

# Great Eastern Main Line Study

## Railway investment choices

July 2019



# Contents

|                                      |    |
|--------------------------------------|----|
| 1 Executive Summary                  | 03 |
| 2 The Great Eastern Main Line Study  | 04 |
| 3 Governance and strategic questions | 08 |
| 4 Long term growth assessment        | 10 |
| 5 Future services                    | 15 |
| 6 Accommodating future services      | 29 |
| 7 Recommendations                    | 33 |



# 1 Executive Summary

The Great Eastern Main Line Study forms part of Network Rail's Continuous Modular Strategic Planning (CMSP). The study focuses on the long-term capacity needs of the railway on this key route in the East of England, considering the expected growth in rail passenger demand over a 25 year period and the likely increase in train services and changes to the rail network to support this growth. This study has been facilitated by Network Rail and developed in partnership with the county councils of Essex, Suffolk and Norfolk, the Department for Transport, the New Anglia Local Enterprise Partnership, Greater Anglia and the Great Eastern Main Line Task Force.

During the next two years, rail services on this route are expected to be transformed through the replacement of the entire fleet with new, higher capacity trains. There are also a number of new services expected throughout the remainder of the franchise, such as the Norwich in 90 services introduced at certain times of the day. This study takes these improvements as a starting point, considers how passenger capacity will be improved with new trains and what the longer term needs of the Great Eastern Main Line are. The study has sought to answer several 'strategic questions' to inform stakeholders and funders on the options for enhancing the rail network on this route over the medium to long term.

The study has assessed long-term growth using a variety of population, economic and employment growth data. Over the next 25 years, growth in rail demand in the high peak hour towards London Liverpool Street is expected to be significant, increasing by between 40 and 60 % over the period. The provision of increased services to meet this demand is particularly challenging on a rail network that is already very capacity constrained.

Through a timetable assessment, the study has identified options to facilitate the increased passenger services alongside growth in rail freight. Several of these options have previously been identified with some early development taking place. Further assessments are expected to take place to recommend a more detailed timing and priority for the delivery of the options identified. It is recognised that most of the recommendations contained in this study focus on the route in Essex where capacity is most limited, however, the impact of these schemes would benefit the provision of additional services on the whole route including to and from Suffolk and Norfolk.

The study recommends that, following further assessment of the options, 'order of magnitude' costs are obtained for these schemes to support a Strategic Outline Business Case for investment. It is also recommended that the timing of further development of schemes should be determined following the introduction of new trains when the performance benefits on the network are established.



# 2 The Great Eastern Main Line Study

## 2.1 Scope and Geography

The Great Eastern Main Line (GEML) is the principal rail corridor in the East of England linking London with the key centres of Chelmsford, Colchester, Ipswich and Norwich. With train services terminating at London Liverpool Street, the GEML is a direct, heavily used, commuter route into the major employment hub of the City of London. Stratford is becoming increasingly important for the GEML with a growing employment base and its connectivity to other parts of London and the high-speed route to Kent from Stratford International station.

The East of England is one of the fastest growing regions of the UK in terms of population and the economy<sup>1</sup>. A number of economic reports have indicated this and this is expected to continue to be the case in the future. This growth presents a particular challenge for the railway in the peak hours. Today, at peak times, the GEML operates at maximum capacity without the ability to run any additional trains into London Liverpool Street.

The last major line upgrade for the route was completion of electrification and new electric trains in the late 1980s, which, at the time, transformed rail services in the region. The replacement of these trains with a new generation of rolling stock by Greater Anglia starting in 2019, will again provide a significant improvement to rail users but longer-term capacity challenges remain. This study considers these challenges and how to address them efficiently.

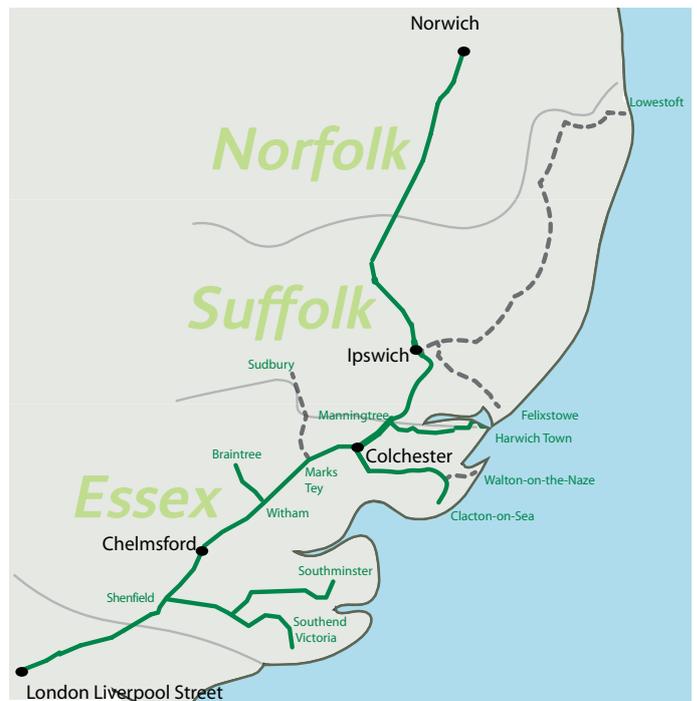
The scope of this study considers the main line between London, Ipswich and Norwich and associated lines where there are direct services to London Liverpool Street, these are the branch lines to Southminster, Southend Victoria, Braintree, Clacton on Sea and Harwich Town. The map shown in Figure 1 identifies the geographic scope of the study and area covered.

## 2.2 Rail industry strategy

Greater devolution of economic planning, transport planning and decision-making means that the strategic assessment of the railway involves a greater level of complexity when compared with strategies produced in the past. Network Rail has previously published, in 2016, the Anglia Route Study, which considered the rail network across the whole region including the West Anglia route, London Orbital, Essex Thameside and rural routes, in addition to the GEML itself.

This study provides a more focused assessment of the GEML independently to consider the likely growth on this corridor, as opposed to a more regional view. The production of a more focused study such as this provides greater ownership by key funders and stakeholders, such as the Great Eastern Main Line Task Force, in taking forward the case for investment to Government and other funders.

Figure 1: Scope of the study, includes routes shown in green



<sup>1</sup> <https://ec.europa.eu/growth/tools-databases/regional-innovation-monitor/base-profile/east-england>

With industry support, Network Rail has commenced a process of Continuous Modular Strategic Planning (CMSP), of which the GEML study forms a part. Further details about long term planning of the railway can be found at: <https://www.networkrail.co.uk/running-the-railway/long-term-planning/>

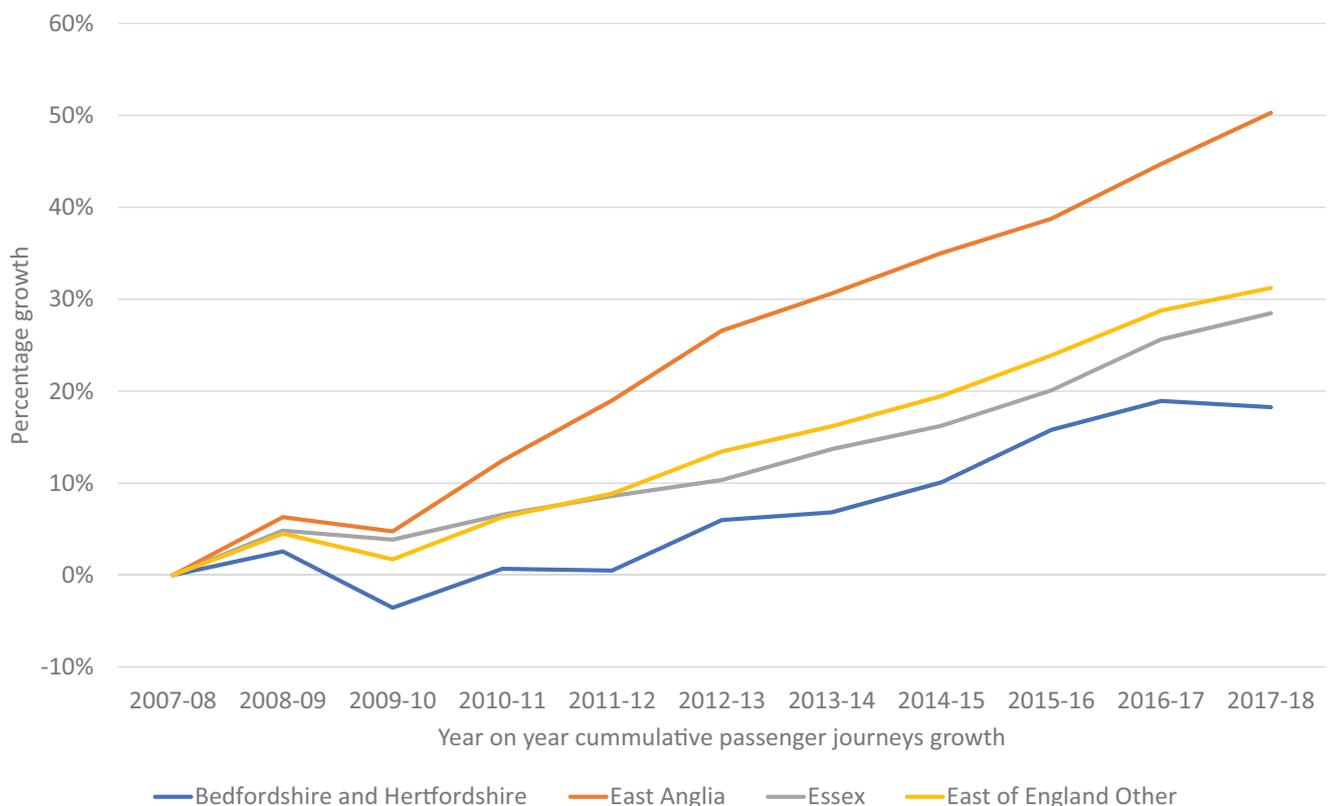
The GEML study commenced in Summer 2018. It was chosen to take forward as one of the early studies in a national programme. The GEML was considered a priority as there have been changes to the future planning assumptions for the route since publication of the Anglia Route Study in 2016. In particular, changes to growth levels and the introduction of new, higher capacity rolling stock, which has an impact on the choices to funders recommended by the route study.

Network Rail initially proposed a remit for this study. The remit proposed that the study included the following:

- To review growth and demand forecasts for services on the route in the medium and long term;
- to consider future train services expected on the route;
- to understand the order and timing of future investment in the route to meet required services;
- to identify any other interventions that are likely to be needed.

This study does not consider possible enhancements needed to improve the quality of the rail service on the GEML unless provided through a scheme to increase capacity.

**Figure 2: Historic year-on-year passenger journeys growth within the East of England**



**Source:** ORR Regional rail journeys - East of England (Table 15.2). See ORR Data Portal for further information on methodology and assumptions relating to this chart. Bedfordshire and Hertfordshire (Bedfordshire, Hertfordshire and Luton), Essex (Essex, Thurrock, Southend-On-Sea) and East Anglia (Cambridgeshire, Norfolk, Peterborough, Suffolk).

## 2.3 The GEML at present

Around 190m journeys<sup>2</sup> were made in 2017-18 to/from and within the East of England<sup>3</sup> region compared to around 146m in 2007-08, this is an increase of 30 % over 10 years. East of England journeys make up 10 % of all national rail journeys made in 2017-18. Figure 2 splits journeys made within the East of England and sub regions.<sup>4</sup> This shows that year-on-year passenger journeys within the East of England has grown at a steady rate with passenger demand in East Anglia increasing by 50 % since 2007-08. This rate of growth is higher than the national passenger journey rate which grew by about 45 % over the same period.<sup>5</sup>

A significant proportion of the growth on the GEML is related to passenger growth at Stratford. Ticket data shows around 90m journeys were made to/from and within GEML stations in 2017-18 with over 90 % of these journeys being made to/from other GEML stations.<sup>6</sup>

## 2.4 Existing schemes impacting on the GEML

### 2.4.1 Beaulieu Park new station

The provision of a new station to the north of Chelmsford, in an area known as Beaulieu, is a long-standing aspiration of Essex County Council to support a significant housing and commercial development in the area. The development at Beaulieu has planning permission and early phases of construction have already begun. The delivery of the station is dependent upon a successful bid to the Housing Infrastructure Fund which is currently pending. The station is key to enabling continued development at this location and is expected to help relieve pressure on Chelmsford station.

In addition to providing sustainable transport for future residents at Beaulieu, the station is expected to facilitate commuting to the proposed employment areas on the site. It is also expected that, with the location of the station being very close to major highways such as the A12, it is likely to be attractive to new and existing rail users across mid-Essex,

some of whom might divert from using other stations on the GEML.

The current station proposal at Beaulieu consists of three platforms, two on the existing main line and an additional central loop of up to 775 metres. The two outer main lines are to accommodate a through line speed of 100mph. Figure 20 shows a simple illustration of three track layout option that is currently being developed.

### 2.4.2 London Liverpool Street capacity enhancement

London Liverpool Street station has seen a significant increase in passenger use in recent years. The ORR has reported that in the 20 years from 1998 to 2018, passenger numbers increased from 35 to 67 million, almost doubling to make it the third busiest station in the country. It is also a major station for accessing the London Underground system. The introduction of Elizabeth Line services in the near future will help relieve the pressure on the station as most of the existing 'TfL Rail' services will be diverted into the new sub-surface platforms instead of the existing terminus. However, growth on other rail services and other changes requires further capacity improvements at this key London terminus.

Despite the expected capacity relief from the full introduction of the Elizabeth Line, the introduction of new, higher capacity rolling stock on all Greater Anglia services is likely to increase pressure on the station. This is a result of larger numbers of passengers alighting services in the morning peak, in addition to continued passenger growth and future service increases. At present, a scheme is being developed to increase passenger circulation capacity and access to and from the station to reduce crowding and potential safety risks. Longer term growth of rail services into London Liverpool Street is likely to necessitate a more significant redevelopment of the station. Options for such a scheme, considering passenger growth over the next 25 years, are currently being developed.

<sup>2</sup> ORR Data Portal Regional rail journeys - East of England - Table 15.2

<sup>3</sup> East of England refers to Bedfordshire and Hertfordshire, East Anglia and Essex

<sup>4</sup> Determined by NUTS2 boundaries. NUTS2 refers to Nomenclature of Territorial Units for Statistics, 2015 secondary boundary definitions. A standard developed by the European Union

<sup>5</sup> ORR Data Portal Regional rail journeys - GB and England Scotland Wales - Table 15.3 (2017-18)

<sup>6</sup> MOIRA LENNON data: MOIRA is an industry demand forecasting model that contains LENNON ticket data (Latest Earnings Network Nationally Over Night)

### 2.4.3 Elizabeth Line

The full introduction of Elizabeth Line services, formerly known as Crossrail, will provide increased capacity and new journey opportunities for rail passengers on the GEML between Shenfield and London Liverpool Street. The impact of such services beyond Shenfield will be less significant as interchange to the Elizabeth Line services is most likely to take place at Stratford or London Liverpool Street. The study does not consider the longer-term capacity needs of the Elizabeth Line services and focuses on the GEML services that start beyond Shenfield.

It should be noted that the Elizabeth Line provides the potential for increased track capacity for longer distance services on the GEML between Stratford and London Liverpool Street following diversion to the new tunnel section. This would, however, require the remodelling of Bow Junction, near Stratford to allow the increased capacity to be used.

### 2.4.4 Stratford Station

Stratford is becoming an increasingly important location for employment within London. In recent years there have been significant housing and commercial developments in the area which will continue in the future.

This growth, combined with increased passenger interchange following the introduction of full Elizabeth Line services, will increase the need for capacity at the station. Network Rail is working with Transport for London and the London Legacy Development Corporation to develop options to increase passenger access and interchange capacity to support future growth. These options will consider the growth expected on the GEML identified in this study.

### 2.5 Franchise commitments

The East Anglia passenger franchise was awarded to Greater Anglia in August 2016 for a 9 year period to 2025. As part of the franchise, the operator will introduce a completely new fleet of trains across the network which is planned from 2019. In addition, a number of timetable improvements and additional services will be introduced, such as faster journeys to Norwich.

This study takes as its baseline, the committed changes to be delivered as part of the franchise. As the study assesses the morning (08:00-08:59) and evening (17:00-17:59) peak services arriving/departing London Liverpool Street, changes expected throughout the franchise have limited impact on the analysis for this study. In the off peak, however, these changes are significant.



# 3 Governance and strategic questions

This study has been facilitated by Network Rail on behalf of the rail industry and local stakeholders in Essex, Suffolk and Norfolk. The following groups have had a role to play in the development of the study:

## Network Rail Route Investment Review Group

**(RIRG):** To commission the study and agree remit for the Project Board to endorse. Represented by the Rail Delivery Group and train and freight operators.

**Study Project Board:** To agree strategic questions, set out technical work and endorse the study findings. Represented by the Department for Transport (DfT), the County Councils of Essex, Suffolk and Norfolk, the New Anglia Local Enterprise Partnership and Greater Anglia. The Great Eastern Main Line Task Force has also been consulted by the Study Project Board.

**Rail Industry Working Group:** To inform and consult on the study following Project Boards. Represented by the Rail Delivery Group (RDG) and train and freight operators.

## 3.1 Existing identified enhancements

The future growth and enhancements for the GEML were previously considered as part of the Anglia Route Study published in 2016. The study was published before the decision to replace the entire rolling stock fleet. This study will consider the need for these enhancements with the more recent assessment of passenger growth and the capacity increase expected following the introduction of new trains. In summary, the following enhancements were previously identified as being required before the year 2043 and are shown in figure 3:

**London Liverpool Street** - additional platform capacity at London Liverpool Street station.

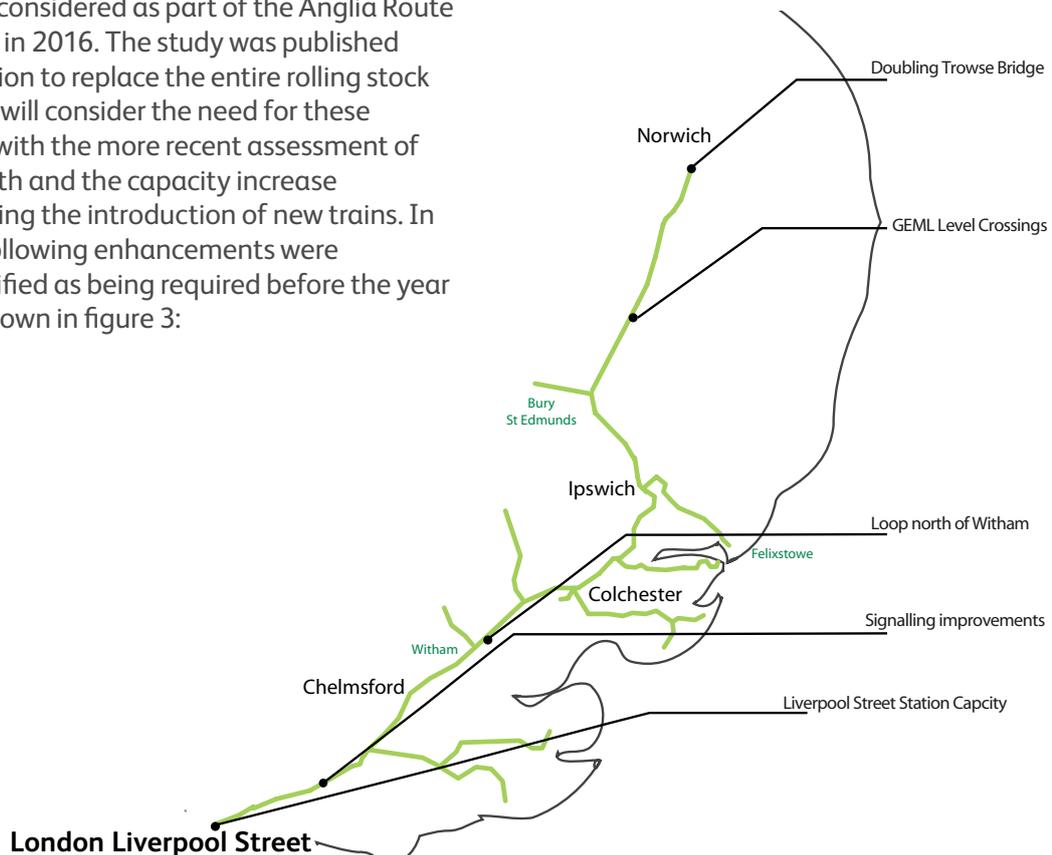
**Signalling improvements** - to allow for an increase to the maximum practical capacity by reducing the two-minute gap between services (planning headway) to 1 1/2 minutes apart or less.

**A passing loop north of Witham** - to achieve an increase in train services to meet the increased demand without having to slow down the outer services and requires the opportunity to overtake slower passenger services.

**Four-tracking or grade separation at Haughley Junction, near Stowmarket** – to support an increase capacity for rail freight on the Felixstowe to Peterborough (via Ely) corridor in addition to passenger services.

**Track doubling of Trowse Bridge, Norwich** - to achieve additional services to Cambridge and Ely in addition to services from London to Norwich.

**Figure 3: Enhancements previously reported in the Anglia Route Study to be required to meet forecast passenger and freight growth**



### 3.2 Great Eastern Main Line Task Force

The Great Eastern Rail Campaign was launched approximately five years ago by the New Anglia Local Enterprise Partnership to outline the case for investment in the rail network in East Anglia. The campaign is supported by over 100 of the region's businesses and educational institutions and has published a Rail Prospectus for East Anglia, setting out the priorities for rail in the region.<sup>1</sup>

The Great Eastern Main Line Task Force, which includes representation from Government and industry experts, meets bi-monthly and seeks to take forward the priorities identified in the Rail Prospectus. The Task Force has had a key role to play in supporting the development of this study and the study supports the Task Force's objectives by identifying how the rail network can support and enhance the expected growth in the region in the medium to long term.

### 3.3 Strategic Questions

To meet the remit of this study, a number of 'strategic questions' have been identified by the Project Board. As a capacity focused study, it was intended that a refresh of the previous recommendations included in the Anglia Route Study would take place and this would be updated with the current view of growth and wider strategic assumptions. The following principal question was agreed:

**What are the priorities and timescales for identified rail infrastructure capacity enhancement between London and Norwich?**

In seeking to answer this question, a number of further 'sub' questions were also considered to be required to provide greater clarity. These are:

- 1 How does the introduction of new rolling stock on this corridor impact on priorities for rail infrastructure investments?
- 2 What is the current view on rail growth between London and the key centres on the Great Eastern Main Line (GEML)?
- 3 How does the future timetable planning assumptions impact on the ordering of capacity interventions?
- 4 What is the current stage of development and timescales/phasing for delivery for schemes on this corridor?
- 5 Is there any additional infrastructure required not previously identified?

### 3.4 Future scenarios

This study is consistent with the current Anglia Route Study, and with other long-term strategic studies produced nationally, in that it considers the impact of growth on the rail network in the period up to the year 2043. It also considers growth over a number of interim years to identify where there may be investment required and how investment may best be phased over time. In addition to 2043, the study has also assessed expected growth on the rail network for the years 2024, 2029 and 2033.



**Great Eastern Rail Campaign**  
Delivering better, faster trains for Essex, Suffolk and Norfolk

<sup>1</sup> This can be found at: <https://newanglia.co.uk/great-eastern-rail-campaign/>

# 4 Long term growth assessment

An assessment of the long term rail passenger growth for the route has been undertaken as part of this study. Two scenarios have been considered.

## 4.1 Future growth scenarios

### Scenario 1 (Baseline):

'Baseline' growth that reflects forecast changes to the economy, population growth and modes of transport. This approach is consistent with Network Rail's long-term planning undertaken for other routes.

The Baseline scenario follows industry passenger forecasting guidance and examines key economic drivers known to influence passenger demand, such as, Gross Domestic Product, employment, population, other public/private transport costs e.g. car, bus and air costs.

Over the next 25 years, growth in rail demand in the high peak hour<sup>1</sup> towards London Liverpool Street is expected to be significant, increasing by between 40 and 60% over the period. The provision of increased services to meet this demand is particularly challenging on a rail network that is already very capacity constrained.

'Baseline' levels of growth for key centres on the GEML have been derived separately. This assessment shows that for the 15 year period to 2033. It is expected that passenger numbers using the GEML will increase by between 2 and 2.5% per year depending upon the location. This growth is likely to continue in the long term beyond 2033. Table 1 shows a summary of the levels of growth expected to and from locations on the route in the period up to 2033.

### Scenario 2 (Higher):

The higher growth scenario for demand to and from key GEML centres examined data provided by stakeholders. This included more detailed housing information and the proximity of housing to rail stations, data on rail's mode share and the employment catchment of the towns and cities. This information was combined with the Baseline forecasts of flows to /from London and these centres.

In considering a 'higher' growth level specifically for key centres, Network Rail issued a 'call for evidence' for GEML Task Force and study Project Board members to consider a range of information that could be used to establish a growth scenario. Information provided to inform this was primarily future housing and employment growth evidence. A number of sources of evidence were provided by the three county councils and other publicly available data. These included:

- Delivering Economic Growth in Chelmsford to 2036 and Future Transport Network;
- List of Future Jobs in Essex;
- New housing plans for the East of England region;
- Local Plan Data.

On the basis of the information provided, and assessment of this information, a higher level of passenger growth has been identified. In the period up to 2033, it is considered that passenger numbers using the GEML are likely to increase by approximately 3.2% per year from most locations on the route.

Table 1: Forecasted growth rate per year between 2018 & 2033 for baseline scenario and historic growth rate per year between 2007 & 2018 for comparison

| Location   | Historic all day passenger growth rate per year to/from station (ORR footfall data) 2007/08 - 2017/18 | All day passenger growth rate per year to/from station 2018 - 2033 |
|------------|---|--|
| Chelmsford | 1.5%  | 2.1%   |
| Colchester | -0.3%   | 2.3%   |
| Ipswich    | 1.8%  | 2.4%   |
| Norwich    | 1.9%  | 2.5%   |

<sup>1</sup> Passenger demand on GEML services is highest during the morning peak 0800-0859 towards London Liverpool Street

Table 2: Forecast growth per year between 2018 & 2033 Higher growth scenario and historic growth rate per year between 2007 & 2018 for comparison

| Location   | Historic all day passenger growth rate per year to/from station (ORR footfall data) 2007/08 - 2017/18 | All day passenger growth rate per year to/from station 2018 - 2033 |
|------------|---|--|
| Chelmsford | 1.5%  | 3.2%   |
| Colchester | -0.3%   | 3.2%   |
| Ipswich    | 1.8%  | 3.5%   |
| Norwich    | 1.9%  | 3.2%   |

In the period between 2033 and 2043 (without clear evidence of higher growth so far into the future and lack of clear forecasting data past 2039), it is considered that such growth will be approximately 1.8% per year (compared with approximately 1.1% for baseline growth). Table 2 shows a summary of the levels of growth expected to and from locations on the route in the years between 2018 and 2033.

#### 4.2 Rolling stock considerations

Greater Anglia began introducing new rolling stock with new timetable changes (2019) with all introductions expected to be in service by the end of 2020. This will improve train capacity along with the frequency of services into London. This study has only assessed the rolling stock changes proposed in terms of passenger capacity. The new rolling stock will increase the seating capacity on the GEML and may provide a journey time

benefit, however, this has not been investigated due to timings for the new rolling stock not being confirmed during the development of this study.

The images shown in figure 4 are of the new trains that are due to be introduced in 2019. On the left is the Stadler train, which will operate on the Norwich 'inter-city' services and on the right, the Bombardier train for all other services. Bi-mode (diesel and electric) trains will also be introduced on routes across East Anglia which use electrified and non-electrified track. Table 3 shows the change in rolling stock seating capacity.

Figure 4: New Greater Anglia rolling stock for 'inter-city' to Norwich (left) & other services (right)



Table 3: Percentage change in seating between old and new rolling stock

|            |                               |                       |
|------------|-------------------------------|-----------------------|
| Suburban   | 17% - 36% increase in seating | 164 - 305 extra seats |
| Inter-city | 22% increase in seating       | 139 extra seats       |

Note: Suburban services is shown as a range as there are a number of different rolling stock types currently running with each having a varied seating capacity

This study has assessed the contribution that the new trains are likely to provide in terms of capacity<sup>1</sup> for passenger growth in the future. Assumptions for the treatment of flip-up seats and associated standing space is not confirmed. Flip-up seats affect the overall capacity assumed in the study and how crowding is measured. If they are not treated as seats it would bring forward the need for intervention by five years. This is influenced by the behaviour of passengers that will be more clearly understood when the new trains are introduced.

As part of the assessment of the need for additional services, the increased capacity of the new trains is expected to defer the need for additional services<sup>2</sup> to London Liverpool Street as would be the case with the capacity of the existing rolling stock. This capacity increase is significant as, in addition to providing an improved passenger experience, it reduces the need for expensive infrastructure interventions in the short term.

### 4.3 Growth at rail stations

Consideration has been given to recent levels of passenger growth at stations on the GEML. A review of recent ORR footfall data shows that growth at larger stations on the route, particularly Chelmsford and Colchester, has been lower than neighbouring smaller ones. Table 4 shows the difference in growth rates from a selection of stations and shows year on year percentage growth of a selection of stations over the last 3 years between 2013/14 to 2016/17 for season tickets. It should be noted that the percentage changes for Marks Tey, Hythe and Ingatestone are noticeably higher but are growing from a much lower base.

Table 4: Year on year percentage change in season tickets sales between 2013/14 & 2016/17 for locations in Essex (Source: ORR footfall data)

| Location    | Year on year change over last 3 years |
|-------------|---------------------------------------|
| Chelmsford  | 0.4%                                  |
| Colchester  | 1.3%                                  |
| Marks Tey   | 4.8%                                  |
| Hythe       | 6.7%                                  |
| Ingatestone | 2.9%                                  |

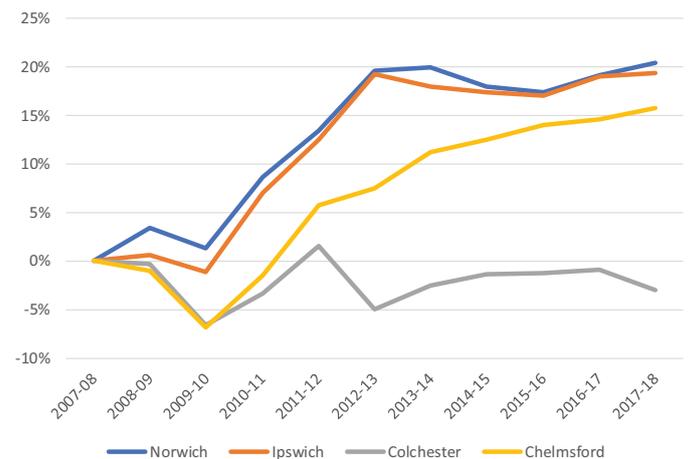
1 It should be noted that the seating capacity of the class 720 trains include flip up seating (unless otherwise stated) and that the exclusion of these seats within the assumptions could bring forward, potentially up to five years, the need for service introductions and interventions on GEML.

2 Using methodology shown in 4.2.

This difference is likely to be due to the attractiveness of car parking facilities at the smaller stations and an improvement in the frequency of rail services offered in recent years. It could also be due to growth being ‘choked off’ at the larger town centre stations due to congestion for access and at the stations generally.

Considering the principal stations on the route, it should be noted that the highest percentage growth in passenger numbers has been from Ipswich and Norwich stations, increasing by up to 20% over a ten year period. Figure 5 shows year on year growth at Norwich, Ipswich, Colchester and Chelmsford based on ORR historic footfall data. It should be noted that, although the data shows lower percentage growth for Chelmsford, this station has higher passenger usage than Norwich, Ipswich, and Colchester, with around 8.6 million passengers in 2017/18 compared to around 3.4 to 4.4 million passengers at the other stations respectively. Passenger use of Colchester station has slightly declined over the last ten years.

Figure 5: Cumulative passenger growth at GEML stations from 2007/08 to 2017/18 (Source: ORR footfall data)



There may be several reasons for this, such as, passengers switching to other stations such as Colchester Town and Hythe which have seen increases in passenger numbers and the number of train services calling at these stations. Potentially road or station congestion may be affecting this station. An initial review of conditions at Chelmsford and Colchester stations has taken place as part of the study to understand the capacity challenges. These are important to understand the issues that might contribute to lower growth in recent years. It should be noted that further more in depth work should be undertaken at these stations. A review of conditions at Chelmsford and Colchester stations has taken place as part of the study to understand the capacity challenges. These are important to understand the issues that might contribute to lower growth in recent years.

## Chelmsford

Chelmsford has one of the highest number of passengers relative to the number of station platforms in the country with constraints on platform widths due to the station's location on top of a viaduct. This creates significant pressure on the station. The passenger numbers and the physical constraints of the station result in severe congestion regularly being experienced in both the morning and evening peak hours. The platform widths and vertical circulation are areas of most significant concern.

To assess the conditions at Chelmsford, video surveys were undertaken in November 2018 to observe passenger movement and crowding at the station. The images shown in figure 6 illustrate the typical weekday morning peak and evening peak on the London-bound platform 2. Congestion was observed on the platform as passengers wait to board trains during the morning peak hours towards London.

**Figure 6: Typical conditions on the London Bound platform 2 at Chelmsford in the morning and evening peak hours**



During the evening peak, the main areas of congestion are around the stairs down the concourse, with resulting queues on the platform. This issue can impact on the reliability of services, increasing dwell times while the platform areas clear and delaying the despatch of trains.

Other issues observed through the surveys included:

- On one of the days surveyed, with the cancellation of one of the fast London services, congestion on the platform reached a level where many passengers were forced to stand in the area of the platform past the yellow safety line.
- There is also a significant peak in demand at around 4pm after schools close resulting in station crowding. This requires increased station staff on the platform at these times to ensure passenger safety.

These surveys showed that the station does not offer much resilience to cope with an increase in passengers waiting in the event of perturbation or high peak demand. Further growth at this station is expected to make these issues more significant. It is recommended that longer term capacity options are developed for Chelmsford to address the issues identified from the surveys carried out as part of this study.

## Colchester

Video surveys were also carried out at Colchester to observe passenger movement and crowding at the station. The main station capacity issue observed at the station relates to the island platforms 1 and 2 during the evening peak, where northbound services from London call.

Platform, stair and subway capacity are all under pressure when large volumes of passengers alight from services. For these platforms, there is one set of stairs leading to the subway with limited space for passenger movement at the top. Platform widths are also severely constrained by buildings on the platform which creates an issue when queues extend to this point. Figure 7 shows an image of conditions at this location.

**Figure 7: Typical conditions for alighting passengers on island platforms 1 and 2 at Colchester in the evening peak**



The observed footage shows that passengers can generally clear the platform within a two-minute period. This is, however, likely to be a greater cause of concern as passenger numbers continue to grow and congestion issues worsen. It is recommended that improvements to passenger access and platform capacity are considered for these platforms.

Although this study has focused on Chelmsford and Colchester stations, it is recognised that there are challenges at many other stations on the GEML which is not just capacity related. In developing proposals for improvement at GEML stations, it is recommended that Ipswich and Norwich stations are also considered.

#### 4.5 Growth in rail freight

It should be noted that growth in passenger demand is also matched by an expected growth in rail freight on the route. This growth is particularly related to increased containerised freight between the port of Felixstowe and the West Midlands and the North. The route section between Ipswich and Haughley Junction, near Stowmarket will be expected to accommodate up to two 775 metre trains per hour in each direction in the future, in addition to growth in passenger services, increasing further in the longer

term. Assessments undertaken as part of this study have considered this expected freight demand in addition to the continued use of existing freight paths between Ipswich and Stratford.

The increased rail freight expected on the GEML is dependent on the delivery of capacity schemes elsewhere on the rail network. Of particular significance is the Ely area where a number of rail improvements are being developed. For services using the GEML, increased capacity in the Ely area makes provision for increased rail freight capacity from Felixstowe port and supports increased Ipswich to Peterborough passenger services.



## 5 Future services

In the peak commuting hours at present, rail services on the GEML are very busy with some services requiring people to stand. The introduction of new trains will provide some relief to crowding but in the medium to long term, further capacity will be needed to meet future growth in the number of passengers on the route.

To assess the need for more services, this study has considered the scenarios of expected growth and undertaken an assessment to meet 'Conditional Outputs'. This is the level of services that are expected to be needed to support increasing passenger demand or more technically, 'where an output is met by a condition that has been fulfilled'.

### 5.1 Expected future capacity issues

The expected future growth identified in both of the growth scenarios considered will either require additional services to be provided, and potential infrastructure enhancement to support that, or changes to the timetable and stopping patterns on the route.

The passenger heat maps (shown in Figures 8 to 11) are intended to reflect what the 'average' peak passenger might expect in terms of on-train crowding. Both scenarios assume that the number of trains arriving at London Liverpool Street in the high peak remains at current 22 trains per hour. These maps average passenger demand across total capacity of all trains travelling over each link regardless of whether the trains call at all stations and assume standing may occur on all services. The maps do not adjust for any standing allowances and assume flip-up seats are treated as seats. Where load factors, based on passenger to seat ratio, is between 85 to 100% (dark green links) this indicates that passengers will be experiencing crowding issues on some but not all the 22 services into London during the high peak. Some of these trains will be crowded. When services are approaching 2-3 passengers per square metre (purple coloured links) this implies passengers are standing at standard capacity allowances across all services, in practice though some services will be very crowded.

By 2033 in the 'Baseline' Scenario, passengers load factors are predicted on average to be 85-100%. This implies some services will feel quite busy even though some trains may not be as full. The higher growth scenario shows passengers are now standing on all trains, at around 1 per square metre with additional pressure shown in both scenarios between Billericay and Shenfield towards London. By 2043, both scenarios show standing is increasing with the higher scenario indicating standing on all trains at a density of somewhere between 2-3 passengers per metre square from Chelmsford and Billericay towards London. The levels of crowding on some services arriving at London Liverpool Street in the morning high peak hour will be much higher as the heat maps average out seats and passenger demand.



Figure 8: Morning high peak to London heat map with 'baseline' scenario of growth in 2033

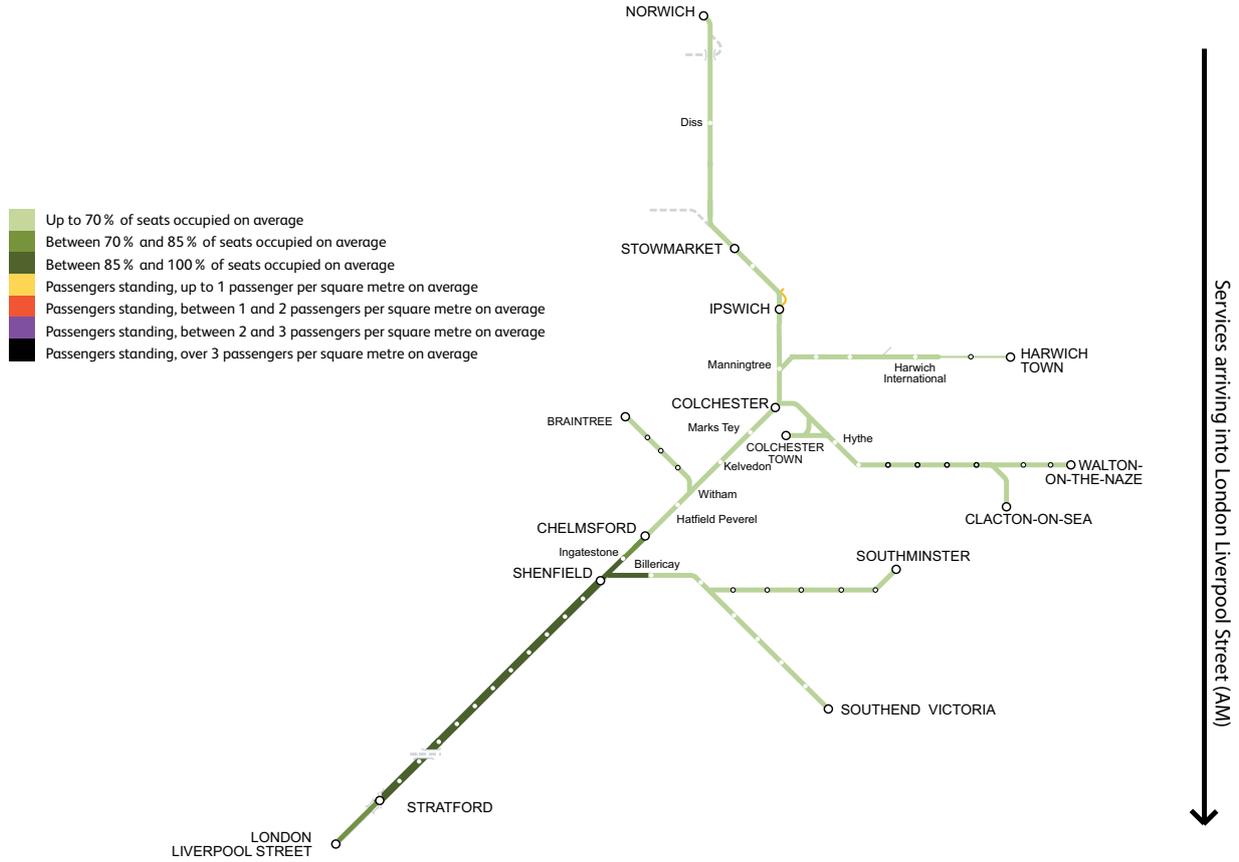
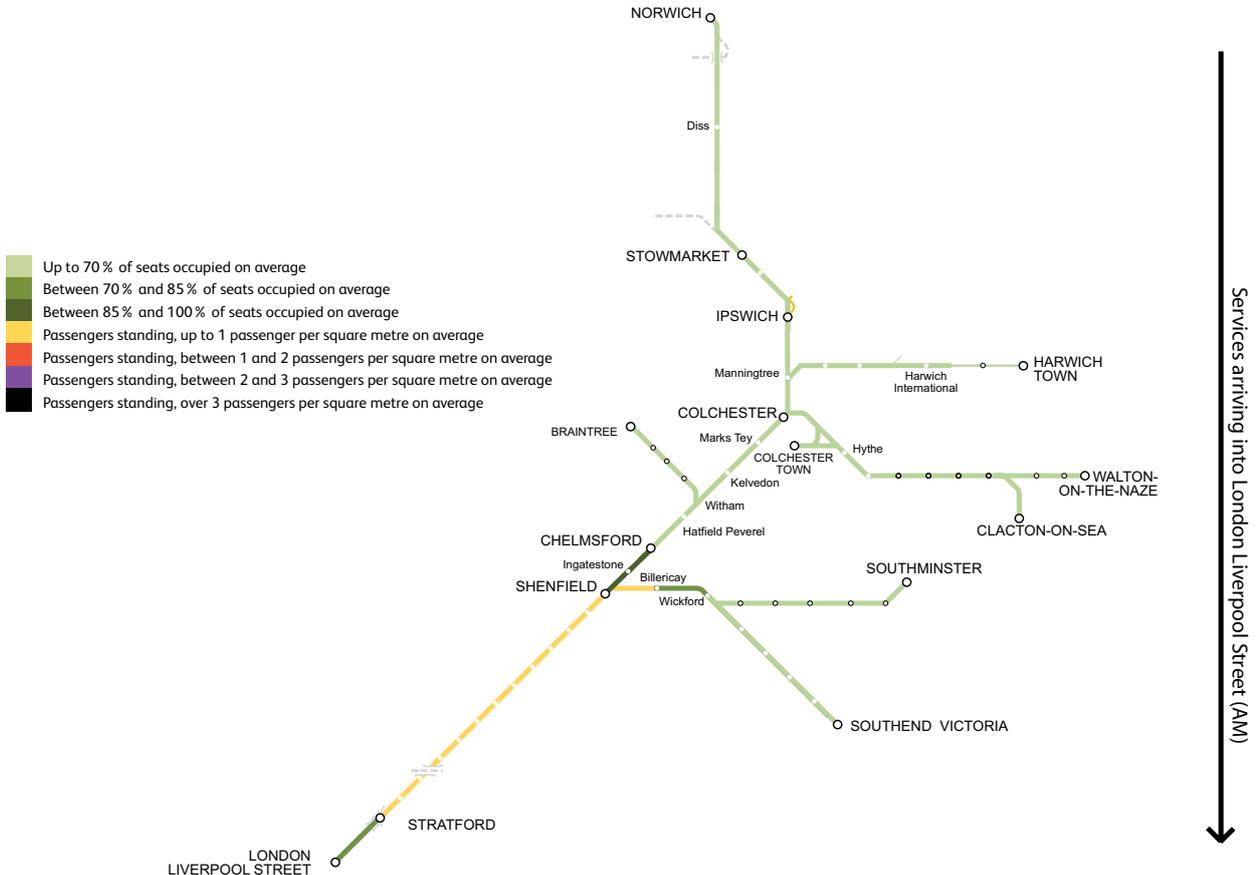


Figure 9: Morning high peak to London heat map with 'baseline' scenario of growth in 2043



**Note:** These maps are based on calculating the average density of passengers across total capacity of services towards Liverpool Street between 0800-0859 based on the critical load point and assumes that flip-up seats are treated as seats.

Figure 10: Morning high peak to London heat map with 'Higher' scenario of growth in 2033

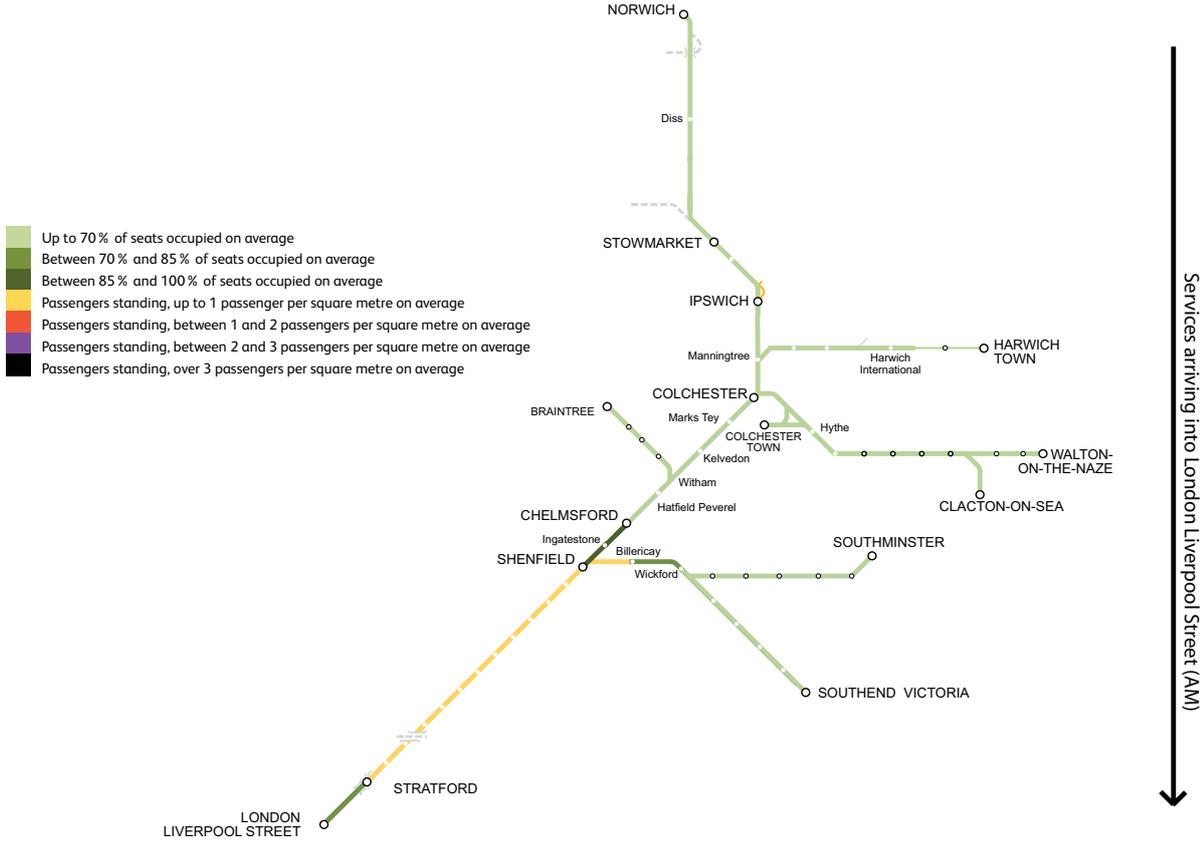
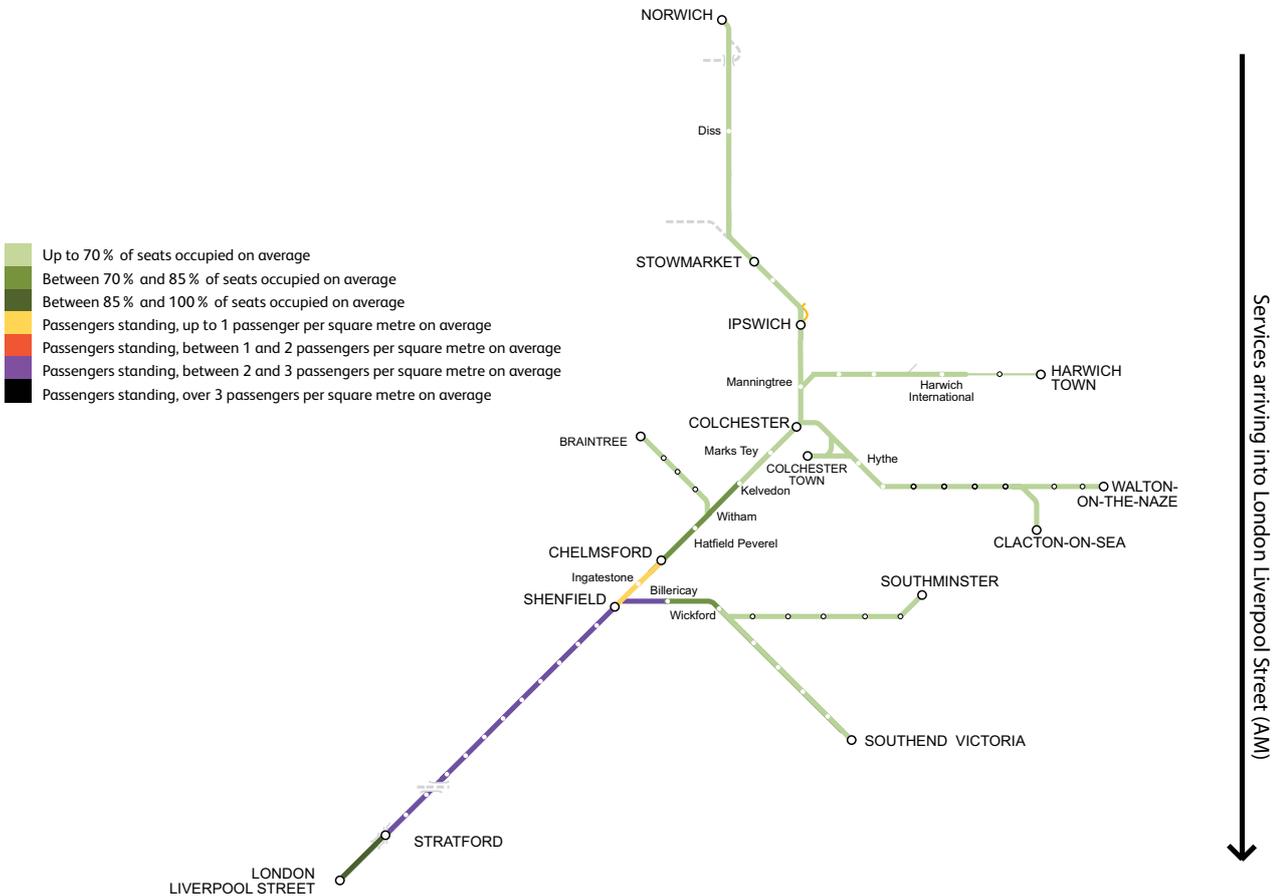


Figure 11: Morning high peak to London heat map with 'Higher' scenario of growth in 2043



**Note:** These maps are based on calculating the average density of passengers across total capacity of services towards Liverpool Street between 0800-0859 based on the critical load point and assumes that flip-up seats are treated as seats.

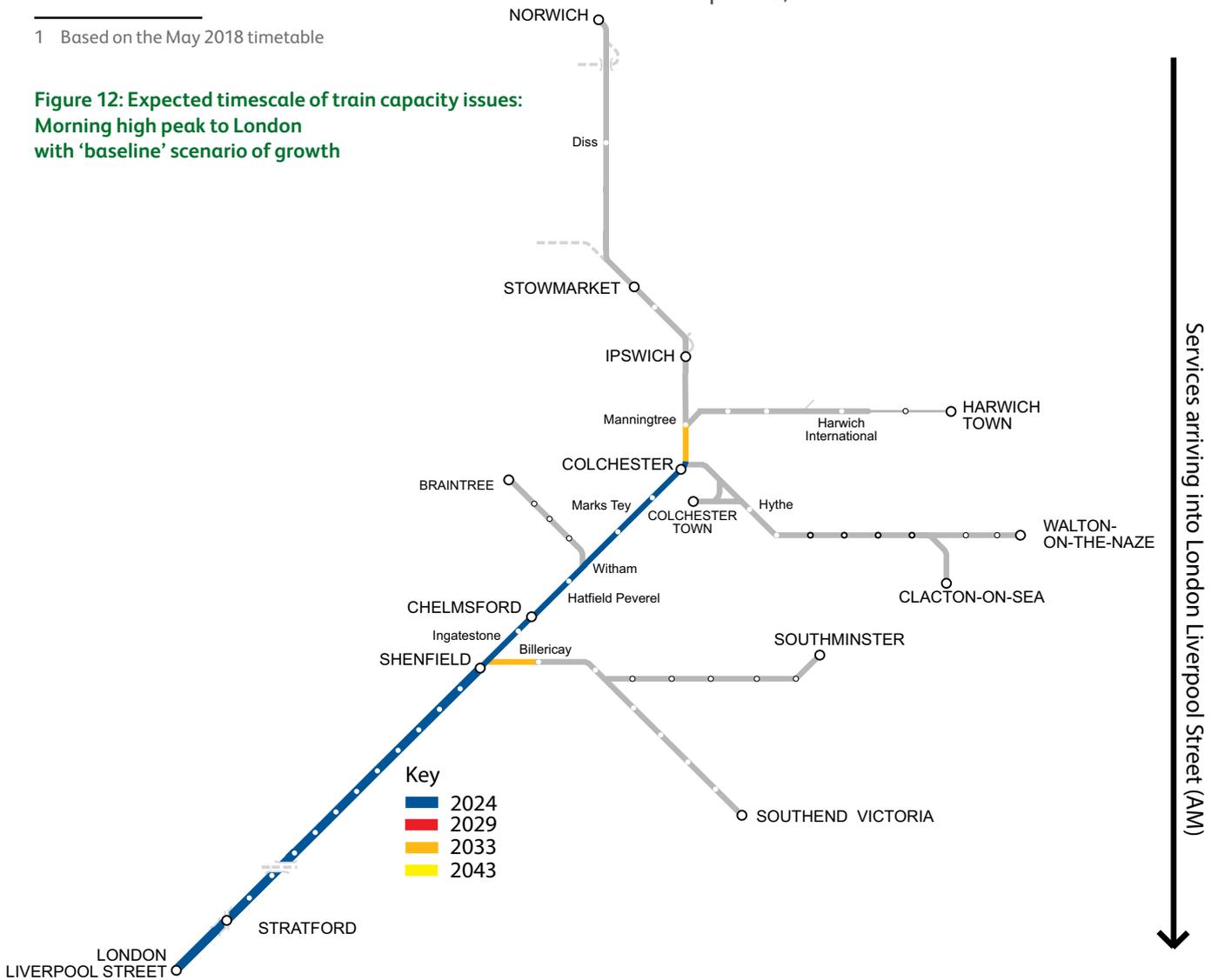
In contrast to the heat maps which show what the ‘average’ peak passenger might expect in terms of on-train crowding, Figures 12 to 15 provide an illustration of where there is expected to be insufficient capacity for growth. These figures are based on

- (a) where at least one train is over-capacity, and or
- (b) there is no alternative train with spare capacity that has at least an equivalent journey time as currently exists<sup>1</sup>.

It should be noted that each of these figures takes account of the train capacity increase expected from the introduction of new trains and do not assume any changes to the existing timetable. Due to the change in the new rolling stocks configuration, lengthening is not a possible solution as they are already at their maximum carriage lengths.

<sup>1</sup> Based on the May 2018 timetable

**Figure 12: Expected timescale of train capacity issues: Morning high peak to London with ‘baseline’ scenario of growth**



Changes to the timetable could provide some additional capacity on the route, however, this would require further investigation.

For each of the maps showing where train capacity issues are likely to exist (5.1.1 to 5.1.4), this is where demand for services has exceeded the seating/standing capacity (dependent on whether a service allows for standing). For these assessments, standing has been limited to 20 minutes between stops.

**5.1.1 Morning high peak to London with ‘baseline’ scenario of growth**

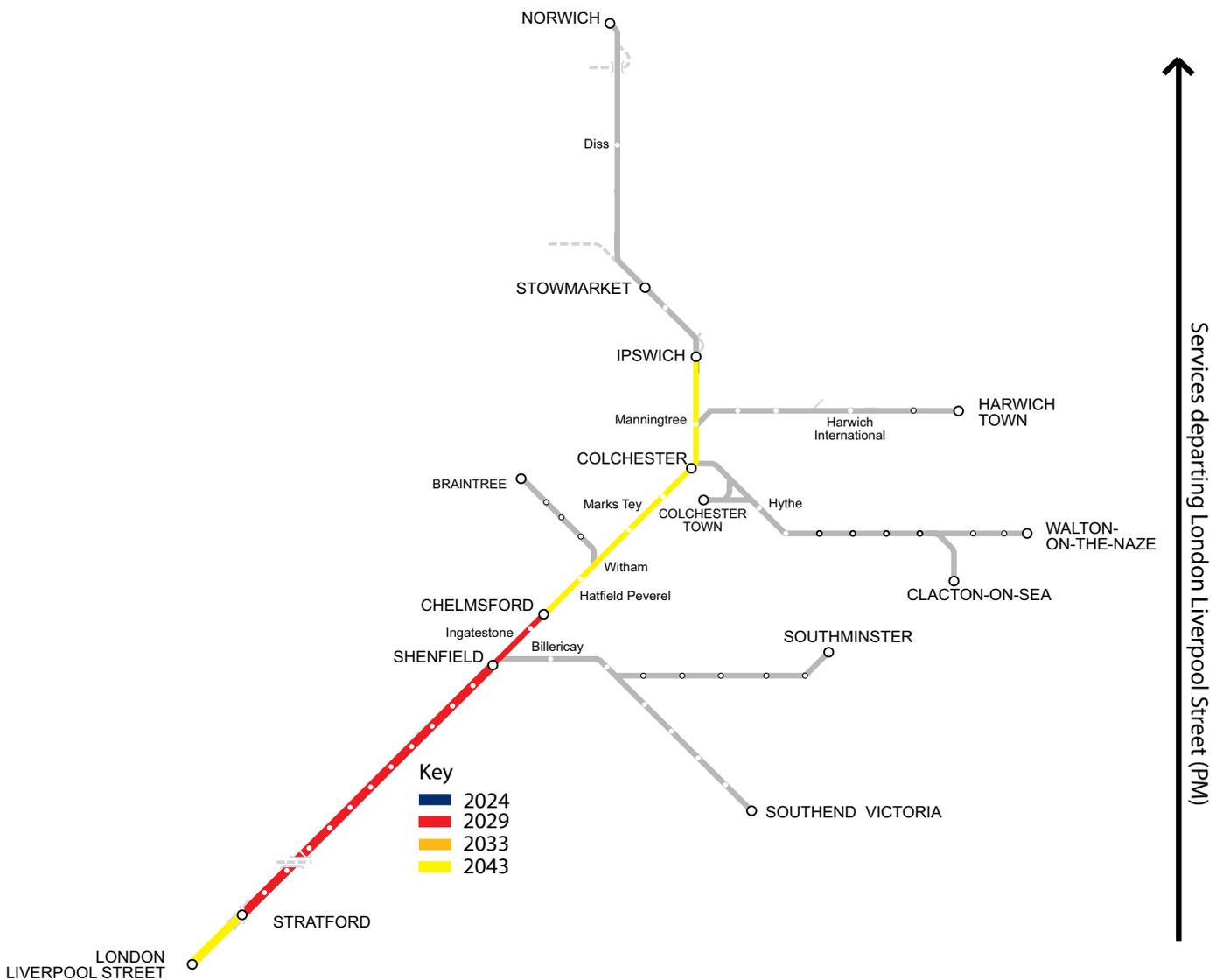
It is expected that, without changes to the timetable, stopping patterns and service uplifts, there is likely to be train capacity issues on services to London Liverpool Street as far out as Colchester in 2024 and this is expected to extend to Manningtree and Billericay by 2033. (Refer to table 5.3.1 for suggested service uplifts under option B).

**Note:** This figure shows (a) where at least one train is over-capacity, and or (b) there is no alternative train with spare capacity with a similar journey time.

### 5.1.2 Evening high peak from London with 'baseline' scenario of growth

It is expected that, without changes to the timetable, stopping patterns and service uplifts, there is likely to be train capacity issues on services between Stratford and Chelmsford in the evening peak by 2029 which then extends to London Liverpool Street and Ipswich by 2043. (Refer to table 5.3.2 for suggested service uplifts under option B)

Figure 13: Expected timescale of train capacity issues: Evening high peak from London with 'baseline' scenario of growth



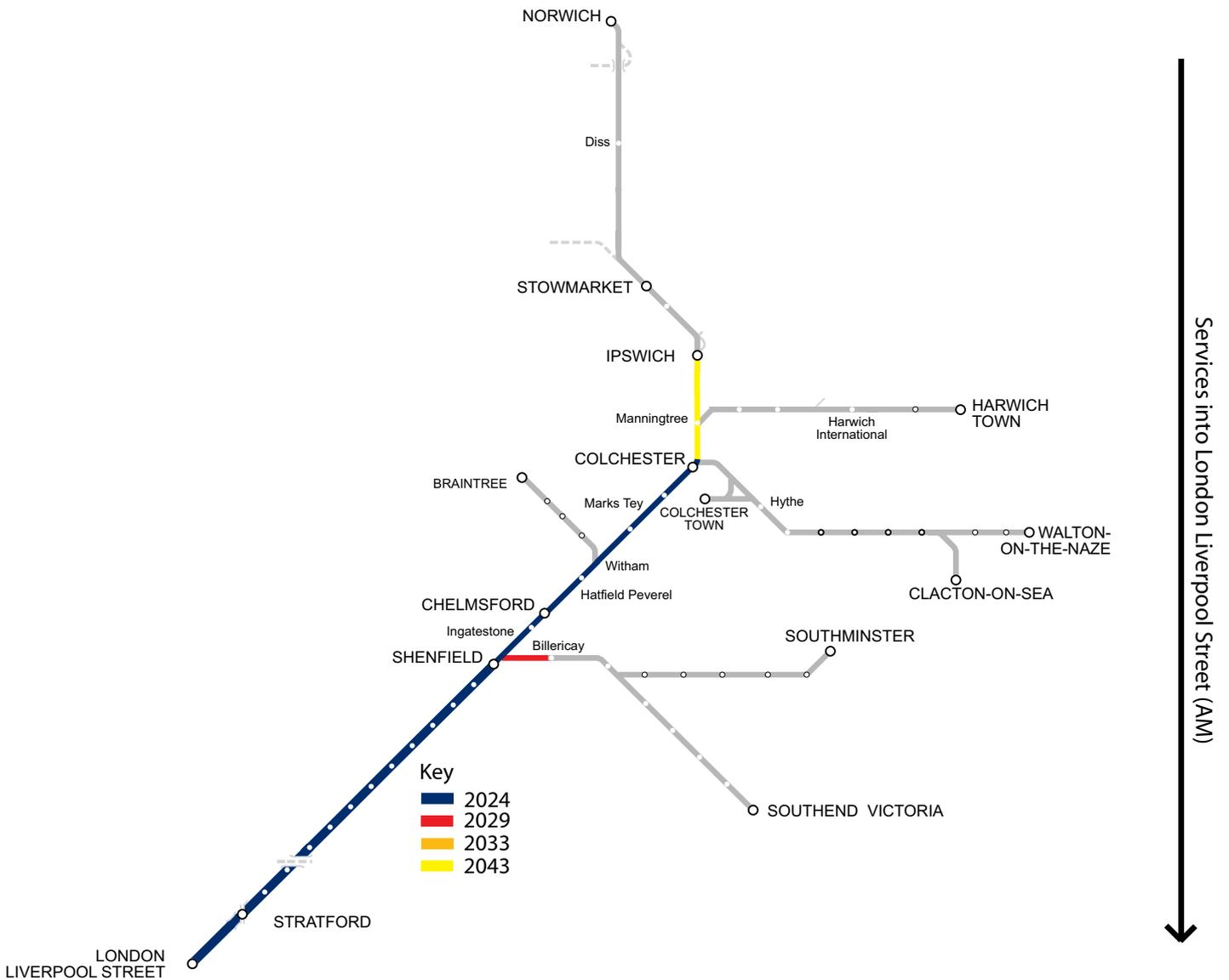
**Note:** This figure shows (a) where at least one train is over-capacity, and or (b) there is no alternative train with spare capacity with a similar journey time.

**5.1.3 Morning high peak to London with ‘higher’ scenario of growth**

It is expected that, without changes to the timetable, stopping patterns and service uplifts, there is likely to be train capacity issues on services to London Liverpool Street as far out as Colchester by 2024, this is expected to extend to Billericay by 2029, Manningtree by 2033 and then to Ipswich by 2043.

(Refer to table 5.3.3 for suggested service uplifts under option B)

**Figure 14: Expected timescale of train capacity issues: Morning high peak to London with ‘higher’ scenario of growth**

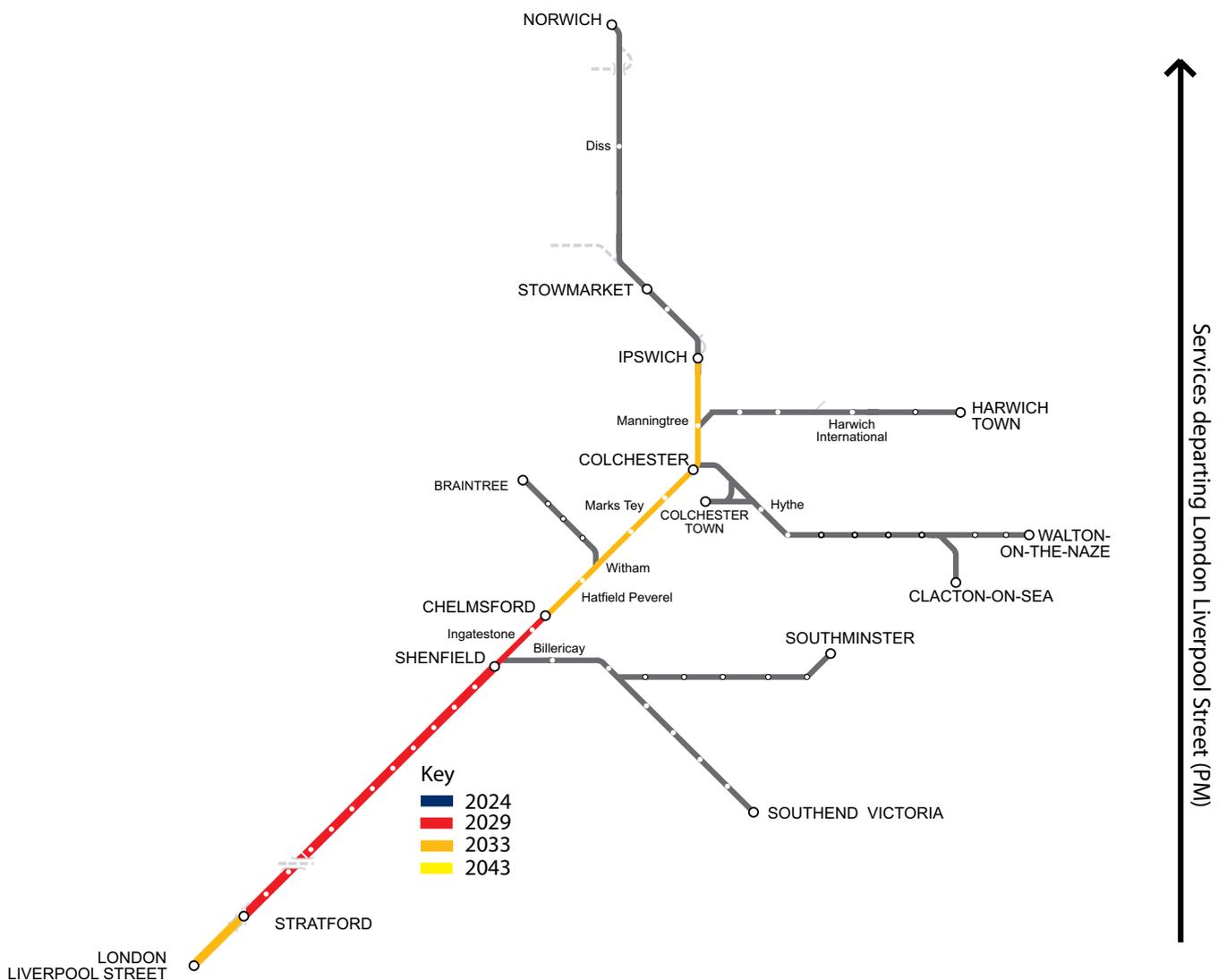


**Note:** This figure shows (a) where at least one train is over-capacity, and or (b) there is no alternative train with spare capacity with a similar journey time.

### 5.1.4 Evening high peak from London with 'higher' scenario of growth

It is expected that, without changes to the timetable, stopping patterns and service uplifts, there is likely to be train capacity issues on services between Stratford and Chelmsford in the evening peak by 2029 which then extends to London Liverpool Street and Ipswich by 2033. (Refer to table 5.3.3 for suggested service uplifts under option B)

Figure 15: Expected timescale of train capacity issues: Evening high peak from London with 'higher' scenario of growth



**Note:** This figure shows (a) where at least one train is over-capacity, and or (b) there is no alternative train with spare capacity with a similar journey time.

## 5.2 Conditional outputs

To determine conditional outputs, this study has investigated two levels of output, the first is a lower intervention option (A) which utilises the full capacity of existing services and a greater intervention option (B) where additional services are introduced if needed to ensure passengers do not experience any journey time disbenefit by needing to use alternative services.

Table 5 provides an explanation of the two options in terms of the benefits and disbenefits of each. As part of the study development, it was the clear view of the study Project Board and Network Rail that the recommendations relevant to the (B) option are those that this study proposes to take forward.

As shown in the table below, for the (A) option, it is likely that rail passengers using the GEML would experience a reduction in service quality, journey times and severe overcrowding in the peak hours because of growing demand. The (B) option proposes additional services to ensure that current levels of journey time to London in the peak hours are at least maintained.

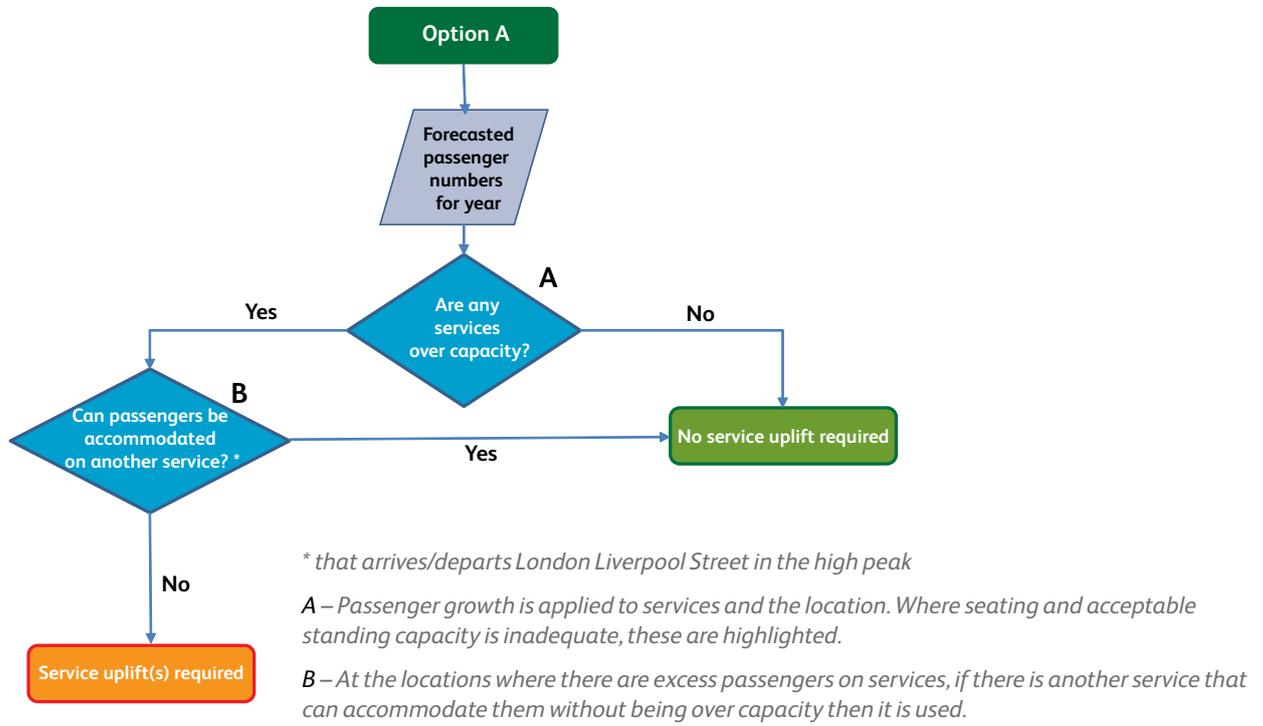
Table 5: Summary of conditional output options

| Option   | Benefits  | Disbenefits  |
|--|---|--|
| <p><b>A – Lower intervention</b></p> <p>Uses full capacity of existing services.</p> <p>Note: passengers are likely to experience a reduction in service quality and journey time and is not a study recommendation. Represents a 'do minimum' with limited service increases.</p> | <ul style="list-style-type: none"> <li>- Utilises capacity on existing services within peak hour.</li> <li>- Involves minimal interventions and service uplifts.</li> </ul>   | <ul style="list-style-type: none"> <li>- May require passengers to use an earlier/later service to arrive at destination within the peak hour.</li> <li>- Passengers may travel on a slower alternative train within the peak hour increasing journey time.</li> <li>- Passengers may not find flip-up seats to be comfortable on longer journeys.</li> <li>- Customer dissatisfaction will increase as services feel more crowded.</li> </ul> |
| <p><b>B – Greater intervention</b></p> <p>Services to maintain existing train journey time.</p>  | <ul style="list-style-type: none"> <li>- Allows passengers to travel on an alternative service without additional journey time (not including time spent waiting on platform)</li> <li>- Provides greater opportunity to accommodate growth in the peak</li> <li>- More regular seating available</li> <li>- Greater passenger satisfaction.</li> </ul> | <ul style="list-style-type: none"> <li>- May require passengers to use an earlier/later service to arrive at destination within the peak hour.</li> <li>- Time between services may be shorter as service frequency from some stations increases.</li> <li>- Will require greater intervention and service uplift.</li> </ul>  |

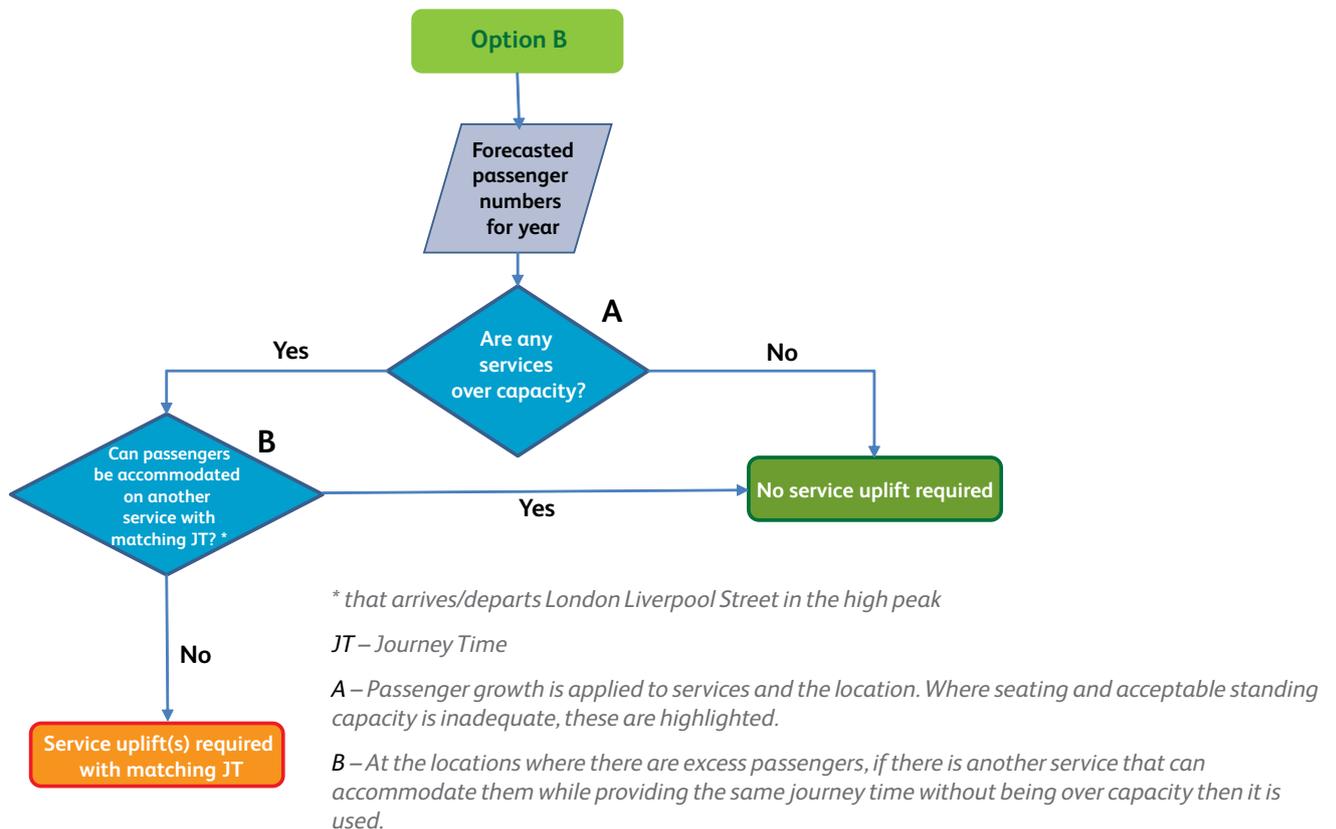


The two diagrams in Figures 16 and 17 illustrate the method of generating the outputs with the two options.

**Figure 16: Method of meeting conditional outputs for option A (Lower intervention)**



**Figure 17: Method of meeting conditional outputs for option B (Greater intervention)**



### 5.3 Meeting the Conditional Outputs

An assessment of the conditional outputs, with both options, has identified the need for additional services in the future to meet peak demand to and from London to different extents. To establish where extra services are likely to be required, the existing peak hour timetables have been considered.

For each service, where passenger demand exceeds the available capacity, an additional service is identified as being needed to meet the demand. Metrics around standing allowances have been applied for those stations within 20 minutes of a destination to align with the guidelines around rail passenger numbers and crowding.

The increased services required to meet future growth are shown in tables 6 to 9 including the year in which these are expected to be needed by. In these tables, for each current train service frequency, it identifies when additional services would need to be introduced and the total frequency of the services.

Note that following tables (6 – 9) do not match exactly where train capacity issues were identified in 5.1, these show the services that are expected to be increased to address the issues considering operational ease when planning a timetable. These services are only a suggestion of where services could start and end, the operator or franchise specifier may provide additional services from different locations. A summary of the following tables can be found in tables 10-11 on page 28.

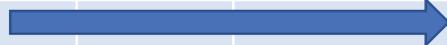
**Table 6: Morning peak services arriving into London Liverpool Street in the ‘Baseline’ growth scenario (08:00-08:59)**

| Service                        | Current Frequency* | New train service frequency for Baseline Growth |           |           |           |
|--------------------------------|--------------------|---|-----------|-----------|-----------|
|                                |                    | 2024  | 2029      | 2033      | 2043      |
| Braintree – London             | 1                  |   |           |           |           |
| Chelmsford – London            | 2                  |   |           | 3         | →         |
| Clacton – London               | 3                  | 4   | →         |           |           |
| Harwich International – London | 1                  |   |           |           |           |
| Harwich Town – London          | 1                  |   |           | 2         | →         |
| Ipswich – London               | 1                  |   |           |           |           |
| Norwich – London               | 2                  |   |           |           |           |
| Southend Victoria – London     | 6                  |   |           | 7         | →         |
| Southminster – London          | 2                  |   |           | 7         | →         |
| Stowmarket – London            | 1                  |   |           |           |           |
| Witham – London                | 2                  |   |           |           | 3 →       |
| <b>Total</b>                   | <b>22</b>          | <b>22</b>                                       | <b>22</b> | <b>22</b> | <b>23</b> |
|                                |                    | <b>23</b>                                       | <b>23</b> | <b>26</b> | <b>27</b> |

**Key**  
 Option A   
  Option B only   
 → Indicates continuation

\*Current frequency is from the May 2018 timetable used for the baseline assumption  
 Option A uses the full capacity of existing services  
 Option B ensures that services maintain existing train journey times

**Table 7: Evening peak services departing London Liverpool Street in the 'Baseline' growth scenario (17:00-17:59)**

| Service                    | Current Frequency* | New train service frequency for Baseline Growth |  |      |   |
|----------------------------|--------------------|---|--|------|---|
|                            |                    | 2024  | 2029   | 2033 | 2043  |
| London – Ipswich           | 3                  |   |  |      | 4  |
| London – Norwich           | 4                  |   |  |      |   |
| London – Clacton           | 3                  |   |  |      |   |
| London – Southend Victoria | 6                  |   |  |      |   |
| London – Southminster      | 1                  |   |  |      |   |
| London – Colchester Town   | 1                  |   |  |      |   |
| London – Braintree         | 1                  |   |  |      |   |
| London – Witham            | 1                  |   | 2  |      |   |
| London – Harwich Town      | 0                  |   |  |      |   |
| Total                      | 20                 | 20  | 20   | 20   | 20  |
|                            |                    | 20  | 21   | 21   | 22  |

### Key

 Option A     Option B only     Indicates continuation

\*Current frequency is from the May 2018 timetable used for the baseline assumption

Option A uses the full capacity of existing services

Option B ensures that services maintain existing train journey times

**Table 8: Morning peak services arriving into London Liverpool Street in the 'Higher' growth scenario (08:00-08:59)**

| Service                        | Current Frequency* | New train service frequency for Higher Growth |           |           |           |
|--------------------------------|--------------------|---|-----------|-----------|-----------|
|                                |                    | 2024  | 2029      | 2033      | 2043      |
| Braintree – London             | 1                  |   |           |           |           |
| Chelmsford – London            | 2                  |   | 3         |           |           |
| Clacton – London               | 3                  | 4   |           |           |           |
| Harwich International – London | 1                  |   |           |           |           |
| Harwich Town – London          | 1                  |   |           |           |           |
| Ipswich – London               | 1                  |   |           | 2         | 2         |
| Norwich - London               | 2                  |   |           |           |           |
| Southend Victoria – London     | 6                  |   | 7         |           | 7         |
| Southminster – London          | 2                  |   |           |           |           |
| Stowmarket – London            | 1                  |   |           |           |           |
| Witham – London                | 2                  |   |           |           | 3         |
|                                |                    |   |           |           | 3         |
| <b>Total</b>                   | <b>22</b>          | <b>22</b>                                     | <b>22</b> | <b>22</b> | <b>25</b> |
|                                |                    | <b>23</b>                                     | <b>25</b> | <b>26</b> | <b>27</b> |

**Key**

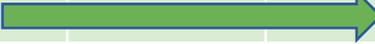
Option A      Option B only      Indicates continuation

\*Current frequency is from the May 2018 timetable used for the baseline assumption

Option A uses the full capacity of existing services

Option B ensures that services maintain existing train journey times

**Table 9: Evening peak services departing London Liverpool Street in the 'Higher' growth scenario (17:00-17:59)**

| Service                    | Current Frequency* | New train service frequency for Higher Growth |  |   |   |
|----------------------------|--------------------|---|--|---|---|
|                            |                    | 2024  | 2029   | 2033  | 2043  |
| London - Ipswich           | 3                  |   |  |   | 5    |
|                            |                    |   |  | 4  |   |
| London – Norwich           | 4                  |   |  |   |   |
|                            |                    |   |  |   |   |
| London – Clacton           | 3                  |   |  |   |   |
|                            |                    |   |  |   |   |
| London – Southend Victoria | 6                  |   |  |   |   |
|                            |                    |   |  |   |   |
| London – Southminster      | 1                  |   |  |   |   |
|                            |                    |   |  |   |   |
| London – Colchester Town   | 1                  |   |  |   |   |
|                            |                    |   |  |   |   |
| London – Braintree         | 1                  |   |  |   |   |
|                            |                    |   |  |   |   |
| London - Witham            | 1                  |   |  |   |   |
|                            |                    |   | 2  |   | 3  |
| London – Harwich Town      | 0                  |   |  |   |   |
|                            |                    |   |  |   | 1  |
| Total                      | 20                 | 20  | 20   | 20  | 22  |
|                            |                    | 20  | 21   | 22  | 24  |

#### Key

 Option A     Option B only     Indicates continuation

\*Current frequency is from the May 2018 timetable used for the baseline assumption

Option A uses the full capacity of existing services

Option B ensures that services maintain existing train journey times

**Note:** London to Ipswich increase by 2 services in option A, both additional services aren't restricted by journey time and can call at the necessary stops to match demand therefore meeting growth in higher scenario (based on option A methodology).

Table 10 provides a summary of the expected increase in services to and from London to support the expected peak hour passenger growth in the future following the introduction of new rolling stock.

**Table 10: Total service frequency required to and from London Liverpool Street in the morning and evening peak (Option A - Lower intervention)**

| <b>GEML service frequency required (Option A – Lower intervention)</b>    |          |      |      |      |      |
|---|----------|------|------|------|------|
| Direction and growth scenario   | Current* | 2024 | 2029 | 2033 | 2043 |
| London Liverpool Street arriving between 0800 and 0859 (Baseline growth)  | 22       | 22   | 22   | 22   | 23   |
| Departing London Liverpool Street between 1700 and 1759 (Baseline growth) | 20       | 20   | 20   | 20   | 20   |
| London Liverpool Street arriving between 0800 and 0859 (Higher growth)    | 22       | 22   | 22   | 22   | 25   |
| Departing London Liverpool Street between 1700 and 1759 (Higher growth)   | 20       | 20   | 20   | 20   | 22   |

**Table 11: Total service frequency required to and from London Liverpool Street in the morning and evening peak (Option B - Higher intervention)**

| <b>GEML service frequency required (Option B – Greater Intervention)</b>  |          |      |      |      |      |
|---|----------|------|------|------|------|
| Direction and growth scenario   | Current* | 2024 | 2029 | 2033 | 2043 |
| London Liverpool Street arriving between 0800 and 0859 (Baseline growth)  | 22       | 23   | 23   | 26   | 27   |
| Departing London Liverpool Street between 1700 and 1759 (Baseline growth) | 20       | 20   | 21   | 21   | 22   |
| London Liverpool Street arriving between 0800 and 0859 (Higher growth)    | 22       | 23   | 25   | 26   | 27   |
| Departing London Liverpool Street between 1700 and 1759 (Higher growth)   | 20       | 20   | 21   | 22   | 24   |

\*Current frequency is from the May 2018 timetable used for the baseline assumption.

**Note:** For both Options A and B changes in service frequency have been estimated based on the assumption that flip-up seats are treated as seats. If flip-up seats were not treated as seats, then the need for increased frequency would be brought forward possibly by 5 years.



## 6 Accommodating future services

The introduction of additional services on the GEML in the peak hours presents a challenge. The two-track section of the route between Shenfield and Colchester is a particular constraint as is the most intensively used section between Stratford and London Liverpool Street. The section of four track on the GEML, extending as far as Shenfield, is relatively short (approx. 20 miles) in comparison to other similar routes from London, such as the Brighton Main Line (extending to Three Bridges, approx. 35 miles), and the South Western Main Line (extending to Basingstoke, approx. 50 miles). This study has considered what the most efficient changes to the existing infrastructure that may be required to achieve the expected long-term outputs.

### 6.1 Timetable assessment

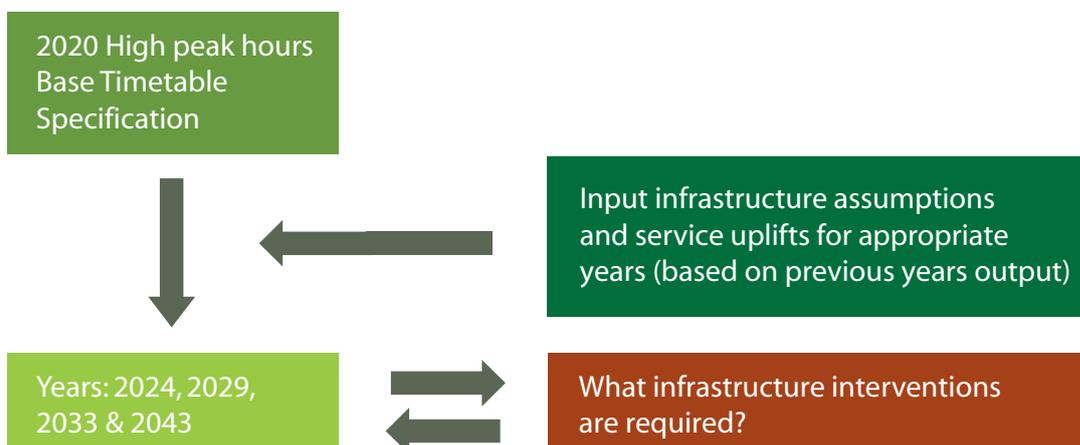
A timetable assessment has considered how the existing infrastructure on the GEML is able to accommodate additional services in the future. The assessment has applied the additional services onto a base timetable (May 2018) and used it to identify if there are any locations where the infrastructure is unable provide the capacity for the additional services.

This assessment identified what possible interventions may be required and the expected timescale to meet the outputs. Figure 18 summarises the method for carrying out the timetable assessment. It should be noted that level crossings were not considered as part of the assessment and would require further assessment.



Photo credit: GEML Taskforce

Figure 18: Method of carrying out timetable assessment



## 6.2 Timetable assessment findings

The timetable assessment identified a number of issues in relation to the capacity of the GEML to provide for additional services:

- The GEML is currently operating at full capacity in the peak hours between London and Colchester and between Ipswich and Haughley Junction. This means that, without changes to the existing timetable and/or potential increased journey times, no additional passenger services can be accommodated.
- The most significant capacity constraint is at Bow Junction, located between London Liverpool Street and Stratford. This junction cannot accommodate any additional services in the peak hours beyond the current timetable, without remodelling of the junction.
- To deliver any additional services on the two-track section north of Shenfield, a combination of passing loops (to allow fast train to overtake stopping trains and rail freight) and headway improvements (trains running closer together) are needed. It is possible that some additional services can be achieved without these enhancements with modification to the existing timetable and a potential increase in journey times.
- The provision of an hourly fast service from London to Norwich in 90 minutes and Ipswich in 60 minutes requires delivery of each of the enhancements identified in 5.3 without changes to the journey time, calling pattern or frequency of other services.

## 6.3 Enhancements that may be required

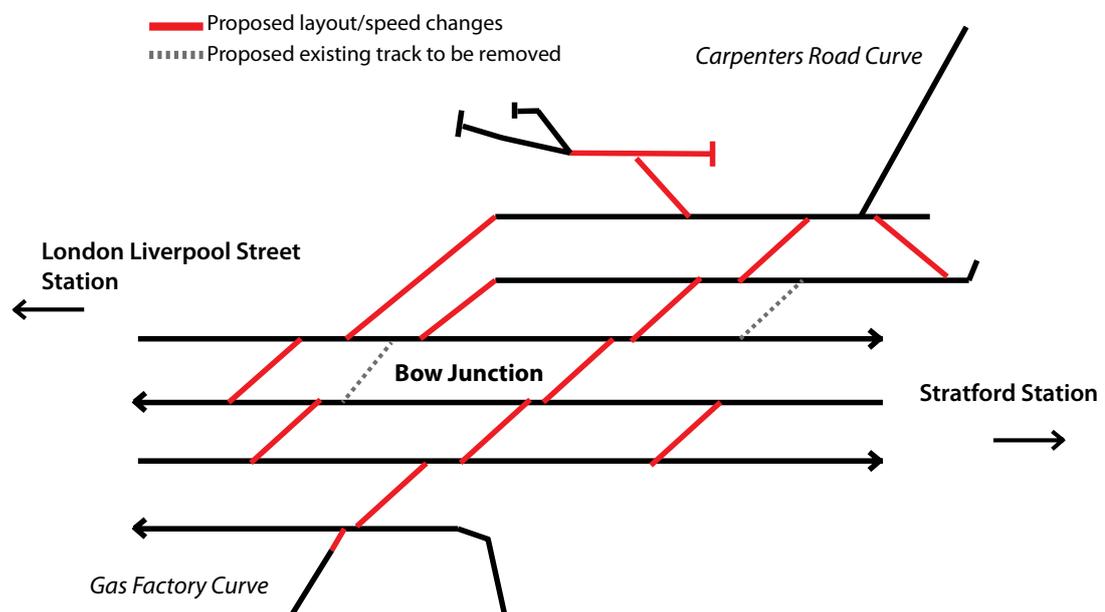
The timetable assessment has indicated that to achieve the ‘conditional outputs’ identified in this study, a number of enhancements are required to increase the capacity of the route. These enhancements are expected to address the capacity needs of the route over the next 25 years for both the baseline and the higher growth scenarios developed. The following locations on the GEML are where enhancements may be required to support additional services in the future.

### 6.3.1 Bow Junction remodelling

This rail junction is located close to Stratford on the route between Stratford and London Liverpool Street. At present, the slow or ‘electric’ lines into London Liverpool Street are used primarily by ‘TfL Rail’ services originating from as far as Shenfield. In the future, following the full introduction of Elizabeth Line services through Central London, there is an opportunity to remodel the junction to provide greater use of these lines for longer distance services. This scheme could provide a significant increase in capacity for services between London Liverpool Street and Shenfield, potentially up to 10 additional trains per hour at the junction if the associated capacity was provided. Figure 19 shows a simple track diagram of the junction with the proposed new track sections allowing trains to move between the four lines.

This scheme has previously been developed but not funded for delivery. It was previously estimated (in 2015), that the cost of delivery of the scheme is likely to be up to £100 million.

Figure 19: Simple track diagram of potential Bow Junction remodelling scheme



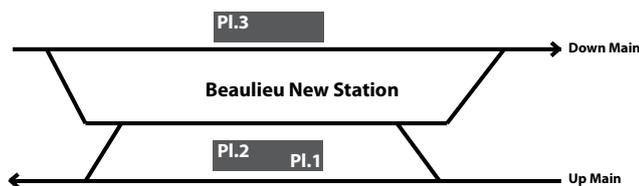
### 6.3.2 Loops between Chelmsford and Witham

Timetable modelling has indicated that, to allow for increased passenger services on this busy two track section of the railway, the provision of passing loops at an efficient location between Chelmsford and Witham is needed to allow fast trains to overtake slower passenger and freight services. The proposal for a new station at Beaulieu, to the north of Chelmsford, could be the preferred location to provide this loop facility.

The current station proposals for Beaulieu Park have two options, one of which provides the ability to stop trains while keeping the main line open for other trains to pass. Further timetable assessment will indicate whether this option provides the capacity required to meet the long-term service conditional outputs. It could be that further scope will need to be added to the current proposal to meet the long-term requirements.

Figure 20 shows a three-platform station with a loop to allow trains to call at the new station while allowing fast through services to pass in either direction. The proposal for a scheme here should be developed further to establish how the longer-term benefits could be delivered most efficiently.

**Figure 20: Simple track diagrams of the current options for a new station at Beaulieu Park**



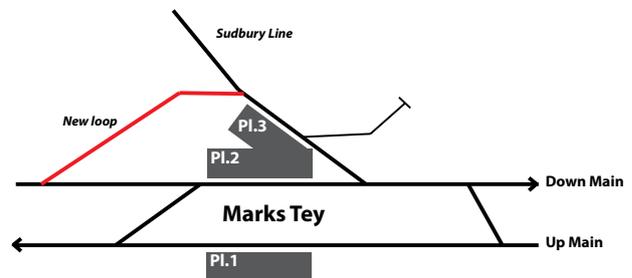
### 6.3.3 Passing loops south of Colchester (potential down bay at Marks Tey being turned into a loop)

In addition to the passing loops between Chelmsford and Witham, it has also been identified that there is a need for a second set of passing loops on the route closer to Colchester. Marks Tey has been suggested as a possible location for an additional loop as its location is efficient from a timetabling perspective and there is an option of adapting the Sudbury line platform to allow for 'main line' northbound services to be held to allow faster trains to pass.

Figure 21 illustrates a possible revised track layout for this station to provide a third platform for 'main line' trains to call at. Please note that this sketch is only to provide an indication of how this scheme might be developed. There has not been a feasibility assessment

to check if an option as drawn can be delivered. Additional works might be necessary to achieve the capacity required at this location.

**Figure 21: Illustration of a potential northbound passing loop at Marks Tey station**

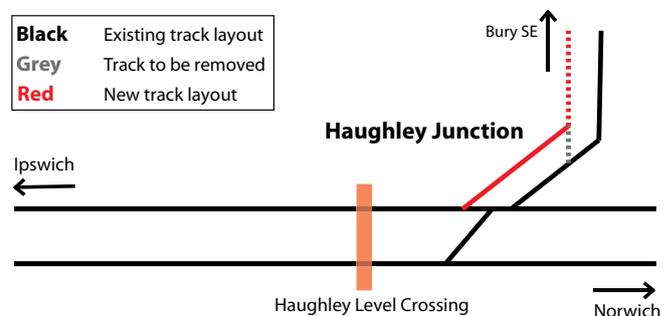


### 6.3.4 Haughley Junction doubling

This scheme provides additional track capacity at this important junction near Stowmarket. The scheme proposal is to replace an existing single lead track junction into a twin lead track arrangement principally to provide for future increases in demand for rail freight services from Felixstowe to the West Midlands and the North. The junction is already a performance constraint, leading to delays and reduced flexibility to restore normal running during disruption. It also supports the expected increased frequency of Ipswich to Cambridge and Peterborough services.

The scheme is currently being developed to Outline Business Case level and it has been indicated that the scheme could cost between £10 and £20 million. Subject to funding, the scheme could be delivered in the next three years. Figure 22 shows a simplified version of the currently proposed track layout.

**Figure 22: Current proposed changes to Haughley Junction**



**Note:** Several options for this scheme current exist.

### 6.3.5 Other schemes

The timetable assessment has also indicated that further additional tracks and reductions in headways, between Shenfield and Colchester are needed to achieve the required outputs. The extent of this additional scope, the likely timing of it and the choices that can be made through changes to the existing timetable, will be determined as part of more detailed timetable assessments.

The sections of additional (third or fourth) track, if required, would be between Shenfield and Chelmsford and between Ipswich and Haughley Junction. While the extent of this is to be determined, it is recommended this potential need should be considered if development proposal near the railway could limit the ability or increase the cost of provision of a four-track railway on these sections in the long term.

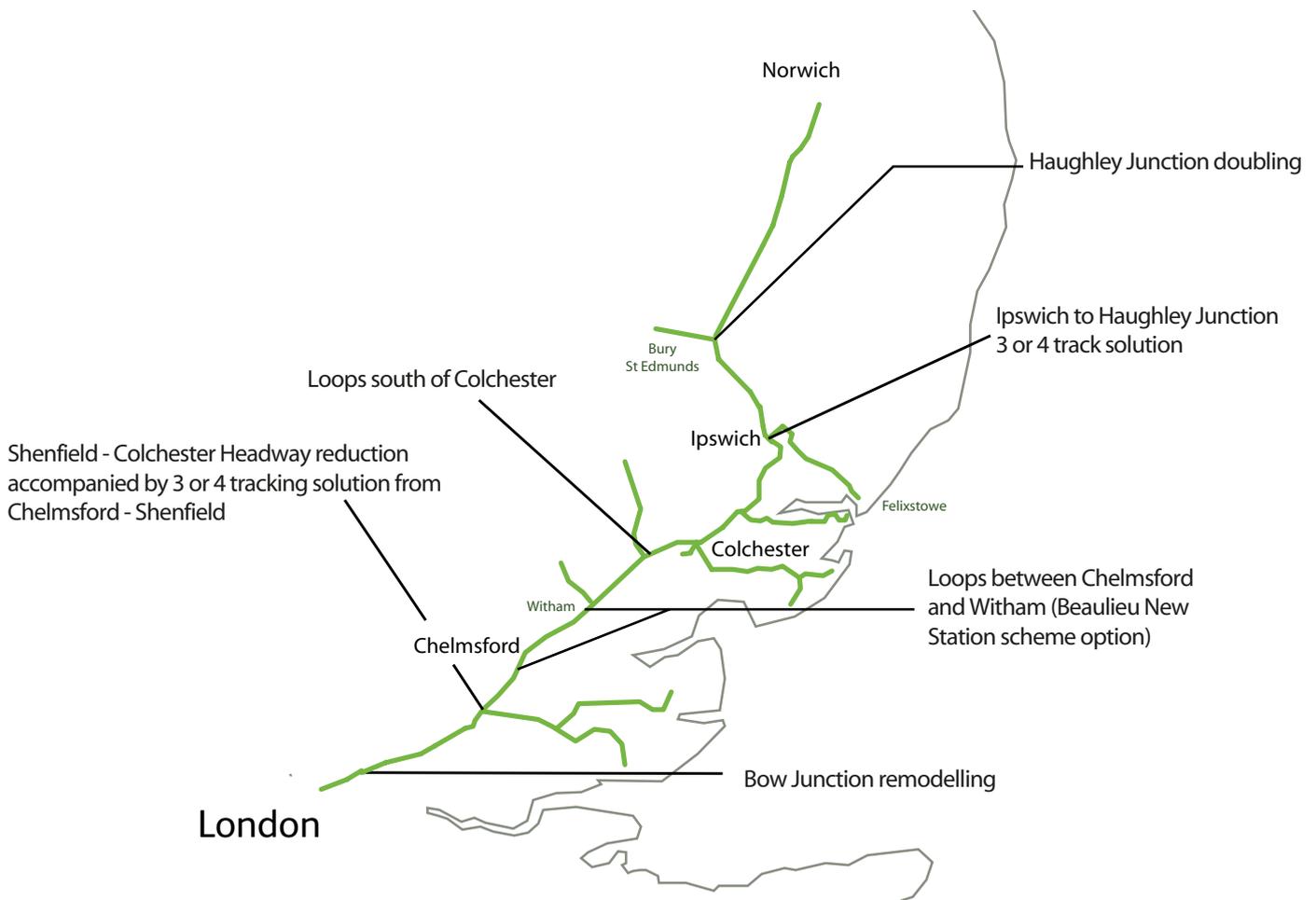
The provision of headway improvements also provides an opportunity for increased capacity before more expensive schemes, such as additional tracks, are needed. Reductions in headways can be delivered by an alteration in signal design, for example, by reducing the distance between signals.

### 6.3.6 Trowse Bridge, Norwich

The assessments as part of this study have not identified the need for track doubling and replacement of Trowse Bridge in Norwich as a result of increased GEML services to London.

It is recognised that Trowse swing bridge is already a bottleneck (as a single line bridge), which leads to delays in the event of disruption. With franchise commitments for additional off-peak 'inter-city' services, aspirations for a half hourly Norwich to Cambridge service (and potential extension of the future East-West Rail service) and the potential for more services to Peterborough, there is likely to be a need to create additional capacity and flexibility at this key location. Other local aspirations and road bridges mean there are complimentary strategic goals already aligned, which fit with local economic, social and wider development aims.

**Figure 23: Locations of the identified enhancements that may be required**



# 7 Recommendations

The assessments carried out as part of this study have indicated that there are both challenges and opportunities in the future for the GEML. The challenges relate to the expected impact of growth and the capacity of the railway to meet this growth. The opportunities include the benefits that will be achieved once the new fleet of trains has been introduced and significant economic benefits that are likely to be achieved from investing in the railway in the East of England region.

## 7.1 Answers to Strategic Questions

This study set out to answer a number of 'strategic questions' which are outlined in 3.3 and analysis shown in earlier sections. Table 12 provides a summary of answers to these questions.



**Table 12: Summary response to the strategic questions set for the study**

| Study questions set  | Summary answer   |
|--|--|
| What are the priorities and timescales for identified rail infrastructure capacity enhancement between London and Norwich? | Section 5.3 outlines the schemes that are a priority to enhance the capacity for the route. The timescales for these schemes are dependent upon the impact and performance of new trains and the desire for faster services to Norwich. Further timetable assessments will inform the ordering of schemes including the development of the Strategic Outline Business Case.                  |
| How does the introduction of new rolling stock on this corridor impact on priorities for rail infrastructure investments?  | It has been assessed that new rolling stock has a significant impact on the capacity of the route, increasing seating capacity on services by up to a third. New rolling stock impacts on the timing of new infrastructure, not the priority of them.  |
| What is the current view on rail growth between London and the key centres on the Great Eastern Main Line (GEML)?          | The assessment as part of this study has indicated that, depending upon the growth scenario under consideration, passenger growth is expected to be approximately 2.5 to 3% per year in the period up to 2033.   |
| How does the future timetable planning assumptions impact on the ordering of capacity interventions?                       | The ordering of the capacity interventions has not been determined. Further timetable assessment will inform more accurately when these schemes are likely to be needed.   |
| What is the current stage of development and timescales/phasing for delivery for schemes on this corridor?                 | The Haughley Junction doubling scheme is currently being developed to Network Rail's GRIP 3 level. It is recommended that this scheme is delivered first. The Bow Junction remodelling scheme has previously been developed to Network Rail's GRIP 3 level. Of the remaining schemes identified, this scheme should be developed further when the performance of new rolling stock is known. |
| Is there any additional infrastructure required not previously identified?   | This study has identified the potential for passing loops at two locations between Chelmsford and Colchester. It has also indicated that signalling headway reductions can provide additional capacity along with sections of additional track capacity. Although not a capacity recommendation for this assessment, further development of Trowse Bridge should be considered.              |

## 7.2 Development with the Rail Network Enhancements Pipeline process

This study has identified a number of likely enhancements required to the GEML in the medium and long term. The future potential development and delivery of these schemes could be considered for funding by the Department for Transport (DfT) and other potential public and private sector organisations. To achieve DfT funding, the development of the schemes should align to the Rail Network Enhancements Pipeline (RNEP) process and must have a robust business case. The recommendations from this study have not yet entered this process.

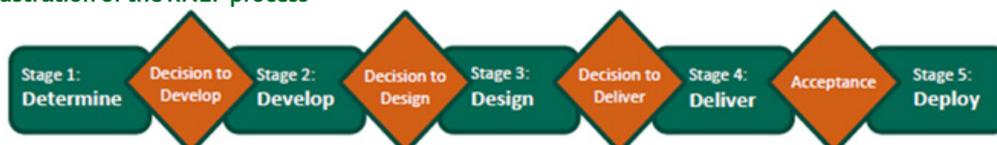
Figure 24 illustrates the stages of the process and when key decisions on the progression of scheme will take place. The first stage of the process, the 'determine' stage, is the establishment of the case for intervention and the development of a Strategic Outline Business Case. Following completion of this study, the New Anglia Local Enterprise Partnership will be leading the development of this first phase for the schemes identified in this study. Should a decision to develop be made, it is likely that Network Rail will lead the development of the schemes from this point.

### 7.3 Housing growth at locations on the GEML

The 'higher' growth scenario considered in this study was very much driven by the provision of new housing, and therefore increased population, expected in the future. This is particularly the case for Essex. At present, there are a number of locations close to the GEML where significant numbers of new homes are expected to be built. In addition to Beaulieu, considered by the study, there is also consideration being given for major developments at Ingatestone, Kelvedon and close to the station at Marks Tey.

This study has not considered the specific locations on the GEML where there is likely to be step change in the demand for rail services resulting from major housing developments due to the uncertainty of the timing and locations where these will proceed. It is recommended that, for the route section between Shenfield and Colchester, provision is made for the possible need for additional tracks at multiple locations, or new tracks on the entire length of this route section should it be proven to be required in the long term

Figure 24: Illustration of the RNEP process



For the schemes that have been identified in this study, these should be developed in a way to efficiently provide for greater track capacity in the longer term.

### 7.4 Taking forward the recommendations

The assessments carried out indicate that a combination of enhancements for the GEML are needed to achieve increased service frequency with current journey times and calling pattern. It is recommended that the scheme to remodel Bow Junction is developed further depending on a number of factors such as how the new train capacity is used by passengers, the effect of timetable changes and impact of Crossrail and further clarification of growth figures. The delivery of the Bow Junction scheme should be seen as the first step in achieving greater frequency of passenger services on the GEML.

This study identified the potential need for a large number of new schemes in the medium term to achieve the outputs required. Once the ordering of the priorities is established, it is recommended that a programme of enhancements, potentially up to a 20 year period, is set out for the route. This will enable more short-term timetable related options to be considered to minimise the potential for greater congestion on services in the peak hours before new services can be introduced. A delay in providing more capacity for the route is likely to require the need for more station calls and/or slower journey times to maximise the use of services and available track capacity while passenger demand continues to rise.

Table 13 provides a summary of the enhancement options identified and the key driver for each scheme that maybe be required over the next 25 years and further considerations.

### 7.5 Further GEML assessments

A further, more detailed, assessment, which involves a concept timetable looking to adapt the existing timetable for future growth, will be investigated. This will help determine more clearly the priority of enhancements when the timetable is allowed greater flexibility. Options around service provision and new infrastructure for the proposed new station at Beaulieu could provide an opportunity for this.

It is proposed that this assessment is carried out after completion of this study with the findings reported to members of the study Project Board. These findings will seek to determine the most efficient phasing of delivery of the schemes, greater detail of scope to then develop 'order of magnitude' cost ranges.

It is recognised that there is a strong objective to reduce journey times on the GEML, particularly from stations in Suffolk and Norfolk to London. There is an opportunity to develop further the findings of this study to understand if the capacity recommendations enable some journey time improvements and to consider if there could be some additional scope that would provide additional journey time benefits.

Further assessment will be required of the wider impacts of operating more frequent services in the future. More intensive use of the GEML will have an impact on the level crossings on the route and in many cases, will require the improvement or replacement of them. Also, a larger fleet of trains that is likely to be needed to operate increased services may require new or larger stabling facilities on the route and the potential for new depots. It is recommended that these issues are investigated further following publication of this study.

The case for further investment in the capacity of the GEML is a strong one. The significant growth of the East of England in recent years is expected to continue into the future and the railway is key to achieving local and regional growth objectives. A wider economic benefits study is also proposed to quantify these benefits supporting the more specific case for investment.

Often rail investment can be a means of stimulating investment in a region through faster and higher quality transport links. For the GEML this is also the case but, most importantly, the recommendations included in the study are those that seek to keep up with the growth expected along the route. Failure to deliver such enhancements is likely to act as a brake or barrier to achieving the potential of the region and will, therefore, impact on the national economy.

| Table 13: Summary of enhancement options identified and key drivers  |  |   |
|--|--|---|
| Future enhancement options that may be required for the GEML   | Driver for scheme  | Summary of proposed further actions   |
| Bow Junction remodelling   | To provide any additional services on the GEML supporting growth without changes to service calling patterns and journey times.  | Consider further development of the scheme following the monitoring of the impact of new train capacity and short-term growth. Platform capacity at London Liverpool Street to be assessed.   |
| Loops between Chelmsford and Witham (Beaulieu Park Station scheme option)  | To provide additional services between Shenfield and Witham without changes to service calling patterns and journey times.   | Undertake a further timetable and service options review for the route. This can be taken forward as part of the development of Beaulieu Park station to identify wider opportunities and utilisation of the proposed infrastructure. |
| Haughley Junction doubling   | To provide capacity for forecast rail freight from the port of Felixstowe to the West Midlands and the North and increase the performance and reliability of passenger services. | Completion of Outline Business Case and delivery by 2024 subject to further development and funding.  |
| Loops south of Colchester, & Shenfield – Colchester headway reduction accompanied by 3 or 4 tracking solution from Chelmsford – Shenfield* | To provide additional services between Shenfield and Colchester without changes to service calling patterns and journey times.   | Further assessment of the scheme to be included in a more detailed timetable assessment of the route.   |
| Ipswich to Haughley Junction – 3 or 4 track solution   | To support the provision of an hourly fast service between London and Norwich in 90 minutes and increase the reliability of passenger and freight services.                      | Further timetable assessment of 'trade offs' in providing the additional fast Norwich service. Followed by investigation of potential scope of the scheme.  |
| Trowse Bridge, Norwich   | To support the potential increased services to Ely and Cambridge and to improve the reliability and resilience of existing services to and from Norwich.                         | Further assessment to determine the benefits of the scheme and appropriate timescales for development.  |

\*Subject to further investigation

