

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.

<i>New peak capacity options for Thames Valley commuters</i>		
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.

<i>East Coast Main Line capacity options – London approaches</i>		
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.

<i>New options for Lea Valley corridor</i>		
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.

<i>Sussex route new peak capacity options</i>		
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 recommended 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.

<i>New options for the West London Line</i>		
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:

<i>Heathrow connectivity options</i>		
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 extensions 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: <ul style="list-style-type: none"> • 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.

Executive Summary

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

South Hampshire 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**.

