

# West Sussex Connectivity

Modular Strategic Study

Spring 2020



Continuous Modular Strategic Planning

*System Operator*



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# Acknowledgements

We would like to thank the following for the photographs and illustrations in this document: Network Rail (Alex Hellier, Sam Cullen, George Beale-Pratt, Simon Hulse and Paul Best) and Transport for the South East.

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**Cover photo:** A Southern train departs Arundel station with the castle and cathedral behind.

# Foreword

Welcome to the West Sussex Connectivity Modular Strategic Study, the first small, local study in Kent and Sussex, as part of the Continuous Modular Strategic Planning (CMSP) process.

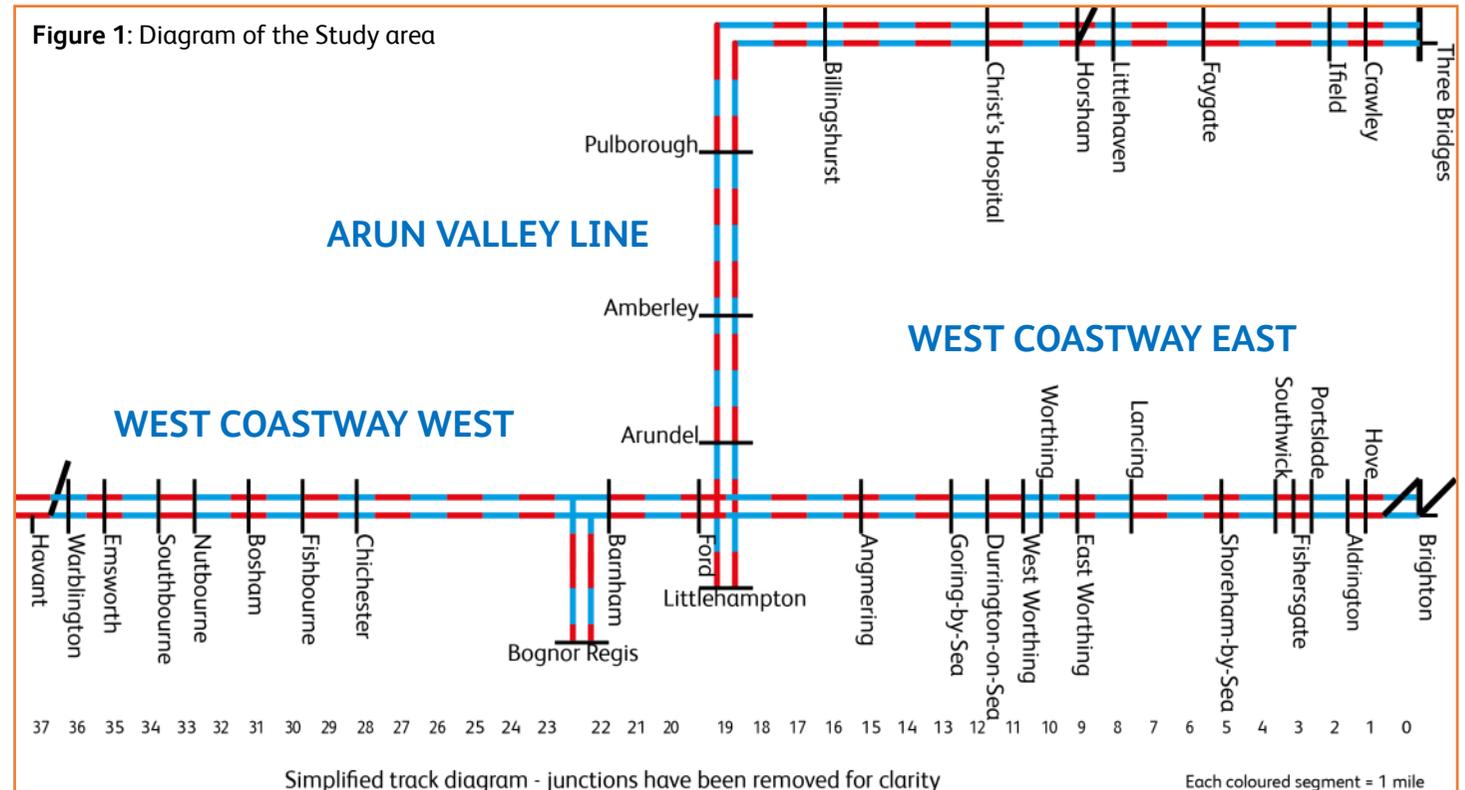
This study follows the Sussex Route Utilisation Strategy (RUS) (2009), London and South East RUS (2011) and Sussex Area Route Study (2015), which looked at the high level demands of the rail network.

The Sussex Area Route Study concentrated mainly on the Brighton Main Line (between London and Brighton) although issues were identified on the West Coastway and Arun Valley lines. This Study is intended to focus on the requirements of stakeholders and the rail industry over the smaller area for the next 20-30 years.

The System Operator South team is also undertaking the following studies:

- Solent
- West of England Line
- Southern Regional Freight
- London Freight Strategy
- Depots & Stabling
- First & Last Mile
- South London and Thameslink Service Improvement
- London Rail Strategy
- North and East Kent Connectivity
- South of England Connectivity.

**Figure 1: Diagram of the Study area**



As well as looking at rail provision, this Study will also look at wider transport issues and housing growth. The recommendations for funders from this Study aim to enable the railway to grow in a sustainable way to help balance the economy of the region and contribute to decarbonisation.

Options have also been identified that will be fed into the Transport for the South East (TfSE) proposed Outer Orbital Area Study.

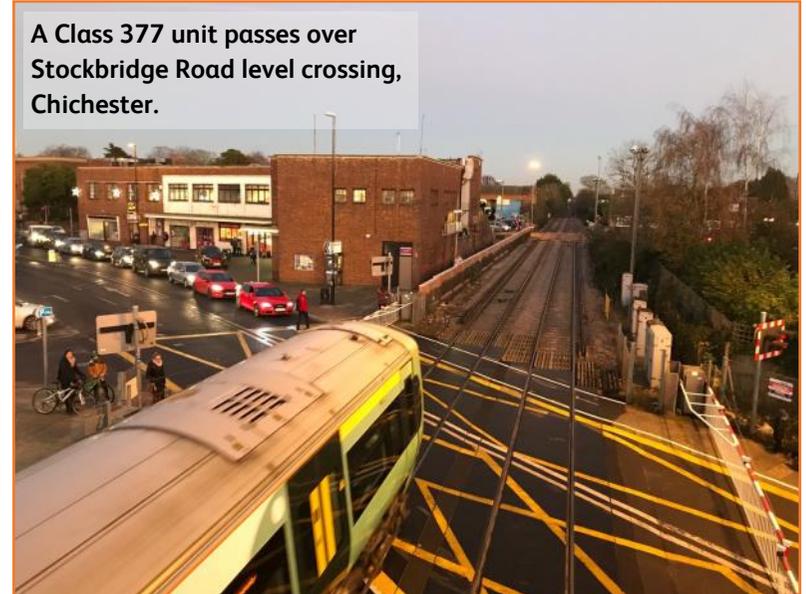
The West Sussex Connectivity Study area, shown in **Figures 1 & 2**, borders the geography of the Solent Study area to the west, South London and Thameslink Service Improvement to the north and the Brighton Main Line Upgrade Programme to the east.

The advantage of the CMSP process is that the focus is on smaller areas with different market emphasis, for example, London is not the dominant market in this Study area.

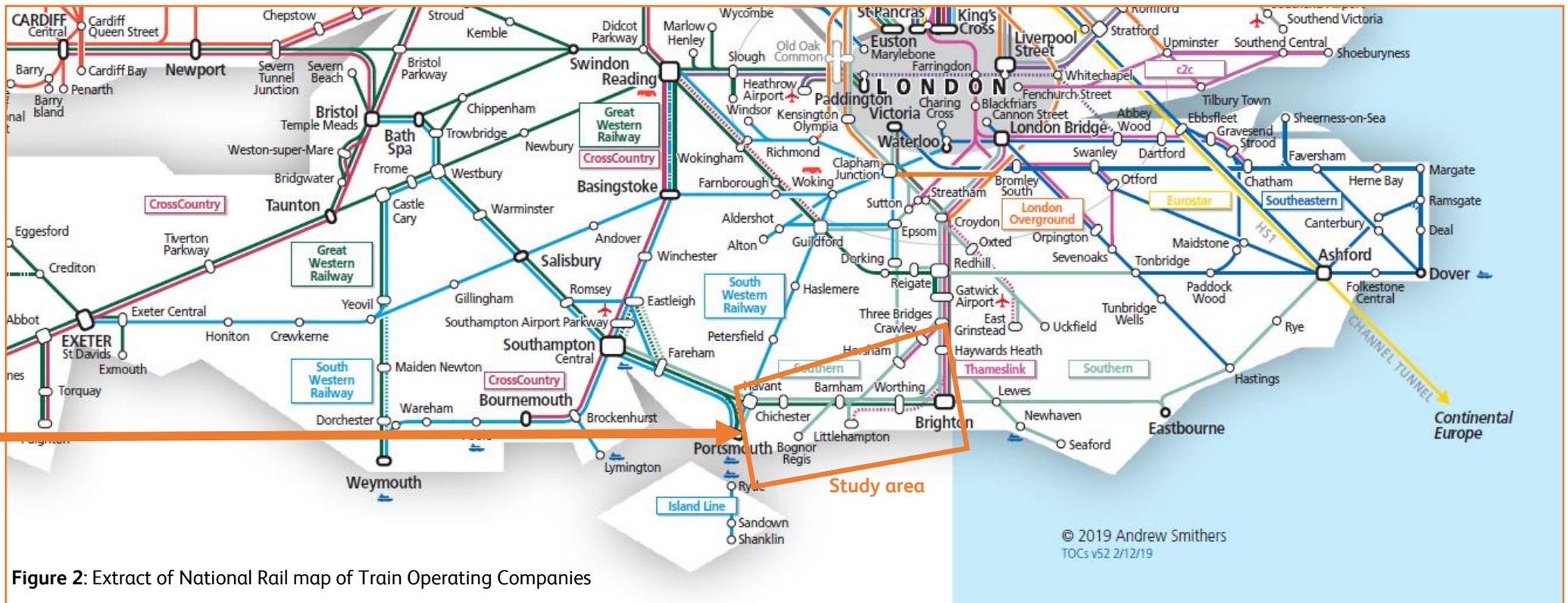
Consistent with our commitment of Putting Passengers and Freight First we have worked closely with stakeholders on the development of the Strategic Questions and some of the solutions to these issues.

This Study adopts a whole transport system perspective to planning the network and train service for the next 30 years.

As changes happen in the area and the industry, our recommendations will be revisited and updated accordingly.



**A Class 377 unit passes over Stockbridge Road level crossing, Chichester.**



**Figure 2:** Extract of National Rail map of Train Operating Companies

# 1. Executive Summary

Building upon extensive stakeholder engagement during the development of the Sussex Route Utilisation Study and Sussex Area Route Study, stakeholders have been centre to the development of the West Sussex Connectivity Study.

The Study commenced in January 2019 and was followed by a period of baselining and meeting stakeholders. It was important that stakeholders drove the Study and their challenges and questions have formed the basis of the work carried out. This document is not the industry telling the stakeholders what the industry wants but explaining how the stakeholders can get what they want.

In consultation with stakeholders we agreed three strategic questions, broken down into six sub-questions within three overarching themes, as detailed in **Table 1.1**.

For the purpose of this study, we have primarily defined connectivity to mean:

- Both direct journey opportunities and journey times
- The ability to allow people to get to where they want and also when they want to go
- Connecting different parts of peoples' lives, home to centres of education, employment and leisure
- Other aspects which can be considered part of connectivity, e.g. on-board wi-fi.

Timetable and service level questions were investigated and a number of Train Service Specifications (TSS) were developed, along with the subsequent infrastructure options.

The outcomes of this work are detailed in the following chapters and the **Technical Appendix**.

**Table 1.1:** Strategic objectives of the West Sussex Connectivity Study

Strategic Themes	Strategic Questions	Sub-questions
Planning for Sustainable Growth	How best to respond to projected future increases in demand and the new housing planned across the region whilst contributing to decarbonisation?	1. Can the rail service accommodate current and projected demand at peak times whilst improving network reliability?
		2. How can rail support the delivery of substantial amounts of new housing?
Wider Transport Connectivity	How the railway links into other transport provision and what changes could be introduced to improve this?	3. Does the railway offer an opportunity to reduce congestion on key roads?
		4. How can access to the railway network be improved from other modes of transport?
Rebalancing the Economy	How can the network be improved for both local and long-distance journey times?	5. How best can the railway deliver local connectivity for shorter journeys in West Sussex?
		6. Can journey times be reduced for longer distance services and additional services beyond Southampton introduced?

## Stakeholder Engagement

**Local authorities:**  
 West Sussex County Council  
 Brighton and Hove City Council  
 Adur District Council  
 Worthing Borough Council  
 Arun District Council  
 Havant Borough Council  
 Horsham District Council  
 Crawley Borough Council

**Bus operators:**  
 Brighton and Hove Buses  
 Compass Bus  
 Metrobus  
 Stagecoach

**Rail stakeholder groups:**  
 RailFuture  
 Sussex Community Rail Partnership  
 West Sussex Rail Users Group

**Other stakeholders:**  
 Transport for the South East  
 South Downs National Park Authority  
 Highways England  
 Gatwick Airport Ltd.

**Rail industry:**  
 Department for Transport  
 Govia Thameslink Railway  
 Great Western Railway  
 Network Rail.

## Inclusive of wider priorities

The Study includes the wider priorities of stakeholders and the Government, and has drawn on guidance from the Department for Transport (DfT), Transport for the South East (TfSE) and others.

Any request for Government funding, through the DfT, must demonstrate alignment with the Rail Network Enhancements Pipeline strategic priorities for investment:

1. Keeping people and goods moving smoothly and safely
2. Delivering the benefits from committed programmes and projects already underway
3. Offering more: new and better journeys and opportunities for the future
4. Changing the way the rail sector works for the better.

To encapsulate the widest perspective, Homes England and the Ministry of Housing, Communities & Local Government (MHCLG) have also been involved in the strategy.

## Overlapping interfaces

### Solent Study

In parallel with this Study, the Wessex System Operator team produced a study focused on the Solent area, focussing on rail services between Portsmouth and Southampton.

### TfSE 'Draft Transport Strategy for the South East'

Network Rail has signed a memorandum of understanding with TfSE recognising it as a key partner and committing to ongoing collaboration. Network Rail and other key stakeholders were involved in the production of TfSE's Draft Transport Strategy, published in October 2019.

The recommendations from this Study will feed into TfSE's Outer Orbital Area Study. We will work with TfSE to adopt some of the options and approaches within their policies and priorities.

A photograph of a green and yellow Class 313 train passing over a level crossing. The train is moving from left to right. The level crossing has red and white striped barriers and a signal post. The background shows a clear sky and some greenery.

A Class 313 unit passes over Ford level crossing.

## Recommendations

Our recommendations align to the following:

- Immediate interventions, including those that may need to be progressed through the Rail Network Enhancement Pipeline (RNEP)
- Further development in partnership with TfSE and other stakeholders
- Probable longer-term interventions
- Delivery opportunities.

### Recommendations: Immediate Interventions

#### Replace the Class 313 units with modern Coastway-configured trains

Replace the Class 313 3-car units with modern units that are fitted with toilets, air conditioning, luggage space, cycle space, wheelchair spaces, enhanced passenger information, wi-fi, low density seating which aligns with the windows and at-seat charging facilities.

The new rolling stock should be at least 4-car units, to alleviate existing standing and cater for growth, although 5- or 6-car units should be considered to cater for high growth scenarios. Modern rolling stock would have superior acceleration and braking and a higher top speed.

#### Introduce the train service specification which requires no additional rolling stock and infrastructure

The following recommended changes will optimise the use of existing rolling stock, crews and the infrastructure:

- West Coastway local stopping services run via Littlehampton to allow faster trains to pass, improving longer distance journey times
- Longer trains should operate at weekends and during the evenings in the summer.

#### Advertise the last train from Brighton to Worthing

GTR and the British Transport Police to review advertising the 01:21 Brighton to Worthing service.



A Class 377 unit on a London Victoria train at Shoreham-by-Sea. These are of the Bombardier 'Electrostar' family of rolling stock.

#### Improve coastal connectivity by enabling faster journey times to Bognor Regis and Littlehampton from London

Requires changes to the Class 377 units to enable a quicker process to split/attach trains to reduce journey times.

#### Recommendations: Progress through RNEP

The following are recommended to be initiated as projects for funding through RNEP.

#### Enable reduced level crossing down time by lengthening platforms that are too short for the longest trains

The stations are: Lancing, Goring-by-Sea, Angmering and Littlehaven.

#### Enable faster east-west journeys and improved service resilience via the following infrastructure projects:

- Bi-directional working at Worthing station
- Options for a new platform at Brighton station.

#### Enable early/late trains between Horsham and Gatwick Airport

Currently early and late trains do not operate due to the need to maintain a high-performing railway. Bi-directional signalling would potentially enable services to run earlier and later.

Additional early and late services could significantly reduce the number of car journeys from the Horsham area to Gatwick Airport, recognising the needs of employees and the travelling public.

#### Recommendations: Further development in partnership with Transport for the South East

In the Draft Transport Strategy for the South East (2019), TfSE emphasised the importance of cross-regional rail journeys, that avoid London and represent a viable alternative to the equivalent road journey.

We are recommending work in partnership with TfSE on the following:

- Further development of train service specification options considering the following:
  - ⇒ Improve east-west journey times
  - ⇒ Consistent intervals within the timetable
  - ⇒ Optimising the mix of long-distance and stopping services
  - ⇒ Increasing the volume of services between Brighton and Southampton/Bristol
  - ⇒ Encapsulating the recommendations of the Solent Study.
- Bus links from stations to neighbourhood and employment locations that are remote from the railway with integrated bus and rail timetables
- Consistent approach to the options available for passengers to use other modes to connect to railway stations
- Improving connections from stations to the South Downs National Park

- Exploit the opportunities for improved cycle and walking routes to the station and the facilities at the station to make the interchange as easy as possible.

**Recommendations: Further development in partnership with other stakeholders**

**New stations on the Arun Valley line**

Network Rail will continue to work with stakeholders on a number of proposals for additional stations across the Study area, particularly between Horsham and Three Bridges.

We are working with a number of stakeholders: West Sussex County Council, Crawley Borough Council, Horsham District Council, Coast to Capital Local Enterprise Partnership and the developers. The focus will be on recommending the optimum location of new stations taking into account future housing provision, other transport connections, timetabling impact and investment required.

**Recommendations: Probable longer-term interventions**

- **Non-London services train lengthening** - demand forecast indicates that the coastal services currently provided by 4-car Class 377s may need to be lengthened by 2039 in a high-growth scenario.
- **Platform lengthening** - if coastal services are strengthened beyond 4-car, platform lengthening will be required at Aldrington, Fishersgate and East Worthing. Lancing and Southbourne would also need lengthening if the shortest train is 6-cars or longer.
- **Power supply assessment** - if coastal services are strengthened beyond 4-car, implications on power supply must be assessed.
- **Maximising network capability** - currently there is a variation across the West Coastway of headway and line speed. In order to maximise capability, the medium-term aspiration is to move toward a consistent two-minute headway and 90 mph line

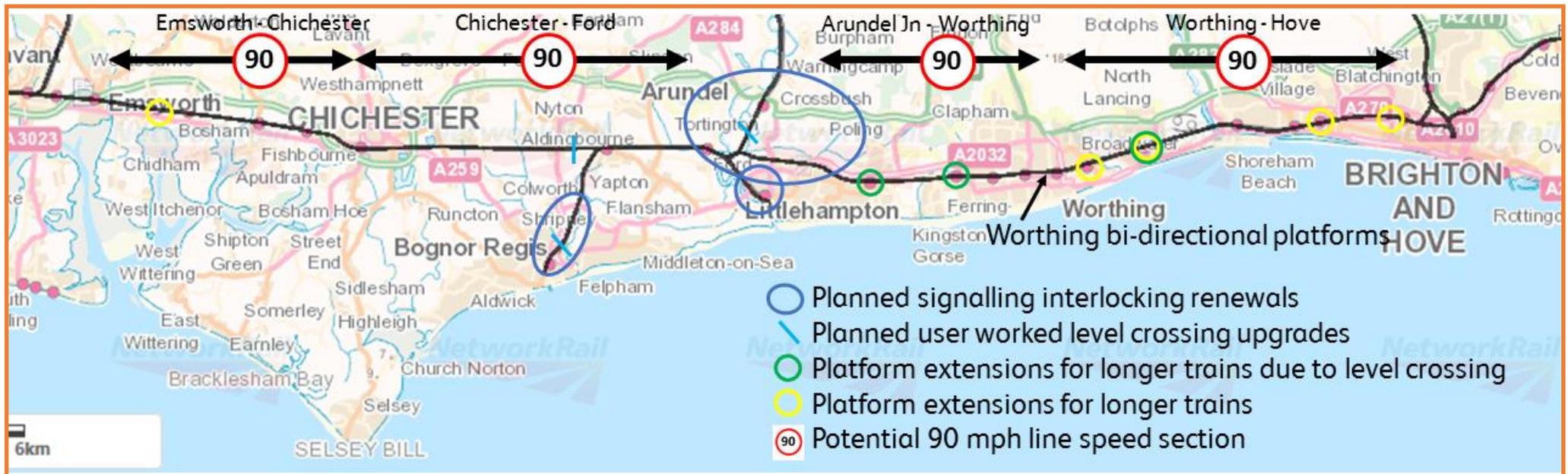
speed to reduce journey times and potentially improve service frequencies.

- **Digital Railway** - where there are planned asset renewals we recommend that Network Rail Southern Region take advantage to introduce Digital Railway technology, to deliver the network capacity described above, see **Figure 1.1**.

**Recommendations: Delivery Opportunities**

Every opportunity should be taken to integrate recommended enhancements with planned renewals. This optimises access to the network, minimising disruption to passenger and freight customers and provides cost efficiencies.

The rail franchising model is currently undergoing reform, we recommend that train service and rolling stock changes are integrated into the new model to enable a whole-system approach.



**Figure 1.1:** West Coastway, Littlehampton and Bognor Regis lines opportunities for Digital Railway. Planned projects and Study proposals (short- to medium-term).

## Options not recommended for further development

The following stakeholder aspirations have been analysed but for a variety of reasons, are not recommended at this time. These will be reviewed if any factors change:

- **Cross-Brighton services** - the Brighton Main Line and both Coastway lines benefits from a high frequency service. There are no robust train paths for cross-Brighton services without sacrificing existing high-demand services. We do not believe that would be an acceptable outcome.
- **Barnham Chord and Arundel Chord** - these Chords would improve connectivity but would not provide sufficient improvement compared to the current service to warrant the investment.
- **Train service specification for a service that provides for all stakeholder aspirations** - this would require 4-tracking between Brighton and Havant (37 miles) which would involve significant disruption, cost and land acquisition. However, train service options have been developed that provide for most of the aspirations such as faster longer-distance services and clockface Brighton Metro services.
- **90 mph line speed between Horsham and Arundel** - unfortunately the geography and location of the stations prevent this upgrade. The route was recently resignalled to optimise its capability.

## Conclusion

All of the recommendations will require continued commitment from funders and stakeholders. We look forward to working collaboratively with industry partners throughout the development of the recommendations contained within study.

This is the beginning of an exciting new chapter for the railway in West Sussex.

The West platforms of Brighton station which could be remodelled to accommodate longer trains.

## 2. Overlapping Interfaces

### Solent Study

**Table 2.1** details the Solent Study's Strategic Questions, which are based on the same themes as this Study. The strategic questions were driven by local stakeholders.

Whilst these do not directly align with those of this Study, there are some obvious similarities such as faster trains between city centres and similar constraints such as the two-track railway.

The recommendation for faster trains to Southampton and Bristol will be further developed within Network Rail and with South Western Railway and Great Western Railway.

The Solent Study was published in Spring 2020.

### Southern Regional Freight Strategy

In parallel to this Study, the early stages of the Southern Regional Freight Strategy have been developed.

In the West Sussex Connectivity Study area, there is the requirement for longer freight trains to Chichester from the Mendips. This is currently constrained by the signalling at Chichester but remodelling Chichester Yard to enable freight trains to directly enter and exit should enable longer trains to operate.

To accommodate future freight growth the TSS developed an hourly path for freight services between Havant and Chichester.

### Depots & Stabling Study

There is a shortage of secure sidings across the network and proposing more or longer trains could lead to more or longer units being required to operate them.

The Depots & Stabling Study identifies the current facilities and identifies options to increase the number of sidings available to operators.

This study has identified opportunities to increase stabling facilities within the West Coastway Study area, for example, delivering additional siding facilities at Brighton Lovers Walk Depot.

### First & Last Mile

A separate First & Last Mile Study examines the first and last mile of the journey, i.e. origin to station and station to destination as part of the door-to-door journey. Some of the principles have been demonstrated in this Study.

### Gatwick Airport

Gatwick Airport station will be redeveloped in the early-2020s to provide improved facilities and interchange with both the airport and within the station itself. Whilst not in the study area, a large number of passengers commute to work, interchange or fly from the airport.

During construction, timetables will be altered, leading to longer trains operating on the West Coastway, the recommendation for platform lengthening at stations with level crossings has been considered as part of the preparation work.

### Brighton Main Line Upgrade Programme

#### Reigate Platform 3

An additional 12-car platform at Reigate station may provide an opportunity to reroute trains resulting in changes on the Three Bridges - Horsham corridor.

#### Croydon Area Remodelling Scheme (CARS)

A major upgrade for the Brighton Main Line is under development for the 2020s, subject to funding being made available.

While this will have no direct impact on local journeys within the study area, services on the Coastway and Arun Valley Lines into London could be affected by the project. It is aiming to deliver six additional high-peak hour (08:00-08:59 hours) trains through the East Croydon area into

**Table 2.1:** Strategic objectives of the Solent Study

Strategic Themes	Strategic Questions
Rebalancing the economy	What does the rail freight industry require of the Solent area?
	What are the key local travel markets that the rail network in the Solent area serves, or needs to serve in the future?
	What inhibits demand at the lowest usage stations in the Solent area, and what actions could increase usage?
Wider Transport Connectivity	What City to City journey time and frequency is required to be competitive with road travel between the two cities (Portsmouth and Southampton) peak and off-peak?
Planning for Sustainable Growth	What level of rail service is required in order for rail to support sustainable growth and development in the large urban areas of the Solent and make a larger contribution to local efforts to enhance public transport and secure mode shift away from the private car?
	What is the extent of poor resilience in the Solent area and how can this be addressed?

London. Decisions about the origin and destination of these trains has not yet been decided and will be determined in a future franchise specification.

## Introduction of Digital Railway on the West Coastway

The Digital Railway Programme will introduce in-cab signalling to trains, removing the requirement for external signals. This study recommends that the West Coastway, Bognor Regis and Littlehampton branch lines should be considered for implementing Digital Railway as part of future resignalling projects.

**Figure 1.1** highlighted the extent of the planned renewals and proposed changes to the network as part of this Study.

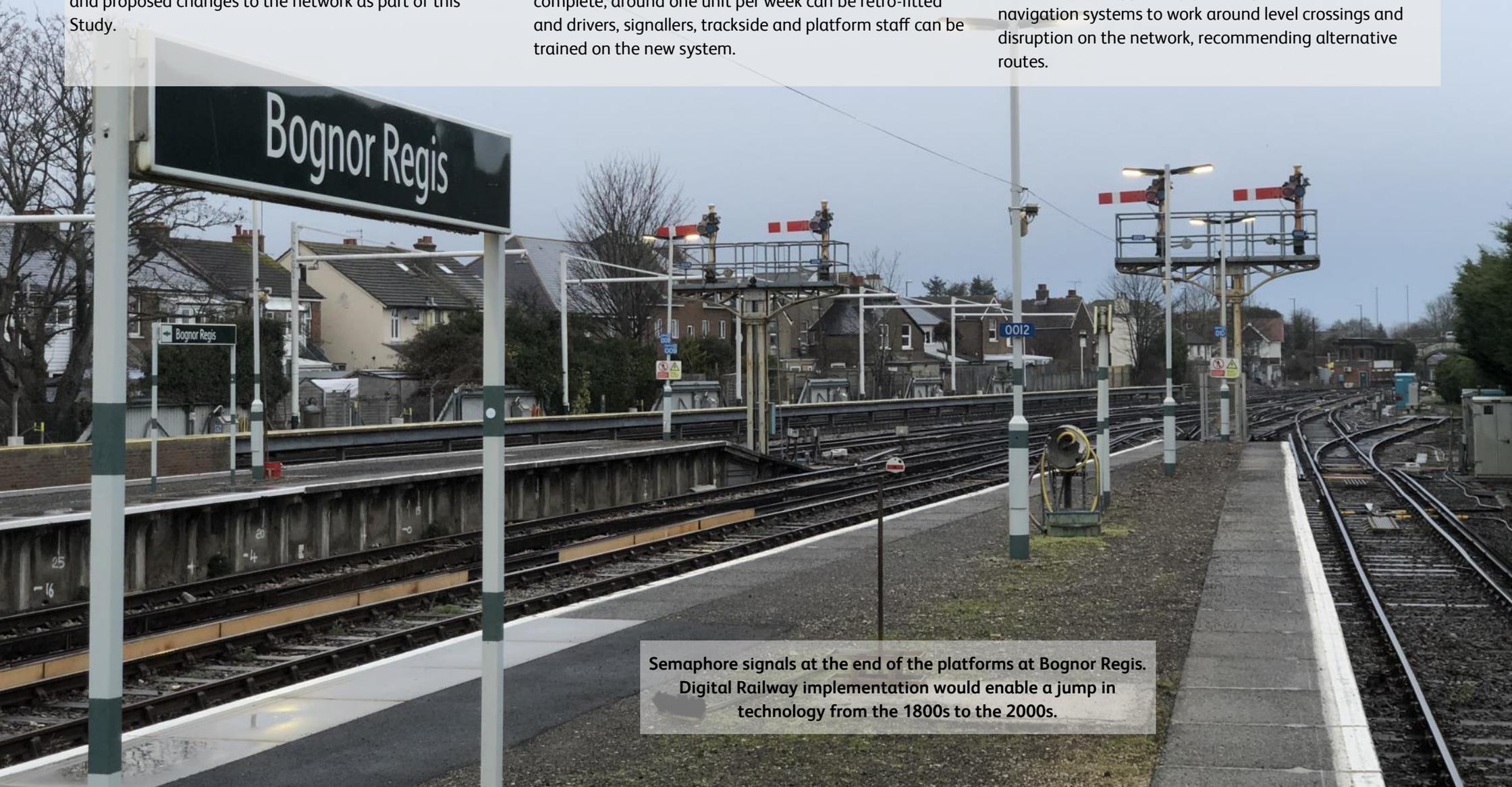
Renewed interlocking and train detection should be 'Digital Railway ready' enabling the new control system to communicate with it.

Replacing the Class 313s will enable a new or cascaded fleet to be introduced to the line, this should be fitted with in-cab signalling before delivery.

GTR are leading the Bombardier Electrostar 'first in class' retro-fitting of in-cab signalling equipment. Once this is complete, around one unit per week can be retro-fitted and drivers, signallers, trackside and platform staff can be trained on the new system.

A benefit of Digital Railway is that the cost of resignalling for the Worthing intervention, 90 mph line speed and two-minute headways can all be achieved without signals 'on the ground' which should reduce the cost of these projects and also enables them to be introduced in a phased manner, possibly starting with the Arundel signalling interlocking.

Digital Railway will improve the data from the railway network enabling journey planning and satellite navigation systems to work around level crossings and disruption on the network, recommending alternative routes.



Semaphore signals at the end of the platforms at Bognor Regis. Digital Railway implementation would enable a jump in technology from the 1800s to the 2000s.

### 3. Transport Background

#### Introduction

The geographic extent of the Study is shown in **Figure 3.1**. The West Coastway line serves the coastal communities between Brighton and Angmering, then inland through Chichester to Havant. Between Worthing and Brighton the line is sandwiched between the English Channel, coastal road and housing to the south and housing, the A27 road and the South Downs National Park to the north.

The Arun Valley Line passes through the conurbations of Crawley and Horsham before heading south-west through rural areas to Arundel where it joins the West Coastway. All of the stations south of Horsham serve small to medium sized communities.

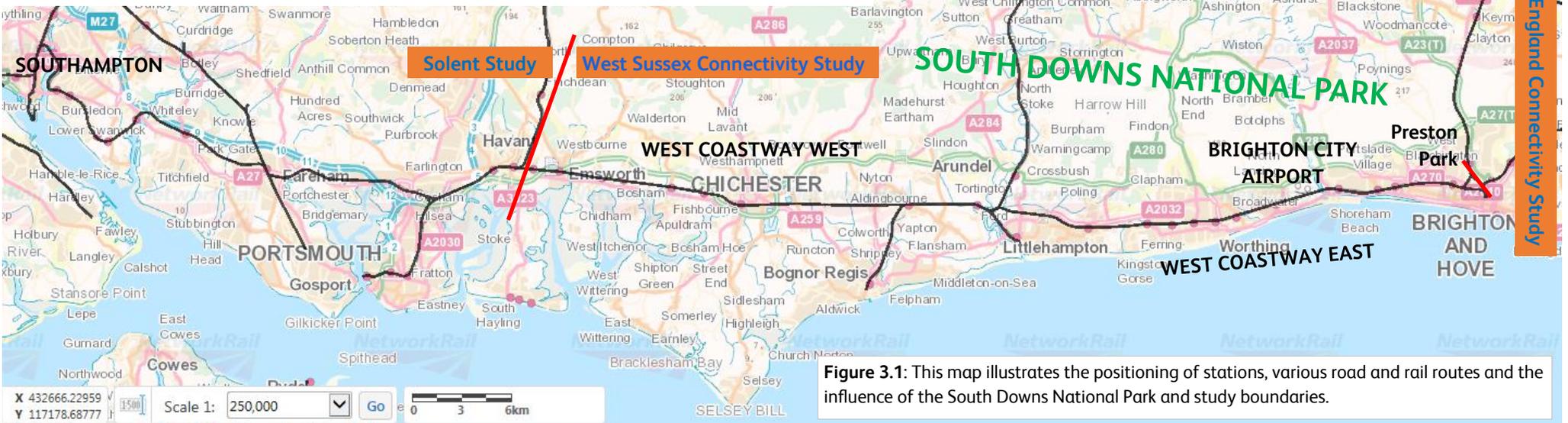
Brighton is the easternmost terminus for trains on the West Coastway, although some trains run to London via either the Arun Valley Line or via Preston Park and the Brighton Main Line. Other terminal stations in the Study area are Littlehampton and Bognor Regis.

Some West Coastway and Arun Valley Line services continue west on the West Coastway into Network Rail’s Wessex Route at Havant to Portsmouth and Southampton (and beyond).

There are no motorways (other than the very end of the M23) in the scope area. The A27 runs parallel to the West Coastway line and is mostly dual carriageway. The A259 is the coastal road connecting the coastal communities between Brighton and Bognor Regis.

The A24 aligns with the Dorking Line but continues south from Horsham whilst the A29 parallels the Arun Valley Line.

The boundary between studies are indicated on the map, as is the approximate line of the South Downs National Park. There are development restrictions in the National Park which means that some local authority housing growth has to be concentrated on areas outside the National Park.



**Figure 3.1:** This map illustrates the positioning of stations, various road and rail routes and the influence of the South Downs National Park and study boundaries.

## Rail

### Train Services

Over 600 trains run on the West Coastway and Arun Valley Lines every weekday, playing an essential role in the region's economy, getting people to where they want to go, whether that's school, work or a trip to the seaside.

Both the Arun Valley Line and West Coastway are double-track with few places for trains to overtake each other, which means that the mix of fast, slow and semi-fast services make it challenging to timetable.

Both routes are electrified with 750V DC conductor (or third) rail and the vast majority of trains are electrically powered. Only engineering trains, freight and the Great Western Railway (GWR) trains are powered by diesel.

Trains vary in length from 3-car on coastal services to 12-car on Thameslink and peak London services.

Passenger trains are mostly operated by Southern and Thameslink, additionally, there are some GWR services.

There is a weekly aggregates freight train from the Mendips to Chichester via Havant.

The current off-peak hour passenger services are:

#### Arun Valley

- 2 x London Thameslink - Redhill- Horsham (slow)
- 2 x London Victoria - Chichester (fast), alternately to Southampton or Portsmouth\*
- 2 x London Victoria - Bognor Regis\* (stopping from Horsham)

#### West Coastway

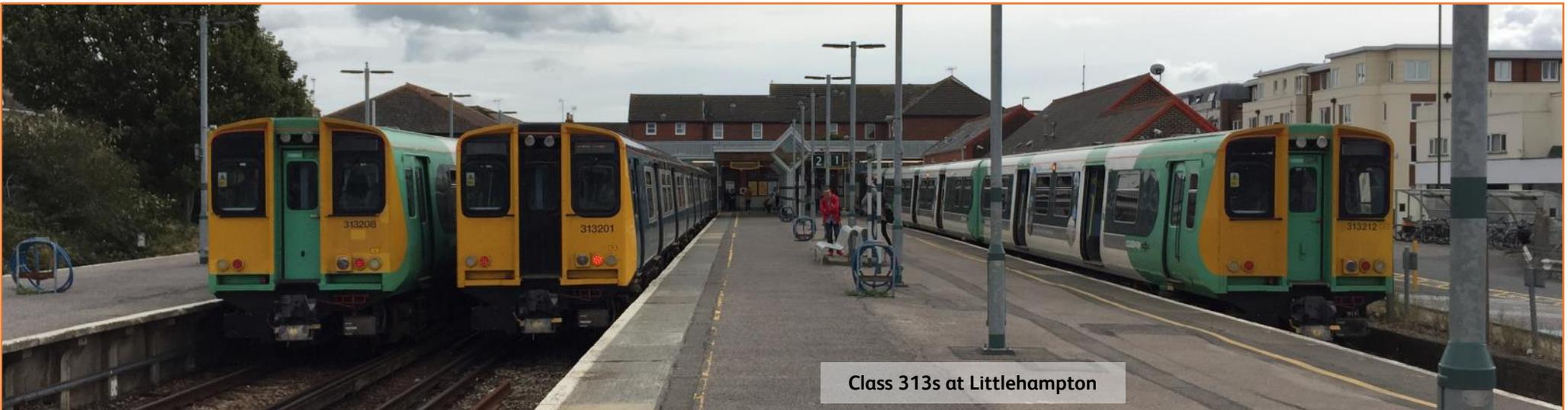
- 2 x London Victoria - Hove - Littlehampton (semi-fast)
- 2 x Brighton - Worthing-Chichester-alternately to Southampton or Portsmouth (semi-fast)
- 2 x Brighton - West Worthing (slow)
- 2 x Brighton - Hove (Hove Shuttle)
- 1 x Littlehampton - Chichester-Portsmouth (slow)
- 1 x Littlehampton - Bognor Regis (slow)
- 1 x Barnham - Bognor Regis (Bognor Shuttle)

\*these services are combined between London Victoria and Horsham.

Some passenger services are infrequent, such as the GWR services to/from Brighton which operates twice a day, the peak-only Thameslink services from Littlehampton and Southern services from Brighton to Littlehampton.

Typical hours of operation are 05:00 until 01:00 hours. Direct trains to London finish earlier on the Arun Valley Line, 23:11 from Horsham. The last train is the 23:27 Horsham to Gatwick Airport, where it is possible to catch a train to London.

Arun Valley Line services to London Victoria combine at Horsham. A 4-/8-car train calls all stations from Bognor Regis to Horsham whilst a 4-car train from Portsmouth or Southampton follows later and catches up with it at Horsham where the trains join to form an 8-/12-car train to London. This enables two different markets to be catered for and makes best use of train paths on the busy Brighton Main Line into London. In the reverse direction, the trains split at Horsham with the front portion running fast to Barnham, the rear portion following calling at all stations to Bognor Regis.



Class 313s at Littlehampton

**TfSE Prioritisation**

The TfSE Draft Transport Strategy for the South East (published October 2019), identifies the Arun Valley Line and the Brighton Main Line as radial routes to London with crowding, reliability and resilience issues.

The Strategy highlights the West Coastway as a Coastal Corridor, along with the parallel M27/A27/A259 roads, with ‘multiple issues and challenges’.

Priorities for rail investment are Brighton Main Line upgrades in the shorter-term and multi-modal interchanges.

The Strategy also considers Bus Rapid Transit and Light Rail Transit schemes, where appropriate for the urban areas they serve, as high priority and generally medium-to long-term.

Figures 3.2 and 3.3 show TfSE’s radial and orbital and coastal corridor challenges and opportunities maps. These highlight the road and rail issues they are seeking to resolve.

This West Sussex Connectivity Study will be used as evidence in the development of the Coastal Corridor Study.

**Travel Demand**

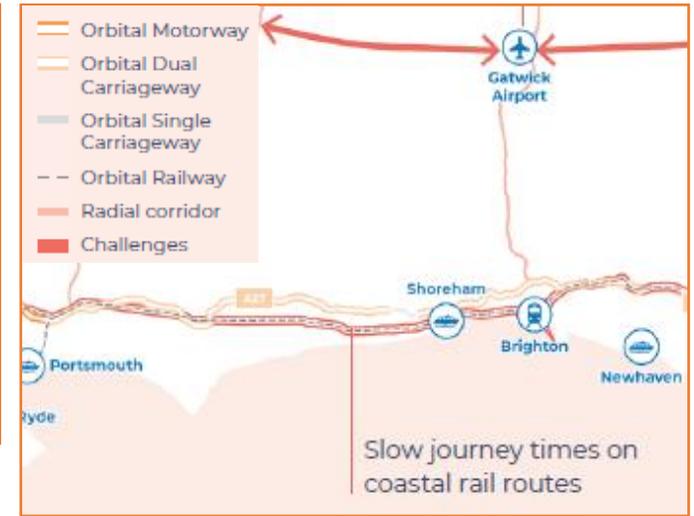
There are 35.1million journeys taken each year starting or ending at stations in the WSC Study area, which serves a population of over 1.1million.

Figure 3.4 identifies that of these, 7.9m (23 %) journeys are made entirely within the area, 2.1m (6 %) journeys to/from the Solent area, 15.7m (45 %) journeys to/from Greater London, and a further 9.4m (27 %) journeys to/from other destinations. Most journeys are medium to long distance; only 4.1m (12 %) of all journeys are below 10km.

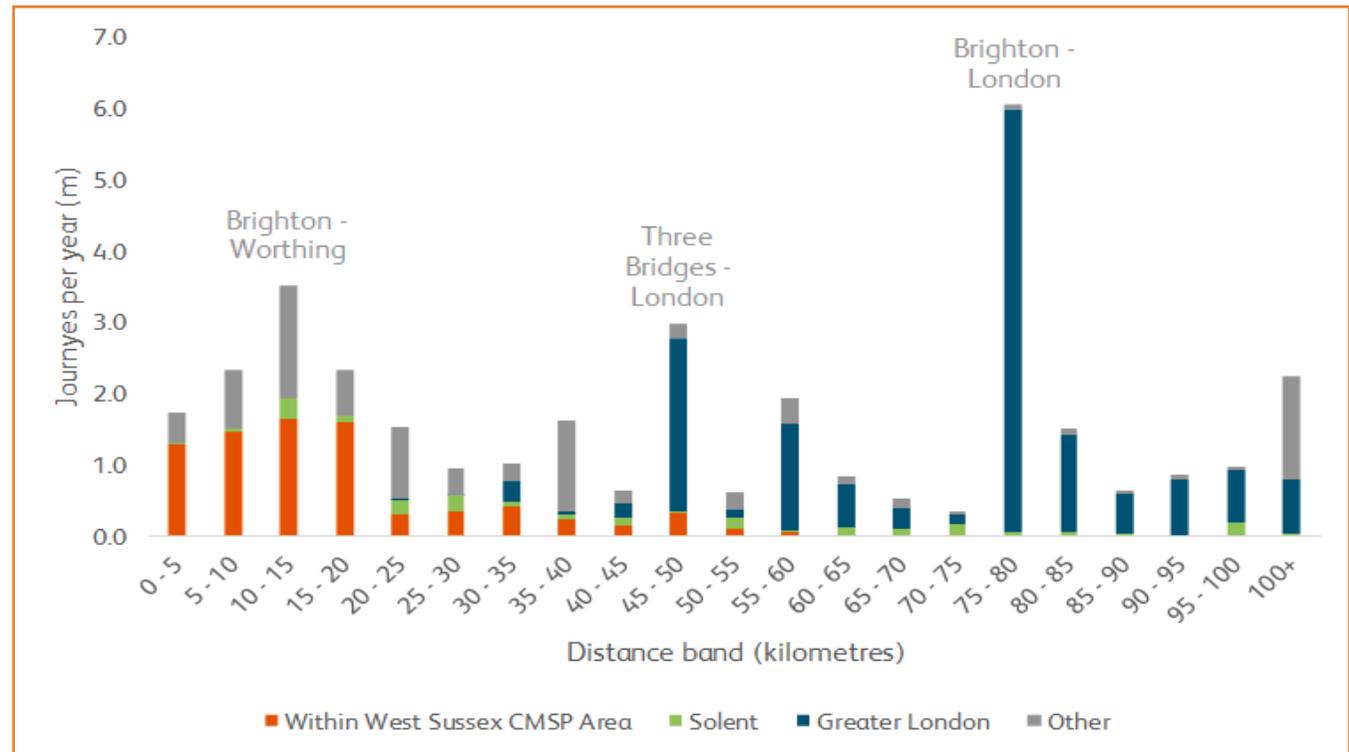
Table 3.1 lists the top 10 flows within the Study area and to the Solent area. All flows include either Brighton or Chichester.



**Figure 3.2:** TfSE’s radial journeys challenges and opportunities (TfSE, 2019)



**Figure 3.3:** TfSE’s orbital and coastal journeys challenges and opportunities (TfSE, 2019)



**Figure 3.4:** Rail journeys starting or ending at stations in the West Sussex Study area. Network Rail 2018-19 data.

Flow	Journeys per year
Brighton - Worthing	545,000
Brighton - Shoreham by Sea	330,000
Crawley - Horsham	257,000
Brighton - Hove	249,000
Chichester - Barnham	239,000
Brighton - Lancing	235,000
Chichester - Portslade	212,000
Brighton - West Worthing	199,000
Chichester - Littlehampton	174,000
Barnham - Bognor Regis	166,000

Table 3.1: Top 10 rail passenger flows in the Study area.

**Travel Beyond the West Sussex Connectivity Study to Western Destinations**

Trains crossing the western boundary of the West Sussex Connectivity Study mostly terminate at Portsmouth and Southampton. There are two trains per day connecting Brighton with Bristol and destinations beyond.

Otherwise, cross-regional train service options are limited and require a change of trains at Havant or Southampton Central, or travelling northbound and changing at Gatwick Airport for the North Downs Line to Guildford and Reading, or crossing central London.

Figure 3.5 shows how many journeys per year are made between the Study area.

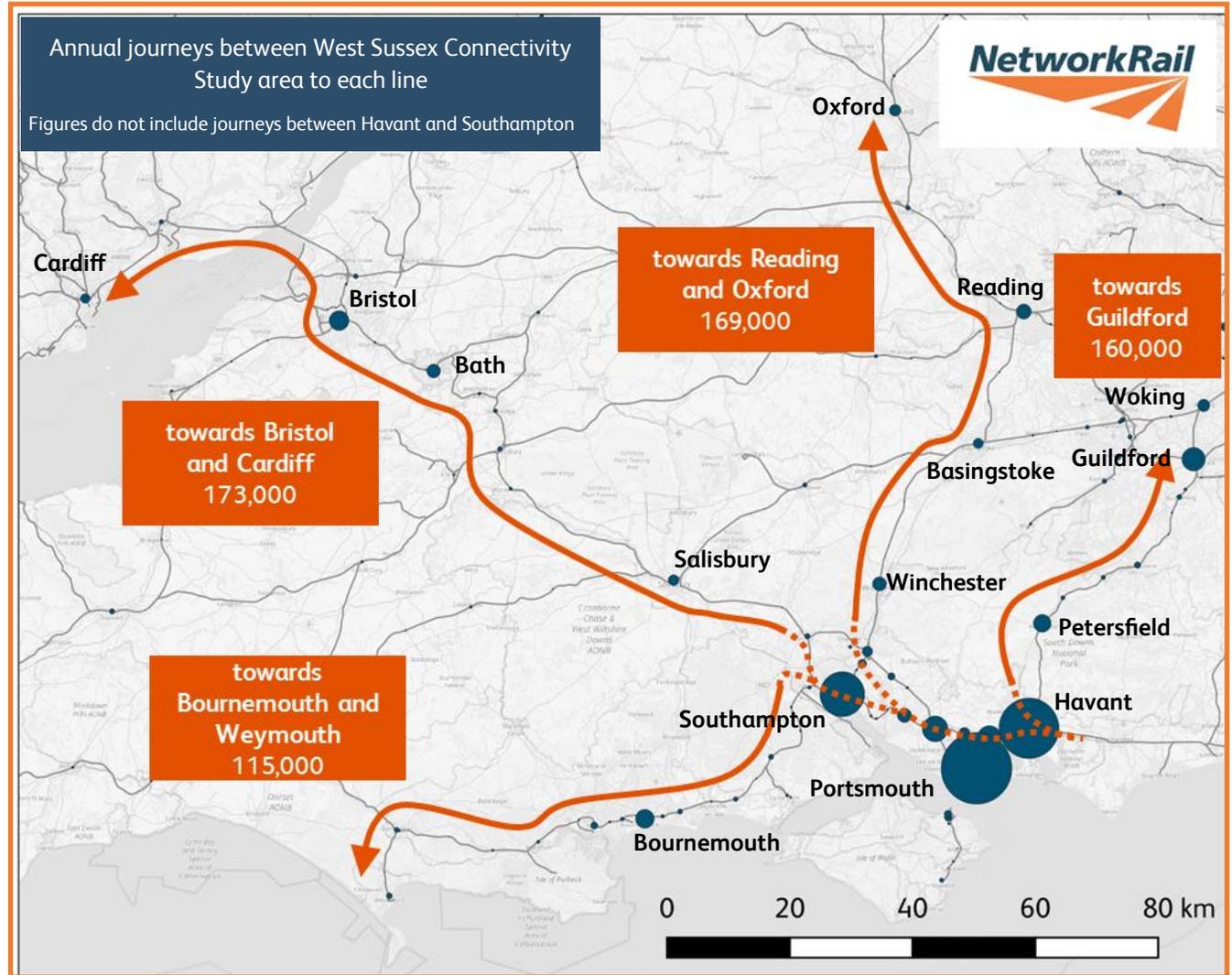


Figure 3.5 Rail journeys per year between West Sussex Connectivity Study stations and stations beyond Havant (by any route). Network Rail 2018-19 data. The circles show journey destinations, the larger the circle, the more journeys.

The line with the highest number of journeys is towards Salisbury, Bristol and Cardiff with 173,000 journeys per year, followed by the route north from Southampton Airport Parkway, Basingstoke, Reading and Oxford with 169,000 journeys per year.

The main drivers for this are likely to be lower fares via Salisbury, compared with travelling via London, not travelling via London and direct services or fewer interchanges.

## Fares

Rail fares for travel within the Study area are broadly consistent with the fare per mile declining with distance. There are no significant anomalies or operator-specific fares, at the time of publication, that have been identified as a significant barrier to rail travel in this market.

It is, however, accepted that many passengers would like a part-time workers season ticket. A national review of fares is being undertaken by the Rail Delivery Group.

For journeys above approximately five miles, rail season ticket fares are cheaper than car travel when taking into account Her Majesty's Revenue and Customs (HMRC) Car Mileage rate at 45p/mile; which is intended to represent the true cost of car ownership. When including the cost of parking in urban centres such as Brighton and Chichester, rail can be significantly cheaper than car travel.

The challenge of the perceived vs. actual cost of car ownership is not in the scope of this Study but **Table 3.2** shows a selection of journeys and compares the various modes. The rail and bus tickets are turn-up-and-go Anytime Day Returns and Off-peak Return tickets for the shopping trip rail fares. The car parking is based on large car parks close to the city centre (for road) or station car parks (for rail) except for Chichester where the nearby Avenue De Chartres car park is used instead.

Rail season ticket fares are slightly more expensive than bus travel for journeys less than five miles in Brighton and Hove; single and return tickets are comparably priced or cheaper.



**Table 3.2:** Example cost comparisons between rail, bus and car

Mode	Worthing to Brighton		Shoreham-by-Sea to Chichester		Chichester to Portsmouth & Southsea	
	Departure time Return at	Cost (journey) Cost (parking) <u>Total cost</u>	Departure time Return at	Cost (journey) Cost (parking) <u>Total cost</u>	Departure time Return at	Cost (journey) Cost (parking) <u>Total cost</u>
<b>All day commute - arrive by 08:55 and depart after 17:05</b>						
Rail	08:25 17:28	£12.40 £5.95 <b>£18.35</b>	08:14 18:04	£16.80 £4.75 <b>£21.55</b>	08:12 17:38	£9.60 £5.60 <b>£15.20</b>
Bus	07:45 18:00	<b>£8.20</b>	06:10 (arrives at 09:08) 19:48	<b>£8.20</b>	07:41 18:29	<b>£8.20</b>
Car	07:15 17:52	£10.35 £9.00 <b>£19.35</b>	07:40 18:15	£23.85 £5.60 <b>£29.45</b>	08:25 17:40	£15.75 £8.60 <b>£24.35</b>
<b>Shopping trip - arrive by 12:00 and depart after 15:00</b>						
Rail	11:26 15:49	£6.70 £5.95 <b>£12.65</b>	11:16 16:07	£12.50 £4.75 <b>£17.25</b>	11:13 15:40	£9.10 £3.20 <b>£12.30</b>
Bus	11:05 16:00	<b>£8.20</b>	09:11 17:44	<b>£8.20</b>	10:47 16:29	<b>£8.20</b>
Car	11:05 16:00	£10.80 £6.00 <b>£16.80</b>	10:50 16:10	£22.50 £2.40 <b>£24.90</b>	11:30 15:35	£15.30 £5.60 <b>£20.90</b>

Sources: Rail journeys and fares - nationalrail.co.uk, bus journeys and fares - stagecoachbus.com, road journeys - Google Maps and car parking information - Parkopedia. Rail fares are standard class Anytime Day Return or Off-peak Return, bus fares are day return tickets and car park tickets do not include the discounts applicable to weekly, monthly or annual season tickets. Data based on travelling on Wednesday 5 February 2020.

### Roads

The TfSE Transport Strategy has examined road network congestion, illustrated in **Figure 3.6**. This congestion will be exacerbated by the 20-30% forecast growth in traffic, shown in **Figure 3.7**. The Chichester area could see over 30% growth by 2050.

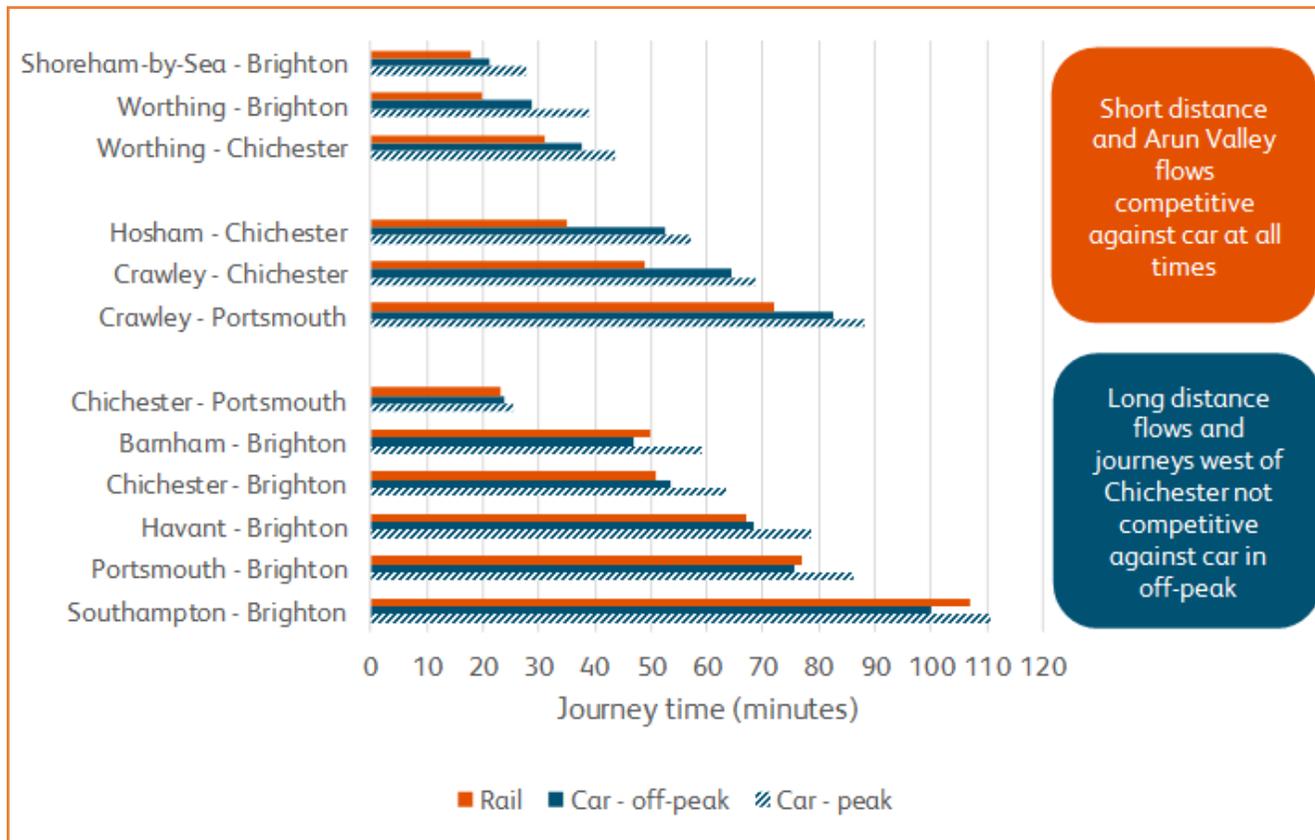
TfSE are using a road vehicle forecast where mile growth is between 17% and 51% by 2050.

Highways England, West Sussex County Council and Brighton and Hove City Council manage the roads in this area.

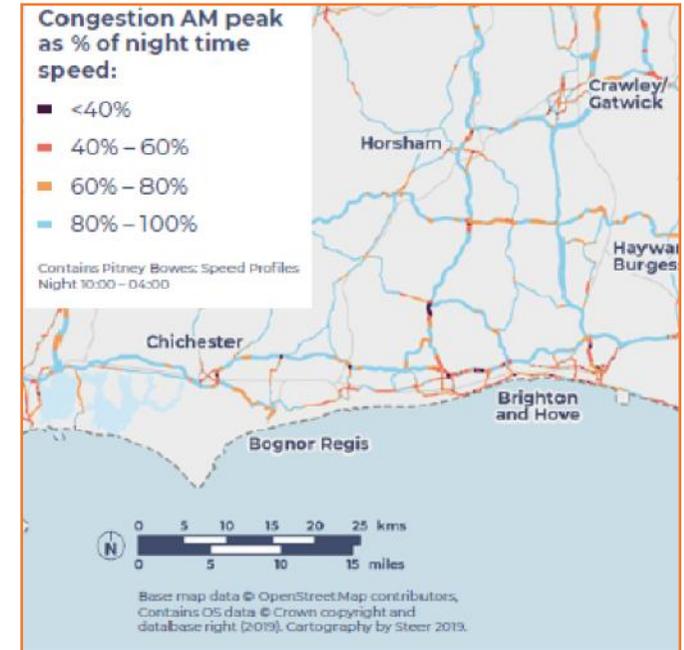
### Rail vs. Road Journey Times

**Figure 3.8** highlights that rail journeys across the Study area are faster than road journeys (on a point-to-point basis) during peak hours for all flows. This is partly due to heavy road congestion, particularly on the A27 road that parallels the West Coastway line, and that journeys on the Arun Valley line take a more direct route than the A24 road.

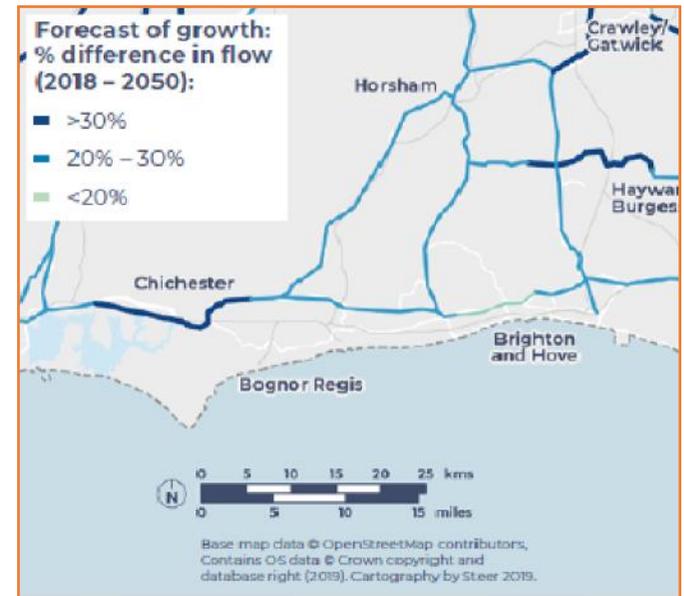
During off-peak times when roads are less congested, rail remains faster than road for shorter distance journeys. For example, from Worthing to Brighton and Horsham to Chichester.



**Figure 3.8:** Comparison of selected peak and off-peak car journey times with train journey times. (Source: Google Maps API, average weekday, peak times departing Wednesday 07:30)



**Figure 3.6:** TfSE Transport Strategy map of AM Peak traffic congestion (TfSE, 2019)



**Figure 3.7:** TfSE Transport Strategy map of forecast of growth in traffic (TfSE, 2019)

However, longer distance journeys on the West Coastway are comparable or slower than driving, Portsmouth to Brighton for example is quicker by car off-peak.

### Level Crossings

There are 113 level crossings in the Study area, these range from footpath and user worked crossings on private land to major road crossings with junctions.

The main types of road level crossing are automatic half-barrier (AHB), full-barrier CCTV or locally monitored level crossings. As AHB level crossings are upgraded, replacement designs may lead to increased barrier down times.

Level crossings affect the traffic flow in the local area, at West Worthing, for example, there is a traffic light junction at the level crossing. The traffic lights go to red before the level crossing sequence begins.

### Level Crossings Blocked by Long Trains

One of the concerns about level crossings in the Study area are the stations where trains are longer than the platform the train has stopped at, with the rear of the train sitting on the level crossing.

They are Lancing, Goring-by-Sea, Angmering, Littlehaven and West Worthing. To counteract this, the platforms can be lengthened, except at West Worthing where the platforms cannot be extended beyond the current 8-car length due to junctions at the opposite end of the platforms to the level crossing.

### Depots & Stabling

When they are not in use, trains have to be stored somewhere, generally they return to a depot or stabling sidings overnight for cleaning and replenishing for the following day's service.

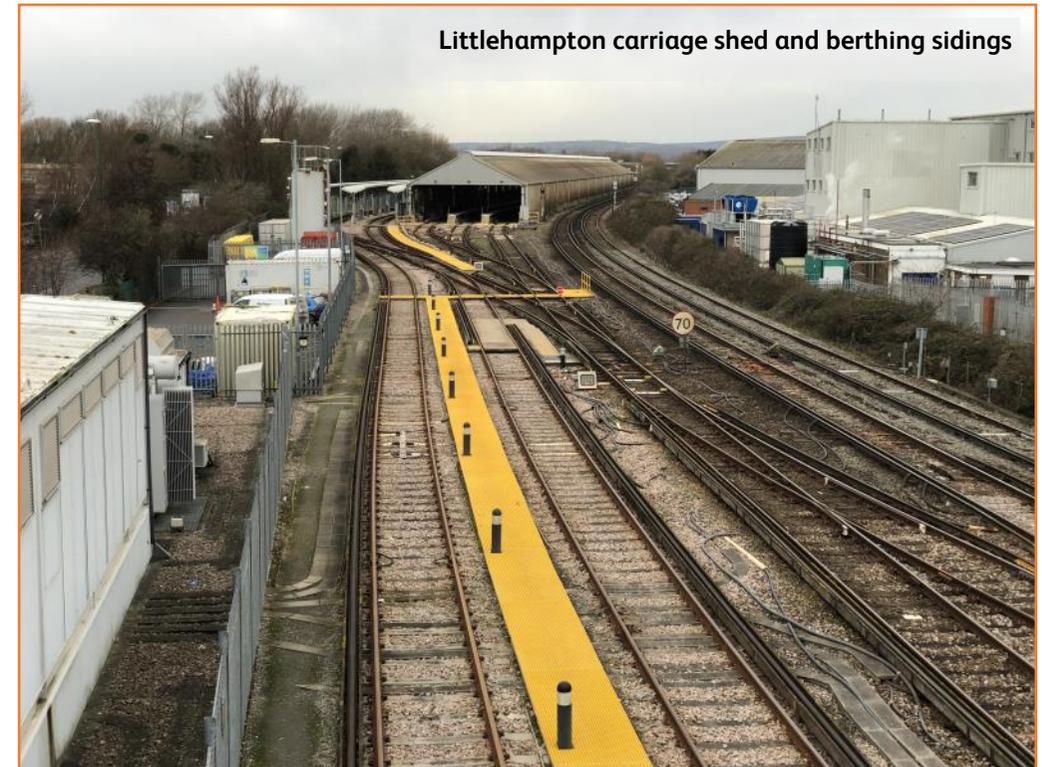
Larger depots such as Brighton Lovers Walk and Selhurst (in London) carry out maintenance and repairs.

Replacing 3-car units with longer units or operating additional trains may result in the requirement for more sidings or extension of existing facilities.

### Traction Power Supply

In Control Period 5 (2014-19), a power supply upgrade programme was completed between Brighton and Littlehampton.

This Study recommends that to meet future growth, an increase in service frequency and changes to rolling stock will be required. Therefore, it is recommended that a power supply assessment will be required for any options taken forward. No power supply enhancements have been costed for the Train Service Specifications detailed on [Pages 42-51](#).



## Bus Services

The main providers of bus services across the Study area are:

- Brighton and Hove Buses between Brighton and Shoreham
- Stagecoach across the coast area and serving Mid Sussex towns like Henfield
- Metrobus who primarily provide services in the Three Bridges/Crawley to Horsham area, as well as a service between Horsham and Worthing.

The City of Brighton and Hove has the highest number of bus passenger journeys per head of any English local authority outside of London, 171.7, in 2018/19. In comparison, West Sussex has 31.1. The South East area average is 38.2 (source: Annual Bus Statistics 2019, DfT).



A Coastliner bus crosses the level crossing.

### Brighton Area

There are several high frequency bus services serving Hove, Portslade, Southwick and Shoreham stations. There are bus routes that link Hove and Portslade stations but the journey does take significantly longer than the rail route as these services are not direct and serve residential and shopping locations along the route.

Hove and Portslade are served by night buses operated by the company from Brighton town centre, with an average frequency of two an hour between midnight and 05:00 hours.

### West Coastway

The 'Coastliner 700' bus route which runs up to every 10 minutes between Brighton and Littlehampton and Littlehampton and Portsmouth. While it mirrors the route of the West Coastway Line, it primarily serves the coastal communities along the route, some of which are a fair way from the railway. Partly because of this, the journey times are much longer than the train, with the 700's journey between Brighton and Littlehampton being two hours, in comparison to 44 minutes via rail.

The Coastliner also operates as a night bus on Thursday to Saturday nights, running once an hour between 23:30 and 03:30 hours.

There are several services within the Worthing and Chichester area (serving Bognor Regis, Durrington on Sea, Lancing, Littlehampton and Worthing), offering connectivity into the town from their outer suburbs and neighbouring settlements and the South Downs National Park.

### Arun Valley

The primary area of operation is between Three Bridges, Crawley and Horsham, although the overall operations extend south to Brighton and Worthing and north to Redhill and Sutton.

The key routes within the Study area include the 'Fastway' service, which operates 24 hours a day between Crawley and Gatwick Airport, operating twice an hour throughout the night. Throughout the day, this bus has a frequency of every 6-7 minutes. A section of this and other routes within Crawley are a 'guided busway', which helps the buses keep to their journey times when there is congestion on the roads.

The buses serve the Manor Royal Business Park, a major employment location, located between Gatwick Airport and Crawley. There are services linking the Business Park with Crawley, Ifield and Horsham stations and an hourly service between Horsham and Worthing.

Buses provide feeder services to Horsham, Pulborough and Billingshurst stations with an hourly service on Mondays to Fridays. There are buses from Horsham to Haywards Heath, connecting the Arun Valley to the Brighton Main Line, which take 45-60 minutes compared to 32-39 minutes by rail (with a change at Three Bridges).

There is also an hourly bus from Pulborough to the Mid-Sussex towns of Petworth and Midhurst.

### Taxis

There are more stations without taxi ranks than with them across the Study area. They vary from lay-bys to dedicated facilities and some stations, such as Barnham, have taxi offices located with the station building.

Stations with taxi ranks: Hove, Portslade, Shoreham-by-Sea, Lancing, Worthing, West Worthing, Littlehampton, Bognor Regis, Barnham, Chichester, Emsworth, Arundel, Pulborough, Horsham and Crawley.

Beyond this, there are ride-hailing and car-sharing services provided by, for example, Uber and Faxe (this is used by Gatwick Airport staff).

## Walking

Most stations are easily accessible on foot, indeed, Fishergate is within 30 minutes walk of three different stations on the same line.

As many stations do not have car parks, walking to the station is common on the West Coastway.

The South Downs National Park offers walkers and hikers views of the Downs through a network of managed paths, some of which are former rail routes. Much of the National Park is only accessible by walking or cycling.

## Cycling

Folding cycles are welcome on all Southern services (provided they are folded up), whereas there are restrictions on conventional bikes - they cannot be carried on services arriving in London or Brighton during the AM Peak or departing in the PM Peak.

However, there are no restrictions for journeys south of Horsham and west of Worthing to Littlehampton, Bognor Regis, Portsmouth and Southampton.

The amount of cycle parking varies between station, Aldrington has just eight spaces in the subway whilst Chichester has 180 and Brighton, 740 spaces.

Some stations have covered racks whilst others have simple stands for bikes to be chained to.

Free, secure bike storage is provided at Southern's Cycle Hubs at Brighton, Horsham, Hove and Portslade. Access at some locations is by using a keypad or The Key smartcard. There is limited cycle capacity on the trains, often one or two spaces.

National Cycle Routes 2 and 223 and the South Downs Way can be found in the Study area giving access for commuting, education, services and leisure.

## Car Parking

Similarly to cycle parking, car parking varies by location, from Faygate and Amberley with nine spaces to Horsham with 207.

13 stations have no car parking facilities, some of these stations are located in an urban area such as Littlehaven where most passengers walk to the station.

## Air

Gatwick Airport is accessible from the West Coastway via either the Arun Valley Line or the Brighton Main Line. It should be noted, that during the AM and PM Peaks, some services do not call at Gatwick Airport station.

The airport is open 24 hours a day with flights throughout the night, therefore there is passenger demand all day and night. There are 24 hour services to the airport from parts of the Brighton Main Line.

Southampton Airport is accessible from the West Coastway and Arun Valley by changing to a Southampton Airport Parkway service at Southampton Central.

Brighton City Airport, Shoreham, is a much smaller airport used for light aircraft, helicopters and executive jets, as well as flight training. It is located about a mile from Shoreham-by-Sea station.

## Sea

The Study area is served by sea into the Port of Shoreham, although this is used by freight rather than passenger traffic.

Foot passengers can use ferries from Newhaven to Dieppe in France, this is easily accessible with trains to Newhaven Town departing from Brighton on the East Coastway line.

Portsmouth offers a variety of destinations: France, Channel Islands and the Isle of Wight by ferry and also hovercraft to the latter. There are a limited number of cruises from the port too, it is mostly a calling point.

It may not be a passenger port, but Shoreham Trust Port provides work for around 1,700 people



Southampton has ferries to the Isle of Wight and Hythe as well as cruises and transatlantic ocean liners.

The air and sea ports are also important employers either directly or indirectly through customers and the supply chain.

## 4. Economic and Social Context

### Population and Employment Distribution

967,000 people live in the Study area, concentrated along the railway route (**Figure 4.1**). Key population centres are Brighton and Hove, Worthing, Littlehampton, Bognor Regis, Chichester, Crawley and Horsham. Key employment centres (**Figure 4.2**) include Brighton and Hove, Worthing, Chichester, Crawley including Gatwick Airport, and Horsham.

The area is well covered by the railway network. Of the 450,000 people in the area who travel to work, in the area, 48 % live within a 15 minute (1,200m) walk of a railway station, and a further 49 % live within a 15 minute drive of a station. Only 3 % of the area's population do not live within 15 minute drive of a station.

TfSE identified Brighton, Bognor Regis and Chichester as major economic hubs in its Draft Transport Strategy for the South East (2019). It defined priority industrial sectors in the Study area as:

- Financial & professional services: Brighton, Crawley, Gatwick Airport
- Advance Engineering & Manufacture: Crawley, Gatwick Airport
- Low Carbon Technologies, Creative Industries and Tourism: the whole of the South East.

The Strategy notes particularly high levels of housing development is planned along the south coast, whilst employment development will be more geographically concentrated than future housing development.

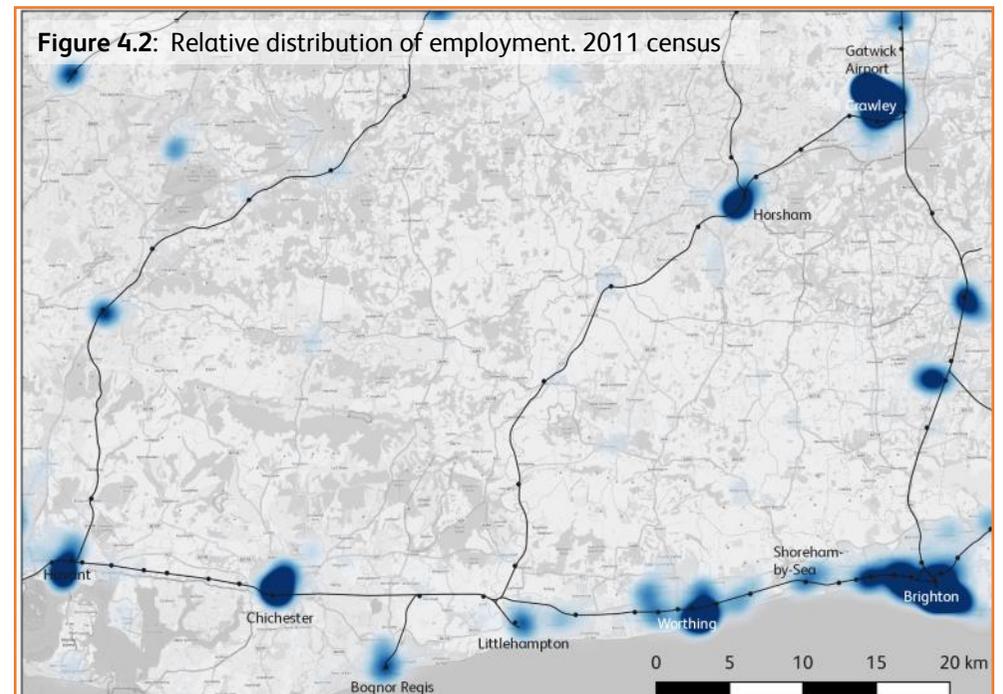
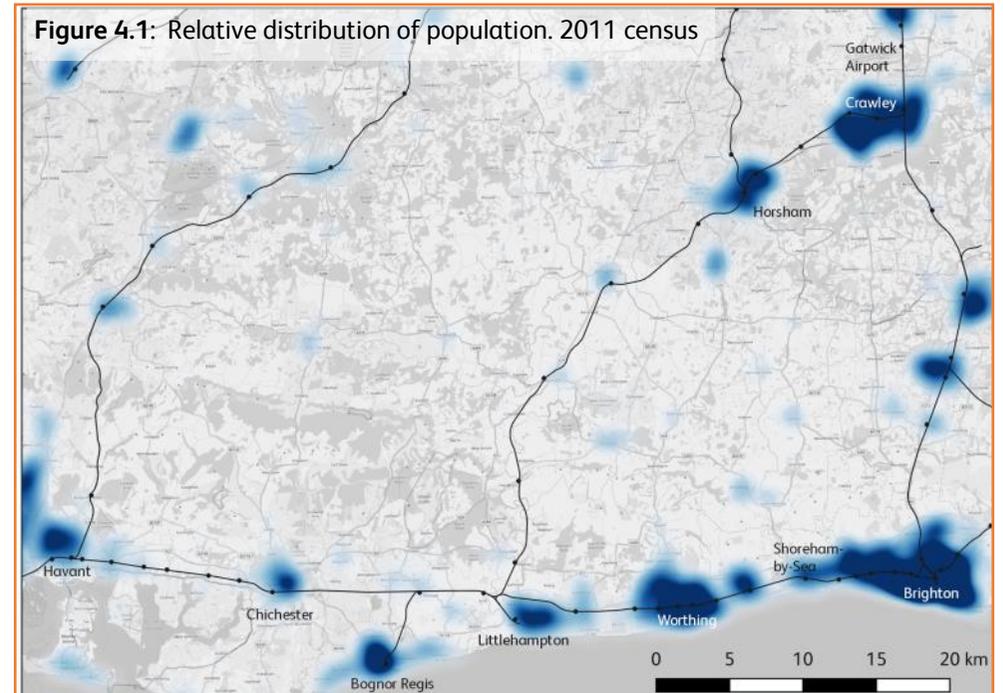
Future job growth will likely occur in the urban areas around Brighton and Hove, Southampton, Portsmouth and Gatwick Airport. This presents a significant transport challenge as many people will be living and working in different places, which means the future transport network may need to provide for longer distance commuter trips within the South East area.

### Social Characteristics and Challenges

TfSE describe the social geography of the South East as home to some of the most prosperous and productive areas of the country, but also contains significant areas of deprivation.

Some areas are economically productive and benefit from good connectivity to London, where there is a concentration of highly-paid jobs. In contrast, many coastal communities, which are less well connected to London and other key economic hubs, have significantly higher levels of deprivation than the England average.

TfSE found that there appears to be a relationship between transport connectivity and prosperity. All of the economic hubs in the South East area have some deprived areas, including those that are perceived to be relatively prosperous.



### Travel Trends in the Area

The mode share of commuters who live in the Study area is broadly comparable to the rest of the South East. Rail accounts for 8 % of all commute trips, while cars and motorbikes account for 64 % of trips (Figure 4.3).

The rail mode share into key employment centres (Figure 4.4) varies between 5 % for Shoreham-by-Sea, Worthing and Horsham to 11 % for Gatwick Airport, which is roughly in line with the region average of 8 %. With the exception of Gatwick Airport and Crawley, the proportion of workers walking or cycling is above the region average with 37 % of commuters travelling to Brighton by active modes.

Figure 4.5 shows the comparative mode share by distance in the West Sussex Study area. Rail has a high mode share for long distance journeys, above 40% on flows greater than 40km (e.g. Brighton to Chichester) and rising to 75 % for flows up to 80km (e.g. Worthing to London). However, rail has a very low mode share for local journeys below 10km where buses provide the primary form of public transport. This is still the case where a rail service is already available.

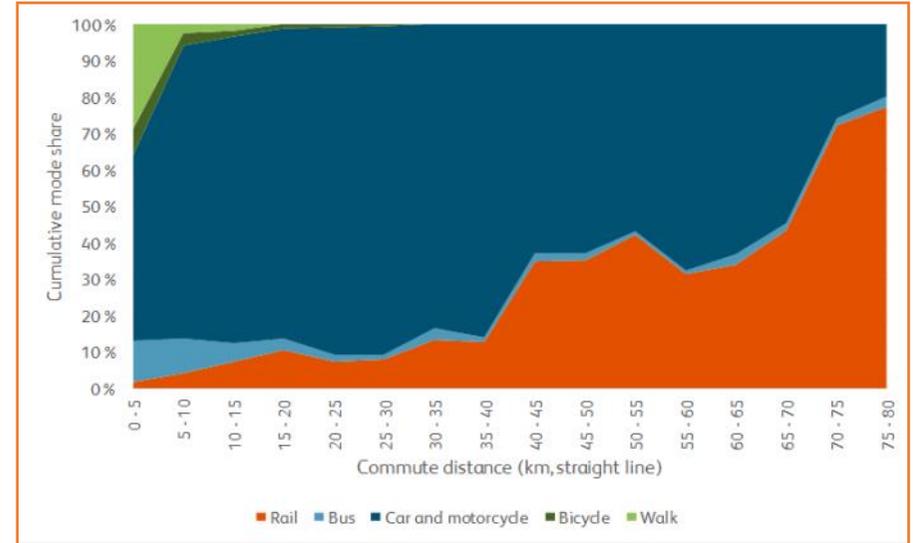


Figure 4.5 Comparative mode share by distance in the Study Area. 2011 census

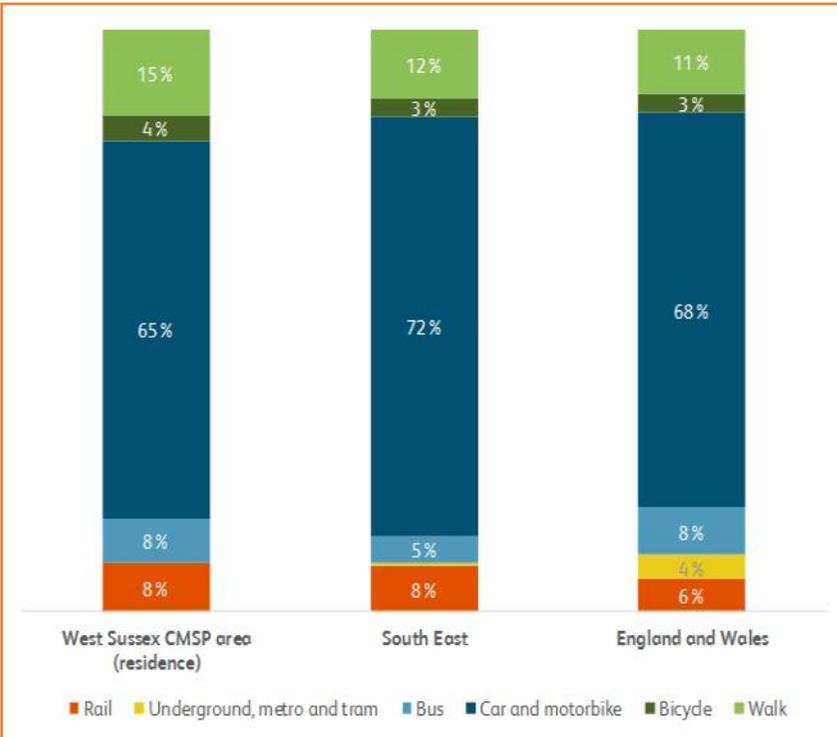


Figure 4.3: Mode share of commute trips starting in the Study area compared to the South East region. 2011 census.

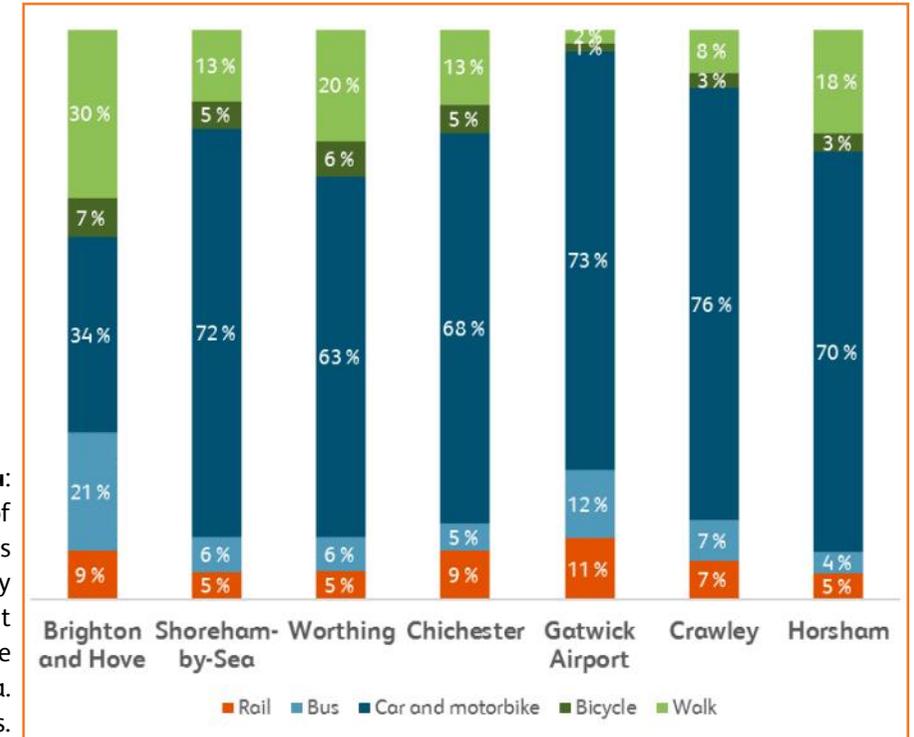
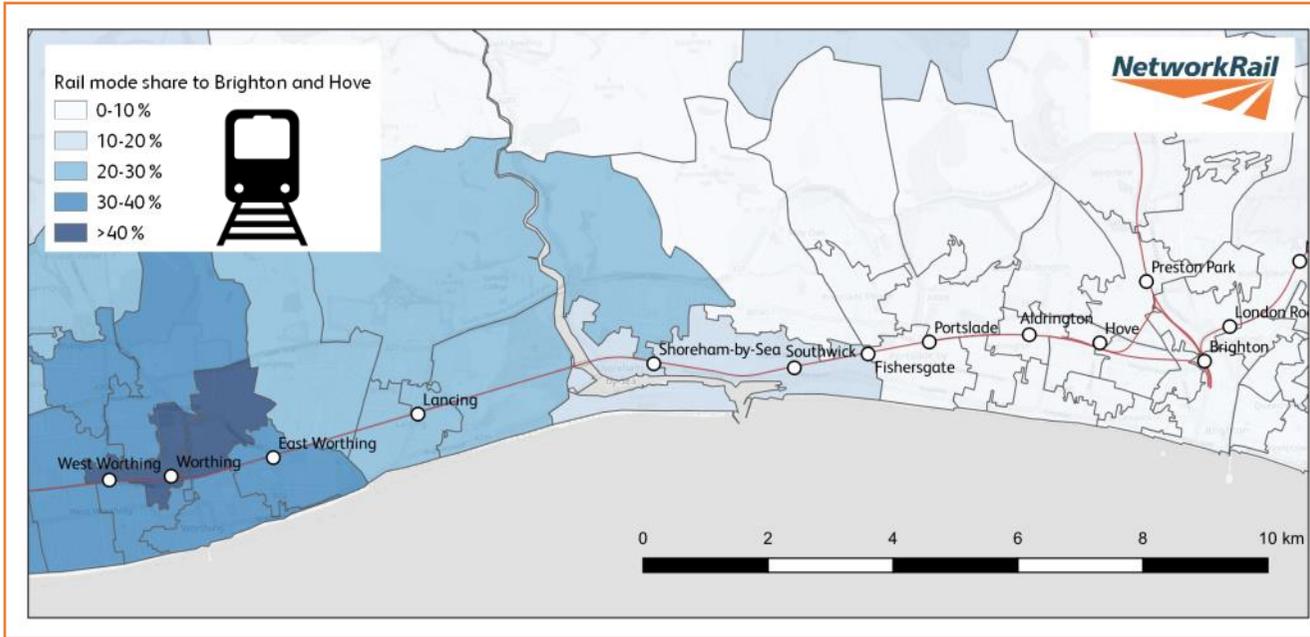


Figure 4.4: Mode share of commute trips ending in key employment centres in the Study area. 2011 census.



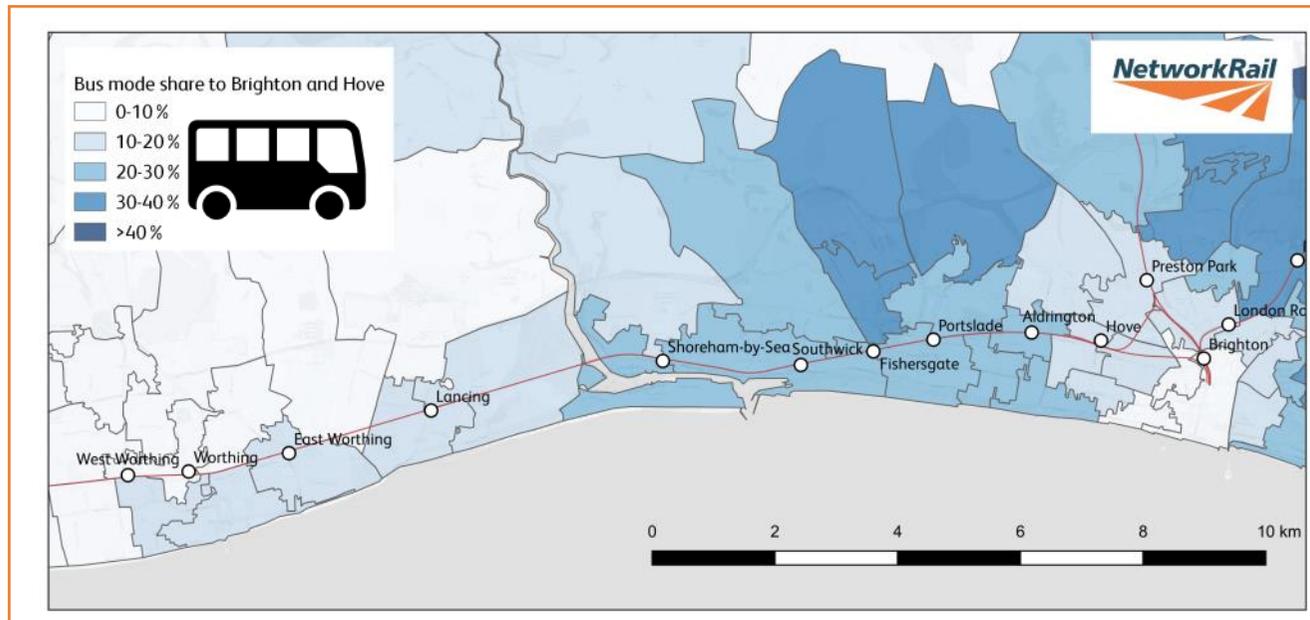
**Figure 4.6:** Rail mode share commuting into Brighton and Hove. Note: less than 10% mode share for stations between Brighton and Fishersgate. 2011 census.

Figure 4.6 shows that despite closely placed stations, fewer residents near Hove, Aldrington, Portslade and Fishersgate use rail for commuting into Brighton. Further west, rail’s mode share rises above 20% and above 40% in parts of central Worthing.

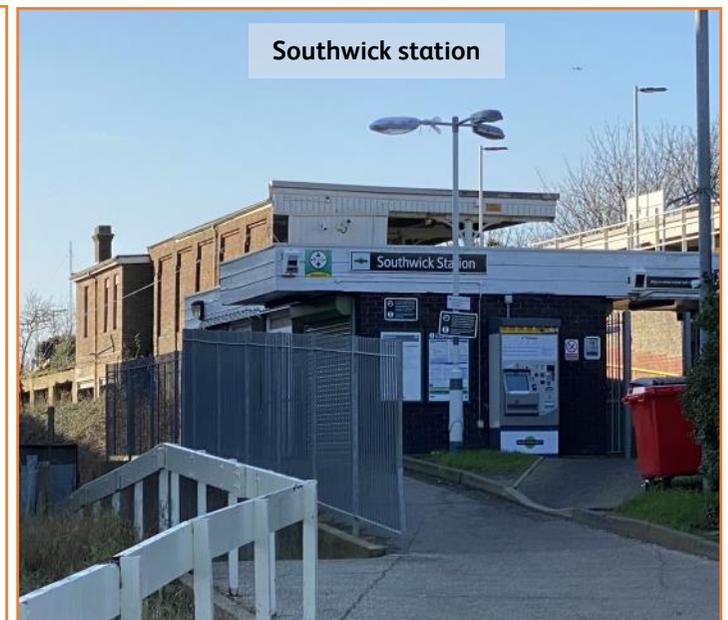
This is borne out in the top 10 rail passenger flows in Table 3.1, the population density hides the fact that rail still has a low market share. Brighton to Worthing has 550,000 rail journeys per year but is the highest passenger flow within the Study area.

Within this 10km area, bus has a much greater mode share (Figure 4.7), owing to higher frequencies and better residential and city centre coverage, which are factors that rail cannot match.

Across the Study area, rail fares are broadly the comparable or cheaper than bus fares, demonstrating that low use is a function of the service offering rather than pricing.



**Figure 4.7:** Bus mode share commuting into Brighton and Hove. Note: more than 20% mode share for stations between Aldrington and Shoreham. 2011 census.



### Forecast Rail Growth

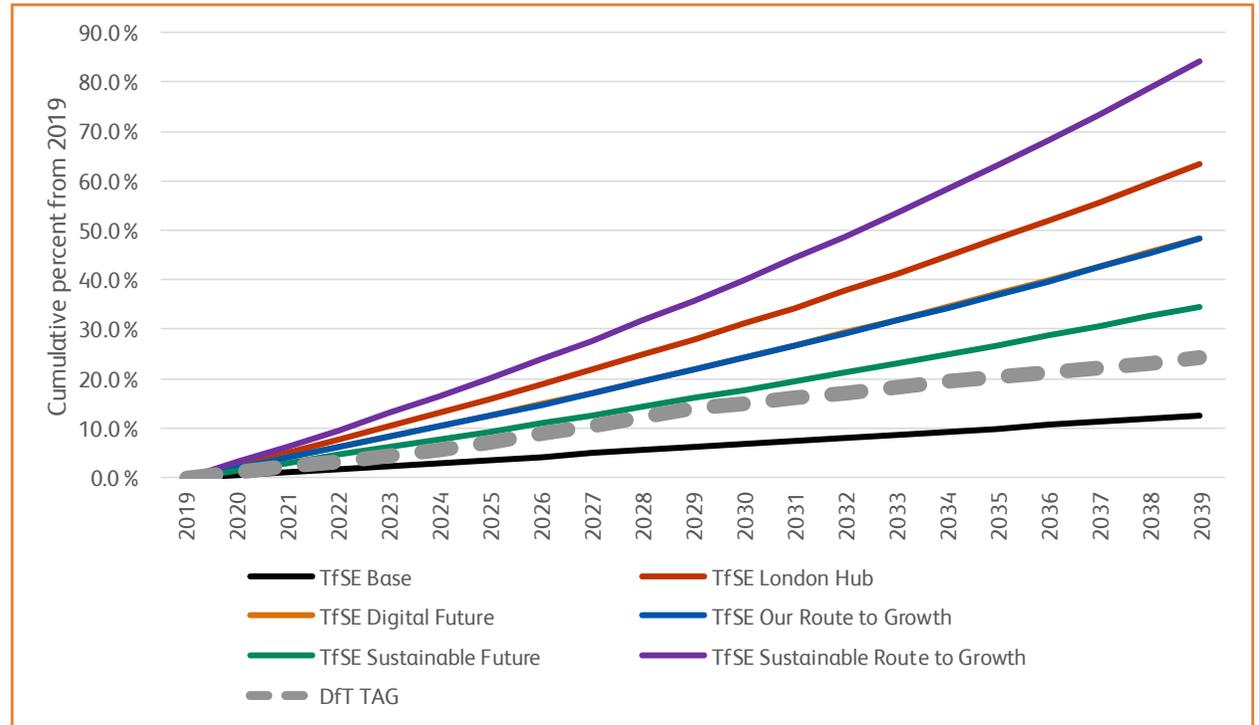
The long-term forecast for rail growth is influenced both by well-understood trends, but also unknown futures such as the impact of technology, attitudes to travel, and policy responses that favour or dissuade the use of different types of travel. TfSE has conducted a series of Scenario Forecasts to represent several unknown futures to 2050.

**Figure 4.8** presents TfSE’s five scenarios and a planning baseline for commuting travel within the TfSE area. Alongside this is the conventional DfT Transport Analysis Guidance (TAG) forecast that represents key economic drivers for peak hour commuting into Brighton.

Stakeholder feedback during working groups strongly indicated a preference for planning scenarios that represented policy interventions rather than the DfT TAG forecast. This Study takes into consideration the following scenarios:

- DfT TAG (+24 % to 2039)
- TfSE Sustainable Future (+35 % to 2039)
- TfSE Sustainable Route to Growth (+84 % to 2039).

The choice of growth rate remains a decision for funders.



**Figure 4.8:** Forecast 20-year rail commuting growth across five TfSE scenarios, a TfSE planning baseline, and a DfT TAG forecast. The appraisals used in this Study are based on Sustainable Future (SF), DfT TAG and Sustainable Route to Growth (SRtG).



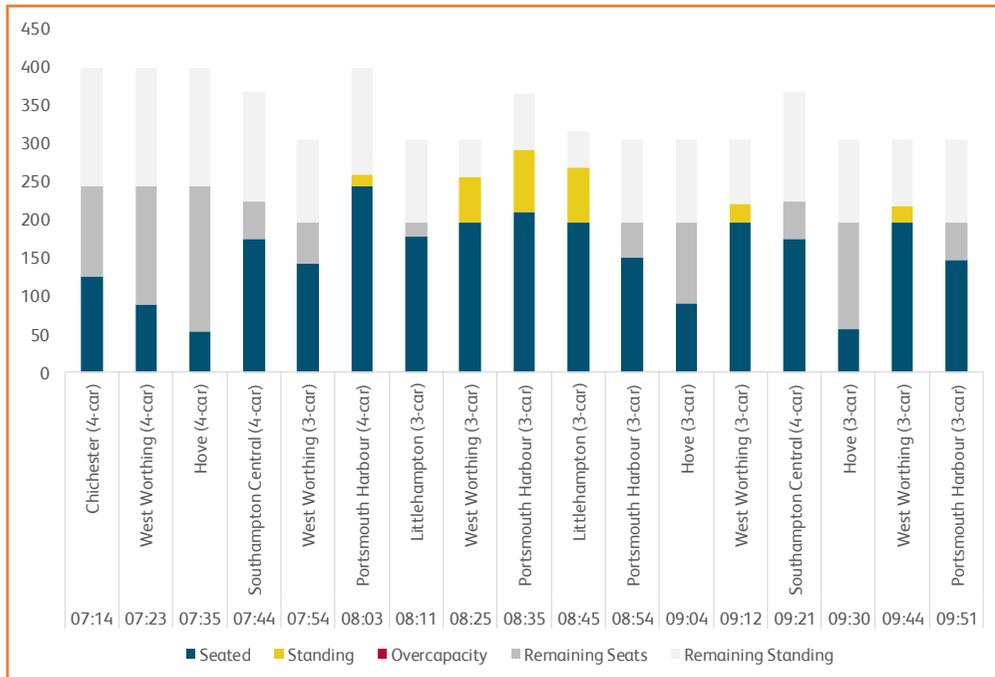
Class 313 and Class 377 units pass at Southwick

### Current On-train Capacity

Passenger rail services into Brighton experience crowding and since 2017 Brighton has been included in the DFT Passengers in Excess of Capacity (PiXC) reports for per city.

**Figure 4.9** demonstrates the loadings of trains arriving at Brighton station between 07:00 and 09:59 hours. The busiest train is the 08:35 arrival, the Great Western service from Portsmouth Harbour. This train is currently changing rolling stock from a 3-car Class 158 to a 3-car Class 166 unit, this provides an additional 16 first class and 26 standard class seats.

**Figure 4.10** indicates the evening peak loadings of trains departing Brighton between 16:00 and 18:59. There are two trains which are over-capacity, the 17:02 Great Western service and the 18:02 to Portsmouth & Southsea. These are both 3-car trains, the former will have improved capacity when the Class 166s take over and the latter is a Class 313 unit.

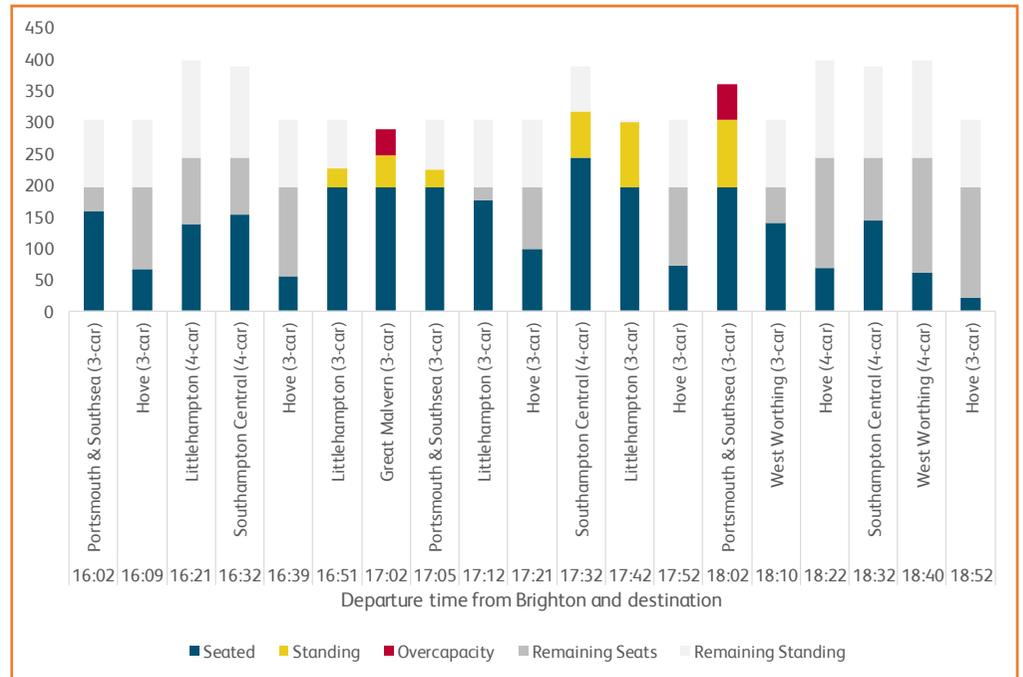


**Figure 4.9:** Average mid-week train loadings into Brighton (Spring 2019 observed) on trains arriving between 07:00 and 09:59. Brighton is the maximum load point on all trains.

Crowding on this line can be attributed to:

- Operating 3-car trains, which form most of the crowded trains
- Uneven loadings caused by long distance trains serving both local and interregional calls, such as the 18:02 Brighton to Portsmouth & Southsea which calls at all stations to Chichester
- Low use of the ‘Hove Shuttle’ service between Brighton and Hove in the PM (which causes crowding on the following service). In the AM busiest hour these services are extended back to Littlehampton to provide additional capacity.

Most passengers do not regularly stand for more than 20 minutes and across all trains there is generally sufficient capacity to seat all passengers west of Shoreham-by-Sea. However some trains have been identified with passengers standing longer than 30 minutes due to a large number of calling points.



**Figure 4.10:** Average mid-week train loadings into Brighton (Spring 2019 observed) on trains departing between 16:00 and 18:59. Brighton is the maximum load point on all trains.

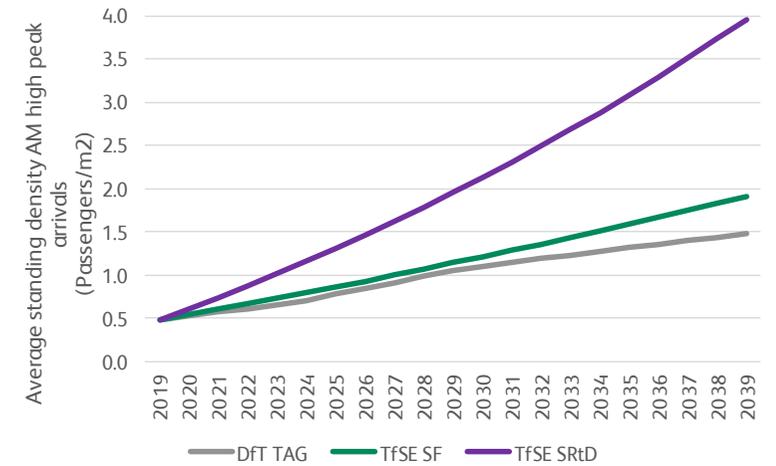
## Future On-train Capacity

Currently there are 0.5 passengers per square metre on average across all trains, by comparison London suburban peak loading is around two passengers per square metre. **Figure 4.11** shows that under the various growth scenario options, standing densities will continue to increase, with between 1.5 and 4.0 passengers standing per square metre in 2039.

**Table 4.1** shows how many additional rail vehicles would be required to meet different future standing densities in 2039.

Additional capacity can be provided by increasing the number of train services or by lengthening trains.

This Study recommends that the current Class 313 units are replaced with longer rolling stock. It is also recommended that the Class 377 4-car units will need to be lengthened by 2039 to support a high growth scenario.



**Figure 4.11:** Average mid-week train loadings into Brighton (Spring 2019 observed) across all trains arriving between 08:00 and 08:59. Brighton is the maximum load point on all trains.

Average standing density in 2039 AM Peak	2/m <sup>2</sup>	1/m <sup>2</sup>	0.5/m <sup>2</sup> (current)	0/m <sup>2</sup> (no standing on average)
DFT TAG	0	2	5	8
TfSE SF	0	4	7	10
TfSE SRtG	7	13	16	21

**Table 4.1:** Capacity gap in number of additional vehicles required to meet various standing density metrics across all trains in 2039.



A Class 313 unit at Shoreham-by-Sea in the evening peak with passengers standing in the doorways

## 5. Strategic Questions and Answers

To structure the West Sussex Connectivity Study, stakeholders identified their wants and needs of the railway in West Sussex. These were turned into Strategic Questions which were then grouped by Strategic Theme.

This Chapter looks briefly at the Strategic Questions, answers them and adds some context, more detailed breakdowns of the answers and context can be found in the [Technical Appendix](#).

The questions are grouped by Strategic Theme:

1. [Planning for Sustainable Growth](#)
2. [Wider Transport Connectivity](#)
3. [Rebalancing the Economy](#).

Each question is shown in a standard way:

 The actual strategic question



Stakeholder feedback or context

**Challenges** - identified issues that could affect the answer.

**Answer** - bullet point list of what can (✓) or can't (✗) be done or further work required (!).

**Context** - Further information behind the reasoning of the answer.

1. Can the rail service accommodate current and projected demand at peak times whilst improving network reliability?



### 1A. Is the railway accommodating demand at peak times?

The initial request for a more optimistic growth forecast came from Brighton and Hove City Council, further stakeholders asked if we were considering additional factors in our forecasts, i.e.: greater rail use through government policies as a result of the decarbonisation agenda. (TfSE, Brighton and Hove City Council, West Sussex County Council and others)

#### Challenges

- The West Coastway trains are operated by a mix of 3-car Class 313 and 4-car Class 377 units.

#### Answer

- ✓ The railway is accommodating demand at peak time on the West Coastway. However, changes will have to be implemented to support forecasted passenger demand such as changes to the rolling stock and infrastructure.

! Some platforms are only 4-car, therefore they will need extending if longer rolling stock was introduced.

#### Context

To meet forecast demand it is recommended that the current Class 313 units are replaced with longer trains. Depending on the growth and standing density models and timetable option, 4-car units would support forecast growth. However, 5-/6-car units would be required to meet TfSE's Sustainable Route to Growth forecast demand by 2039.

To enable longer trains to operate within the Study area there is a requirement for platform extensions at several locations, see [Table 5.1](#), to accommodate the new lengths of trains. For the extended platforms provision could be made so that there is the opportunity to extend them further in future to accommodate longer trains. If West Coastway services are longer than 5-cars, we recommend an additional platform will be required at Brighton due to platform capacity.

There is an aspiration from GWR to lengthen their current 3-car units to 5-car units following the completion of rolling stock cascade. This is due to be completed in the next few years and will increase capacity to 411 seats from 246.

Station	Length in 20m coaches	
	Platform 1	Platform 2
Aldrington	4	4
Fishergate	4	4
Lancing	5	5
East Worthing	4	4
Southbourne	6	5
Ifield	5	5
Faygate	5	5
Amberley	5	5

**Table 5.1:** Stations with short platforms

## 1. Can the rail service accommodate current and projected demand at peak times whilst improving network reliability?



### 1B. Is the railway accommodating additional demand caused by seasonal/special events?



Stakeholders have expressed that they would prefer if the public travelled by public transport to major events in the study area in which they expect rail to play a key part in that.

#### Challenges

- The Study area hosts various large events throughout the year a small selection are shown in **Table 5.2**.
- A key challenge is balancing the demand between running additional services for special events and the requirement to restrict services to support maintenance activities.

#### Answer

! The operator should consider increasing train services and train lengths to accommodate special events.

#### Context

The Study area hosts various large events throughout the year which are well attended by the public travelling from all over the country.

In addition to this, areas such as Brighton and Bognor Regis are key holiday destinations in the summer months. Butlin's Bognor Regis Resort alone has 5,800 beds.

There are more than 60 annual cultural festivals held in Brighton & Hove, held during nine months of the year.

Falmer Stadium hosts events throughout the year, not just football matches, at its conference centre.

For major events within the Study area it is recommended that Network Rail and the passenger train operating companies are informed at the earliest convenience to plan a train service and rolling stock that is appropriate to the event.

Event	Nearest station	Visitor numbers
Brighton Fringe 1,034 events in 4 weeks	Brighton	604,008
Brighton Pride 3 day event	Parade from Hove, returning from Brighton	300,000
Goodwood Revival (vintage cars) 3 day event	Chichester	200,000
Qatar Goodwood Festival (horse racing) 5 day event	Chichester	100,000
Arundel Festival 10 day event	Arundel	20-30,000
Victorious Festival (music) 3 day event	Portsmouth & Southsea	120,000
Isle of Wight Music Festival 4 day event	Portsmouth Harbour	59,000

**Table 5.2:** A selection of large events held in or close to the Study area.

## 1. Can the rail service accommodate current and projected demand at peak times whilst improving network reliability?



### 1C. Do the first and last trains provide good connectivity?



Requests for the last train of the day to be extended on Thursdays, Fridays and Saturdays to help support the night time economy  
(*Brighton and Hove City Council*)

Requests for earlier trains from the Arun Valley line to serve Gatwick Airport, to help staff get to the airport via public transport  
(*Gatwick Airport Ltd. & West Sussex County Council*)

#### Challenges

- Network Rail plans maintenance and railway upgrades at certain times to reduce the disruption to passengers, such as on bank holidays, Sundays and overnight, when the network is less busy. Therefore, running earlier and later trains has to be balanced against planned railway works.
- GTR identified that anti-social behaviour had been reported on later services that operate on the West Coastway to Worthing.

#### Answer

- ✓ There is currently an unadvertised train that departs from Brighton station at 01:21 that travels along the West Coastway. This Study recommends that this train is advertised to allow a later service from Brighton station. GTR is investigating the feasibility of this recommendation.
- ! The Brighton Main Line forms the central spine between London and the South Coast and is a heavily utilised railway corridor. As a result, it would be extremely difficult to amend railway works to support later Gatwick services as the railway is already constrained in the availability of time to complete major works.
- ! The importance of early morning trains between Horsham and Gatwick Airport is recognised. Further work is recommended to investigate how this can be achieved. For example, bi-directional working between Horsham and Crawley/Three Bridges to enable overnight maintenance work to be carried out on one line at a time.

#### Context

Following the recommendation of this study GTR are working with the British Transport Police to investigate whether it is possible to advertise the 01:21 service.

Further work would be required to investigate the feasibility of amending the maintenance and railway upgrade plans to support later and earlier trains departing from the Arun Valley to Gatwick airport. By providing additional services could encourage modal shift from road to rail therefore supporting decarbonisation.

The above represents two very specific examples raised at the stakeholder working groups. Further investigation would be required to determine whether the level of late and early services across the study area is meeting passenger requirements.

## 2. How can rail support the delivery of substantial amounts of new housing?

### Q&A

### 2A. Does the current rail service reflect the changing housing market?



Over 70,000 new homes are proposed across the study area as part of the seven councils' local plans. Councils, especially those with high housing growth targets have an aspiration for rail to play a role in accommodating this population growth. *(All local authorities)*

### Challenges

- **Figure 5.1** shows the number of new homes required to be built in each local authority in total and by year.
- A significant proportion of proposed housing infrastructure is not located near the rail network. For example, the development at the north end of the Fitzalan Corridor between Littlehampton and Lyminster is close to the rail network but about two miles from Littlehampton or Angmering stations. Therefore, it is a challenge as how best to facilitate and promote access into the rail network.
- Significant housing growth is planned by several stations to the west of Chichester. Four of these (Warblington, Nutbourne, Bosham and Fishbourne) are presently only served by one train an hour and have very low passenger figures in part due to the parallel bus service to Chichester which is slower but more frequent, however, parts of these settlements are closer to the stations than the bus stops on the A259.
- Proposed housing infrastructure west of Chichester could lead to requests for an increased frequency at the smaller stations. This will have to be balanced against other stakeholder aspirations for reduced journey times on longer distance services between Brighton and Portsmouth/Southampton.

### Answer

- ! **Prioritise the creation of new employment space close to stations.**
- ! **Provide public transport options that connect with the right station, not necessarily the closest.**
- ✓ **Timetable changes could offer connectivity and journey time improvements.**



- ✓ It is recommended that Network Rail work with TfSE, identifying hub stations and alternative transport links which could significantly reduce the journey times and service patterns of the network (especially the West Coastway).
- ✓ The recommendation of longer trains will future-proof many of the services, particularly on the West Coastway.

### Context

For each proposed housing infrastructure plan there is a requirement for it to be assessed not only against its closest station but for the whole line route.

There is a requirement to balance proposed housing growth with current passenger services, to ensure that the key impacts are highlighted. For example, introducing new stations has an impact on the journey time of services.

## 2. How can rail support the delivery of substantial amounts of new housing?

### Q&A

**2B. Do the location of stations adequately cover the area's population and are there opportunities for new stations to serve the area?**



There are stations throughout the study area which are very close in proximity to each other.

The developers of three major housing schemes between Horsham and Crawley are lobbying for new stations to serve their developments.

### Challenges

- Hove, Aldrington, Portslade, Fishersgate, Southwick and Shoreham-by-Sea are within 5 miles from Brighton. Therefore catchment areas overlap.
- Aldrington and Fishersgate have a low footfall at 731 and 469 passengers per day, compared to 4,052 at Portslade (which is between these stations).
- West of Chichester, local bus services provide a better frequency and operate closer to the centres of population although the journey time is longer - this shows that passengers are favouring frequency over journey time.
- Calling at additional stations will have an impact on journey times. A balance will have to be made between journey time aspirations and serving new communities. To improve journey times within the Study area services may have to be reduced at current stations.

### Answer

- ✓ It is recommended that a wider whole-transport system assessment should be undertaken with TfSE to review how the local railway serves its communities as part of wider transport connectivity.
- ! There may be opportunities to review train service provision at smaller stations.
- ! Further assessment is required in dialogue with developers for proposed developments to understand the impact of new stations on current and aspirational train services.

### Context

Network Rail, DfT, TfSE, the Coast to Capital LEP and local authorities will continue to work collaboratively together to investigate the feasibility of introducing new stations on the Arun Valley Line.



A rail over road bridge just east of Southwick station

## 2. How can rail support the delivery of substantial amounts of new housing?

### Q&A

## 2C. Is the rolling stock used for local journeys appropriate for the needs of passengers?



The Class 313s (built in 1976) are unpopular with stakeholders due to their limited on-board facilities such as toilet provision, air conditioning and Wi-Fi availability.

### Challenges

- The 3-car Class 313 have been in service for over 40 years and have limited on-board passenger facilities and are limited to a maximum speed of 75 mph.
- 4-car trains are required to reduce standing at peak times and provide for future passenger growth.
- The introduction of new rolling stock within the study area could require further enhancements to support this such as power supply upgrades and the extension of platforms.

### Answer

- ✓ It is recommended that these units be replaced as soon as possible.
  - ✓ Replacement rolling stock should be fitted with modern conveniences such as air conditioning, toilets, dedicated wheelchair spaces, low density seating aligned to the windows, enhanced public information screens, bicycle racks, luggage racks, wi-fi, at-seat power supplies etc.
  - ✓ Replacement trains should be capable of travelling at 90 mph to enable improved journey times.
  - ✓ Replacement units should be at least 4-cars in length (20m vehicles).
- ! If the new units are longer than 4-cars it is recommended that some platforms are extended (Brighton if the rolling stock is longer than 5-cars). Depots and stabling sidings may need to be extended.

### Context

To support future growth and demand requirements it is recommended that rolling stock is replaced to provide extra capacity. The study area comprises a mixture of commuters and leisure passengers such as those visiting holiday destinations and exploring the National Park. Therefore, it is essential that future rolling stock meets the needs of those passengers by providing sufficient luggage and cycling space, wi-fi, wheelchair spaces and at-seat charging.

The DfT TAG forecast shows that 4-cars will cover growth to 2039.

However, if there is a significant swing from private transport/bus to rail, longer trains may be required. This can be caused by improving the frequency of services, London Overground demonstrated that increased frequency led to increased patronage, requiring trains to be lengthened. London Overground extended the original 3-car units to 4- and subsequently 5-cars over a period of a few years.



A Class 313 unit at Brighton

### 3. Does the railway offer an opportunity to reduce congestion on key roads?

#### Q&A

#### 3A. Is there an opportunity to reduce congestion on the road network?



It was identified by stakeholders that congestion on main roads such as the A27 and A259 is a major issue across West Sussex. Congestion hotspots include the A27 between Lancing and Worthing, the A259 between Bognor Regis and Chichester and the A27 through Arundel.

#### Challenges

- Most road trips are short distance. Heavy rail does not serve short distance travel very well, unless there is a high frequency service. There are little opportunities to increase the frequency sufficiently.
- A lot of trips are to locations not on the rail network such as business parks, e.g. Manor Royal near Crawley, which have very good road connections but are still quite distant from the railway station. The road connectivity and abundance of car parking at some business parks makes driving more attractive. Needs more integrated services and consideration of non-heavy rail public transport.
- Some stations have platforms that are too short for the longest trains calling there resulting in extended barrier down times.

#### Answer

- ✓ Implement train service changes to increase services and decrease journey times making it more competitive to car journeys.
- ✓ Support Local Authorities prioritise the creation of new employment space close to stations.
- ✓ Improve transport links between railway stations and employment hubs.
- ✓ It is recommended that platforms be lengthened to reduce the impact of long trains calling at stations with level crossings.
- ! It is likely that level crossing barrier down times may increase as a result of introducing additional services.

#### Context

The evidence demonstrates that to get people out of cars requires:

- as close to turn up and go frequency as possible, e.g. better than 10 minute intervals
- be as close to door to door as possible e.g. bus from home street to outside destination work place or tram from neighbourhood to near work place.

To encourage mode shift from road to rail it is recommended that additional faster services between Brighton and Chichester are introduced.

There is also a requirement to ensure that there is an integrated bus service which aligns with the railway timetable to serve neighbourhoods and key employment locations which are not located near railway stations.

Network Rail is committed to working with the local authorities, Coast to Capital LEP and TfSE on the provision of public transport to employment sites.

Closer to Brighton, buses are very popular but the density of traffic increases journey times and some routes have had a reduction in buses to maintain a robust timetable. Network Rail will work with TfSE to understand why people choose car or bus over train when commuting to Central Brighton.

To enable wider transport connectivity across the Study area there is an opportunity to further develop apps to support passengers with planning their multi-modal transport journeys. As technology evolves and digital signalling comes on-stream, more information can be provided by the rail Traffic Management System to enable apps to know, through prediction or actual information, when level crossings will be activating. They could highlight issues on the rail network and advise if an alternative station would get you to your destination quicker. There could also be integration with autonomous vehicles.

### 3. Does the railway offer an opportunity to reduce congestion on key roads?

#### Q&A

### 3B. Are there opportunities to close any level crossings and replace with bridges?



MPs for Worthing and Shoreham, have frequently expressed their frustration with the number of crossings. Coast to Capital LEP has also previously stated removing level crossings wherever possible is a key target of theirs.

*(All local authorities, local MPs, Coast to Capital LEP)*

#### Challenges

- There are 39 highway level crossings across the study area. Changes to the train service frequency could contribute to road congestion as level crossings will require more downtime.
- Even when a new road bridge has been constructed, it is often the case that the level crossing cannot be closed as it provides a link between communities for people on foot, bicycle or with reduced mobility.
- 12-car Thameslink services currently operate at the stations identified in **Table 5.3**. Current platform lengths don't accommodate 12-car units therefore trains overhang onto level crossings causing extended downtime.
- There is a requirement to balance the needs of local authorities as level crossings are sometimes deemed as an enabler to reduce traffic flow.

#### Answer

- ✓ It is recommended to extend the platform lengths at the stations identified in **Table 5.3** to remove the overhang of the 12-car units.
- ✓ Closing level crossings is a priority for Network Rail and the Office for Rail and Road.
- ✗ Feasibility identified it wasn't possible to extend the platforms at West Worthing due to the junctions at the opposite end of the platforms to the level crossing.
- ! As part of the Digital Railway Programme, Network Rail is investigating solutions to reduce level crossing down times.

Station	Platform length (coaches)	Number of trains per day		
		Stopping	Overhanging	%-age
Lancing	5	104	11	11 %
Goring-by-Sea	6	67	12	18 %
Angmering	6	84	12	14 %
Littlehaven	8	43	40	93 %

**Table 5.3:** Stations with short platforms where long trains block the road during station calls and the number of trains per weekday that this occurs.

#### Context

Network Rail will continue to innovate and use new technology to improve level crossing safety and recognise the wider impacts of down time. Risk assessments are completed for all level crossings which inform Network Rail's level crossing management strategy. The main objective of this strategy is to close and upgrade crossings across the network, which will improve safety for everyone.

This study recommends that the platforms at Lancing, Goring-by-Sea, Angmering and Littlehaven are extended to accommodate 12-car services to prevent unnecessary level crossing downtime resulting in road congestion.

West Worthing station has a level crossing at the Worthing-end and junctions at the opposite end so it cannot be extended beyond its current 8-car length.

## 4. How can access to the railway network be improved from other modes of transport?

### Q&A

### 4A. How do we better improve integration between rail and bus services?



Bus companies have highlighted that they find it difficult to integrate their bus service timetables with the national railway timetables to enable transport integration.

*(Stagecoach/Compass Bus)*

#### Challenges

- To enable wider transport connectivity it is essential that the rail and bus industry is aligned.
- Different revenue streams, commercial models and ticketing structures could serve as a barrier for progress towards an integrated bus/rail ticketing product.

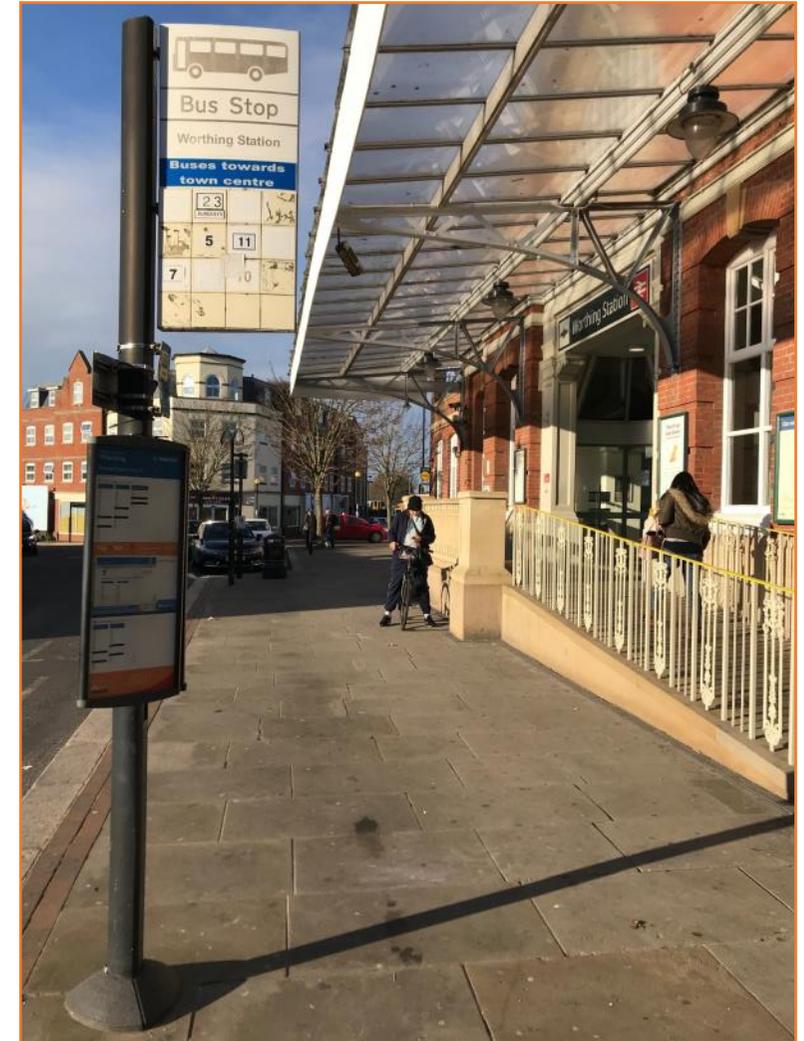
#### Answer

- ✓ Following bus operator feedback GTR is working with bus operators to share the timetables ahead of the key changes.
- ✓ PlusBus is a discount price travelcard which can be purchased with National Rail train tickets which allows unlimited travel on participating bus and tram operators. Currently within the Study area there are PlusBus zones in Brighton & Hove, Worthing, Bognor Regis, Chichester, Havant, Crawley & Gatwick and Horsham. Further integration with other companies could improve integration resulting in wider transport connectivity.

#### Context

The study recommends that further development is required to investigate possible improvements to rail and bus service integration. This recommendation will be incorporated within the First & Last Mile strategic study which is being developed by Network Rail.

It is also recommended that TfSE examine options to improve integration through both ticketing and timetabling between both modes.



Worthing station bus stop

## 4. How can access to the railway network be improved from other modes of transport?

### Q&A



### 4B. Are we providing enough car parking capacity at stations?

With housing growth scheduled in areas that are driving distance from their local station, some councils are concerned that there isn't sufficient car parking capacity. *(Arun District Council)*

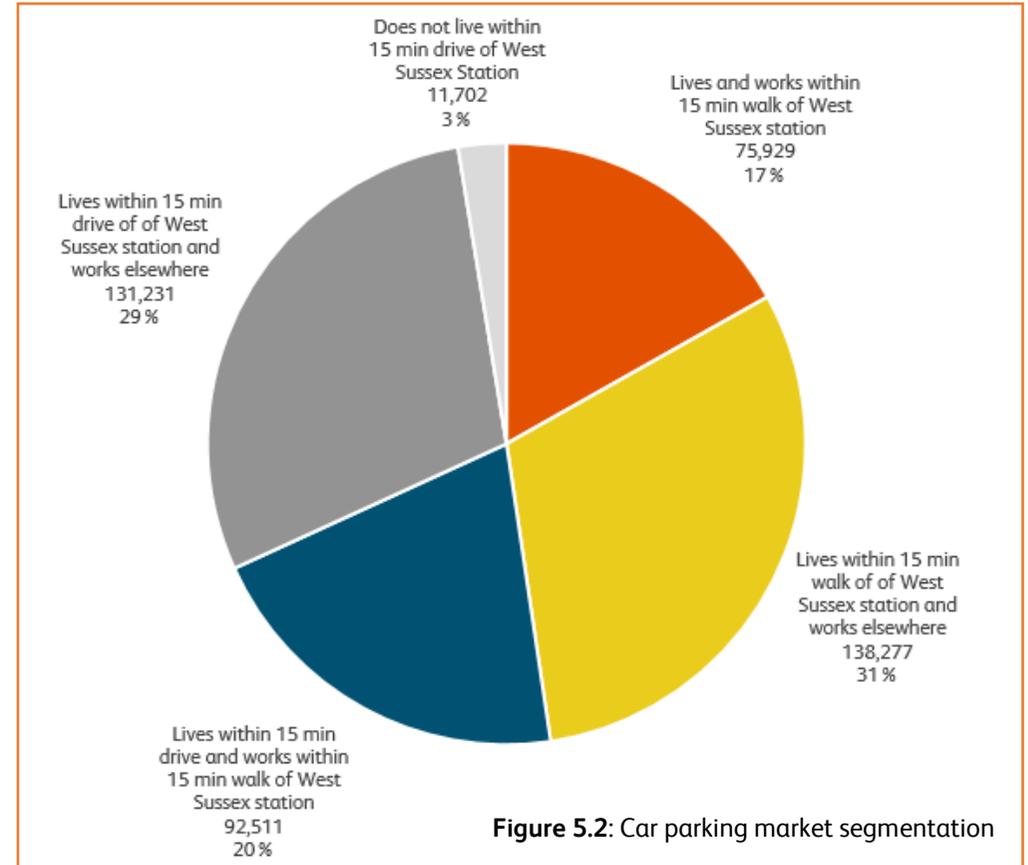
Concerns about existing demand for parking spaces was also raised, with the impact of commuters parking on neighbouring roads and how that affects local communities. *(South Downs National Park Authority)*

#### Challenges

- The location of many existing stations close to sizeable residential communities means that land available for car park expansion is constrained.
- 20% of people live within 15 minutes drive of a station and then work within 15 minutes walk of another station, **Figure 5.2** illustrates this in the dark blue segment.

#### Answer

- ✓ Prioritise the creation of new employment space close to stations.
- ✓ It is recommended that Network Rail and TfSE exploit the opportunity to improve public transport interchange, walking and cycling routes to the stations.
- ✓ Opportunity to decarbonise through encouraged use of public transport and reduction of car parking.
- ✓ GTR and Network Rail are developing a car parking strategy to maximise use of car park land within the Network Rail land boundary.
- ✓ It is recommended that TfSE investigate whether car parks should be expanded or other opportunities for modal shift considered. The following will need to be taken into consideration, reducing carbon emissions, traffic congestion and on-street parking.



#### Context

As highlighted in **Question 4A**, to support wider connectivity and decarbonisation it is recommended that the integration of different modes of transport is required. Metrobus operates on the Arun Valley line in which buses are fitted with on-bus information screens which identify 'live' train departures which interface with bus stops.

## 4. How can access to the railway network be improved from other modes of transport?

### Q&A

### 4C. Are we providing a viable public transport option to the South Downs National Park and other outdoor spaces?



The South Downs National Park Authority wish to increase the modal share of people accessing the park by public transport. A possible deterrent could be the lack of an integrated transport ticket which allows travel across the South Downs.

### Challenges

- The National Park comprises a mixture of road and rail infrastructure.
- Bus operators have identified that they have removed bus stops to prevent tail backs on rural roads and dangerous driving practices of other drivers.
- Network Rail is often lobbied for the reopening of closed lines through the National Park.

### Answer

- ✓ Bus operators are engaged with PlusBus and further developing opportunities for integration into existing systems as this currently only covers a small part of the area.
- ✓ It is recommended that Network Rail, TfSE and the South Downs National Park work together to identify opportunities to improve access to the National Park.
- ! The UK Government have committed funding to the 'Beeching reversal' programme which investigates re-opening previously closed routes which could benefit the South Downs National Park.
- ! Former closed railway lines could be transformed into low impact bus routes which could be integrated with railway stations and link communities throughout the park.



A view across the Arun Valley from Arundel Castle

## 5. How best can the railway deliver local connectivity for shorter journeys in West Sussex?

### Q&A

### 5A. Are there gaps in local connectivity?

There are aspirations for alternative services such as:

Direct trains from Brighton to Arundel/the Arun Valley Line (*South Downs National Park/Arun District Council*)

Direct trains Chichester to Bognor Regis (*Chichester District Council*)

The re-introduction of cross-Brighton services (*attendees from RailFuture meeting*)

There is also growing calls for increased 'inter-regional' connectivity that could be delivered by a more frequent and faster service from Brighton to destinations beyond Sussex (*TfSE and Brighton and Hove City Council*)



### Challenges

- The current infrastructure does not provide for direct trains from the Arun Valley Line towards Brighton or from Bognor Regis direct to Chichester.
- The cross-Brighton route is only available from Platform 3 at Brighton and blocks access to most other platforms during the move causing major impacts on the operational railway.

### Answer

- ✘ New chords would be required at Arundel and Barnham to enable direct trains to operate - this is not recommended at this time.
- ✘ New infrastructure would be required at Brighton station to enable the direct trains to enter via the west and exit via the east. Cross-Brighton services would impose excessive risk to the operational timetable.
- ! It is recommended that Network Rail support TfSE on the development of future infrastructure options to reduce East-West Coastway journey times.
- ! The DfT's London & South Coast Rail Corridor Study suggested revisiting the Arundel Chord in the longer-term, in association with West Coastway capacity improvements. There is no case for pursuing the Arundel Chord at this stage in terms of diversionary benefits.

### Context

The Sussex Route Study previously investigated the Arundel Chord as a diversionary route for the Brighton Main Line. A key factor that reduced its appraisal benefits was that only two trains per hour could operate and that would be to the detriment of existing Arun Valley and West Coastway services. Journey time improvements have been achieved providing better connections at Ford/Barnham.

A new Chord at Barnham would be required to enable direct services between Bognor Regis and Chichester. New housing proposed at Bognor Regis is west of the station so road is a more direct route to Chichester, making it more attractive than rail.

Brighton station has undergone some key changes to improve interchange such as the moving of ticket barriers resulting in more concourse space available for movements. The Study investigated the feasibility of constructing a footbridge between all platforms to provide better interchange, however due to insufficient space on some platforms this was deemed not feasible. If the platforms were to be remodelled in the future to support longer rolling stock, the feasibility of the footbridge should be reinvestigated.

## 6. Can journey times be reduced for longer distance services and additional services beyond Southampton introduced?

### Q&A

## 6A. Are we delivering competitive journey times and frequency for longer distance services from Brighton – e.g. to Bristol and beyond?



GWR have stated their desire to operate a more regular service along the West Coastway – potentially up to an hourly service – if the infrastructure allowed (*GWR*)

There is also growing calls for increased ‘inter-regional’ connectivity that could be delivered by a more frequent and faster service from Brighton to destinations beyond Sussex (*TfSE and Brighton and Hove City Council*)

### Challenges

- The Brighton to Bristol and beyond service operates twice a day.
- Operating a regular through service to Bristol could require additional pathways or change of pathways beyond the Study area.
- There are already 78,000 passenger journeys per year from the Study area to Bath, Bristol and Cardiff - additional direct services could attract more passengers.

### Answer

- ✓ The train service specification completed as part of this Study has identified an hourly path from Brighton to Southampton which could be used for trains to Bristol and beyond.
- ! It is recommended that TfSE and other key stakeholders take into consideration the Solent Study outputs and the opportunity to increase Brighton to Bristol services identified in this Study.

### Context

There are capacity issues in the Southampton area, so these will need to be resolved, potentially through splitting/attaching at Fareham. The Solent Study recommends an infrastructure enhancement at Fareham which could enable this.



A Great Western Class 166 unit at Brighton

## 6. Can journey times be reduced for longer distance services and additional services beyond Southampton introduced?

### Q&A

## 6B. How do we balance aspirations for faster journey times and longer distance services with existing markets on short distance services?



There is support for existing shorter, local journeys along the line to passengers and the role that smaller stations can play within urban areas (*Brighton and Hove City Council/West Sussex County Council*)

Multiple stakeholders suggested that journey times from the Arun Valley, especially at Bognor Regis, are too slow (average journey time to London 1 hour 45 minutes) and are inhibiting the growth in rail usage there; despite being a significantly bigger town than Chichester, Bognor Regis has a much smaller percentage of passengers using the rail service.

### Challenges

- The current infrastructure within the Study area is restricted to two tracks, therefore this inhibits the number of fast, slow and semi-fast trains that can operate as there are few places for trains to overtake.
- West of Shoreham-by-Sea, rail has a higher market share for journeys to Brighton, therefore there are pressures to operate more fast trains.
- East of Shoreham-by-Sea, rail does not have a competitive frequency offering and it would be difficult to increase the frequency. It is recommended TfSE and other stakeholders evaluate the merits of modal shift to rail or faster trains.

### Answer

- ✓ Train service specification options have been developed and are detailed over the next few pages, Option 1 is recommended. Further work is required on the other options to balance benefits and stakeholder aspirations.
- ✓ It is recommended that TSS Option 2's infrastructure enhancements are progressed through the Rail Network Enhancements Pipeline.
- ✗ Other major infrastructure solutions, such as three- and four-tracking the route have been identified but are not recommended at this time. This is due to the extensive land acquisition, high cost and disruption.

### Context

Improvement to journey times across the study area would support economic growth and social inclusion as it would be more attractive for passengers to travel. In the local industry strategy 'Gatwick 360' Coast to Capital LEP identified coastal towns as significant economic assets for the area.

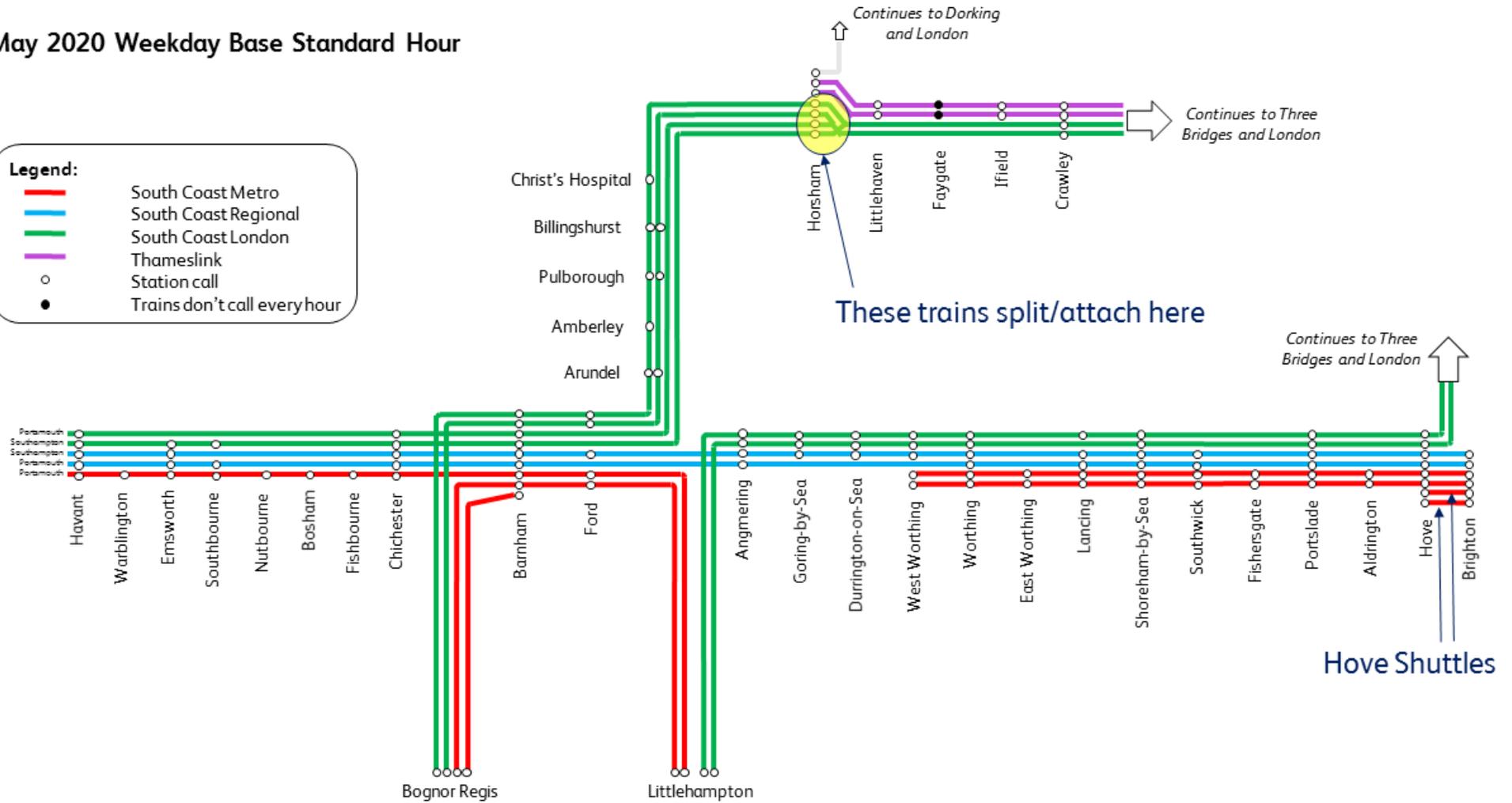
Over the following pages there are the high level details of the train service specification options that have been developed, along with the cost, pros and cons of each, starting with the May 2020 service as a baseline, the options are:

1. The maximum that can be achieved with existing resources and infrastructure - this option is recommended for implementation.
  2. The maximum that can be achieved with minimum additional infrastructure - this option is recommended for further infrastructure development.
  3. Faster east-west journey times requiring major additional infrastructure - it is recommended that the merits of this option be considered by TfSE's Outer Orbital Area Study.
  4. Faster east-west journey times where modern light rail or alternative network replaces the Metro services - it is recommended that the merits of this option be considered by TfSE's Outer Orbital Area Study.
- A. Faster journey opportunities to/from London - this option is recommended for the rolling stock and infrastructure requirements to be developed.

### May 2020 Weekday Base Standard Hour

**Legend:**

- Red line: South Coast Metro
- Blue line: South Coast Regional
- Green line: South Coast London
- Purple line: Thameslink
- Open circle: Station call
- Black dot: Trains don't call every hour



This is the map of the existing services. Over the following pages there are train service specification options that build on this service. This diagram is provided for comparison.

**Baseline timetable:** The train service that operates May 2020 (off-peak standard weekday hour)

# Stakeholder key aspirations:

Improve Journey Times   Improve spacing between trains   Improve Connectivity   Hourly train to Bristol   Increase Capacity

### Existing Infrastructure

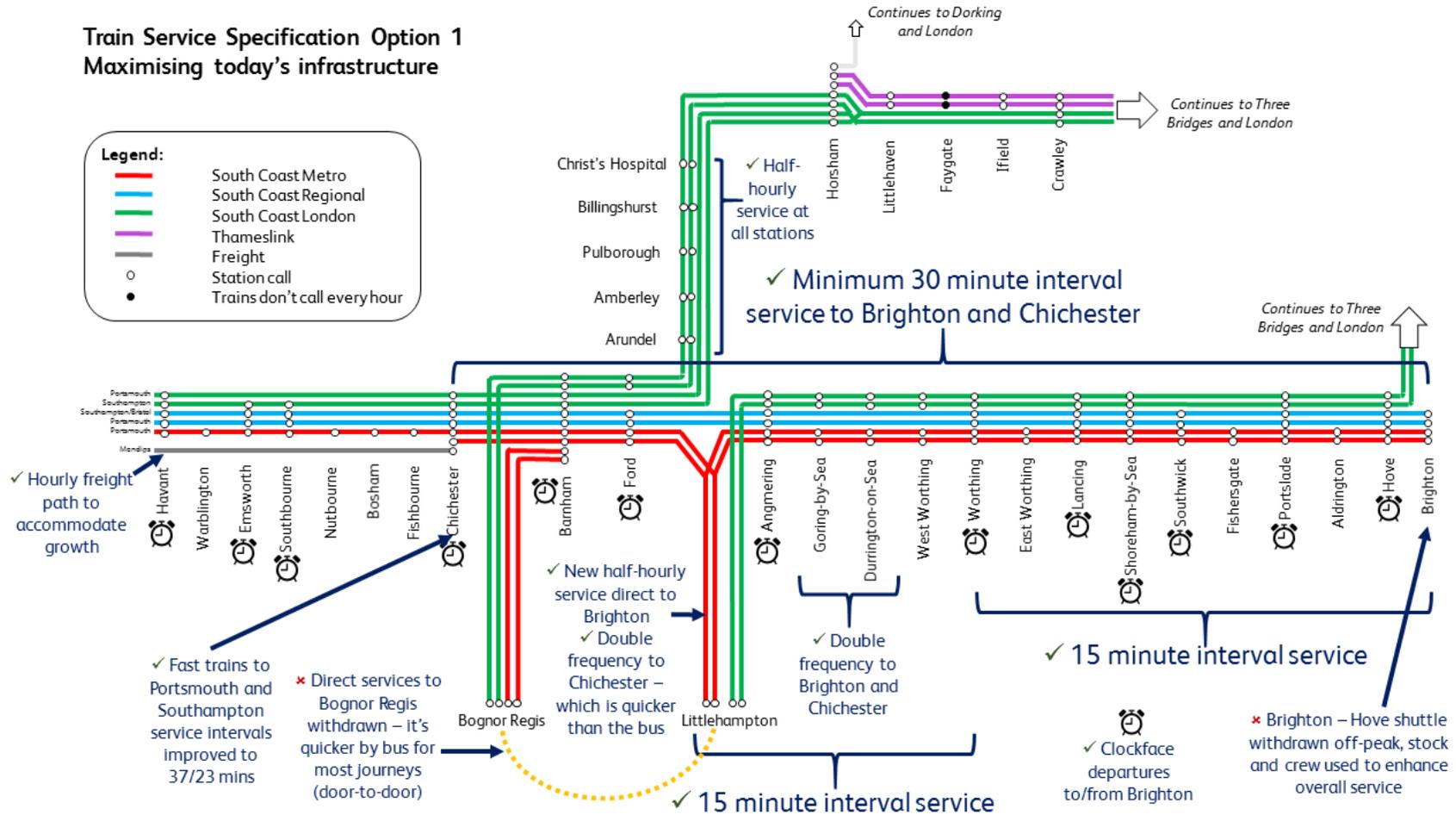
- Existing two-track railway
  - 113 level crossings
  - Four platforms at Horsham, Littlehampton and Bognor Regis
  - Three platforms at Brighton, Hove, Worthing and Bognor Regis
  - Tunnels:
    - ⇒ Preston Park - Hove (Cliftonville Tunnel, 535 yards (489m))
    - ⇒ Brighton - Hove (Hove Tunnel, 220 yards (201m))
    - ⇒ Amberley - Arundel (North Stoke Tunnel (83 yards (75.9m))
- Major junctions at Horsham, Hove, Arundel Jn, Ford Jn, Littlehampton Jn and Barnham
  - Stations:
    - ⇒ West Coastway East - 14
    - ⇒ Arun Valley - 10
    - ⇒ West Coastway West - 9
    - ⇒ Branches - 2
  - Fully electrified to 750 volts direct current via conductor rail.

Vehicles per train	Total number of additional vehicles to the baseline		Cost Range	Benefit Cost Ratio		Value for Money Rating	
	Option	Option + Bristol		Option	Option + Bristol	Option	Option + Bristol
4-car	The total number of additional vehicles will appear here.	Includes an additional one train per hour extended from Southampton to Bristol and beyond.	The infrastructure costs presented are an order of magnitude range based on very early development.	These columns reflect the Benefit Cost Ratio over the lifetime of the scheme, appraised using the DfT Transport Appraisal Guidance (TAG) .		The values are Poor (BCR of 0-1.0), Low (1.0-1.5), Medium (1.5-2.0), High (2.0-4.0), Very High (>4.0). Further information is available in the DfT Value for Money Framework.	
5-car				Each option is appraised for three growth rate scenarios. Higher growth rates deliver higher value for money as (a) timetable improvements benefit a larger number of people, and (b) additional capacity alleviates a higher level of crowding. The three growth rates are DfT TAG (+24% to 2039), TfSE Sustainable Future (SF) (+35% to 2039) and TfSE Sustainable Route to Growth (+84% to 2039). See <a href="#">Page 23</a> for more information about growth rates.			
6-car							

### Additional information

- GWR currently operate two trains per day (weekdays) between Brighton and Bristol (and beyond).
- Thameslink currently operate limited peak services to to/from Littlehampton via Hove and Preston Park. There are also limited shoulder/off-peak services which are not identified on the maps.
- For the timetable options it is assumed 3-car Class 313s have been replaced by 4-car Class 377s as a proxy for new rolling stock. The costs and benefits of lengthening 3-car trains to 4- or more cars are included in the appraisals.
- The Train Service Specifications concentrated on a standard hour, therefore additional peak services are not shown. In the AM High Peak Hour (08:00-08:59) there are no Hove Shuttles but two Littlehampton-Brighton trains instead. In the PM Peak (16:00-18:59) some Brighton - West Worthing trains are extended to Littlehampton. The appraisal compares the May 2020 all-day timetable to the Option all-day timetable, including all peak extensions and the existing twice-daily trains to Bristol.

### Train Service Specification Option 1 Maximising today's infrastructure



- #### Gains
- ✓ 15 minute interval service between Worthing & Brighton and Worthing & Littlehampton.
  - ✓ Improved spacing of trains between Chichester and Southampton/Portsmouth.
  - ✓ Double frequency from Goring-by-Sea, Durrington-on-Sea to Brighton, from West Worthing, Durrington-on-Sea, Goring-by-sea direct to Chichester, Littlehampton – Chichester, Christ's Hospital and Amberley.
  - ✓ Many stations gain clockface half-hourly services to/from Brighton.
  - ✓ Fishbourne, Bosham, Nutbourne, Warblington, Bedhampton and Hilsa gain direct (slow) trains to Brighton with passenger choice of faster journey changing at Barnham.
  - ✓ Brighton High Peak Hour arrivals, additional 4 vehicles (replacing 3-car with 4-car assuming GWR still 3-car).

- #### Losses
- ✗ Brighton – Hove shuttle (reducing 6tph to 15 minute interval Brighton-Hove) in the off-peak. However, the Hove shuttle is very lightly loaded off-peak.
  - ✗ West Worthing-Brighton reduced from three direct trains per hour to half hourly.
  - ✗ No direct trains between Littlehampton and Bognor Regis – replaced with a connection into Barnham – Bognor Regis shuttle (there is also a 20 minute frequency bus service).
  - ✗ There are a few journey time improvements through new direct services because this Option reflects improved connectivity and frequency.
  - ✗ There are two extra trains in each direction resulting in longer/more level crossing activations between West Worthing and Littlehampton/Ford.

## Option 1: Maximising today's infrastructure

# Stakeholder aspirations met:

- ✓ Improve spacing between trains   ✓ Improve Connectivity   ✓ Hourly train to Bristol   ✓ Increase Capacity

### Investment

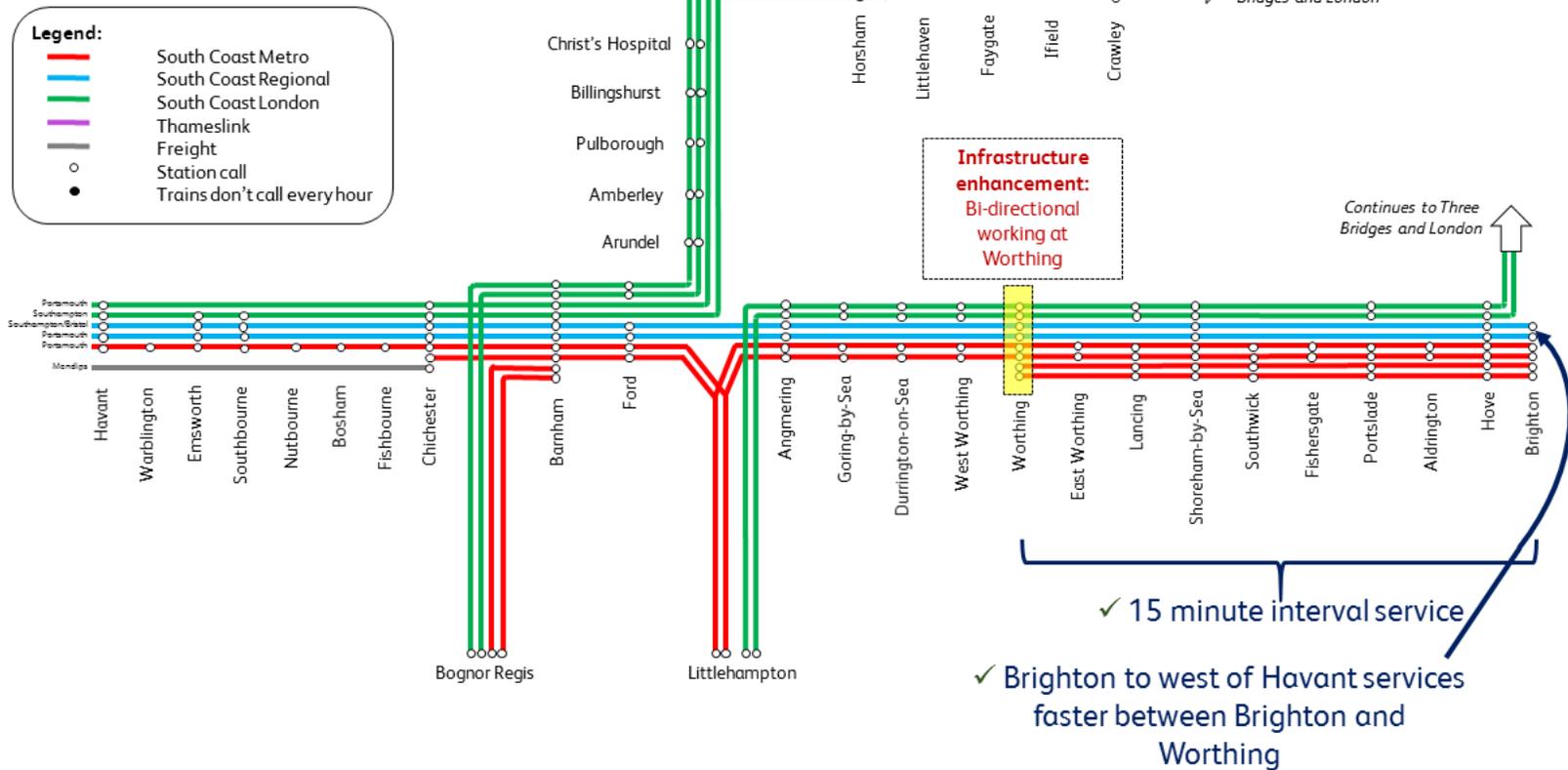
- The 4-car option requires no changes to the existing railway infrastructure as all platforms are of sufficient length. However, investment will be required to replace Class 313s with Class 377s.
- Power supply enhancements may be required if rolling stock changes are implemented. This Study has completed no power supply assessments and associated costs therefore it is recommended that this is completed if Options are progressed.
- If coastal services are strengthened beyond 4-car, it is recommended that the lengthening of platforms will be required at Aldrington, Fishersgate, East Worthing, Lancing and Southbourne.
- 6-car will additionally require a new platform at Brighton as only Platforms 1 & 2 can be used by West Coastway services. This would make them too long to platform share so additional facilities would be required.

Vehicles per train	Total number of additional vehicles to the baseline		Cost Range	Benefit Cost Ratio		Value for Money Rating	
	Option 1	Option 1 + Bristol		Option 1	Option 1 + Bristol	Option 1	Option 1 + Bristol
4-car	11	26	£0	1.9 to 4.5	1.4 to 2.7	Medium to Very High	Low to High
5-car	26	41	£16m to £43m	0.8 to 1.5	1.0 to 1.9	Poor to Medium	Poor to Medium
6-car	31	46	£30m to £82m	0.6 to 1.2	0.8 to 1.6	Poor to Low	Poor to Medium

### Commentary

- This Option is recommended as it provides value for money with all trains operating as 4-cars with very little additional expenditure. It could be delivered through the existing franchise or a future agreement when that expires. The total number of additional vehicles represents the change from 3-car Class 313 to 4-car Class 377 units.
- The Cost Range, above, for 5-car includes platform extensions at Aldrington, Fishersgate, Lancing, East Worthing and Southbourne. 6-car includes the West Coastway platform extensions and an additional platform at Brighton.
- Adding direct services to Bristol requires an additional pathway which increases the operating costs and reduces the value for money, whereas in the other TSS Options it replaces a fast Southampton service, reducing the operating costs and increasing the value for money. It provides Low to High (4-car) value for money but may require further work beyond the border of the Study area.

### Train Service Specification Option 2 Small infrastructure enhancements



- #### Gains
- ✓ The same as Option 1 except Worthing - Littlehampton not 15 minute interval but 10/20 minute interval.
  - ✓ Journey time from Brighton compared with Option 1 improved by 5-6 minutes to Worthing, Angmering, Ford, Barnham, Chichester and main stations to Portsmouth and Southampton.
  - ✓ Two additional trains per hour operate between Brighton and Worthing resulting in 6 trains per hour Brighton - Hove - Shoreham - Worthing.
  - ✓ Additional infrastructure would also enable trains to turn back at Worthing at times of disruption or for engineering work, which would reduce the bus mileage required.
  - ✓ Brighton High Peak Hour arrivals, additional four vehicles compared with Option 1.

- #### Losses
- ✗ West Worthing-Brighton reduced from three direct trains per hour to half hourly
  - ✗ No direct trains between Littlehampton and Bognor Regis - replaced with a connection into Barnham - Bognor Regis shuttle (there is also a 20 minute frequency bus service).
  - ✗ Portslade, Southwick and Lancing semi-fast train terminates at Worthing with a four minute connection for semi-fast train to Chichester and beyond.
  - ✗ There are two extra trains in each direction resulting in longer/more level crossing activations between West Worthing and Littlehampton/Ford.

## Option 2: Small infrastructure enhancements

# Stakeholder aspirations met:

- ✓ Improve Journey Times
- ✓ Improve spacing between trains
- ✓ Improve Connectivity
- ✓ Hourly train to Bristol
- ✓ Increase Capacity

### Investment

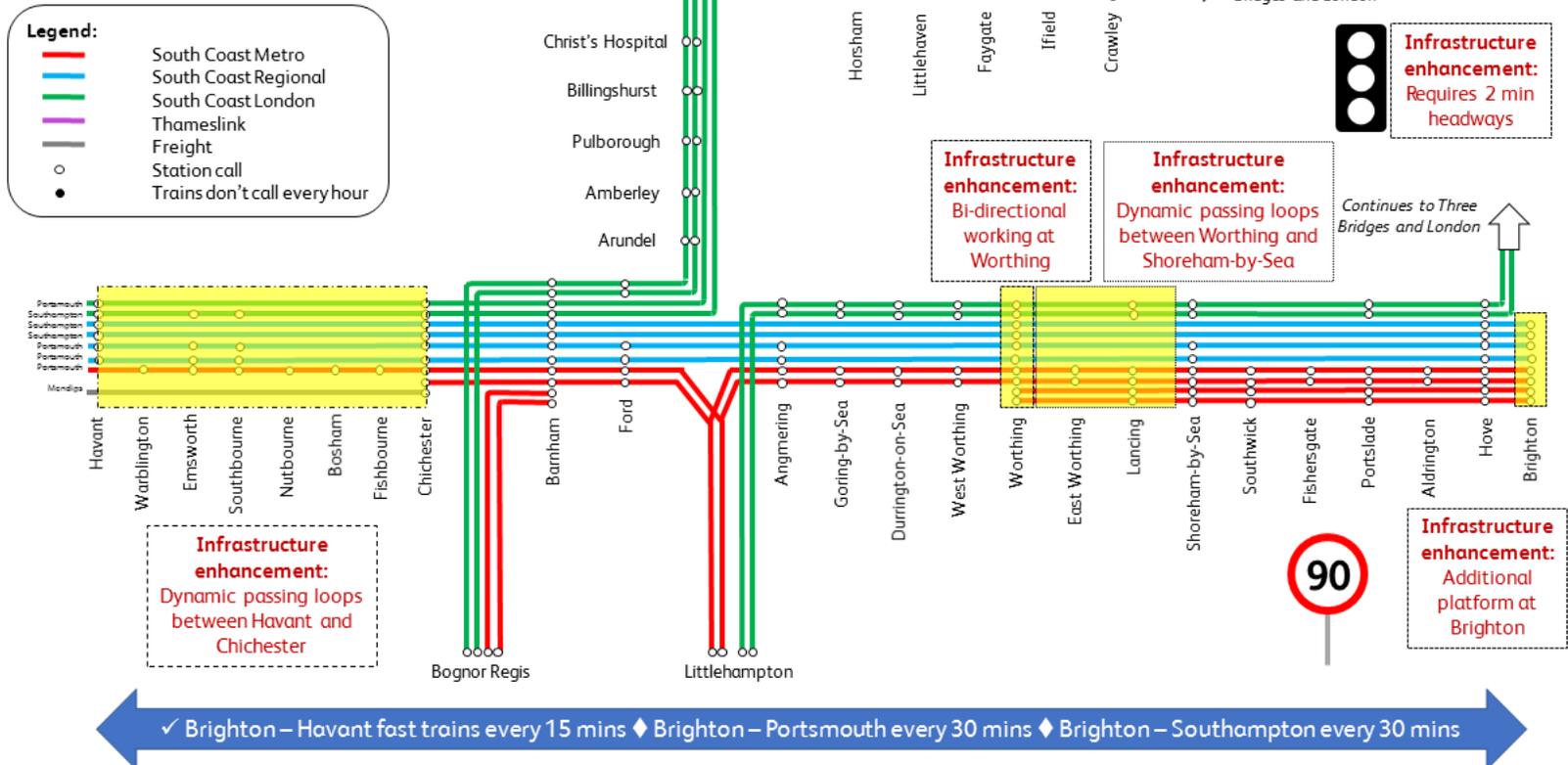
- This Option requires an infrastructure enhancement at Worthing to enable trains to use all three platforms bi-directionally. Currently, Platform 1 is a loop platform which does enable faster trains to overtake slower one. Platform 3 does have the facility to turnback towards Brighton but it is not controlled by a running signal so it cannot be used for passenger trains.
- The infrastructure investigated for this Option included two crossovers on the approach to the station from each direction and an alternative version which effectively three-track between West Worthing and Worthing station in addition to the crossovers, this enables trains to enter Platform 1 loop line much further back, allowing a following faster train to pass sooner. It also allows the platforms to be widened at the west-end, reducing safety risks and improved positioning of signals (if they are required).

Vehicles per train	Total number of additional vehicles to the baseline		Cost Range	Benefit Cost Ratio		Value for Money Rating	
	Option 2	Option 2 + Bristol		Option 2	Option 2 + Bristol	Option 2	Option 2 + Bristol
4-car	23	18	£27m to £88m	0.9 to 1.8	1.2 to 2.5	Poor to Medium	Low to High
5-car	40	30	£43m to £131m	0.6 to 1.1	0.8 to 1.6	Poor to Low	Poor to Medium
6-car	57	42	£57m to £170m	0.4 to 0.8	0.6 to 1.2	Poor	Poor to Low

### Commentary

- It is recommended that the infrastructure options are progressed through the RNEP for further development and construction. Some of the cost of the project may be reduced if Digital Railway technology is implemented at the same time as no external signals would be required. This area is controlled by Lancing Signal Box, which is scheduled for an interlocking renewal in Control Period 7 (2024-29).
- The Cost Range, above, for 4-car is the cost of bi-directional working at Worthing. For 5-car it includes the cost of bi-directional working at Worthing plus platform extensions at Aldrington, Fishersgate, Lancing, East Worthing and Southbourne. The 6-car option builds on the previous enhancements, however, amendments are required at Brighton station.

### Train Service Specification Option 3 Large infrastructure enhancements



### Gains

- ✓ Brighton - Havant every 15 minutes.
- ✓ Brighton - Portsmouth every 30 minutes.
- ✓ Brighton - Southampton every 50 minutes.
- ✓ Approximate journey time improvements:
  - Brighton - Barnham 15 minutes quicker than today.
  - Brighton - Chichester 17 minutes quicker than today.
  - Brighton - Havant 20 minutes quicker than today.
  - Brighton - Portsmouth 12-13 minutes quicker than today.
  - Brighton - Southampton 24 minutes quicker than today.

### Losses

- ✗ West Worthing-Brighton reduced from three direct trains per hour to half hourly.
- ✗ No direct trains between Littlehampton and Bognor Regis - replaced with a connection into Barnham - Bognor Regis shuttle (there is also a 20 minute frequency bus service).
- ✗ Portslade, Southwick and Lancing semi-fast train terminates at Worthing with a four minute connection for semi-fast train to Chichester and beyond.
- ✗ There are four extra trains in each direction between West Worthing and Littlehampton/ Ford and two extra trains in each direction between Hove & West Worthing and Ford & Havant. resulting in longer/more level crossing activations.

## Option 3: Large infrastructure enhancement

# Stakeholder aspirations met:

- ✓ Improve Journey Times
- ✓ Improve spacing between trains
- ✓ Improve Connectivity
- ✓ Hourly train to Bristol
- ✓ Increase Capacity

### Investment

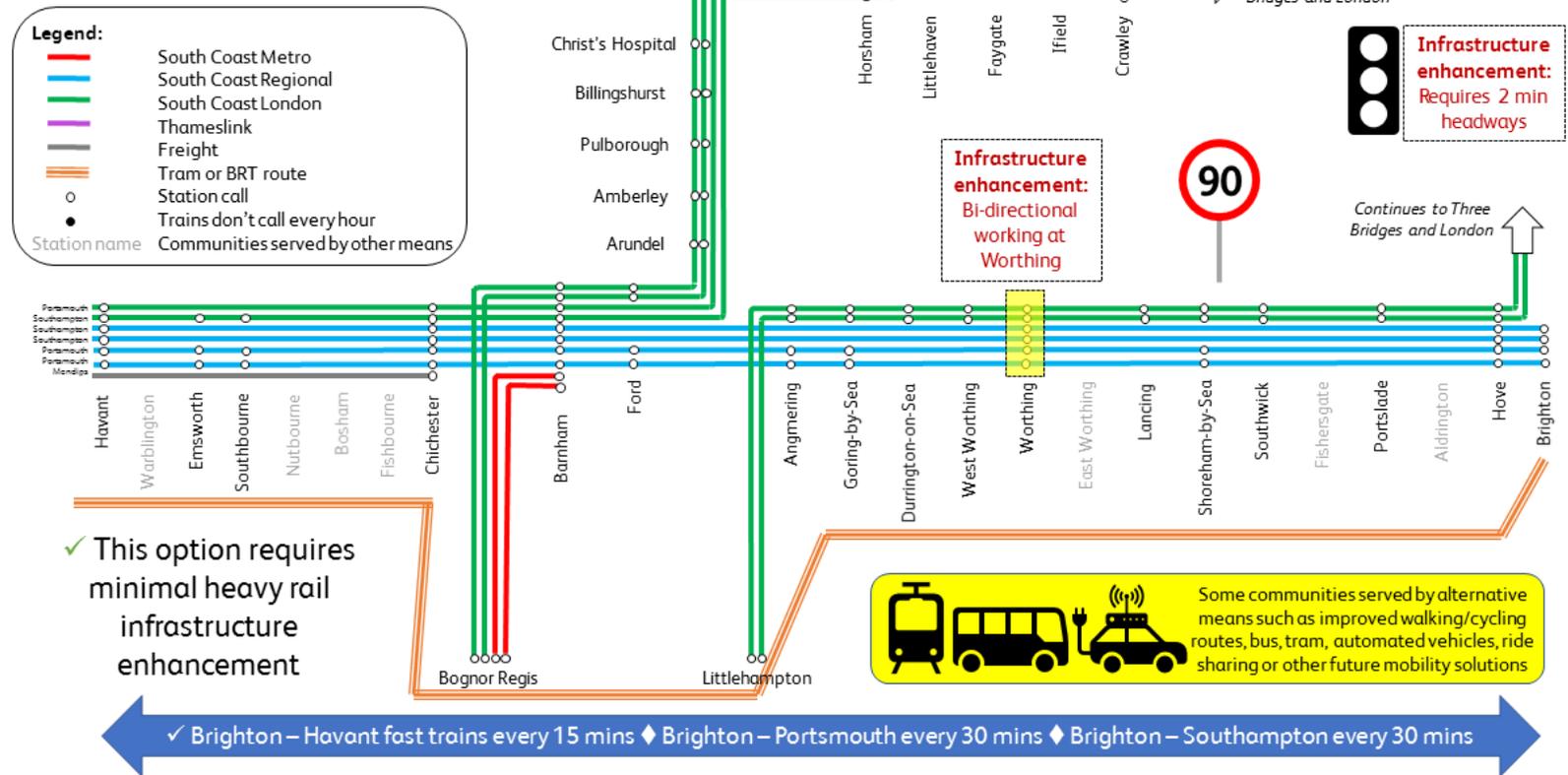
- Worthing bi-directional working enhancement detailed in Option 2.
- Three-tracking to provide dynamic passing loops will be required. As part of the development of this Study, we investigated the feasibility of dynamic passing loops between Lancing & Shoreham-by-Sea and Nutbourne & Bosham. The TSS identified that five passing loops would be required. However, these have not all been developed at this stage. Therefore the Cost Range below is not a true reflection of the final cost. Further development is required to understand the full cost and scope of this option.
- Requires a new platform at Brighton with two trains operating from all three West Coastway platforms.
- Resignalling required between Brighton and Havant to provide two-minute signalling headways (the gap between trains signalled on green aspects).
- Line speed enhancement to 90 mph is also required, this will also involve resignalling as well as track, geotechnical, structures, gauging and power supply assessments.

Vehicles per train	Total number of additional vehicles to the baseline		Cost Range	Benefit Cost Ratio		Value for Money Rating	
	Option 3	Option 3 + Bristol		Option 3	Option 3 + Bristol	Option 3	Option 3 + Bristol
4-car	47	42	A high-level feasibility assessment of three dynamic loops identified a cost range of between £30m and £250m each. This figure represents varying complexity such as land acquisition, constructability and disruption. The BCR represented low value for money at a total cost of £1.2bn. Due to the complexity of the other required locations, the estimate is likely to be significantly higher than that, therefore no further work was completed.				
5-car	70	60					
6-car	90	75					

### Commentary

- The dynamic loops, two-minute signalling headways and line speed enhancements require extensive resignalling but with Lancing and Chichester Signal Boxes due interlocking renewal in Control Period 7 (2024-29) significant cost reductions could be achieved if the projects were combined. Digital Railway technology should also be introduced to reduce costs further.
- The feasibility of improving the line speed to 90 mph was investigated on the West Coastway and Arun Valley lines. However, this feasibility discovered that it was not possible to raise the line speed between Horsham and Arundel Junction, therefore it is not recommended that this section is further developed. To maximise longer-term network capability it is recommended that further development is required to investigate improvements to headways and line speeds. There is an opportunity to combine this with the renewals programme to enable efficiencies.
- It is recommended that this Option is further considered by TfSE as it provides a mix of fast and stopping trains possible, along with significant journey time improvements although it requires significant investment, extensive and disruptive work to implement.

### Train Service Specification Option 4 Faster east-west services with no Metro



#### Gains

- ✓ Reduction in level crossing down times between Hove and Angmering.
- ✓ Brighton - Havant every 15 minutes.
- ✓ Brighton - Portsmouth every 30 minutes.
- ✓ Brighton - Southampton every 50 minutes.
- ✓ Approximate journey time improvements:  
 Brighton - Barnham 15 minutes quicker than today.  
 Brighton - Chichester 17 minutes quicker than today.  
 Brighton - Havant 20 minutes quicker than today.  
 Brighton - Portsmouth 12-13 minutes quicker than today.  
 Brighton - Southampton 24 minutes quicker than today.

#### Alternative modes

- ✓ Connect more communities
- ✓ Provide faster door-to-door journeys offsetting the slower station to station journey times
- ✓ Much higher frequency than heavy rail can achieve
- ✓ Improved pedestrian and cycle access to rail

#### Losses

- ✗ Some longer distance journeys from smaller stations will be replaced by using alternative means to a main station for interchange, offset by increase in frequency of journey opportunities.

## Option 4: for Faster east-west trains with no Metro services

# Stakeholder aspirations met:

- ✓ Improve Journey Times
- ✓ Improve spacing between trains
- ✓ Improve Connectivity
- ✓ Hourly train to Bristol
- ✓ Increase Capacity

### Investment

- Worthing bi-directional working enhancement detailed in Option 2.
- Resignalling required between Brighton and Havant to provide two-minute signalling headways (the gap between trains signalled on green aspects).
- Line speed enhancement to 90 mph also required, this will also involve resignalling as well as track, geotechnical, structures, gauging and power supply assessments.

Vehicles per train	Total number of additional vehicles to the baseline		Cost Range	Benefit Cost Ratio		Value for Money Rating	
	Option 4	Option 4 + Bristol		Option 4	Option 4 + Bristol	Option 4	Option 4 + Bristol
4-car	This Option has not been appraised as no development has been completed.						
5-car							
6-car							

### Commentary

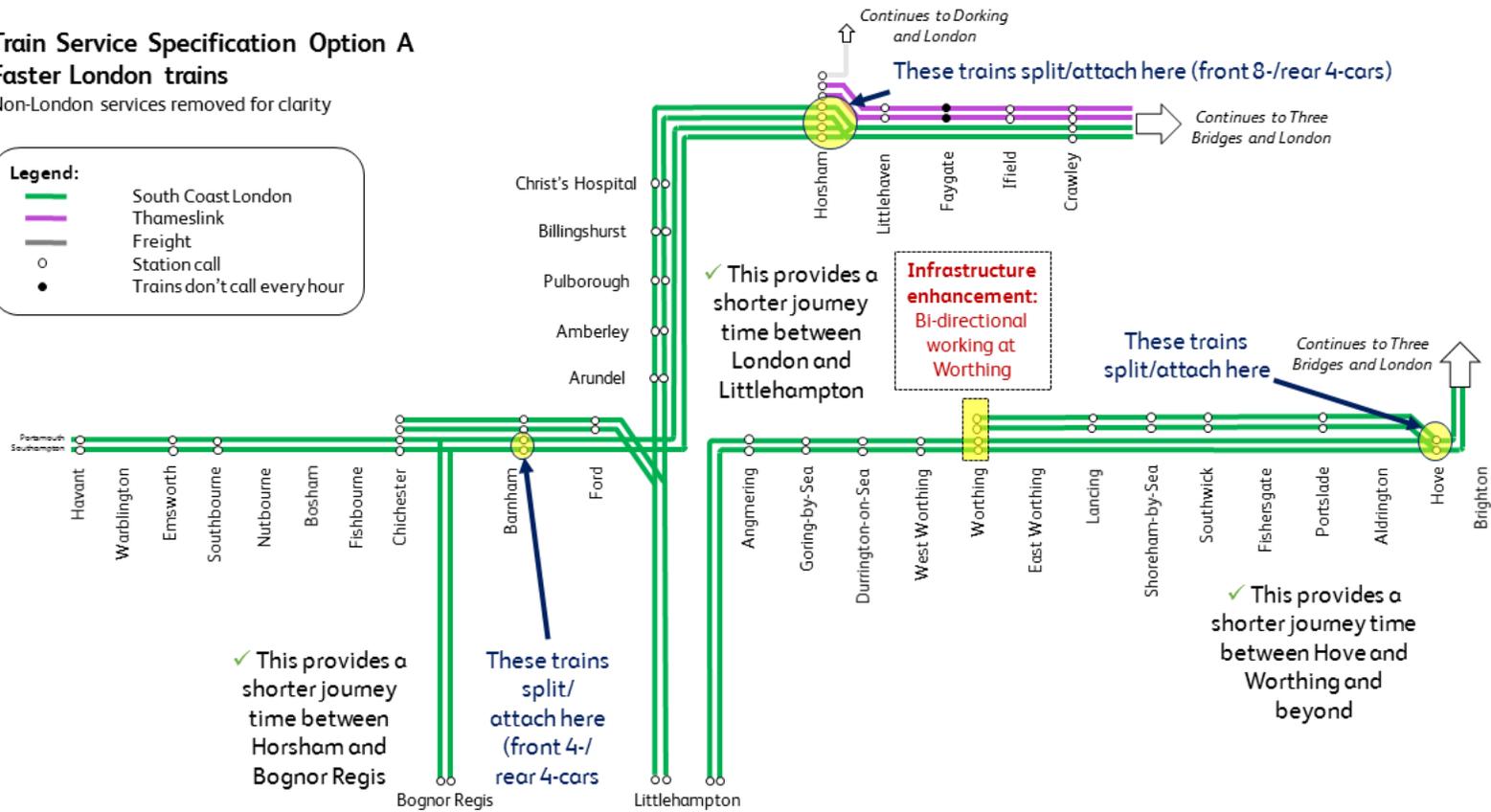
- This Option is essentially, Option 3 with the Brighton-Worthing-Littlehampton-Chichester-Portsmouth Metro services (the stopping trains) replaced by tram, bus rapid transit etc.
- The two-minute signalling headways and line speed enhancements require extensive resignalling but with Lancing and Chichester Signal Boxes due interlocking renewals in CP7 (2024-29) significant cost reductions could be achieved if the projects are combined. Digital Railway technology should also be introduced to reduce costs further.
- The feasibility identified that line speed improvements up to 90 mph could be achievable between Hove - Worthing, Worthing - Arundel Junction, Ford - Chichester and Chichester - Havant. However, further development is required.
- It is recommended that this Option is further considered by TfSE as it provides a the fast east-west trains without the dynamic passing loops. It was not appraised as the costs of providing alternative means of transport is not known.

### Train Service Specification Option A Faster London trains

Non-London services removed for clarity

**Legend:**

- South Coast London
- Thameslink
- Freight
- Station call
- Trains don't call every hour



- ### Gains
- ✓ Southbourne and Emsworth double frequency to two trains per hour to London
  - ✓ 14 minutes faster journeys between London and Bognor Regis.
  - ✓ 14 minutes faster journeys between London and Littlehampton.
  - ✓ 3 minutes faster journeys between London and Chichester.
  - ✓ 3 minutes faster journeys between London and small Arun Valley stations.
  - ✓ 4 minutes faster journeys between London and Worthing and stations to Angmering.
  - ✓ Direct journeys between London and Southwick.
  - ✓ Direct trains from Arun Valley Line stations south of Horsham to Littlehampton and Chichester.
  - ✓ Littlehampton Chichester if combined with options 1-6 increased to 4 tph.

- ### Losses
- ✗ Journey time London-Portslade, Shoreham-by-Sea and Lancing may be slower (some options fast portion stops at Shoreham-by-Sea making it slightly faster, but this reduces the journey time improvement to Worthing).

## Option A: Faster journey opportunities to/from London

### Stakeholder aspirations met:

- ✓ Improve Journey Times
- ✓ Improve spacing between trains
- ✓ Improve Connectivity
- ✓ Increase Capacity

#### Investment

- This Option requires a software/hardware change to the existing Class 377 fleet to enable faster splitting and attaching. Alternatively, a new fleet of trains could be introduced with this ability.
- Worthing bi-directional working enhancement detailed in Option 2.

Vehicles per train	Total number of additional vehicles to the baseline	Cost Range	Benefit Cost Ratio	Value for Money
	Option A		Option A	Option A
12-car	Not applicable	£125m	4.6 to 39.6	Very High

#### Commentary

- This Option provides faster services between London and the Coast, it is possible to implement this with any of the other Options.
- The Arun Valley line trains split first at Horsham (as now) to provide a 4-car stopping service to Chichester via Littlehampton. The front portion (8-cars) runs fast to Barnham (as now) where it splits: the front 4-car continues to Portsmouth/Southampton (as now) and the rear 4-car runs to Bognor Regis. The reverse working sees the trains combining at Barnham and Horsham. This provides faster journey times to Bognor Regis and Littlehampton. This would be the quickest way to Littlehampton. Additional rolling stock would be required in the off-peak.
- The West Coastway service, runs as now via the Brighton Main Line to Hove, where it divides, the front portion runs fast to Worthing then most stations to Littlehampton, the rear portion then follows calling at all stations to Worthing. This requires the bi-directional signalling enhancement at Worthing to enable the slow portion to terminate and turn back.
- This is, obviously, a performance risk as one segment running late, will effect the other two trains but the journey time improvements and new journey opportunities it presents cannot be overlooked. Performance and service robustness would have to be studied in detail as part of the timetable change process.
- The Study recommends further investigation into the software/hardware upgrade of the Class 377s and implementation of this Option.

## Conclusion

This Study has drawn on the aspirations of the stakeholders to produce a number of questions which, in answering, have produced outputs that can be taken forward as recommendations.

The immediate interventions are:

- Replace the Class 313 units with modern Coastway-configured trains
- Introduce the Train Service Specification Option 1, which requires no additional rolling stock or infrastructure
- Improve coastal connectivity to London through improvements to the Class 377s to enable faster attaching/detaching
- Advertise the last trains from Brighton to Worthing
- Enable reduced level crossing down times by lengthening platforms that are too short for the longest trains
- Enable faster east-west journeys and improve service resilience by progressing Worthing bi-directional working, see TSS Option 2
- Enable later/earlier trains between Horsham and Gatwick Airport
- Progress Worthing bi-directional working and an additional platform at Brighton through the RNEP process

Other recommendations requiring further development with Transport for the South East:

- Further development of TSS Options considering the following:
  - ⇒ Improve east-west journey times
  - ⇒ Consistent intervals within the timetable
  - ⇒ Optimising the mix of long-distance and stopping services
  - ⇒ Increasing the volume of services between Brighton and Southampton/Bristol
  - ⇒ Encapsulating the recommendations of the Solent Study
- Bus links connecting neighbourhoods and employment locations to stations with integrated timetables
- Consistent approach to the options available for passengers to use other modes to connect to the railway
- Improving connections from stations to the South Downs National Park
- Exploit the opportunities for improved cycle and walking routes to the station and the facilities at the station to make interchange as easy as possible.

Further development work, in partnership with other stakeholders, is recommended to find a way forward for the proposed new stations on the Arun Valley line.

Probably longer-term interventions recommended are:

- Non-London services train lengthening
- Platform lengthening to ensure platforms are not shorter than the shortest train
- Power supply assessment for longer trains
- Maximising network capability.

Delivery opportunities through Digital Railway technology and enhanced renewals to provide the two-minute headways and 90 mph (where possible) as part of the asset renewal programme is recommended.

The rail refranchising model is currently undergoing reform, it is recommended that train service and rolling stock changes are integrated into the new model to enable a whole-system approach.



A Class 313 unit passes a new substation between Shoreham-by-Sea and Southwick.

## Glossary

Word or phrase	Meaning
<a href="#">4-tracking</a>	Quadruple tracks, currently the lines are double track so two more tracks would be added
<a href="#">750V DC</a>	Trains in the Study area operate on 750 volts direct current through a third (or conductor) rail
<a href="#">AHB</a>	Automatic Half Barrier level crossing - typically used in rural areas
<a href="#">AONB</a>	Area of Outstanding Natural Beauty
<a href="#">Arun Valley Line</a>	The railway line between Three Bridges and Arundel Junction, near Ford
<a href="#">BML</a>	Brighton Main Line - the railway between Brighton and London via Gatwick Airport. There is also a <a href="#">BML Upgrade Programme</a> .
<a href="#">Bus Rapid Transit</a>	Fast bus transport solution
<a href="#">C2C LEP</a>	Coast to Capital Local Enterprise Partnership - business partnership from the Coast to Croydon
<a href="#">CARS</a>	Croydon Area Remodelling Scheme - major upgrade of the Brighton Main Line in the Croydon area
<a href="#">CCTV Level Crossing</a>	Closed Circuit TeleVision remotely monitored level crossing, typically the barriers close the road completely used in built-up areas
Chord	A line joining two other lines, can be single or double track
<a href="#">Clockface</a>	Same departure time every hour
<a href="#">CMSP</a>	Continuous Modular Strategic Planning - the process to develop 'future plans' (to 30 years) for the Network Rail managed rail network
<a href="#">Control Period</a>	Network Rail is funded by the DfT in 5-year Control Periods. This Study was published in Year 2 of CP6 (2019-24)
<a href="#">DfT</a>	Department for Transport - government department
<a href="#">Digital Railway</a>	UK name for the European Train Control System and other technologies, it introduces in-cab signalling and traffic management
<a href="#">Double track</a>	Two parallel sets of railway lines, they are operated directionally
<a href="#">East Coastway</a>	The railway between Brighton and Seaford/Eastbourne/Hastings
<a href="#">GTR</a>	Govia Thameslink Railway - passenger train operating company. Includes <a href="#">Southern Railway</a> and <a href="#">Thameslink</a> .
<a href="#">Guided busway</a>	Segregated bus road with concrete sides to guide the buses
<a href="#">GWR</a>	Great Western Railway - passenger train operating company
<a href="#">Headways</a>	Signalling headways - the time it takes for a train to pass through a section beyond a signal before it can show a green aspect
<a href="#">HMRC</a>	Her Majesty's Revenue and Customs
<a href="#">Homes England</a>	Government housing development body
<a href="#">Light Rail</a>	Modern tram system
<a href="#">MHCLG</a>	Ministry of Housing, Communities & Local Government - government department
mph	Miles Per Hour
<a href="#">National Park</a>	South Downs National Park
<a href="#">ORR</a>	Office for Rail and Road - the industry regulator
<a href="#">PiXC</a>	Passengers in eXcess of Capacity - DfT measure of overcrowding on trains
<a href="#">RNEP</a>	Rail Network Enhancements Pipeline - a national process to fund and develop projects
<a href="#">Route Study</a>	High level study as part of the Continuous Modular Strategic Planning process
<a href="#">RUS</a>	Route Utilisation Strategy - predecessor to the Route Studies
<a href="#">SWR</a>	South Western Railway - passenger train operating company
<a href="#">TAG</a>	The DfT Transport Analysis Guidance used for appraisal and modelling
<a href="#">TfSE</a>	Transport for the South East - shadow transport authority for the South East (not including London)
TSS	Train Service Specification - high level timetable requirements for a standard hour, usually a list of services or basic single-hour timetable
<a href="#">West Coastway</a>	The railway line between Brighton and Havant
West Coastway East	The railway line between Brighton and Arundel Junctions
West Coastway West	The railway line between Arundel Junctions and Havant

## Bibliography

Item	Source	Year of publication/ search
Map of Train Operating Companies	<a href="#">National Rail</a>	2019
Sussex Area Route Study	<a href="#">Network Rail</a>	2015
Draft Transport Strategy for the South East	<a href="#">Transport for the South East</a>	2019
London & South Coast Rail Corridor Study	<a href="#">Department for Transport</a>	2016
Reigate Platform 3 project	<a href="#">Network Rail</a>	Ongoing public consultation
Croydon Area Remodelling Scheme	<a href="#">Network Rail</a>	
Map of Figs.1.1 & 3.1	Network Rail GeoRIMN	2020
Figs. 3.2, 3.3, 3.6, 3.7 & 4.8	<a href="#">Transport for the South East</a>	2019
Figs. 1, 3.4, 3.5, 4.8 to 4.11, 5.2, Tables 1.1. 2.1, 3.1, 4.1, 5.1 & 5.3	<a href="#">Network Rail</a>	2020
Table 3.2 Cost comparisons	<a href="#">National Rail</a>	2020
	<a href="#">Stagecoach Bus</a>	2020
	<a href="#">Google Maps</a>	2020
	<a href="#">Parkopedia app</a>	2020
Fig. 3.8 Comparison of journey times	<a href="#">Google Maps</a>	2019
Annual Bus Statistics	<a href="#">Department for Transport</a>	2019
Fig. 4.1 to 4.7, Census data	<a href="#">Office for National Statistics</a>	2011
Fares review	<a href="#">Rail Delivery Group</a>	2019
Table 5.2	<a href="#">Visit Britain</a>	2017
	<a href="#">Amex Stadium</a>	2020
Fig. 5.1	Network Rail and stakeholders	2019
	<a href="#">Ordnance Survey Election Maps</a>	2019



Passengers queuing at Brighton station's barrier line. Several trains had recently arrived.