5.1**) or four (**Option S5.2**) freight train paths per hour to be scheduled. The fourth path would be available for National Delivery Service trains, charter passenger services or late running trains. This is part of the work mentioned in paragraph 10.8.2.26.

Assessment of Option S5.1 – three ftph in each direction between Basingstoke and Southampton	
Concept	Provide additional pathway within the standard hour clock face timetable to enable the three freight train pathways per hour required to meet future freight demand.
Operational analysis	Timetable analysis shows that this pathway is available with slight tweaks to existing services.
Infrastructure required	None.
Passenger impact	Slight tweaks to existing timetable.
Freight impact	Reserved freight pathways every 20 minutes.
Financial and economic analysis	TBA.
Link to other options	
Conclusion	Further work being carried out to cost this scheme and will be reported in the Final London and South East RUS document.

7 A clock face timetable is one where a train departs at the same minutes past the hour every hour.

Assessment of Option S5.2 – four ftph in each direction between Basingstoke and Southampton	
Concept	Provide two additional pathways within the standard hour clock face timetable to enable the four freight train pathways per hour required to meet future freight demand.
Operational analysis	Timetable analysis shows that these pathways are available with slight tweaks to existing services.
Infrastructure required	None.
Passenger impact	Slight tweaks to existing timetable.
Freight impact	Reserved freight pathways every 15 minutes to cater for late running services, additional engineers trains and charter passenger trains.
Financial and economic analysis	TBA.
Link to other options	
Conclusion	Further timetable work being carried out to cost this scheme and will be reported in the Final London and South East RUS document.

10.8.6.4 The new freight train pathway and the requirement to stop freight trains at Eastleigh to change crews have been considered whilst looking at the additional passenger services between Eastleigh and Southampton to meet **Gap S1**.

10.8.6.5 The construction of a new platform at Eastleigh should reduce conflicts caused by crew changes in the down direction (away from London).

10.8.6.6 In the up direction, crew changes would benefit from the extension of the up loop line (Platform 1), **Option S5.3**, as following trains could use the through line or cross to Platforms 2 or 3.

Assessment of Option S5.3 – managing freight train crew changes at Eastleigh	
Concept	Extension of the up loop/slow line to the south, repositioning of the traincrew facilities at Eastleigh and new access to Platform 3 (and possible future Platform 4) via the Yard.
Operational analysis	Extending the up loop and gaining access to the station through the yard takes the rear of the train off the main line, freeing up alternative routes for other services.
Infrastructure required	New, higher speed crossovers into Platform 1 and an extension to the approach line and high speed crossovers into the south-end of the down yard to access Platform 3 (and future Platform 4).
Passenger impact	Improved journey times due to reduced pathing time waiting freight services to change crew.
Freight impact	Robust scheduling.
Financial and economic analysis	TBA.
Link to other options	
Conclusion	Further work being carried out to cost this scheme and will be reported in the final London and South East RUS document.

10.8.6.7 A scheme is already underway looking at the impact of lengthening freight trains between Southampton and the West Coast Main Line, the final RUS will report on the outcomes expected from this scheme.

10.8.6.8 An alternative route for freight services to run via Romsey, should Dibden Bay container terminal be constructed, could be available but services would have to run round at Millbrook which is not ideal. A chord from the Test Valley directly onto the SWML, heading westbound, was dismissed due to severe speed restrictions required and the excessive cost that such infrastructure would incur. The chord would have to diverge from the Test Valley line just north of, and then pass under, the A35 Redbridge Causeway road before joining the SWML on the causeway viaduct.

11. Emerging conclusions

11.1 Existing strategy

11.1.1 This document has outlined the principal currently committed schemes affecting peak capacity on routes into and around the capital. This major ongoing programme of investment in response to rising demand includes:

- Crossrail, providing a new high capacity cross-London route on an east-west axis
- the Thameslink Programme, providing new cross-London capacity on a north-south axis and some additional trains into London. Several routes (eg the Brighton Main Line) will benefit directly and others (eg the Hertford Loop) are expected to benefit indirectly as existing capacity is reallocated
- an extensive train and platform lengthening programme
- certain additional peak trains for example on the Windsor lines, utilising the previous international platforms at London Waterloo, and on the Great Eastern route
- infrastructure schemes targeting key bottlenecks on radial lines, for example Hitchin flyover, major improvements in the Reading station area and additional track layout capacity at Gatwick Airport
- an upgrade to the Chiltern main lines through the Evergreen 3 project
- completion of the London Overground network
- freight upgrades, enabling the growth element of traffic to/from principal ports to avoid the capital
- upgrading of key stations, including London King's Cross, London Bridge and East Croydon amongst others.

11.1.2 In addition previous strategy rolled forward into this Route Utilisation Strategy (RUS) includes a number of schemes not currently funded but whose recommendations from previous analysis have been carried forward into this London and South East RUS. These include:

- additional rolling stock to enable all high-peak trains to run at full length
- further platform lengthening
- the Intercity Express Programme, together with electrification for the Great Western and Midland Main Line routes
- further alleviating key constraints, for example at Redhill and through the Medway Towns
- train service changes recommended by previous RUSs, for example a new peak Cheshunt – Seven Sisters service and stopping some peak Gatwick Express services to London Victoria at Clapham Junction
- further station upgrades, including high priority works to reduce congestion at key locations such as at London Charing Cross and Clapham Junction
- further freight upgrades, including the electrification of the Gospel Oak – Barking route.

11.1.3 Existing strategy also includes the commencement of work on a new line from London Euston to Birmingham via a new station at Old Oak Common, as the first stage of a wider High Speed Rail network. As well as providing major capacity and journey time improvements for long distance travellers this would also free up capacity for commuters from the home counties and increase the proportion of freight moved by rail rather than road.

11.2 Further development recommended by this RUS

11.2.1 This document has outlined opportunities for further incremental capacity upgrades on key routes. Notable schemes being considered include:

- development of the West Anglia route, focusing initially on additional trains from the Lea Valley route to Stratford
- further additional trains on the Windsor lines into London Waterloo, for which a revised track layout and an extra platform is required at Queenstown Road to achieve an 18 trains per hour peak service overall. The RUS also anticipates Airtrack services from Heathrow Airport using this corridor at some stage
- platform lengthening to eight-car on the West London Line
- introduction of a fast outer Thames Valley to Paddington peak shuttle, responding to significant growth forecast from this area by taking advantage of the new track layout capacity provided under the Reading remodelling scheme
- further development of Crossrail on the Great Western Main Line, by extending Heathrow Express services though the Crossrail tunnels. This would be necessary to facilitate the above, whilst providing an increased frequency from the City of London to Heathrow Airport

- a possible Crossrail extension onto the slow lines of the West Coast Main Line (WCML), which appears to have potential to reduce the number of trains and people needing to be accommodated at London Euston station during the construction of High Speed 2 and beyond
- improvements in rail access to Heathrow Airport
- further freight upgrades, notably of the cross-country route via Bury St Edmunds to enable some existing traffic to avoid London
- possible reopening of the east-west rail corridor between Bicester and Bletchley which, as well as having notable passenger benefits, would enable freight traffic from Southampton for the north of England to be routed onto the WCML directly, avoiding the need to travel through the busy West Midlands rail network.

11.2.2 Longer-term issues requiring further analysis to identify solutions include:

- the need to identify a robust means of increasing capacity on the Great Eastern Main Line, which is likely to require significant additional infrastructure
- the need to identify a robust means of increasing capacity on the South West Main Line, which is likely to require significant additional infrastructure
- development of a consensus regarding whether any future heavy rail-compatible tunnels across London are required, for example the Chelsea – Hackney line (Crossrail 2)
- whether any extensions to the Transport for London rail network might be appropriate, for example an extension to the Bakerloo Line beyond Elephant & Castle
- optimisation of the strategy for High Speed Rail, including the need to provide sufficient local transport links to the major High Speed Rail station anticipated at Old Oak Common
- the use of fares and alternative land use policy to distribute passengers, particularly in the high-peak hour.

11.3 Impact on London Underground

11.3.1 The RUS recognises that the strategy presented herein for commuting into the capital on the National Rail network should avoid putting additional pressure on the London Underground system, beyond that which is manageable by committed Transport for London upgrade schemes and those which can reasonably be assumed as achievable in the lifetime of this strategy.

11.3.2 The key cross-London baseline schemes in this RUS, Crossrail and the Thameslink Programme, are specifically designed to alleviate existing severe congestion issues on the London Underground system. In particular Crossrail provides capacity parallel to the London Underground Central Line whilst the Thameslink Programme provides capacity parallel to the London Underground Northern Line.

11.3.3 Further interventions considered by this RUS have sought to be consistent with this approach. For example the additional Crossrail trains proposed to Heathrow Airport and the WCML have potential to alleviate London Underground station capacity issues at Paddington and Euston respectively, together with underground lines serving these stations. Similarly the option of additional trains from the Lea Valley line to Stratford has potential to avoid passengers travelling through Central London. Any longer-term development of a new line on the Chelsea – Hackney corridor should alleviate congestion on further routes, including the London Underground Victoria line and, with a slightly modified alignment, could potentially also increase connectivity to High Speed 2 at London Euston.

11.3.4 The passenger demand and forecast growth reported in this RUS is for the National Rail network. However the forecasts have been produced by considering the multi-modal transport networks across London and the South East, ie including rail, tube, Docklands Light Rail, tram and bus. Passenger growth by mode on a station-by-station basis is beyond the RUS scope and model capability, but growth on the underground network could be analysed from the model output to inform future studies.

11.3.5 The rail passenger growth on the routes presented in **Chapter 6** can be used to inform demand growth at stations, including the impact on London Underground. However it is emphasised that the rail growth alone does not give the full picture. For example, these figures in isolation do not differentiate between routes where high rail growth will also result in high London Underground growth (as passengers attracted to the route use both modes to complete their journey), and routes where high rail growth is accompanied by low underground growth (as the rail market share increases by means of diversions away from the London Underground). Further analysis would therefore be required in the event of any specific concerns.

11.4 Summary

11.4.1 This London and South East RUS seeks to build on the strategy outlined in previous Generation One RUSs, and develop these further where necessary. It is designed to provide the reader with an overview of key developments to the rail network in and around the capital over the coming years. It has also incorporated a more detailed chapter considering the South Hampshire and Solent area, given that this was not covered by a previous Generation One RUS.

11.4.2 The modelling and forecasting approach undertaken by this RUS is also being used to support ongoing development work on infrastructure schemes being considered in Network Rail's Control Period 5. This includes the principal schemes listed in this RUS, plus work on passenger congestion relief at stations as indicated in **Appendix A**.

11.4.3 Views of stakeholders are a key factor in the further development of this strategy. **Chapter 12** outlines the consultation process and next steps.

12. Consultation process and next steps

12.1 Introduction

12.1.1 Consultation with stakeholders, both within and outside the rail industry, is essential to the successful development of a Route Utilisation Strategy (RUS). Close involvement of stakeholders helps to ensure that:

- the correct gaps are identified
- the widest range of options is considered and the most appropriate solutions recommended
- implementation of the strategy can be undertaken more readily.

12.1.2 According to the RUS Guidelines;

> "Network Rail should develop a Draft RUS in conjunction with relevant stakeholders. It should then publish this Draft RUS, specifying a reasonable consultation period within which representations may be made. Having taken account of any representations received, Network Rail should publish and provide to the ORR the RUS it proposes to establish, together with any representations received."

Extract from the ORR Guidelines on Route Utilisation Strategies – April 2009

12.1.3 The key steering group for this London and South East RUS has been its Stakeholder Management Group. This comprises representatives from within the rail industry and Network Rail has sought to achieve a consensus amongst SMG on this strategy prior to publication.

12.1.4 In addition wider stakeholder briefings are now being held, including to elected representatives, rail user groups and other parties with major interests. These meetings are undertaken so that key stakeholders beyond the rail industry have the opportunity to contribute to the RUS process and that they are able to make best use of the formal consultation period.

12.1.5 Attention has been drawn to the existence of this Draft for Consultation on Network Rail's website and through a press release that accompanies its publication.

12.2 How you can contribute

12.2.1 We welcome contributions to assist us in developing this RUS. Specific consultation questions have not been set as we welcome comments on the document as a whole but we are particularly interested in feedback on the options proposed that seek to address the gaps identified.

12.2.2 Consultation responses can be submitted either electronically or by post to the addresses below:

LondonandSoutheastG2@networkrail.co.uk

London and South East RUS
RUS Programme Manager
Network Rail
Kings Place
90 York Way
London N1 9AG

12.2.3 Following the consultation period responses received will be placed on Network Rail's website, so that all views expressed are visible to all. Responses from private individuals will have personal details removed or will not be published.

12.3 Response date

12.3.1 This RUS will have a formal consultation period of 90 days. The date for receiving responses is therefore 18 March 2011. Earlier responses would be very much appreciated in order to maximise the time available to us to react and respond in the final RUS document.

12.4 Next steps

12.4.1 After the formal consultation period closes, the SMG will agree any further work that is required and the final RUS document will be published in summer 2011.

12.4.2 Following publication of the final RUS, the Office of Rail Regulation will determine whether to formally establish the strategy or require Network Rail to undertake additional work.

12.4.3 The established RUS will then form a strategy to be considered in future decision making.

Appendix A: Stations

A.1 Introduction

A.1.1 This appendix considers the impact of rail passenger demand on the network's stations. Stations that are considered by the RUS to be suffering from strategically significant levels of congestion are listed, together with schemes that are either committed or being developed to relieve such issues at the site concerned.

A.1.2 Stations are key to the safe and efficient operation of the railway, and comprise an important part of the passenger journey experience. However several key stations are put under considerable pressure by the sheer number of users at present. Given the strategy outlined in this Route Utilisation Strategy (RUS) for increasing on-train capacity, consideration of the capacity of the most congested stations is also required.

A.1.3 Especially in Central London station capacity could potentially become as much of a constraint to future growth as would on-train capacity, if gaps are not identified and resolved. This is especially relevant to the evening peak period, when passengers waiting on the concourse or on platforms can hinder the flow of passengers onto and off the trains.

A.1.4 Central London termini and strategic interchange stations, principally in inner London, are covered in this appendix. The schemes shown are being developed by Network Rail or Transport for London (TfL) as appropriate. Several of the station schemes result from the major projects, i.e. the Thameslink or Crossrail Programmes, or London Underground upgrades, whilst others interact with development plans around the station area.

A.1.5 This chapter ties in with the work undertaken through the Network RUS: Stations which is due to be published in early 2011.

A.2 Demand at London stations

A.2.1 The Office of Rail Regulation (ORR) publishes annual count data, for station entries, exits and interchanges. The annual data for 2008/09 is shown in **Table A.1** to set the context of the scale of the congestion issues. Only the busiest stations are shown, ie those in Central London, key interchanges or stations congested for other reasons, based on discussions between Network Rail, Transport for London and the Train Operating Companies.

A.2.2 The counts are based on rail ticket data, so only show the rail passengers. Passengers using only the London Underground or other modes will not be captured; neither will non-travellers using the station, for example for the retail facilities, or to meet or greet passengers. The interchanges shown are between National Rail services only.

A.2.3 As the usage figures are based on rail ticket sales data, the main limitations are that:

- the data was produced prior to the full implementation of Oyster Pay as You Go on the National Rail network, therefore is reliant on sales of paper tickets
- tickets with non-geographical destinations, eg zonal travelcards require a model infill to represent the station usage
- travelcards bought at some non-National Rail outlets are not captured and have to be infilled
- fare evaders who do not buy tickets are not recorded.

Appendix A: Stations

Table A.1 – annual station entries + exits and interchanges (2008/09)

Station	Managed by	Annual rail users – entries + exits	Annual rail users – interchanges
Balham	Southern	5,100,000	270,000
Barking	c2c	3,800,000	180,000
Bromley South	Southeastern	5,800,000	830,000
Clapham Junction	South West Trains	17,400,000	16,400,000
Ealing Broadway	First Great Western and London Underground Limited	3,200,000	90,000
East Croydon	Southern	20,600,000	6,400,000
Finsbury Park	First Capital Connect	5,500,000	2,600,000
Forest Gate	National Express East Anglia	1,700,000	0
Gidea Park	National Express East Anglia	2,600,000	8,000
London Blackfriars	First Capital Connect	13,000,000	420,000
London Bridge	Network Rail	49,700,000	5,000,000
London Cannon Street	Network Rail	21,600,000	200,000
London Charing Cross	Network Rail	36,700,000	1,700,000
Farringdon	London Underground Limited	1,200,000	80,000
London Fenchurch Street	Network Rail	15,700,000	200,000
London King's Cross	Network Rail	24,600,000	2,700,000
London Liverpool Street	Network Rail	55,100,000	1,400,000
London Marylebone	Chiltern Railways	11,400,000	300,000
London Paddington	Network Rail	29,300,000	1,500,000
London Victoria	Network Rail	70,200,000	4,500,000
London St Pancras International	Network Rail	17,500,000	2,800,000
London Waterloo	Network Rail	87,900,000	4,600,000
London Waterloo East	Southeastern	6,700,000	900,000
Lewisham	Southeastern	6,300,000	2,800,000
Seven Sisters	National Express East Anglia	2,200,000	5,000
Stratford	National Express East Anglia	12,300,000	1,100,000
Tottenham Hale	National Express East Anglia	4,000,000	170,000
Vauxhall	South West Trains	14,600,000	0
Walthamstow Central	National Express East Anglia	2,200,000	0
West Ham	London Underground Limited	1,200,000	10,000
West Hampstead Thameslink	First Capital Connect	2,300,000	140,000
Wimbledon	South West Trains	15,200,000	1,300,000

A.3 Committed schemes and schemes in development

A.3.1 Many stations are already the subject of committed investment for Control Period 4 (CP4), or beyond that where associated with major programmes such as Thameslink or Crossrail, which will allow room for the extra station users. These are outlined in **Table A.2** for the Central London termini and **Table A.3** for the other key London stations.

A.3.2 Beyond this there are also further opportunities for schemes in CP5 or beyond to address current and forecast congestion, and some such schemes are already under development. These are also described in **Tables A.2 and A.3**.

Table A.2 – Central London stations – committed schemes and schemes in development

Station	Committed scheme description	Schemes under development	Due	Funding source
Farringdon	Farringdon is being developed into one of London's busiest transport hubs. When work is completed, it will handle over 140 trains every hour and offer direct trains to three of London's major airports (Gatwick, Luton and Heathrow).		2018	Thameslink Programme and Crossrail
London Blackfriars	London Blackfriars station is currently receiving a significant investment to enhance both the station and the track layout. Once complete the station will be the first to span the River Thames, with entrances on both the north and south banks for better connections to businesses and tourist attractions. Longer platforms will allow 12-car trains to run, a key requirement for the Thameslink Programme.		2012	Thameslink Programme
London Bridge	London Bridge will be the subject of extensive remodelling, both at the station and on the tracks, following the Olympics, as a key part of the Thameslink Programme. This phased work will allow the station to cope with the additional demand expected as the Thameslink Programme increases the capacity on the route.		2018	Thameslink Programme
London Cannon Street	Outside party scheme increasing concourse capacity.		CP4	Outside party
London Charing Cross		The case for longer-term congestion relief for CP5 and beyond is being developed. 12-car capability in platform 4 considered within this scheme.	CP5	CP5 HLOS (High Level Output Specification)
London Euston		A new high speed line is part of the recommended strategy to deal with capacity shortages on the West Coast Main Line. This would include redevelopment of London Euston by 2026.		
London Fenchurch Street		The case for longer-term congestion relief for CP5 and beyond is being developed.	CP5	CP5 HLOS

Appendix A: Stations

Table A.2 – Central London stations – committed schemes and schemes in development

Station	Committed scheme description	Schemes under development	Due	Funding source
London King's Cross	London King's Cross is currently undergoing a transformation into a world-class transport hub providing passengers with more trains, better connections and a more pleasant experience. The station will be extended through a new western concourse, three times the size of the current area. The concourse will be multi-levelled with retail and catering outlets, as well as improved step-free access to the London Underground and London St Pancras International.		2013	CP4 HLOS
London Liverpool Street	London Liverpool Street will benefit from congestion relief as part of the Crossrail programme. There will be a new low level station for the Crossrail trains, and the station design will improve connectivity with the underground and surface stations, including to Moorgate.		2018	Crossrail
London Paddington	Re-development to accommodate extra passengers from Crossrail is part of the Crossrail programme.	In addition a separate Paddington station passenger capacity scheme is under development.	2018/CP5	Crossrail/CP5 funding
London Victoria	London Underground major upgrade scheme to reduce station closure in morning peak which will relieve station concourse congestion.	The case for longer-term congestion relief for CP5 and beyond is being developed.	CP4/CP5	LUL/CP5 HLOS
London Waterloo	London Waterloo is planned for remodelling including a committed scheme to reopen London Waterloo International, which has been closed since Eurostar services were transferred to London St Pancras International. A scheme is planned to move retail units to the balcony at first floor level to relieve concourse congestion.	Further congestion relief is potentially needed at London Waterloo in the longer term, building on the CP4 scheme. Pedestrian modelling is being undertaken to understand congestion issues at the terminus.	2014	CP4 HLOS
Waterloo East	A second station entrance via Hatfields is funded but remains subject to planning consents.		TBA	Network Rail Discretionary Fund

Table A.3 – Greater London stations committed schemes and schemes in development

Station	Committed scheme description	Further schemes in development	Due	Funding source
Balham	Balham has work funded to open up the entrance to the west of the tracks that leads onto Balham High Road. The planned works will assist flow issues from the bottom of stairwell to the ticket gates. It is believed these will be sufficient to handle demand in CP4 and CP5.	Provision of a second stairwell from the platforms to the subway and entrance to the Bedford Road end to be revisited for CP6.	2011	National Stations Improvements Programme (NSIP)
Barking		Barking is on TfL's severely crowded list in the Mayor's Transport Plan. Plans were initiated to improve the station forecourt area, to help address congestion and interchange issues whilst giving the area a facelift, however funding has not been secured.		
Bromley South	Bromley South redevelopment includes work on the ticket hall area, installation of new platform furniture and toilets; Access for All works may trigger development of new gateline facility.		CP4	NSIP/Access for All
Clapham Junction	CP4 plans begin to address the issues at Clapham Junction; a new entrance via the currently disused 'Brighton buildings' is under construction. This will provide direct access from street level onto the footbridge, from which lifts to all platforms have recently been installed.	Crowding in and access to/ from the subway will continue to be a CP5 problem, so the case is being analysed for further development to relieve congestion in CP5.	CP4/CP5	Multiple
Ealing Broadway	Ealing Broadway will be redesigned to cater for Crossrail. The Ealing Broadway Interchange Study by Steer Davies Gleave for Ealing Council looks at how the interchange and environment of Ealing Broadway can be improved. The study is available from the Ealing Council website.	TfL and Network Rail analysis indicates there is a case for further improvements in CP5.	2018	Crossrail
East Croydon	The East Croydon passenger capacity scheme will enable the station to cope with additional passengers, linked to the development of adjacent sites and additional capacity on the Brighton Main Line. Work will involve a mid-platform dispersal bridge, a new west entrance, and concourse improvements.	Further capacity could be added in the form of an additional east entrance, linked to the development site adjacent to the railway.	CP4	CP4 HLOS and outside party contributions
Finsbury Park	The disused eastern platform will be brought back into use with associated platform access and secondary means to exit. This will be accompanied by the extensions to some platforms for Thameslink trains.	TfL and Network Rail analysis indicates there is a case for further improvements in CP5.	2013 (CP5)	Thameslink Programme/ NSIP/NRDF
Forest Gate	Forest Gate will receive platform extensions as part of Crossrail.		2018	Crossrail
Gidea Park	Gidea Park will receive platform extensions as part of Crossrail.		2018	Crossrail
Lewisham	Lewisham has received a new staircase and other improvements to address congestion in CP4.		2010	

Appendix A: Stations

Table A.3 – Greater London stations committed schemes and schemes in development

Station	Committed scheme description	Further schemes in development	Due	Funding source
Seven Sisters	The Seven Sisters improved access scheme includes widening staircases, extending canopies and providing additional seating, lighting and Customer Information Systems equipment. This will facilitate anticipated increases in passengers at Seven Sisters station, including the interchange between the National Rail and London Underground networks.	TfL and Network Rail analysis indicates Seven Sisters is a strong candidate for investment in CP5.	2014	CP4 HLOS
Stratford	Major redevelopment will increase capacity ready for the 2012 Olympics.		2012	Olympic Delivery Authority
Tottenham Hale		Tottenham Hale has been identified by TfL as having a good case for investment in CP5. The extent of remodelling needed depends on the recommendation regarding Options C2 – C4 (West Anglia four-tracking). If recommended, this will provide an opportunity to enhance the station accompanying this scheme.		
Vauxhall	Planned works for CP4 include opening up a second arch and new improved access to LU lines, with new lifts to all platforms.		CP4	NSIP/Access for All
Walthamstow Central		Works to improve station area are planned for CP5, though a funding source is not yet identified.		
West Ham	West Ham resignalling provides the opportunity to address station congestion, increasing station capacity and improving interchange with the DLR and LUL lines.		2011	NRDF
West Hampstead Thameslink	Construction on a new station building is underway. The building on Iverson Road will increase passenger capacity, ease congestion by widening walkways, and improve the interchange with West Hampstead Overground and Underground stations. It will also link into and complete the new footbridge, with lifts to all platforms.	Further connectivity improvements between the stations in this area are sought by stakeholders	2011	Thameslink
Wimbledon	Forecourt improvements, taxi interchange and Disability Discrimination Act compliant access improvements are planned.	Wimbledon is on TfL's priority list for investment in CP5. Developing the station will assist the Mayor's Transport Strategy for better orbital routes and strategic interchange. Network Rail is assessing the case for further development to relieve congestion in CP5.	CP4/CP5	NSIP/CP5 HLOS

A.4 Schemes in development – further details

A.4.1 Network Rail is assessing the case for several schemes, particularly at Clapham Junction, London Charing Cross, London Fenchurch Street, London Victoria and Wimbledon through the CP5 development process. This comprises measuring the congestion problems at these locations, how severe the issues are, what interventions could be made and how much they would cost. If good value-for-money schemes can be produced, there is a natural progression for funding in CP5 through inclusion in the Interim Strategic Business Plan, and eventually the High Level Output Specification for CP5.

A.4.2 For potential station improvements not currently being taken forwards through CP5 development process, other funds are likely to be available when criteria are met. For example, the Network Rail Discretionary Fund can deliver smaller schemes that meet value-for-money and other criteria. Industry partners will need to work together to find appropriate ways to achieve aspirations for stations in these times when funding is limited.

A.4.3 The Network RUS: Stations is developing a toolkit for options which will assist in the development of suitable schemes to meet present and future gaps.

A.4.4 The industry recognise that combining congestion relief schemes with interchange improvements and Access for All work gets the best value for money projects. Combining National Rail schemes with London Underground projects is also a major opportunity to achieve the best solution for the transport system as a whole.

A.5 Future requirements

A.5.1 The strategy with respect to station capacity for the next ten years is shown in **Table A.3**. In order to respond to the demand forecast in **Chapter 6**, further schemes may become necessary, focusing on the busiest stations in **Table A.1**.

Appendix B: Solent and South Hampshire bus services

This table details bus services that run from one station to another and therefore compete with rail travel. Southampton City Centre is listed separately.

The table includes details of the bus route, bus company and breaks down the service to show the frequency and journey times in the morning and evening peaks as well as the off peak. Saturdays and Sundays are detailed separately. Some buses run at odd frequencies, for example not every 15 minutes but four buses in that hour, this is shown in the table as bph (buses per hour). First and last buses are shown to indicate the extent of the service. Some routes from Southampton city centre have an earlier last bus Monday to Thursday with extra night buses on Fridays and Saturdays to accommodate social activities.

Appendix B – Solent and South Hampshire bus services

bph = buses per hour
JT = journey time
N = night bus

				Weekdays								Saturdays				Sundays			
					Morning peak (08:00–08:59)		Off-peak (12:00–12:59)		Evening peak (17:00–17:59)				Off-peak (12:00–12:59)				Off-peak (12:00–12:59)		
From	To	Bus company	Bus route	First	Frequency	JT	Frequency	JT	Frequency	JT	Last	First	Frequency	JT	Last	First	Frequency	JT	Last
Bitterne	Southampton Central	First Hampshire	8/8A	06:15	5 bph	00:30	6 bph	00:22	6 bph	00:23	23:13	07:25	6 bph	00:22	23:13	09:13	Every 30 mins	00:22	22:15
Bitterne	Southampton City Centre	First Hampshire	9/9A	07:30	Every 20 mins	00:16	Every 20 mins	00:14	Every 20 mins	00:14	22:41	07:37	Every 20 mins	00:14	22:41	09:55	Hourly	00:10	22:37
Bitterne	Southampton City Centre	First Hampshire	11C/ 12C	05:24	4 bph	00:16	4 bph	00:16	4 bph	00:13	22:21	06:23	4 bph	00:13	22:21	08:24	Hourly	00:12	22:21
Bitterne	Botley	Bluestar	3	07:20	Hourly	00:28	Hourly	00:28	Every 30 mins	00:30	23:16	08:00	Hourly	00:28	23:16	10:12	Hourly	00:23	19:12
Bitterne	Southampton City Centre	Bluestar	3	06:46	Hourly	00:19	Hourly	00:16	Hourly	00:16	23:04	07:30	Hourly	00:16	23:04	09:01	Hourly	00:14	18:01
Bitterne	Swaythling	Bluestar	14	09:00	No service		Hourly	00:22	No service		14:00	09:00	Hourly	00:22	14:00		No service		
Bitterne	Southampton City Centre	Bluestar	14	09:00	No service		Hourly	00:49	No service		14:00	09:00	Hourly	00:49	14:00		No service		
Bitterne	Southampton City Centre	Bluestar	18	06:07	Every 10 mins	00:14	Every 10 mins	00:14	Every 10 mins	00:14	23:25	06:47	Every 10 mins	00:14	23:25	08:45	Every 20 mins	00:17	22:04
Bitterne	Southampton Central	Bluestar	18	06:07	Every 10 mins	00:18	Every 10 mins	00:18	Every 10 mins	00:18	23:25	06:47	Every 10 mins	00:18	23:25	08:45	Every 20 mins	00:21	22:04
Bitterne	Southampton City Centre	Brijan Tours	7	06:54	1 bph	00:18	Hourly	00:13	Hourly	00:13	17:52	08:32	Hourly	00:13	17:52		No service		
Botley	Fareham	First Hampshire	26	07:19	Infrequent	00:39	Infrequent (13:31)	00:31	Infrequent (18:03)	00:36	18:03	08:07	Infrequent (11:46)	00:31	18:03		No service		
Botley	Bitterne	Bluestar	3	06:22	No service in hour	00:34	Hourly	00:29	Hourly	00:27	22:43	07:05	Hourly	00:29	22:43	08:37	Hourly	00:24	17:37
Botley	Southampton City Centre	Bluestar	3	06:22	No service in hour	00:53	Hourly	00:45	Hourly	00:40	22:43	07:05	Hourly	00:45	22:43	08:37	Hourly	00:38	17:37
Botley	Southamp-ton Airport Parkway	Velvet	A	06:58	No service in hour	00:33	Hourly	00:33	Hourly	00:33	17:06	08:06	Hourly	00:33	17:06		No service		
Botley	Eastleigh	Velvet	A	06:58	No service in hour	00:49	Hourly	00:49	Hourly	00:49	17:06	08:06	Hourly	00:49	17:06		No service		
Botley	Hedge End	Brijan Tours	8	07:21	Hourly	00:16	Hourly	00:16	Hourly	00:16	17:21	07:21	Hourly	00:16	17:21		No service		
Botley	Eastleigh	Brijan Tours	8	07:21	Hourly	00:46	Hourly	00:46	Hourly	00:46	17:21	07:21	Hourly	00:46	17:21		No service		
Chandler's Ford	Southampton City Centre	First Hampshire	24	17:17	No service		No service		Daily	00:22	17:17		No service				No service		

Appendix B – Solent and South Hampshire bus services

bph = buses per hour
JT = journey time
N = night bus

				Weekdays								Saturdays				Sundays			
					Morning peak (08:00–08:59)		Off-peak (12:00–12:59)		Evening peak (17:00–17:59)				Off-peak (12:00–12:59)				Off-peak (12:00–12:59)		
From	To	Bus company	Bus route	First	Frequency	JT	Frequency	JT	Frequency	JT	Last	First	Frequency	JT	Last	First	Frequency	JT	Last
Chandler's Ford	Winchester	Bluestar	1	06:32	Every 20 mins	00:38	Every 20 mins	00:28	Every 20 mins	00:30	23:07	06:57	Every 20 mins	00:28	23:07 03:31N	09:29	Every 30 mins	00:26	23:30
Chandler's Ford	Southampton City Centre	Bluestar	1	06:03	2 bph	00:32	Every 20 mins	00:24	Every 20 mins	00:29	23:53	06:48	Every 20 mins	00:24	23:53	08:50	Every 30 mins	00:25	23:08
Chandler's Ford	Eastleigh	Velvet	C1	06:48	Hourly	00:20	Hourly	00:15	Hourly	00:15	22:52	07:48	Hourly	00:15	22:52	09:58	Hourly	00:15	17:58
Chandler's Ford	Eastleigh	Velvet	C2	09:20	No services		Hourly	00:15	No service		15:20	09:20	Hourly	00:15	15:20		No service		
Chandler's Ford	Southampton Central	Stagecoach	46B	09:38	No service	00:41	Daily		No service		09:38		No service				No service		
Chandler's Ford	Southampton City Centre	Stagecoach	46B	09:38	No service	00:47	Daily		No service		09:38		No service				No service		
Chandler's Ford	Winchester	Stagecoach	46/46A 46B	13:15	No service		Daily	00:34	No service		13:15		No service				No service		
Eastleigh	Southampton Airport Park-way	First Hampshire	A	18:36	No service		No service		(Hourly 18:36 to 21:36)	(00:09)	21:36	18:36	(Hourly 18:36 to 23:36)	(00:09)	23:36		No service		
Eastleigh	Swaythling	Bluestar	2	06:11	3 bph	00:21	Every 20 mins	00:16	2 bph	00:16	22:23	07:06	Every 20 mins	00:16	22:23	08:36	Hourly	00:16	22:40
Eastleigh	Southampton City Centre	Bluestar	2	06:11	2 bph	00:42	Every 20 mins	00:37	2 bph	00:34	22:23	07:06	Every 20 mins	00:37	22:23	08:36	Hourly	00:37	22:40
Eastleigh	Southampton Airport Park-way	Velvet	A	06:45	Hourly	00:10	Hourly	00:10	Hourly	00:15	18:05	08:15	Hourly	00:10	17:15		No service		
Eastleigh	Botley	Velvet	A	09:15	No services		Hourly	00:41	Hourly	00:46	18:05	08:15	Hourly	00:41	17:15		No service		
Eastleigh	Chandler's Ford	Velvet	C1	07:05	Hourly	00:18	Hourly	00:15	2 bph	00:20	23:20	07:05	Hourly	00:15	23:20	09:20	Hourly	00:12	17:20
Eastleigh	Chandler's Ford	Velvet	C2	08:35	Hourly	00:18	Hourly	00:15	No service		14:40	08:40	Hourly	00:15	14:40		No service		
Eastleigh	Hedge End	Brijan Tours	8	08:14	Hourly	00:30	Hourly	00:30	Hourly	00:30	18:14	08:14	Hourly	00:30	18:14		No service		
Eastleigh	Botley	Brijan Tours	8	08:14	Hourly	00:44	Hourly	00:44	Hourly	00:44	18:14	08:14	Hourly	00:44	18:14		No service		
Fareham	Botley	First Hamp-shire	26	06:38	Infrequent	00:29	Infrequent	00:33	Infrequent	00:36	18:05	07:10	Infrequent	00:33	17:05		No service		
Fareham	Hedge End	First Hampshire	26	06:38	Infrequent	00:34	Infrequent	00:38	Infrequent	00:41	18:05	07:10	Infrequent	00:38	17:05		No service		
Fawley	Hythe	Bluestar	9	05:50	Hourly	00:25	Hourly	00:25	No service in hour	00:24	22:09	06:11	Hourly	00:25	22:09	08:55	Hourly	00:23	22:03

Appendix B – Solent and South Hampshire bus services

bph = buses per hour
JT = journey time
N = night bus

				Weekdays								Saturdays				Sundays			
					Morning peak (08:00–08:59)		Off-peak (12:00–12:59)		Evening peak (17:00–17:59)				Off-peak (12:00–12:59)				Off-peak (12:00–12:59)		
From	To	Bus company	Bus route	First	Frequency	JT	Frequency	JT	Frequency	JT	Last	First	Frequency	JT	Last	First	Frequency	JT	Last
Fawley	Southampton Central	Bluestar	9	05:50	Hourly	00:57	Hourly	00:57	No service in hour	00:52	22:09	06:11	Hourly	00:52	22:09	08:55	Hourly	00:53	22:03
Fawley	Southampton City Centre	Bluestar	9	05:50	Hourly	01:05	Hourly	01:05	No service in hour	00:56	22:09	06:11	Hourly	01:05	22:09	08:55	Hourly	01:00	22:03
Fawley	Hythe	Bluestar	H3	08:21	Every 2 hours	00:26	Every 2 hours	00:26	No service		16:21	08:21	Every 2 hours	00:26	16:21		No service		
Hamble	Southampton City Centre	First Hampshire	16/ 16A/ 16X	06:43	Every 20 mins	00:40	Every 20 mins	00:35	Every 20 mins	00:35	23:07	07:03	Every 30 mins	00:35	23:06	07:05	Hourly	00:34	23:06
Hedge End	Southampton Central	First Hampshire	8/8A	06:20	Every 20 mins	00:52	Every 20 mins	00:47	Every 22 mins	00:49	19:20	07:06	Every 20 mins	00:47	18:47	09:27	Hourly	00:46	18:47
Hedge End	Fareham	First Hampshire	26	07:14	Infrequent	00:44	Infrequent (13:26)	00:36	Infrequent	00:43	17:58	08:02	Infrequent (11:41)	00:36	17:58		No service		
Hedge End	Eastleigh	Brijan Tours	8	07:37	Hourly	00:30	Hourly	00:30	Hourly	00:30	17:37	07:37	Hourly	00:30	17:37		No service		
Hedge End	Botley	Brijan Tours	8/8A	07:39	Hourly	00:14	Hourly	00:14	Hourly	00:14	18:44	07:39	Hourly	00:14	18:44		No service		
Hythe	Marchwood	Bluestar	8	06:28	1 bph	00:20	Hourly	00:20	Hourly	00:20	18:43	07:28	Hourly	00:20	18:43	09:44	Infrequent	00:20	16:14
Hythe	Totton	Bluestar	8	06:28	1 bph	00:37	Hourly	00:37	Hourly	00:37	18:43	07:28	Hourly	00:37	18:43	09:44	Infrequent	00:37	16:14
Hythe	Southampton Central	Bluestar	8	06:28	1 bph	00:49	Hourly	00:49	Hourly	00:49	18:43	07:28	Hourly	00:49	18:43	09:44	Infrequent	00:49	16:14
Hythe	Southampton City Centre	Bluestar	8	06:28	1 bph	00:54	Hourly	00:54	Hourly	00:54	18:43	07:28	Hourly	00:54	18:43	09:44	Infrequent	00:54	16:14
Hythe	Fawley	Bluestar	9	07:33	No service in hour	00:21	Hourly	00:21	2 bph	00:21	23:49	07:53	Hourly	00:21	23:49	09:34	Hourly	00:19	23:43
Hythe	Southampton Central	Bluestar	9	06:14	Every 20 mins	00:34	Every 20 mins	00:32	2 bph	00:32	22:33	06:35	Every 20 mins	00:32	22:33	09:18	Every 30 mins	00:30	22:31
Hythe	Southampton City Centre	Bluestar	9	06:14	Every 20 mins	00:42	Every 20 mins	00:40	2 bph	00:40	22:33	06:35	Every 20 mins	00:40	22:33	09:18	Every 30 mins	00:37	22:31
Hythe	Fawley	Bluestar	H3	07:50	No service in hour	00:20	Every 2 hours	00:20	No service		15:50	07:50	Every 2 hours	00:20	15:50		No service		
Marchwood	Hythe	Bluestar	8	07:03	1 bph	00:23	Hourly	00:20	Hourly	00:20	19:18	07:03	Hourly	00:20	19:18	11:19	Infrequent	00:20	17:49
Marchwood	Totton	Bluestar	8	06:48	1 bph	00:17	Hourly	00:17	Hourly	00:17	19:03	07:48	Hourly	00:17	19:03	10:04	Infrequent	00:17	22:18
Marchwood	Southampton Central	Bluestar	8	06:48	1 bph	00:29	Hourly	00:29	Hourly	00:29	19:03	07:48	Hourly	00:29	19:03	10:04	Infrequent	00:29	22:18
Marchwood	Southampton City Centre	Bluestar	8	06:48	1 bph	00:34	Hourly	00:34	Hourly	00:34	19:03	07:48	Hourly	00:34	19:03	10:04	Infrequent	00:34	22:18

Appendix B – Solent and South Hampshire bus services

bph = buses per hour
JT = journey time
N = night bus

				Weekdays								Saturdays				Sundays			
					Morning peak (08:00–08:59)		Off-peak (12:00–12:59)		Evening peak (17:00–17:59)				Off-peak (12:00–12:59)				Off-peak (12:00–12:59)		
From	To	Bus company	Bus route	First	Frequency	JT	Frequency	JT	Frequency	JT	Last	First	Frequency	JT	Last	First	Frequency	JT	Last
Millbrook	Southampton Central	First Hampshire	4	06:31	Every 30-35 mins	00:42	Every 30 mins	00:33	Every 30 mins	00:39	17:30	08:20	Hourly	00:33	17:30	10:35	Hourly	00:26	16:35
Millbrook	Southampton Central	First Hampshire	17/17A	05:33	Every 10 mins	00:20	Every 10 mins	00:19	Every 10 mins	00:19	23:20	06:05	Every 10 mins	00:19	23:20	07:29	Every 20 mins	00:17	23:20
Netley	Southampton City Centre	First Hampshire	16/16A/16X	06:54	Every 20 mins	00:28	Every 20 mins	00:23	Every 20 mins	00:23	23:18	07:14	Every 30 mins	00:23	23:17	07:18	Hourly	00:19	23:19
Romsey	Winchester	Stagecoach	66	06:40	1 bph	00:36	Hourly	00:29	Every 30 mins	00:29	19:50 23:54N	07:45	Hourly	00:29	19:10 23:54N		No service		
Southampton Airport Parkway	Eastleigh	First Hampshire	16A/A	18:23	No service		No service		(Hourly 18:23 to 23:23)	(00:10)	23:23	18:23	(Hourly 18:23 to 23:23)	(00:10)	23:23		No service		
Southampton Airport Parkway	Southampton Central	Unilink	U1C	05:30	Every 10 mins	00:38	Every 10 mins	00:38	Every 10 mins	00:38	23:25	06:00	Every 15 mins	00:38	23:25	06:00	Every 15 mins	00:38	23:25
Southampton Airport Parkway	Southampton City Centre	Unilink	U1C	05:30	Every 10 mins	00:41	Every 10 mins	00:41	Every 10 mins	00:41	19:45	06:00	Every 15 mins	00:41	19:45	06:00	Every 15 mins	00:41	19:45
Southampton Airport Parkway	Eastleigh	Velvet	A	07:29	2 bph	00:22	Hourly	00:16	Hourly	00:16	17:39	08:39	Hourly	00:16	17:39		No service		
Southampton Airport Parkway	Botley	Velvet	A	09:25	No services		Hourly	00:31	Hourly	00:31	18:15	08:25	Hourly	00:31	17:25		No service		
Southampton Central	Millbrook	First Hampshire	4	07:05	Every 40 mins	00:32	Every 40 mins	00:32	Every 35 mins	00:35	17:47	08:40	Hourly	00:32	17:41	10:08	Hourly	00:24	17:21
Southampton Central	Totton	First Hampshire	4	07:05	Every 40 mins	00:38	Every 40 mins	00:38	Every 35 mins	00:43	17:47	08:40	Hourly	00:38	17:41		No service		
Southampton Central	Woolston	First Hampshire	8/8A	06:23	6 bph	00:14	Every 10 mins	00:16	6 bph	00:16	23:20	06:22	6 bph	00:16	23:20	09:30	Every 30 mins	00:15	17:57
Southampton Central	Bitterne	First Hampshire	8/8A	06:23	6 bph	00:25	Every 10 mins	00:28	6 bph	00:25	23:20	06:22	6 bph	00:23	23:20	09:30	Every 30 mins	00:23	22:23
Southampton Central	Hedge End	First Hampshire	8/8A	07:24	Every 22-24 mins	00:46	Every 20 mins	00:45	Every 20 mins	00:49	18:32	06:22	Every 20 mins	00:44	18:32*	09:57	Hourly	00:46	22:23
Southampton Central	Woolston	First Hampshire	10/10A	06:14	5 bph	00:16	Every 10 mins	00:16	Every 10 mins	00:18	23:26	07:08	Every 10 mins	00:16	23:26	08:15	Every 30 mins	00:16	22:53
Southampton Central	Millbrook	First Hampshire	17/17A	05:30	Every 10 mins	00:17	Every 10 mins	00:18	Every 10 mins	00:20	23:37	06:44	Every 10 mins	00:18	23:37	06:45	Every 20 mins	00:15	23:37
Southampton Central	Romsey	Bluestar	4	07:09	2 bph	00:46	Every 30 mins	00:46	Every 30 mins	00:46	23:24	08:14	Every 30 mins	00:46	23:24	09:24	Hourly	00:46	18:24

Appendix B – Solent and South Hampshire bus services

bph = buses per hour
JT = journey time
N = night bus

				Weekdays								Saturdays				Sundays			
					Morning peak (08:00–08:59)		Off-peak (12:00–12:59)		Evening peak (17:00–17:59)				Off-peak (12:00–12:59)				Off-peak (12:00–12:59)		
From	To	Bus company	Bus route	First	Frequency	JT	Frequency	JT	Frequency	JT	Last	First	Frequency	JT	Last	First	Frequency	JT	Last
Southampton Central	Totton	Bluestar	8	07:34	1 bph	00:12	Hourly	00:12	Hourly	00:12	18:49	08:44	Hourly	00:12	18:49	10:50	Infrequent	00:12	21:54
Southampton Central	Marchwood	Bluestar	8	07:34	1 bph	00:29	Hourly	00:29	Hourly	00:29	18:49	08:44	Hourly	00:29	18:49	10:50	Infrequent	00:29	21:54
Southampton Central	Hythe	Bluestar	8	07:34	1 bph	00:49	Hourly	00:49	Hourly	00:49	18:49	08:44	Hourly	00:49	18:49	10:50	Infrequent	00:49	17:20
Southampton Central	Hythe	Bluestar	9	07:04	Every 20 mins	00:31	Every 20 mins	00:31	5 bph	00:39	23:14 03:54N	07:24	Every 20 mins	00:31	23:14 03:54N	09:34	Every 30 mins	00:30	23:14
Southampton Central	Fawley	Bluestar	9	07:04	Hourly	00:52	Hourly	00:52	3 bph	01:00	23:14 03:54N	07:24	Hourly	00:52	23:14 03:54N	09:34	Hourly	00:49	23:14
Southampton Central	Totton	Bluestar	10/11	07:09	Every 30 mins	00:13	Every 30 mins	00:13	Every 30 mins	00:13	18:24	07:49	Every 30 mins	00:13	18:24		No service		
Southampton Central	Totton	Bluestar	12	06:54	1 bph	00:13	Every 30 mins	00:13	Every 30 mins	00:13	23:09 03:10N	07:24	Every 30 mins	00:13	23:09 03:10N	08:44	Hourly	00:11	23:14
Southampton Central	Bitterne	Bluestar	18	06:50	Every 10 mins	00:27	Every 10 mins	00:27	Every 10 mins	00:27	23:09	07:10	Every 10 mins	00:27	23:09	08:41	Every 20 mins	00:21	22:48
Southampton Central	Southampton Airport Park-way	Unilink	U1A/ U1E	06:00	Every 10 mins	00:36	Every 10 mins	00:36	Every 10 mins	00:41	00:05	06:00	Every 15 mins	00:36	00:05	07:00	Every 15 mins	00:36	00:05
Southampton Central	Chandler's Ford	Stagecoach	46B	12:34	No service		Daily	00:41	No service		12:30		No service				No service		
Southampton Central	Winchester	Stagecoach	46/46A 46B	06:58	Infrequent	01:13	Infrequent	01:15	No service		16:20	08:38	Infrequent	01:08	17:59		No service		
Southampton City Centre	Woolston	First Hampshire	1/1A	05:46	Every 10 mins	00:09	Every 10 mins	00:10	Every 12 mins	00:12	23:47	06:16	Every 12 mins	00:10	23:47	07:16	Every 30 mins	00:09	23:47
Southampton City Centre	Swaythling	First Hampshire	7/7A	05:43	Every 20-25 mins	00:20	Every 20 mins	00:21	Every 20 mins	00:21	23:35	07:35	Every 20 mins	00:19	23:10	08:10	Every 30 mins	00:17	23:10
Southampton City Centre	Bitterne	First Hampshire	9/9A	07:41	Every 20 mins	00:14	Every 20 mins	00:15	2 bph	00:17	22:13	07:50	Every 20 mins	00:15	22:13	10:08	Hourly	00:13	22:18
Southampton City Centre	Bitterne	First Hampshire	11C/ 12C	06:20	Every 15 mins	00:14	Every 15 mins	00:15	Every 15 mins	00:17	22:45	07:09	Every 15 mins	00:13	22:45	08:45	Hourly	00:11	22:45
Southampton City Centre	Woolston	First Hampshire	11C/ 12C	04:58	4 bph	00:09	Every 15 mins	00:09	Every 15 mins	00:12	18:30	05:57	Every 15 mins	00:09	18:25		No service		
Southampton City Centre	Woolston	First Hampshire	16/ 16A/ 16X	06:27	Every 20 mins	00:09	Every 20 mins	00:10	Every 20 mins	00:11	22:34	06:27	Every 30 mins	00:10	22:34	06:27	Hourly	00:08	22:34

Appendix B – Solent and South Hampshire bus services

bph = buses per hour
JT = journey time
N = night bus

				Weekdays								Saturdays				Sundays			
					Morning peak (08:00–08:59)		Off-peak (12:00–12:59)		Evening peak (17:00–17:59)				Off-peak (12:00–12:59)				Off-peak (12:00–12:59)		
From	To	Bus company	Bus route	First	Frequency	JT	Frequency	JT	Frequency	JT	Last	First	Frequency	JT	Last	First	Frequency	JT	Last
Southampton City Centre	Netley	First Hampshire	16/ 16A/ 16X	06:27	Every 20 mins	00:23	Every 20 mins	00:23	Every 20 mins	00:25	22:34	06:27	Every 30 mins	00:23	22:34	06:27	Hourly	00:18	22:34
Southampton City Centre	Hamble	First Hampshire	16/ 16A/ 16X	06:27	Every 20 mins	00:33	Every 20 mins	00:33	Every 20 mins	00:36	22:34	06:27	Every 30 mins	00:33	22:34	06:27	Hourly	00:32	22:34
Southampton City Centre	Southampton Airport Park-way	First Hampshire	16A/A	17:07	No service		No service		Twice daily	01:16	18:07	17:07	(Twice Daily)	01:16	18:07		No service		
Southampton City Centre	Eastleigh	First Hampshire	16A/A	17:07	No service		No service		Twice daily	01:26	18:07	17:07	(Twice Daily)	01:26	18:07		No service		
Southampton City Centre	Chandler's Ford	First Hampshire	24	07:14	Daily (not in hour)	00:22	No service		No service		07:14		No service				No service		
Southampton City Centre	Chandler's Ford	Bluestar	1	06:10	2 bph	00:32	Every 20 mins	00:22	Every 20 mins	00:20	22:50 03:15N	07:10	Every 20 mins	00:22	22:50 03:15N	09:10	Every 30 mins	00:19	23:10
Southampton City Centre	Winchester	Bluestar	1	06:10	2 bph	01:07	Every 20 mins	00:50	Every 20 mins	01:00	22:50 03:15N	07:10	Every 20 mins	00:50	22:50 03:15N	09:10	Every 30 mins	00:45	23:10
Southampton City Centre	Swaythling	Bluestar	2	06:50	3 bph	00:18	Every 20 mins	00:18	Every 20 mins	00:18	23:20 03:35N	06:55	Every 20 mins	00:18	23:20 03:35N	09:20	Hourly	00:18	22:35
Southampton City Centre	Eastleigh	Bluestar	2	06:50	3 bph	00:41	Every 20 mins	00:36	Every 20 mins	00:41	23:20 03:35N	06:55	Every 20 mins	00:36	23:20 03:35N	09:20	Hourly	00:36	22:35
Southampton City Centre	Bitterne	Bluestar	3	07:05	Hourly	00:15	Hourly	00:15	Every 30 mins	00:18	23:05	07:45	Hourly	00:15	23:05	10:00	Hourly	00:12	19:00
Southampton City Centre	Botley	Bluestar	3	07:05	Hourly	00:43	Hourly	00:43	Every 30 mins	00:43	23:05	07:45	Hourly	00:43	23:05	10:00	Hourly	00:35	19:00
Southampton City Centre	Romsey	Bluestar	4	07:05	2 bph	00:50	Every 30 mins	00:50	Every 30 mins	00:50	23:20	08:10	Every 30 mins	00:50	23:20	09:20	Hourly	00:50	18:20
Southampton City Centre	Totton	Bluestar	8	07:30	1 bph	00:16	Hourly	00:16	Hourly	00:16	18:45	08:40	Hourly	00:16	18:45	10:46	Infrequent	00:16	21:50
Southampton City Centre	Marchwood	Bluestar	8	07:30	1 bph	00:33	Hourly	00:33	Hourly	00:33	18:45	08:40	Hourly	00:33	18:45	10:46	Infrequent	00:33	21:50
Southampton City Centre	Hythe	Bluestar	8	07:30	1 bph	00:53	Hourly	00:53	Hourly	00:53	18:45	08:40	Hourly	00:53	18:45	10:46	Infrequent	00:53	17:16
Southampton City Centre	Hythe	Bluestar	9	07:00	Every 20 mins	00:35	Every 20 mins	00:35	5 bph	00:45	23:10 03:50N	07:20	Every 20 mins	00:35	23:10 03:50N	09:30	Every 30 mins	00:34	23:10

Appendix B – Solent and South Hampshire bus services

bph = buses per hour
JT = journey time
N = night bus

				Weekdays								Saturdays				Sundays			
					Morning peak (08:00–08:59)		Off-peak (12:00–12:59)		Evening peak (17:00–17:59)				Off-peak (12:00–12:59)				Off-peak (12:00–12:59)		
From	To	Bus company	Bus route	First	Frequency	JT	Frequency	JT	Frequency	JT	Last	First	Frequency	JT	Last	First	Frequency	JT	Last
Southampton City Centre	Fawley	Bluestar	9	07:00	Hourly	00:56	Hourly	00:56	3 bph	01:06	23:10 03:50N	07:20	Hourly	00:56	23:10 03:50N	09:30	Hourly	00:53	23:10
Southampton City Centre	Totton	Bluestar	10/11	07:05	Every 30 mins	00:17	Every 30 mins	00:17	Every 30 mins	00:17	18:20	07:45	Every 30 mins	00:17	18:20		No service		
Southampton City Centre	Totton	Bluestar	12	06:50	1 bph	00:17	Every 30 mins	00:17	Every 30 mins	00:17	23:05 03:05N	07:20	Every 30 mins	00:17	23:05 03:05N	08:40	Hourly	00:15	23:10
Southampton City Centre	Swaythling	Bluestar	14	09:03	No service		Hourly	00:28	No service		14:03	09:03	Hourly	00:28	14:03		No service		
Southampton City Centre	Bitterne	Bluestar	14	09:03	No service		Hourly	00:50	No service		14:03	09:03	Hourly	00:50	14:03		No service		
Southampton City Centre	Bitterne	Bluestar	18	07:03	Every 10 mins	00:14	Every 10 mins	00:14	Every 10 mins	00:14	23:20 03:00N	07:23	Every 10 mins	00:14	23:20 03:00N	08:50	Every 20 mins	00:12	23:00
Southampton City Centre	Southamp-ton Airport Parkway	Unilink	U1A/ U1E	05:23	Every 20 mins	00:41	Every 10 mins	00:41	Every 10 mins	00:46	20:40	05:55	Every 15 mins	00:43	20:40	06:55	Every 15 mins	00:41	20:40
Southampton City Centre	Bitterne	Brijan Tours	7	07:15	No service in hour	00:13	Hourly	00:13	Hourly	00:13	18:10	07:15	Hourly	00:13	18:10		No service		
Southampton City Centre	Chandler's Ford	Stagecoach	46B	12:30	No service		Daily	00:45	No service		12:30		No service				No service		
Southampton City Centre	Winchester	Stagecoach	46/46A 46B	06:54	Infrequent	01:17	Infrequent	01:19	No service		16:20	08:34	Infrequent	01:12	17:55		No service		
Swaythling	Southampton City Centre	First Hampshire	7/7A	05:20	Every 20 mins	00:22	Every 20 mins	00:20	Every 20 mins	00:21	22:42	07:07	Every 20 mins	00:20	22:42	07:41	Every 30 mins	00:17	22:41
Swaythling	Eastleigh	Bluestar	2	07:05	2 bph	00:23	Every 20 mins	00:23	3 bph	00:23	23:35	07:10	Every 20 mins	00:18	23:35	09:38	Hourly	00:18	22:50
Swaythling	Southampton City Centre	Bluestar	2	06:27	2 bph	00:21	Every 20 mins	00:21	2 bph	00:18	22:38	07:22	Every 20 mins	00:21	22:38	08:52	Hourly	00:21	22:53
Swaythling	Southampton City Centre	Bluestar	14	09:22	No service		Hourly	00:27	No service		14:22	09:22	Hourly	00:27	14:22		No service		
Swaythling	Bitterne	Bluestar	14	09:31	No service		Hourly	00:22	No service		14:31	09:31	Hourly	00:22	14:31		No service		
Totton	Southampton Central	First Hampshire	4	06:50	30-35 mins	00:50	Every 30 mins	00:39	Every 30 mins	00:47	17:30	08:15	Hourly	00:39	17:24		No service		
Totton	Marchwood	Bluestar	8	06:46	1 bph	00:17	Hourly	00:17	Hourly	00:17	19:01	06:46	Hourly	00:17	19:01	11:02	Infrequent	00:17	22:05
Totton	Hythe	Bluestar	8	06:46	1 bph	00:37	Hourly	00:37	Hourly	00:37	19:01	06:46	Hourly	00:37	19:01	11:02	Infrequent	00:37	17:32

Appendix B – Solent and South Hampshire bus services

bph = buses per hour
JT = journey time
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				Weekdays								Saturdays				Sundays			
					Morning peak (08:00–08:59)		Off-peak (12:00–12:59)		Evening peak (17:00–17:59)				Off-peak (12:00–12:59)				Off-peak (12:00–12:59)		
From	To	Bus company	Bus route	First	Frequency	JT	Frequency	JT	Frequency	JT	Last	First	Frequency	JT	Last	First	Frequency	JT	Last
Totton	Southampton Central	Bluestar	8	07:05	1 bph	00:12	Hourly	00:12	Hourly	00:12	19:20	08:05	Hourly	00:12	19:20	10:21	Infrequent	00:12	22:35
Totton	Southampton City Centre	Bluestar	8	07:05	1 bph	00:17	Hourly	00:17	Hourly	00:17	19:20	08:05	Hourly	00:17	19:20	10:21	Infrequent	00:17	22:35
Totton	Southampton Central	Bluestar	10/11	07:27	2 bph	00:10	Every 30 mins	00:10	Every 30 mins	00:10	17:57	07:27	Every 30 mins	00:10	17:57		No service		
Totton	Southampton City Centre	Bluestar	10/11	07:27	2 bph	00:18	Every 30 mins	00:18	Every 30 mins	00:18	17:57	07:27	Every 30 mins	00:18	17:57		No service		
Totton	Southampton Central	Bluestar	12	06:27	1 bph	00:10	Every 30 mins	00:10	Every 30 mins	00:10	22:42	06:57	Every 30 mins	00:10	22:42	08:28	Hourly	00:10	21:25
Totton	Southampton City Centre	Bluestar	12	06:27	1 bph	00:18	Every 30 mins	00:18	Every 30 mins	00:18	22:42	06:57	Every 30 mins	00:18	22:42	08:28	Hourly	00:14	21:25
Winchester	Chandler's Ford	Bluestar	1	06:00	Every 20 mins	00:28	Every 20 mins	00:26	Every 20 mins	00:26	23:35	07:00	Every 20 mins	00:26	23:35	09:00	Every 30 mins	00:20	22:50
Winchester	Southampton City Centre	Bluestar	1	06:00	Every 20 mins	01:00	Every 20 mins	00:50	Every 20 mins	00:55	23:35	07:00	Every 20 mins	00:50	23:35	09:00	Every 30 mins	00:45	22:50
Winchester	Chandler's Ford	Stagecoach	46B	07:09	No service in hour	00:38	Daily		No service		07:09		No service				No service		
Winchester	Southampton Central	Stagecoach	46/46A 46B	07:09	No service in hour	01:11	Infrequent	01:13	No service		13:05	07:15	Infrequent	01:07	16:40		No service		
Winchester	Southampton City Centre	Stagecoach	46/46A 46B	07:09	No service in hour	01:17	Infrequent	01:19	No service		15:15	07:15	Infrequent	01:13	16:40		No service		
Winchester	Romsey	Stagecoach	66	06:13	1 bph	00:29	Hourly	00:29	Every 30 mins	00:30	19:12 23:13N	07:16	Hourly	00:26	18:42 23:13N		No service		
Woolston	Southampton City Centre	First Hampshire	1/1A	05:34	Every 10 mins	00:10	Every 10 mins	00:08	Every 12 mins	00:09	23:15	06:15	Every 12 mins	00:08	23:15	07:47	Every 30 mins	00:08	23:15
Woolston	Southampton Central	First Hampshire	8/8A	06:25	5 bph	00:17	6 bph	00:16	6 bph	00:17	23:19	07:32	6 bph	00:14	23:19	09:24	Every 30 mins	00:15	22:45
Woolston	Southampton Central	First Hampshire	10/ 10A	05:16	Every 10 mins	00:18	Every 10 mins	00:17	Every 10 mins	00:17	23:27	06:12	Every 10 mins	00:17	23:27	07:09	Every 30 mins	00:17	22:58
Woolston	Southampton City Centre	First Hampshire	11C/ 12C	06:50	Every 15 mins	00:11	Every 15 mins	00:10	Every 15 mins	00:10	19:00	07:17	4 bph	00:10	18:50		No service		
Woolston	Southampton City Centre	First Hampshire	16/ 16A/ 16X	07:06	Every 2 0 mins	00:11	Every 20 mins	00:09	Every 20 mins	00:09	23:30	07:26	Every 30 mins	00:09	23:29	07:29	Hourly	00:08	23:30

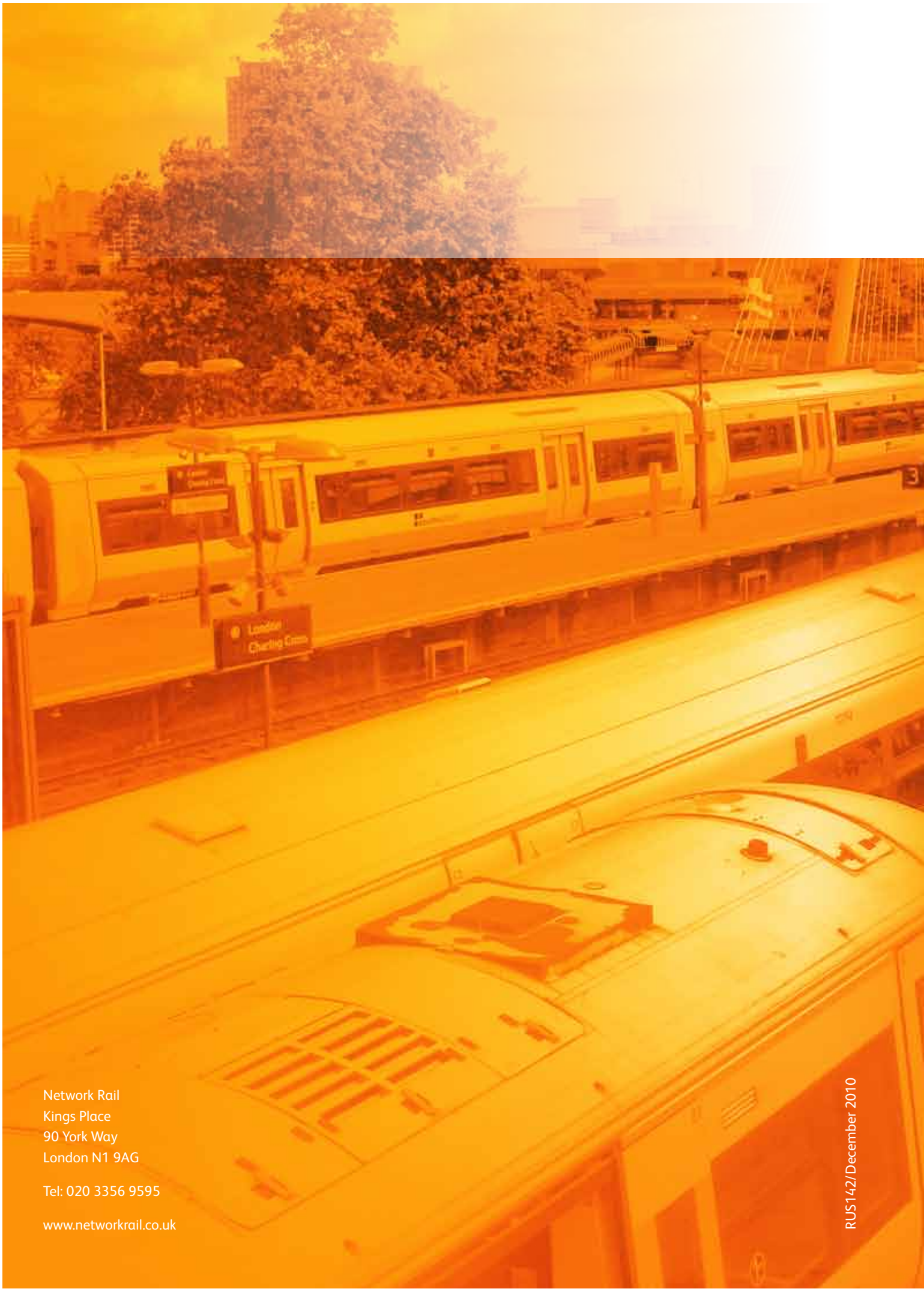
Glossary

Term	Meaning
ATOC	Association of Train Operating Companies.
BAA Heathrow Airtrack	Proposed new rail link to connect Heathrow Terminal 5 to the Windsor lines for direct trains to Reading, Guildford and London Waterloo.
BCR	Benefit cost ratio.
BML	Brighton Main Line – Brighton to London line via Gatwick Airport.
BML2	Brighton Main Line 2 – third party aspiration to connect Uckfield with the East Coastway line and to provide a new route from the Sanderstead area towards New Cross via Elmers End.
Chiltern line	The routes from London Marylebone to the Midlands.
Chord	Short line linking two other lines ie the Eastleigh Chord would link the Botley Line to the South West Main Line enabling trains to bypass Eastleigh.
Class 91 + Mark IV coaches	East Coast Main Line dedicated Class 91 electric locomotives and Mk IV coaches are operated as semi-permanently coupled rakes similar to an electric multiple unit. Introduced in the 1990s following the electrification of the route.
Control Period 4 (CP4)	The 2009/14 period.
Control Period 5 (CP5)	The 2014/19 period.
Control Period 6 (CP6)	The 2019/24 period.
Crossrail	A new high frequency line connecting Maidenhead and Heathrow Airport in the west with Shenfield and Abbey Wood in the east via twin tunnels under Central London.
Crossrail 2	Safeguarded route for proposed new Chelsea to Hackney line.
DfT	Department for Transport.
Down	The direction of trains normally when travelling away from London or large urban centre where direct trains to London do not operate.
ECML	East Coast Main Line – the route from London King's Cross to Yorkshire, Newcastle and Scotland.
ELL	East London Line – extended former London Underground route which connects Dalston Junction with Crystal Palace, West Croydon and New Cross. Operated by London Overground. The line is due to be extended to Highbury & Islington from summer 2011.
Engineering access	The time on the rail network when no trains operate. This provides the means by which maintenance, renewals or enhancement works are undertaken.
ERTMS	European Rail Traffic Management System – Europe-wide system for signalling and controlling trains. Currently being trialled in the UK but becoming widely used in other European countries.
Evergreen 3 project	£250m upgrade of the Chiltern line delivering journey opportunities between Oxford and London Marylebone and raising the linespeed to 100mph with other improvement works to significantly reduce journey times.
FOC	Freight Operating Company.
FPM	Freight Performance Measure – the new benchmarking process used to measure freight train performance.
ftph	Freight trains per hour.
GEML	Great Eastern Main Line – the routes from London Liverpool Street to East Anglia.
Generation One RUS	The original route-based RUSs.

Glossary

Term	Meaning
Generation Two RUS	Reviews, updates and develops the original Generation One RUSs with an overview of a wider area of coverage.
GDP	Gross Domestic Product – the market value of all final goods and services made within the Borders of a country in a year.
GRIP	Guide to Railway Investment Projects – eight point investment life cycle for major projects.
GWML	Great Western Main Line – the routes from London Paddington to the South West and Wales.
Hertford loop	A branch of the ECML between London King's Cross or Moorgate and Stevenage via Hertford North.
High speed rail network	Networks of new lines constructed specifically for running at speeds in excess of the conventional high speed (in the UK that is 125 mph) with no level crossings. HS1 and HS2 are the first routes to be constructed in the UK and have a maximum speed of more than 150mph.
HLOS	High Level Output Specification.
HST	High Speed Train – 1970s developed 125mph train still widely used on long distance services.
HS1	High Speed 1 – the high speed rail link between Ashford International and London St Pancras International stations.
HS2	High Speed 2 – the proposed high speed rail link between London and the West Midlands and, potentially, beyond.
IEP	InterCity Express Programme – the next generation of high speed train to replace the existing 125mph trains.
Infrastructure	This includes signalling, track, structures and telecom assets associated with the rail network.
LDHS	Long distance high speed.
Loading gauge	Loading gauge is the profile for a particular rail route within which all vehicles or loads must remain to ensure that sufficient clearance is available at all structures.
LTS	London, Tilbury and Southend line – the routes from London Fenchurch Street to the south Essex coast.
MML	Midland Main Line - the routes from London St Pancras International to the East Midlands and South Yorkshire.
MOIRA	An industry standard passenger demand forecasting model which uses many of the principles published in the Passenger Demand Forecasting Handbook.
Multiple unit trains (DMU, EMU & DEMU)	These are trains composed of self-contained units, rather than locomotive hauled/pushed, coupled together so that they work in unison under the control of the driver at the front of the leading unit. Units are normally composed of one, or more vehicles which are semi-permanently coupled and a driving compartment is provided at each end of every unit. There are diesel multiple units (DMU), electric multiple units (EMU) and diesel-electric multiple units (DEMU).
NLL	North London Line – the route between Richmond and Stratford.
NPV	Net present value – the whole-life economic benefit and revenue generated by a rail capability change minus the whole-life cost of this change.
Optimism bias	A proportional uplift to scheme cost estimates to allow for historical systematic optimism on the part of UK scheme promoters.
ORR	Office of Rail Regulation – the regulator for the railway industry in Great Britain.
Oxford Economics	A leading forecasting consultancy used as a data source for GDP, employment statistics etc.
PDFH	Passenger Demand Forecasting Handbook - industry standard publication containing detailed research on passenger behaviour and trends.
PiXC	Passengers in eXcess of Capacity – overcrowding measurement.
PPM	Public Performance Measure – the benchmarking process used to measure passenger train performance.
RPI	Retail Price Index – measure of UK inflation.
S&C	Switches and crossings – track components which allow trains to change from one line to another.

Term	Meaning
SDO	Selective Door Opening – used where the whole train does not fit into a station platform to unlock only the doors at the platform.
SMG	Stakeholder Management Group.
SOFA	Statement Of Funds Available – the Government's allocation of funding for rail schemes. Network Rail bids for this funding through its Strategic Business Plan which is then reviewed and allocated by the ORR for Network Rail's next Control Period.
Strategic routes	Network Rail is structured for planning purposes with 17 Routes, which are aligned closely to the traffic flows in the planning areas and operation areas to enable direct use of route plans for delivery.
SWML	South West Main Line – the line between London Waterloo and Weymouth.
TfL	Transport for London.
TfSH	Transport for South Hampshire.
Thameslink Programme Key Output 1	Upgrade of Brighton to Bedford route to allow 12-car trains to operate, including station works at London Blackfriars and Farringdon.
Thameslink Programme Key Output 2	Remodelling of London Bridge station and the eastern and western approaches, including grade separation at Bermondsey and connections to the new viaduct at Borough Market. A new connection will be provided from London St Pancras International low level onto the ECML.
TOC	Train operating company.
tph	Trains per hour.
TT	Timetable – these are usually published in May and December.
TWA	Transport and Works Act orders – the usual way of authorising a new railway or tramway scheme in England and Wales.
Up	The direction of trains normally when travelling towards London or large urban centre where direct trains to London do not operate.
WCML	West Coast Main Line – the routes from London Euston to the West Midlands, North West, North Wales and Scotland.
WCML DC lines	Third rail electrified routes between London Euston and Watford Junction.
Windsor lines	Routes between London Waterloo and Reading via Twickenham and to Windsor & Eton Riverside.
WLL	West London Line – the line between Clapham Junction and Willesden Junction/West Coast Main Line.
25kV AC	25,000 volts alternating current is the electrical supply for the overhead electrified routes.
750V DC	750 volts direct current is the electrical supply for the third rail system.



Network Rail
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