Long Term Planning Process

South East Route: Kent Area Route Study

March 2017

Technical Appendix

Draft for consultation

Contents

Housebuilding as part of Ebbsfleet Garden City

Acknowledgements

We would like to thank the following for the photographs and illustrations in this document:

Network Rail (Alex Hellier, Luke Longley, Shravan Patel and Paul Best), Transport for London (Steve Miles), Southeastern (Elliott Waters) and Ebbsfleet Development Corporation,

Ordnance Survey maps generated using Geo-RINM Viewer:

Introduction

WHAT IS... GRIP?

This acronym is widely used in the industry and refers to the Governance for Railway Investment Projects and has been developed based on industry best practise with significant guidance and input from the Association of Project Management (APM), Chartered Institute of Building (CIOB) and Office for Government Commerce PRINCE2® project delivery framework.

There are eight formal stages to the GRIP process:

1. Output definition
2. Pre Feasibility
3. Option Selection
4. Single Option Development
5. Detailed Design
6. Construction, Testing & Commission
7. Scheme Handback
8. Project Close Out.

Often, with Route Study schemes we are at the pre-output definition stage - we know something needs to be done but we are not necessarily sure what, how or if it can be done!

These Pre-GRIP schemes are taken forward for early development to identify what solutions could be available before launching into a fully fledged scheme.

Due to the vagaries of the schemes at this stage they have a high optimism bias, in other words, a high percentage (60%) of the forecast cost of the scheme is added to cover for future changes when the scheme goes forward into GRIP.

It is anticipated that the eventual cost of the scheme will be reduced but this is not always the case as further work and surveys and design work can highlight previously unknown issues.

1. This Technical Appendix provides the technical evidence to support the conclusions and choices for funders presented in the main **Route Study** document. The areas of technical analysis outlined are capability analysis, concept development (at pre-GRIP level), cost estimation, business case analysis and passenger capacity analysis at stations.

2. The evidence is presented in the order of the 'conditional outputs', to align with the main document.

Capability Analysis - Assumptions & Methodology

3. The understanding of the capacity available on the network today is critical to assess whether any additional services can be accommodated in the timetable. The December 2015 timetable current train planning rules have been used as a basis for the capability analysis for each capacity driven conditional output. For each service route for the conditional output, the assessment was undertaken in three stages aligned to the 2024 and 2044 option.

- **Lengthen Services – 2024:** The usable platform lengths for all stations on the routes were reviewed to assess whether they can accommodate the required lengthened services in their existing state or require platform extensions.
- **Additional Paths – 2024:** The routes were reviewed in the Timetable Planning System (TPS) to assess the opportunities for the required additional paths. This included a review of the service pattern of trains travelling on each route and their interaction at junctions.
- **Maximum Number of Paths – 2044:** A theoretical assessment was made for each route that identified the maximum possible number of trains which the current infrastructure, timings and rules will allow between junction points. This essentially looks at signalling headways.

Concept Development

4. Where the projected passenger demand cannot be accommodated on the existing network or a connectivity gap has been identified, potential interventions were identified and assessed. These are presented as choices for funders. The engineering assessment undertaken has been at a high level and forms the pre-GRIP stage of development in terms of Network Rail's governance process for infrastructure project development. The aim of the assessment is to determine whether potential concepts identified are technically feasible and capture some early thinking about risks, opportunities, deliverability and planning.

Cost Estimation

5. Cost estimates have been prepared for some potential interventions, with others to follow in the final publication. The estimates are based on pre-GRIP data available, concept drawings and high level specification of the scope. To reflect the level of information available to support the estimate production, a contingency sum of 60% has been added. The estimates do not include inflation. Indicative cost ranges have been provided based on this assessment.

Business case analysis

6. Business case analysis has been undertaken to demonstrate to funders whether a potential investment option offers value for money. The analysis follows DfT Webtag guidance, taking into account the investment cost, including capital and operating expenditure and benefits such as time savings, reduced road congestion as people shift to rail and revenue from passengers.

Stations analysis

7. Concepts have been developed for interventions at three stations across the route, which are in the top ones for crowding and congestion nationally. These are Lewisham, Peckham Rye and Denmark Hill whilst Bromley South and Brixton have also been identified for improvements to aid passenger flow but are further down the national priority list. The concepts are high level and based on pre-GRIP data available.

Conditional Ouputs

****Please note that these Conditional Outputs are aspirations for the industry to deliver in the long term subject to value for money, deliverability and affordability. Equally the conditional outputs needs to be deliverable - technologically, operationally and physically****

	Capacity
CO1	Provide sufficient passenger capacity for passengers travelling into Central London to accommodate **2024** peak demand - **London Bridge Metro services**
CO2	Provide sufficient passenger capacity for passengers travelling into Central London to accommodate **2024** peak demand - **London Victoria Metro services**
CO3	Provide sufficient passenger capacity for passengers travelling into Central London to accommodate **2024** peak demand - **High Speed to London St Pancras International**
CO4	Provide sufficient passenger capacity for passengers travelling into Central London to accommodate **2024** peak demand - **London Blackfriars Metro services**
CO5	Provide sufficient passenger capacity for passengers travelling into Central London to accommodate **2024** peak demand - **London Bridge & Victoria Main Line services**
CO6	Provide sufficient passenger capacity for passengers travelling into Central London to accommodate **2024** peak demand - **London Orbital services (East & South London Lines)**
CO7	Provide sufficient passenger capacity for passengers travelling into Central London to accommodate **2044** peak demand - **London Bridge Metro services**
CO8	Provide sufficient passenger capacity for passengers travelling into Central London to accommodate **2044** peak demand - **London Victoria Metro services**
CO9	Provide sufficient passenger capacity for passengers travelling into Central London to accommodate **2044** peak demand - **High Speed to London St Pancras International**
CO10	Provide sufficient passenger capacity for passengers travelling into Central London to accommodate **2044** peak demand - **London Blackfriars Metro services**
CO11	Provide sufficient passenger capacity for passengers travelling into Central London to accommodate **2044** peak demand - **London Bridge & Victoria Main Line services**
CO12	Provide sufficient passenger capacity for passengers travelling into Central London to accommodate **2044** peak demand - **London Orbital services (East & South London Lines)**
CO13	Provide sufficient passenger capacity for passengers travelling between Brighton and Ashford International to accomdate all day demand

	Connectivity
CO14	Provide a minimum of 3-4tph to/from central London during peak off hours from stations within 30 miles of London
CO15	Provide a Generalised Journey Time (GJT) of 40-100 minutes to significant centres of population over 30 miles from central London: **Hastings**
CO16	Provide a Generalised Journey Time (GJT) of 40-100 minutes to significant centres of population over 30 miles from central London: **Ramsgate**
CO17	Provide a Journey Time (JT) of less than 60 minutes within Kent or significantly less than 100 minutes within South East Route (connectivity between urban centres): **Brighton - Ashford International**
CO18	Provide a Journey Time (JT) of less than 60 minutes within Kent or significantly less than 100 minutes within South East Route (connectivity between urban centres): **North Kent - South Kent**

	Capability
CO19	Test the capability of the network to accommodate forecast passenger demand
CO20	Test the capability of the network to accommodate forecast freight demand

	Other Conditional Outputs
CO21	Provide sufficient capacity to accommodate passenger circulation at stations within the Kent Area
CO22	To accommodate demand during week day evenings and on weekends
CO23	To provide connectivity to International Gateways: **Airports**
CO24	To provide connectivity to International Gateways: **Dover Port**
CO25	To provide connectivity to HS2
CO26	To provide connectivity to Crossrail
CO27	To provide connectivity to social infrastructure such as hospitals, educational establishments etc.
CO28	To provide network resilience

1 London Bridge Metro (C01 & C07)

1.1 Capability and Capacity Analysis

1.1.1. The Capability and Capacity Analysis Team have analysed and tested the timetable and capacity options to assess the feasibility of each option.

- Via Orpington
- Via Bexleyheath
- Via Sidcup
- From Hayes

1.1.2. **2024:** The Individual Option Assessments considered the vehicle gaps identified by the Route Study with the options to either lengthen services or operate additional paths to fill the gaps. **Table 1.1** shows the number of additional paths required for each individual route depending on the lengthening option.

Table 1.1 - 2024 additional pathways

Route	Number of additional paths required without lengthening	Number of additional paths required with lengthening to 10-car	Number of additional paths required with lengthening to 12-car
Via Orpington	2	1	0
Via Bexleyheath	1	0	0
Via Sidcup	2	1	0
From Hayes	1	0	0
Total	**6**	**2**	**0**

1.1.3. **2044:** The Individual Option Assessments analysed the maximum possible number of paths required. This is assessed against the 2044 vehicle gaps to identify if the longer term forecasts can be achieved, and what constraints exists if the gaps cannot be filled.

1.1.4. **Table 1.2** shows the total number of paths required for each individual route for both 10-car and 12-car operations to fulfil the 2044 requirements, when combining the base vehicle and vehicle gap figures.

Figure 1.1 - London Bridge Metro area with choices for funders (Figure 5.2 in the main document)

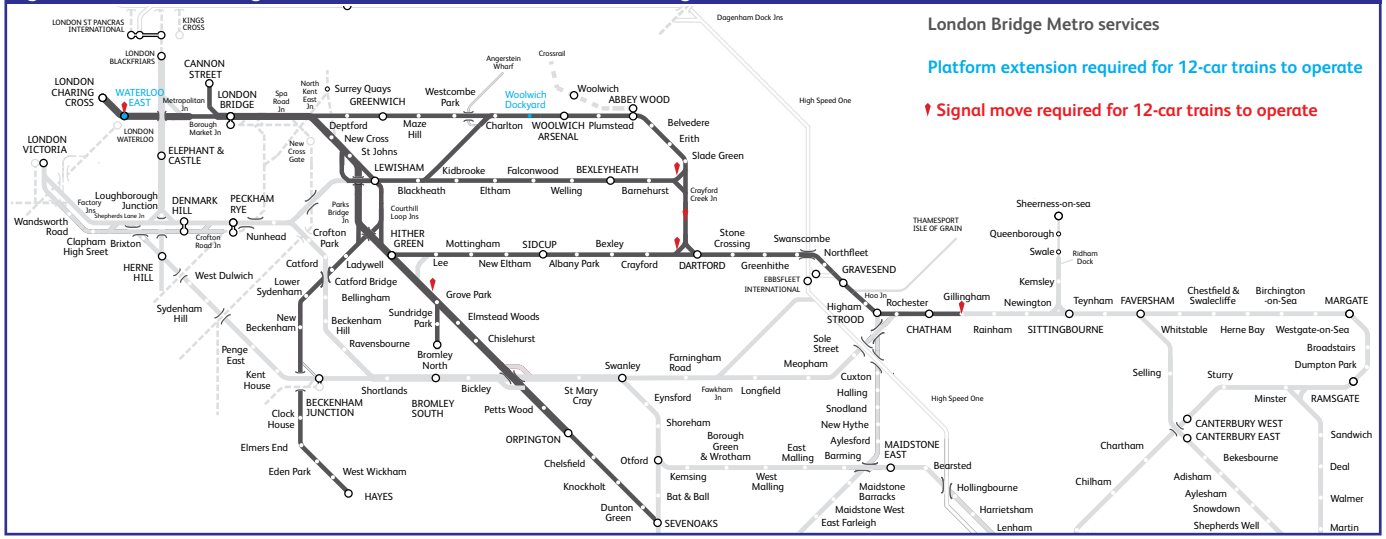


Table 1.2 - 2044 vehicles and pathways

Route	Base vehicles	Vehicle gap	Total vehicles (Base+ Gap)	Max. paths required in 2044	
				10-car	12-car
Via Orpington	72	34	**106**	11	9
Via Bexleyheath	76	22	**98**	10	9
Via Sidcup	78	36	**114**	12	10
From Hayes	52	22	**74**	8	7
Total	**278**	**114**	**392**	**41**	**35**

Figures are Total Vehicles divided by the number of cars (10 or 12).

All figures are rounded up to the nearest whole.

Table 1.3 - Pathways current vs 2044

Route	Current no. of paths		Max. paths required by 2044		Additional paths required by 2044	
	10-car	12-car	10-car	12-car	10-car	12-car
Via Orpington	8	6	11	9	**3**	**3**
Via Bexleyheath	8	7	10	9	**2**	**2**
Via Sidcup	8	7	12	10	**4**	**3**
From Hayes	6	5	8	7	**2**	**2**
Total	**30**	**25**	**41**	**35**	**11**	**10**

Figures are Base Vehicles divided by the number of cars (10 or 12).

All figures are rounded up to the nearest whole.

1.1.5. **Table 1.3** shows the current number of paths for 10- and 12-car operations compared against the maximum paths required for 2044:

1.1.6. An issue with operating 12-car trains between Dartford and London Bridge are the triangle junctions which enable trains to run from Dartford to all three routes or to avoid Dartford by turning on to one of the other routes back to London. The Cannon Street - Bexleyheath - Woolwich Arsenal - Greenwich - Cannon Street service is an example of such a service.

1.1.7. The position of signals on all sides of the Erith triangle means that a 12-car train stopped at a signal blocks the junction behind the train. This can lead to a log jam if trains on opposing tracks block each other in.

1.1.8. The Crayford triangle is not as restrictive as only the Dartford avoiding lines are not long enough for a 12-car train to stop between the signal and the junction.

1.1.9. Options have been developed for these conflicts. Solutions can be as simple as lowering the linespeed to enable the signal to be moved closer to the junction or complicated like extending the loop lines so they run parallel to the main lines before joining them at a junction once the lines are long enough for 12-car trains.

Bromley North Branch

1.1.10. In 2024 there is projected to be a vehicle gap of four vehicles. The options reviewed were:

- Lengthen services to 3-car
- Operate a 4tph service pattern.

1.1.11. In 2044 there is projected to be a vehicle gap of six vehicles.

1.1.12. With current train planning rules values and running times between stations, only 3tph (trains per hour) are achievable as a single shuttle service. 4tph in each direction to be achieved as a single shuttle service would require a service every 15 minutes. This would require a saving of five minutes per service (15 minutes in the hour) and is not achievable with current train planning rules, including the minimum turnaround required at both Bromley North and Grove Park.

1.1.13. An alternative way forward, which is being operated by Southeastern for one hour of the day, operating a 4tph service with a two train drivers, one in each cab. This means the turnaround time at each terminus can be reduced to around two minutes.

1.2 London Bridge Metro Service Train Lengthening Pre-GRIP study

1.2.1. The aim of the study was to identify infrastructure that limits the ability to operate 12-car Class 465 services on the London Bridge Metro Service Route. The study was to support plans to provide additional capacity for projected growth on the London Bridge Metro Service, to meet future demands by extending existing services to 12-car operation. The study focused on identifying constraints restricting 12-car operation on this route, which were identified at Woolwich Dockyard Station (Platforms 1 and 2), Grove Park Station (Platform 3), Waterloo East Station (Platforms B and D), Gillingham Station (Platforms 2 and 3) and the Erith Loop. Charing Cross has been excluded as this has been looked at before, currently there is a restriction on 12-car Class 465 trains in certain platforms.

Woolwich Dockyard:

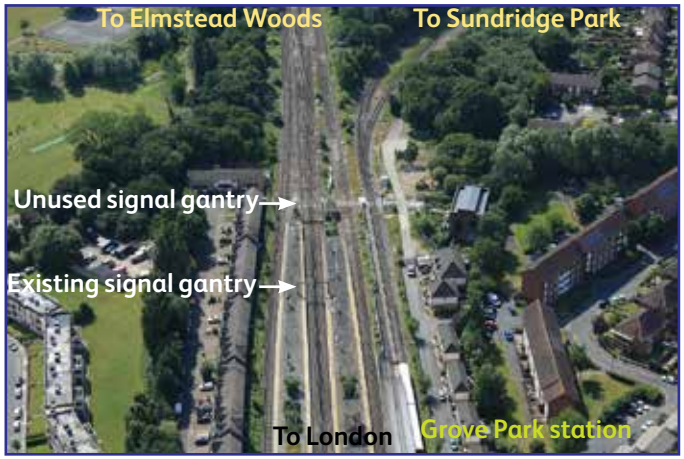
1.2.2. It has been identified that Woolwich Dockyard station requires platform extensions to be able to cater for 12-car services. The Platforms (Platform 1 and Platform 2) can both only currently accommodate up to 10-car service lengths. The station is located within a cutting and has tunnels at either ends.

1.2.3. Two options have been developed for the scheme, but Option 1, which is to extend platforms towards the country end (Kingsman Street), is preferred.

Grove Park:

1.2.4. Platform 3 at Grove Park has been identified to be sufficient for 12-car services to call but has signalling and DOO restrictions that would need resolving to bring the platform into 12-car operation.

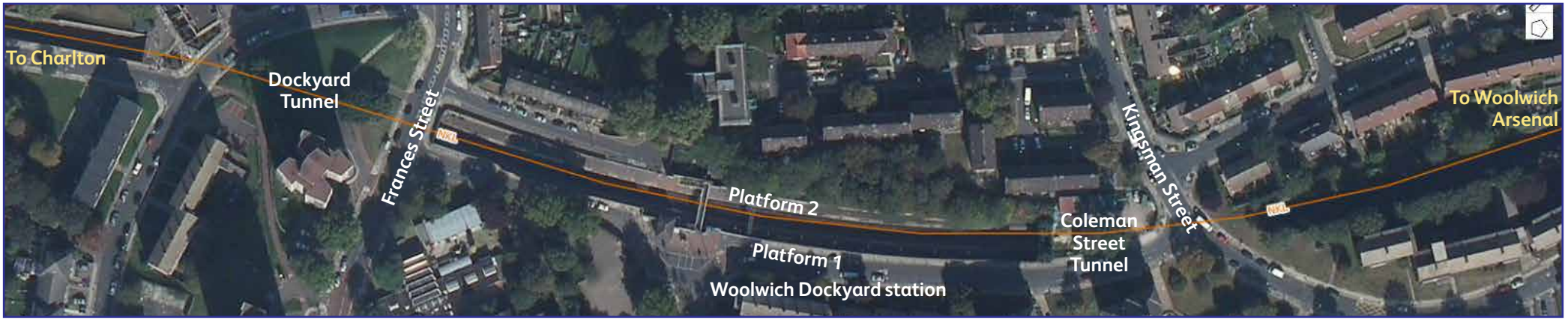
1.2.5. A signal relocation and installation of screens within the existing DOO monitor bank is recommended to provide 12-car service provision.



Erith Loop:

1.2.6. The Erith Loop has both track and signal related restrictions to accommodate 12-car services, before they enter Barnehurst Station. 12-car services would fall foul of the trailing points and block main line operations.

1.2.7. Two options have been developed for the scheme, but Option 1, relocating signal NK262 approximately 25m towards Perry Street Fork Junction to allow 255m standage and allowance for stopping accuracy and stand-back from the signal, is recommended.



Waterloo East:

1.2.8. It was identified that both Platforms B and D currently have limitations that impact on 12-car operations at the station. Platform B is able to stand 12-car Class 375 services, but has reduced stand-back on signals for 12-car Class 465 services. Platform D is very narrow at the country-end, impacting on access and egress from 12-car services.

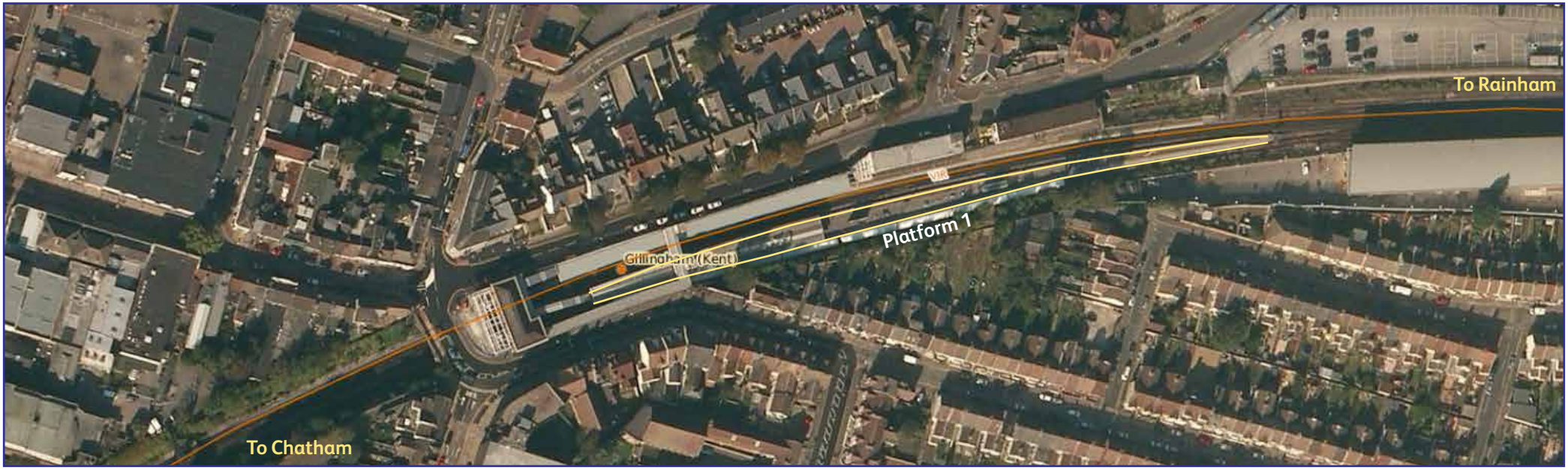
1.2.9. On Platform B, it is possible to extend the platform towards Signal TL2009 at the country-end. On platform D, it is recommended that the platform be widened to provide a minimum 3m width at the country-end.

The rear of a Charing Cross train in Platform B at Waterloo East, the front of the train is close to the signal

Gillingham:

1.2.10. There is a known turn-back restriction on Platform 2 at Gillingham Station. Platforms 2 and 3 at Gillingham have been recorded to take 12-car Class 375 services without significant issues. However, it is understood that Platform 2 is not able to compliantly accommodate 12-car Class 465 trains (note: it is identified that there is an approximately 3m difference in lengths between the 12-car Class 375 and 12-car 465 services).

1.2.11. It is recommended that either, signals on Platform 2 are relocated to provide the minimum stand-back required, or agree with the TOC a stand-back of less than the standard minimum, but ensuring that all passenger and staff crew doors are still located on the platforms.



2 Victoria Metro (CO2 & CO8)

2.1 **Table 2.1** shows the total number of paths required for each individual route for 8-, 10- and 12 car operations to fulfil the 2044 requirements, when combining the base vehicle and vehicle gap figures.

2.2. **Table 2.2** shows the current number of paths for 8-, 10- and 12-car operations compared against the maximum paths required for 2044.

Figure 2.1 - London Victoria Metro area with choices for funders (Figure 5.3 in the main document)

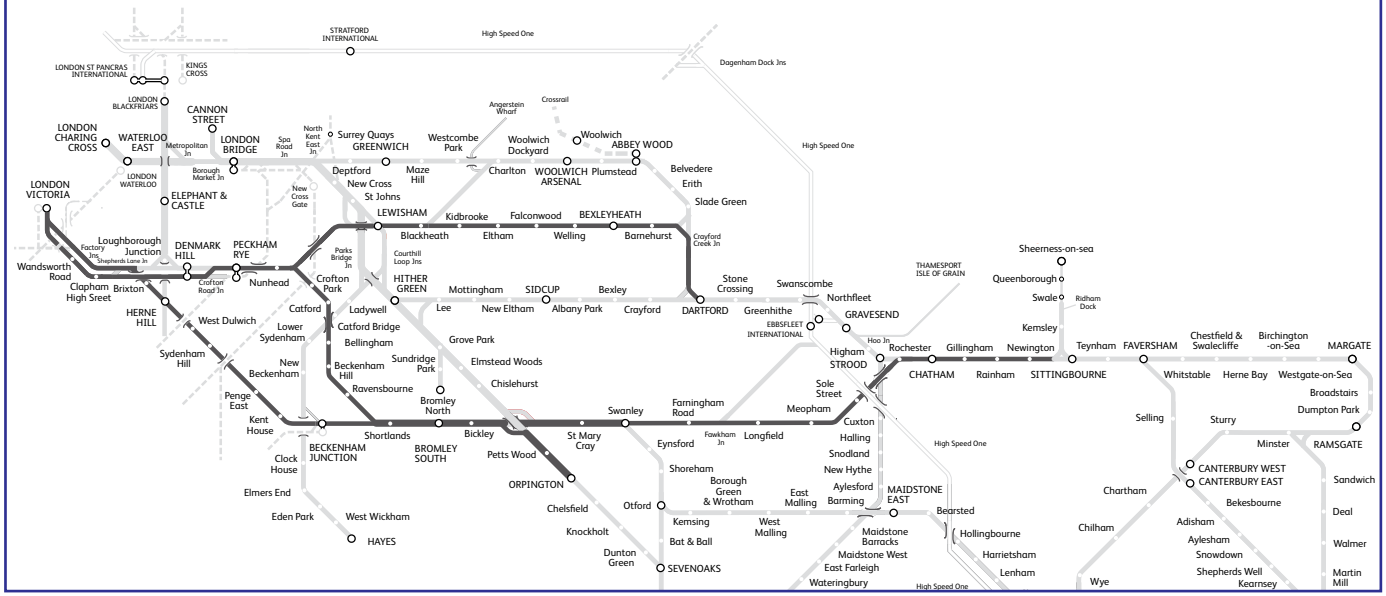


Table 2.1 - 2044 vehicles and pathways

Route	Base vehicles	Vehicle gap	Total vehicles (Base+ Gap)	Max. paths required in 2044		
				8-car	10-car	12-car
Via Herne Hill	36	14	**50**	7	5	5
Via Catford Loop	14	2	**16**	2	2	2
Via Lewisham	22	6	**28**	4	3	3
Total	**72**	**22**	**94**	**13**	**10**	**10**

Figures are Total Vehicles divided by the number of cars (8, 10 or 12).

All figures are rounded up to the nearest whole.

Table 2.2 - Pathways current vs 2044

Route	Current no. of paths			Max. paths required by 2044			Additional paths required by 2044		
	8-car	10-car	12-car	8-car	10-car	12-car	8-car	10-car	12-car
Via Herne Hill	5	4	3	7	5	5	**2**	**1**	**2**
Via Catford Loop	2	2	2	2	2	2	**0**	**0**	**0**
Via Lewisham	3	3	2	4	3	3	**1**	**0**	**1**
Total	**10**	**5**	**7**	**13**	**10**	**10**	**3**	**0**	**3**

Figures are Base Vehicles divided by the number of cars (8, 10 or 12).

All figures are rounded up to the nearest whole.

3 High Speed (CO3 & CO9)

3.1 Capability and Capacity Analysis

3.1.1. **2024 vehicle gaps:** 24 vehicles via Ashford International, six vehicles via Faversham, and six vehicles from Maidstone West. Options to meet the gap:

- Lengthen Maidstone West/Faversham services to 12-car (Ashford International services already operate as 12-car)
- Operate two additional paths from Ashford International
- Operate one additional path from Maidstone West
- Extend the Ebbsfleet International starter to Ashford International
- Extend the Ebbsfleet International starter to Faversham or Rainham
- Attach a 6-car from Sandwich/Ramsgate to a 6-car from Dover in the Folkestone area.

3.1.2. **2044 vehicle gap:** 30 vehicles via Ashford International /six vehicles from Maidstone West.

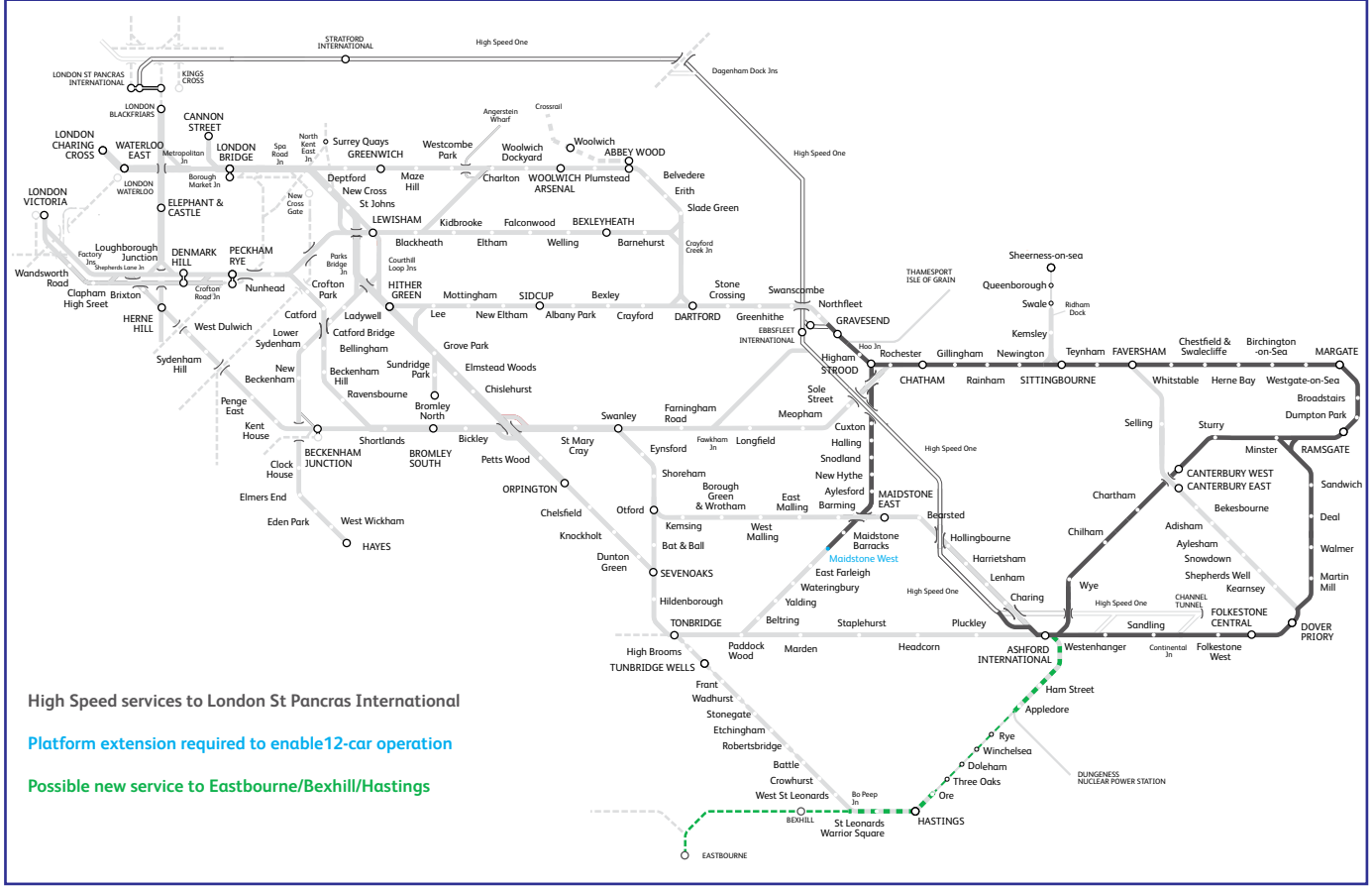
Additional Paths from Ashford - 2024:

3.1.3. With the assumption of maintaining all current Eurostar services as fixed paths, two additional paths from Ashford International to St Pancras International is not achievable. Capacity is available at Ashford International but becomes more constrained from Ebbsfleet International and further constrained at Stratford International.

3.1.4. Allowing for the minor retiming of Eurostar services (between Stratford International and St Pancras International) an additional path departing Ashford International at 07:55 arriving at St Pancras International at 08:31 was achievable within the current timetable.

3.1.5. An earlier path (before the peak) was available departing Ashford at 06:54 arriving St Pancras at 07:30 with no retiming to other services required.

Figure 3.1 - High Speed services with choices for funders (Figure 5.3 in the main document)



3.1.6. During the morning peak other paths were available from Ashford but with capacity constrained between Ebbsfleet and St Pancras. The key challenges and constraints were as follows:

- Compliance around Eurostar services and the avoidance of Eurostar flexing
- Headway compliance at Ebbsfleet West Junction and Stratford International West Junction
- Junction Margin and platform reoccupation compliance at St Pancras International
- Platform capacity and availability at St Pancras International: three platforms for domestic use and Class 395 12-car requiring a minimum 9min turnround time.

3.1.7. Operating any additional paths from Ashford to St Pancras does not consider an increase in other services joining the route at Ebbsfleet.

Additional path from Maidstone West – 2024:

3.1.8. An additional path departing Maidstone West at 08:20 but arriving St Pancras International outside the peak (at 09:14) was available within the current timetable which would fill the vehicle gap for 2024.

3.1.9. This was the clearest path from Maidstone West to Strood as earlier paths would require retiming of multiple services. This path can operate from Strood to St Pancras without any retiming to other services as it does not reach Ebbsfleet West Junction to interact with the main HS1 route until 08:56.

3.1.10. Earlier paths from Maidstone West face the same challenges as the Ashford paths once joining the HS1 route at Ebbsfleet.

3.1.11. The key challenges and constraints between Maidstone West and Ebbsfleet International are as follows:

- Headway compliance between Maidstone West and Cuxton (just south of Strood). This section is controlled by Absolute Block signalling requiring high headway spacing between trains and therefore limiting capacity
- Headway and platform reoccupation compliance at Strood.

Extend Ebbsfleet International starter to Ashford International – 2024:

3.1.12.. The Ebbsfleet starter can be extended to originate from Ashford with a 07:48 departure time which retains the 08:08 departure from Ebbsfleet International and the same path onwards to St Pancras International.

3.1.13. The path between Ashford and Ebbsfleet was clear and compliant without retiming to other services, despite including the additional Ashford path created in stage 2 of the assessment.

Extend Ebbsfleet International starter to Faversham or Rainham – 2024:

3.1.14. Extending the service to Faversham or Rainham whilst retaining the departure time of 08:08 from Ebbsfleet would require the retiming of other services as the extended paths are not naturally TPR compliant.

3.1.15. The key challenges and constraints are as follows:

- Headway compliance between Faversham and Rochester Bridge Jn/Strood.
- Lack of spare capacity between Gillingham (Kent) and Rochester Bridge Jn/Strood.
- Junction margin and conflicting crossing move at Rochester Bridge Jn.
- Headway compliance and platform reoccupation at Strood and Gravesend.

3.1.16. The alternative option of changing departure times from Faversham or Rainham and retiming to find available paths causes problems with compliant paths on the subsequent routes.

3.1.17. The key constraint is with arriving/departing Ebbsfleet International at different times as available capacity is scarce on the HS1 route between Ebbsfleet and St Pancras during the morning peak. Continuing a Faversham or Rainham path from Ebbsfleet International would likely require retiming to other services.

Attach 6-car from Sandwich/Ramsgate with 6-car from Dover in Folkestone Area – 2024:

3.1.18. Folkestone Central and Folkestone West stations can both accommodate 12-car services from a platform length perspective. Although the existing signalling layout does not allow permissive working (platform sharing), and therefore is a constraint to this option.

3.1.19. They are no location specific TPRs which influence the attaching operation.

3.1.20. The TPR requirement is 4 mins for the attachment of the Class 395 units and a minimum of ½ min added to the schedule of the rear portion when approaching to attach.

3.1.21. Considering headway between the front and rear portions, minimum dwell time on both portions for passenger movements and the attachment time, a total of 9 mins is required from when the front portion arrives to the departure of the 12-car service.

3.1.22. Available opportunities for the attaching operation at Folkestone Central during the morning peak are currently restrictive. This is due to repeated empty stock moves into the northbound Platform 1 for the formation of departing services. The most readily available opportunity is at approximately 08:15 or early in the morning (before the peak at approx. 06:15). However there is sufficient capacity with some retiming to the existing timetable.

3.1.23. Opportunities at Folkestone West are partly restricted due to the available gaps between existing services, although less restricted than Folkestone Central. The overall capacity would allow for the attachment with some retiming to the existing timetable.

3.1.24. In the current timetable the most obvious gap is for the front portion to arrive into Folkestone West at 06:48, resulting in a 06:01 departure from Ramsgate, and a 07:49 arrival at St Pancras International for the full 12-cars. The rear portion subsequently has a 06:39 departure from Dover, arriving into Folkestone West at 06:52.

3.1.25. The paths for the front and rear portions based on the above timings are mostly clear and compliant, including from Ashford to St Pancras. The single biggest constraint is on the front portion between Minster South Junction and Sandwich which is controlled by Absolute Block signalling.

3.1.26. There are also issues with the power supply between Ramsgate and Dover Priory which prevents 12-car High Speed services.

Maximum Number of Paths with Eurostar patterns – 2044:

3.1.27. New Ashford International services – a maximum of nine paths to St Pancras International in an hour can be achieved based on the existing morning peak Eurostar services and maintaining the Eurostar fixed paths. This is no greater than the number of paths operated in the current timetable and therefore indicates that the domestic services are constrained by the Eurostar paths.

3.1.28. The number of domestic paths is based on the minimum headway/platform reoccupation between trains applied and all trains stopping for the minimum allowed duration at each specified station as stated in TPR.

3.1.29. The required TPR headway on the route between Ashford and St Pancras is 3 mins or 2 ½ mins if a stopping service follows a non-stop service.

3.1.30. The standard minimum dwell required for a Class 395 at Ashford and Ebbsfleet is 1½ mins, and 1 min at Stratford.

3.1.31. New Maidstone West services – a maximum of six paths from Maidstone West in an hour can be achieved (including existing services).

3.1.32. This is based on the minimum headway/platform reoccupation between trains applied and all trains stopping for the minimum allowed duration at each specified station as stated in TPR.

3.1.33. The required TPR headway between Maidstone West and Cuxton is based on Absolute Block signalling, between Cuxton and Strood the headway is 5 mins.

3.1.34. The standard minimum dwell required for Kent is ½ min. At Maidstone West, Strood and Gravesend 1 min is required.

3.1.35. The standard minimum dwell required for a Class 395 at Ashford International and Ebbsfleet International is 1½ mins, and 1 min at Stratford International.

3.1.36. The pattern of six trains does not consider other services on the route from Ebbsfleet International. It does demonstrate that six paths are achievable from Maidstone West.

3.1.37. New Ashford and Maidstone West services combined – the Ashford services assessment determined that a maximum of nine paths is achievable on the HS1 route based on the morning peak Eurostar service pattern. Subsequently trains originating from Maidstone West are required to pick up one of the nine available paths when joining at Ebbsfleet International.

3.1.38. Operating both Ashford International and Maidstone West services would require an offset as to how many originate from either location, fulfilling the nine paths available from Ebbsfleet International where the services converge.

Key Conclusions

- Maidstone West and Snodland cannot currently accommodate 12-cars. All other stations/platforms for the domestic high speed services can
- Additional paths on the HS1 route are constrained by the fixed Eurostar paths
- The Ebbsfleet International starter can easily be extended to start from Ashford International retaining its current path from Ebbsfleet. Extending to Faversham or Rainham is not feasible without a large timetable rewrite
- Attaching two 6-cars at Folkestone would require a signalling upgrade.

Aerial view of Kings Cross and St Pancras International

3.2 High Speed to Maidstone West Train Lengthening Pre-GRIP study

3.2.1. The aim of the study was to identify infrastructure options that would provide 12-car Class 395 service provision at Maidstone West Station. The study was to support plans to provide additional capacity for the predicted growth on High Speed Services, to meet future demands by enabling 12-car Class 395 services to start and terminate at this station.

3.2.2. Three infrastructure options were investigated to enable this; 12-Car with no platform lengthening and utilising Selective Door Opening (SDO), Turnback Platform 2 (extension of Platform 2), Turnback Platform 1 (extension of Platform 1).

3.2.3. Of the options, the turnback in Platform 2 is preferred.

12-Car with no platform lengthening and utilising Selective Door opening (SDO):

3.2.4. This option was considered, but discounted.

3.2.5. Rail Group Standard GE/GN8577, suggests this method of operation is not acceptable as the Class 395 multiple unit trains do not have interconnecting gangways. This could results in passengers in one unit being unable to move to a part of the train where doors were available for egress. Response of passengers in this situation cannot be assured.

3.2.6. In terms of impact, not only is this operationally complex but dwell times could also be increased as stated in GE/GN8577, Section 2.6.

3.2.7. The biggest issue, however, is that the train does not fit in either platform at Maidstone West so the rear of the train would not be in the platform. When this becomes the front of the train, for the reutrn working, it would be the wrong side of the start back signal if the train were not moved forward or to the opposite platform when the arriving passengers had egressed the train.

Turnback Platform 2 (extension of Platform 2):

3.2.8. It is understood that there is sufficient space within Network Rail boundaries to accommodate the Platform 2 extension required to operate a 12 car Class 395 service at Maidstone West Station.

3.2.9. A deviation from Rail Group Standards will be required as the platform extension will be adjacent to a track radius less than 500m. It should be noted that the existing platform is on the same radius and it is not possible to significantly change the geometry at this site due to physical constraints.

3.2.10. The construction of the platform extension would require the removal of the Up and Down Bay sidings. There is scope for partial retention of the Up siding (to be assessed at later stages of scheme development).

3.2.11. Alterations to the existing signalling will be required. Movement of signals do not require a review of braking calculations as they are within an Absolute Block Section. Signal sighting and dispatch assessment would be required at further design stages. OFF indicators may be required.

Turnback Platform 1 (extension of Platform 1):

3.2.12. It is understood that there is sufficient space within Network Rail boundaries to accommodate the Platform 2 extension required to operate a 12 car Class 395 service at Maidstone West Station.

3.2.13. A deviation from Rail Group Standards will be required as the platform extension will be adjacent to a track radius less than 500m. It should be noted that the existing platform is on the same radius and it is not possible to significantly change the geometry at this site due to physical constraints.

3.2.14. It is possible to achieve the required platform extension and also provide the required loop overlap. However the existing crossover (located towards the Strood-end of the station) would need to be relocated. There are two possible locations, but a full track survey would be required at later design stages to confirm and depending on the location, an alteration to the current speed profile may be required.

3.2.15. The construction of the platform extension would require the removal of the carriage sidings.

3.2.16. Alterations to the existing platform end signals will be required. Movement of signals do not require a review of braking calculations as they are within an Absolute Block Section. Signal sighting and dispatch assessment would be required at further design stages. OFF indicators may be required.

3.2.17. Dependant on the chosen position for the replacement crossover (Paddock Wood-end), there may or may not be the requirement for signalling alterations. Repositioning the crossover in a position close to the existing would likely require no signalling alterations. Repositioning the crossover further south would have a wider impact on the signalling further south.

4 London Blackfriars (CO4 & CO10)

4.0.1. In 2024 there is no vehicle gap for this service group. In 2044 there is a gap of eight vehicles.

4.0.2. **Tables 4.1 and 4.2** illustrates which platforms along the route can accommodate 12-car services:

4.1 London Blackfriars Service Route Train Lengthening Pre-GRIP study

4.1.1. This aim of the study was to identify infrastructure that limits the ability to operate and stop 12-car Class 700 services at stations on the Kent Thameslink Service Route. The study investigated platform lengths and operational equipment which would support train lengthening to 12-car on this service route, allow 12-car trains to serve Brent Cross, and help mitigate the current capacity issues exhibited north of the River Thames.

4.1.2. The study focused on identifying constraints restricting 12-car services stopping at stations on this route. A total of 27 stations were assessed. One siding will require alterations, ranging from simple platform extensions to major station and network alterations, to provide the required capability.

4.1.3. Of the stations requiring alterations, five have, at this stage, been highlighted as significant, incorporating major work and potential network changes. These are:

Herne Hill – Options included a grade separated station and new intersection bridge with an alternative option proposing major remodelling of the junctions either side of the station.

Beckenham Junction – Options include loss of operational routes or reconstruction of overline bridge and major station redevelopment.

Kent House – Options include track slues, land purchase and installation of retaining walls with one option proposing reduction of platforms from four to three.

Elephant and Castle – Option requires installation of a new viaduct extension, in a highly constrained area, to accommodate track slues for island platform extensions.

Shortlands – Options include track slues, land purchase and installation of retaining walls encroaching close to a listed building.

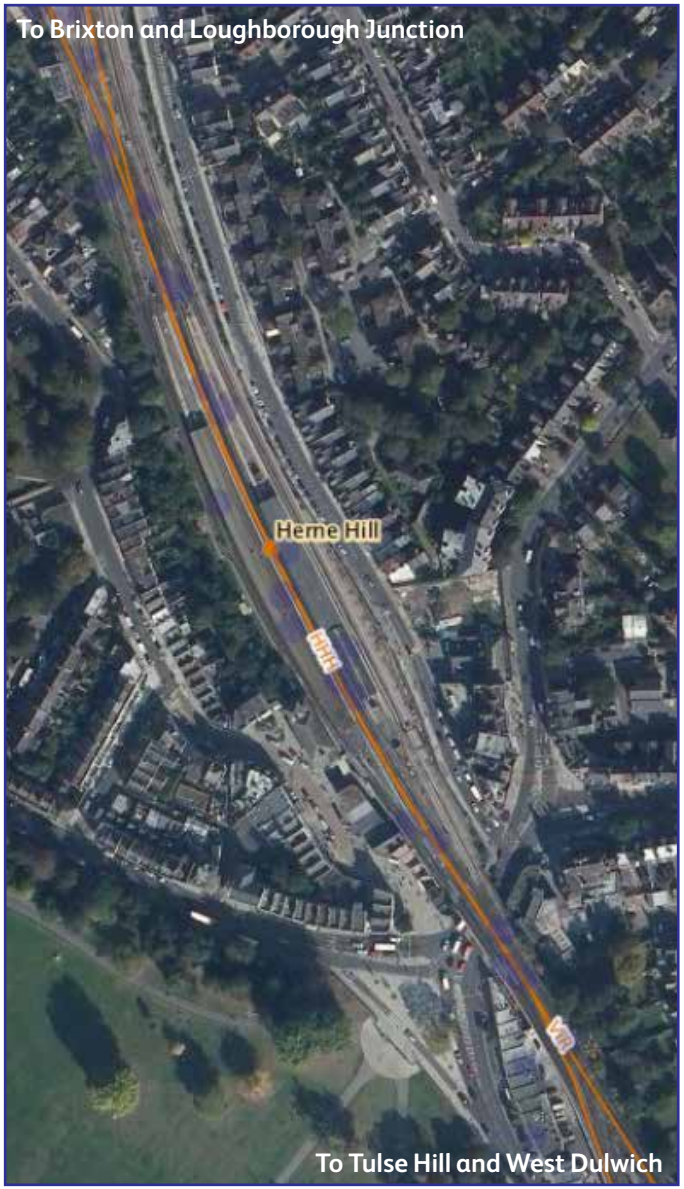
Table 4.1 - 12-car platforms by Thameslink service corridor

Line of route	Station	12-car?	Station assessed for 12-car?	Proposal	Cost range
Sevenoaks via Catford Loop	Sevenoaks	Yes	N/A		Do maximum: £250-500M Do minimum: £175-375M
	Bat & Ball	No	Yes	Extend all platforms towards London or Selective Door Opening	
	Otford	No	Yes	Extend all platforms towards Country or Extend all platforms towards London or Selective Door Opening	
	Shoreham	No	Yes	Extend all platforms towards London or Extend all platforms towards Country or Selective Door Opening	
	Eynsford	No	Yes	Extend all platforms towards Country or Selective Door Opening	
	Swanley	Yes	N/A		
	St Mary Cray	Yes	N/A		
	Bickley	No	Yes	Extend all platforms towards London or Selective Door Opening	
	Bromley South	Yes	N/A		
	Shortlands	No	Yes	Extend all platforms towards Country	
	Ravensbourne	No	Yes	Extend all platforms towards London	
	Beckenham Hill	No	Yes	Extend all platforms towards London or Extend all platforms towards Country	
	Bellingham	No	Yes	Extend all platforms towards London	
	Catford	No	Yes	Extend all platforms towards London	
	Crofton Park	No	Yes	Extend all platforms towards Country	
	Nunhead	No	Yes	Extend all platforms towards London	
	Peckham Rye	No	Yes	Extend Platforms 3 & 4 towards London (Denmark Hill)	
	Denmark Hill	No	Yes	Extend all platforms towards Country	
Orpington via Herne Hill	Orpington	Yes	N/A		Between a minimum of £250M and a maximum of £500M
	Petts Wood	Yes	N/A		
	Beckenham Junction	No	Yes	Extend platforms 2 and 3 towards Country or Modifications to sidings adjacent to the station and extend platforms 3 and 4	
	Kent House	No	Yes	Extend platforms 1, 3 and 4 to 10-car and platform 2 to 12-car towards London or Extend all platforms towards Country or Remodel station to 3 platforms only	
	Penge East	No	Yes	Extend all platforms towards Country or Extend all platforms towards London	
	Sydenham Hill	No	Yes	Extend all platforms towards London	
	West Dulwich	No	Yes	Extend all platforms towards Country or Extend all platforms towards London	
	Herne Hill	No	Yes	Extend all platforms to 10-car and utilise SDO or Provide grade separated solution with new 12-car platforms	
	Loughborough Junction	No	Yes	Extend Platform 1 towards Country Extend Platform 2 in both directions	
Thameslink Corridor	Elephant & Castle	No	Yes	Extend all platforms towards London	£75-175M
	London Blackfriars	Yes	N/A		

4.1.4. Each station has been considered on an individual basis assessing options to extend all platforms to 12-car capacity following an interdisciplinary review of existing engineering, operational and implementation factors. Selective Door Opening should also be considered for some locations.

Table 4.2 - 12-car platforms Maidstone East line

Station	Line of route	12-car?	Station assessed for 12-car?	Proposal
Maidstone East	Maidstone East Line	No	Yes	TBA in Final Route Study
Barming	Maidstone East Line	No	Yes	TBA in Final Route Study
East Malling	Maidstone East Line	No	Yes	TBA in Final Route Study
West Malling	Maidstone East Line	No	Yes	TBA in Final Route Study
Borough Green & Wrotham	Maidstone East Line	No	Yes	TBA in Final Route Study
Kemsing	Maidstone East Line	No	Yes	TBA in Final Route Study


To Brixton and Loughborough Junction
Herne Hill
To Tulse Hill and West Dulwich


To New Beckenham
Beckenham Junction station
To Kent House
and Birkbeck
Southern
Tramlink
To Shortlands


To Penge East
Kent House station
To Beckenham Junction

Above is the view towards Loughborough Junction/Denmark Hill and below is towards London Blackfriars at Elephant & Castle station.

5 London Bridge & London Victoria Main Line (CO5 & CO11)

5.1 London Bridge Main Line

5.1.1. **Table 5.1** shows the total number of paths required for each individual route for 8-, 10- and 12-car operations to fulfil the 2044 requirements, when combining the base vehicle and vehicle gap figures. 8 and 10 car lengths are not applicable to all routes.

5.1.2. **Table 5.2** shows the current number of paths for 8-, 10- and 12-car operations compared against the maximum paths required for 2044.

Table 5.1 - London Bridge services 2044 vehicles and pathways

Route	Base vehicles	Vehicle gap	Total vehicles (Base+ Gap)	Max. paths required in 2044		
				8-car	10-car	12-car
Via Chatham/ Swanley	59	8	**67**	n/a	n/a	6
Via Maidstone East/Swanley	18	8	**26**	4	3	3
Via Tonbridge	135	59	**194**	n/a	20	17
Total	**212**	**75**	**287**	**4**	**23**	**26**

Figures are Total Vehicles divided by the number of cars (8, 10 or 12).

All figures are rounded up to the nearest whole.

Table 5.2 - London Bridge services pathways current vs 2044

Route	Current no. of paths			Max. paths required by 2044			Additional paths required by 2044		
	8-car	10-car	12-car	8-car	10-car	12-car	8-car	10-car	12-car
Via Chatham/ Swanley	n/a	n/a	5	n/a	n/a	6	**n/a**	**n/a**	**1**
Via Maidstone East/Swanley	3	2	2	4	3	3	**1**	**1**	**1**
Via Tonbridge	n/a	14	12	n/a	20	17	**n/a**	**6**	**5**
Total	**3**	**16**	**19**	**4**	**23**	**26**	**1**	**7**	**7**

Figures are Base Vehicles divided by the number of cars (8, 10 or 12).

All figures are rounded up to the nearest whole.

5.2 London Victoria Main Line

2024: Vehicle gap of 1 vehicle.

2044: Vehicle gap of 8 vehicles.

5.2.1. **Table 5.3** shows the total number of paths required for each individual route for 8-, 10- and 12-car operations to fulfil the 2044 requirements, when combining the base vehicle and vehicle gap figures. 8- and 10-car lengths are not applicable to all routes

Table 5.3 - Victoria services 2044 vehicles and pathways

Route	Base vehicles	Vehicle gap	Total vehicles (Base+ Gap)	Max. paths required in 2044		
				8-car	10-car	12-car
Via Chatham/ Swanley	59	8	**67**	n/a	n/a	6
Via Maidstone East/Swanley	18	8	**26**	4	3	3
Via Tonbridge	135	59	**194**	n/a	20	17
Total	**212**	**75**	**287**	**4**	**23**	**26**

Figures are Total Vehicles divided by the number of cars (8, 10 or 12).

All figures are rounded up to the nearest whole.

Table 5.4 - Victoria services pathways current vs 2044

Route	Current no. of paths			Max. paths required by 2044			Additional paths required by 2044		
	8-car	10-car	12-car	8-car	10-car	12-car	8-car	10-car	12-car
Via Chatham/ Swanley	n/a	n/a	5	n/a	n/a	6	**n/a**	**n/a**	**1**
Via Maidstone East/Swanley	3	2	2	4	3	3	**1**	**1**	**1**
Via Tonbridge	n/a	14	12	n/a	20	17	**n/a**	**6**	**5**
Total	**3**	**16**	**19**	**4**	**23**	**26**	**1**	**7**	**7**

Figures are Base Vehicles divided by the number of cars (8, 10 or 12).

All figures are rounded up to the nearest whole.

5.3 Provision of new 12-car siding on the Metropolitan Reversible Line (Cannon Street) Pre-GRIP study

5.3.1. This aim of the study was to identify infrastructure options for providing one or two 12-car sidings to serve Cannon Street Station to replace the soon to be redundant Metropolitan Reversible Line.

Single 12-Car Siding:

5.3.2. To implement this option, the Reversible Metropolitan Line can be converted into a siding complete with buffer stop at the Metropolitan Junction end, therefore requiring the abandonment of the Metropolitan Junction connection.

5.3.3. An alternative was considered whereby the connection could remain. However, a protecting signal and trap point would probably reduce the potential standage to less than 12 coaches. This should be reconsidered if remodelling of Cannon Street is looked at in the future.

5.3.4. The siding has been designed on a 150m curve which drives the need for gauge widening and continuous checking throughout. It must be noted 150m radius is the normal minimum design value for sidings. The line-speed of the siding would effectively remain at 15mph.

5.3.5. A drivers walkways would be required, and there is sufficient space for this. Consideration would need to be given to lighting and access points onto the walkway in future design stages, but it is likely that the walkway would extend back to Cannon Street station. The existing sidings are understood to be abandoned, and as such, there should be no issue with accommodating the driver's walkway through this area.

5.3.6. The scissors layout connecting the Cannon Street Reversible Line to what is currently the Metropolitan Reversible Line can also be retained, providing all existing connectivity into the station. The new siding would commence beyond the clearance point of the scissors layout. The new siding would also still be accessible from Platforms 4 to 7 inclusive despite the track layout in this area to accommodate the new siding.

Two 12-car Sidings:

5.3.7. This option was considered, but discounted. Due to the current leasing arrangements of the viaduct structure supporting the Metropolitan Reversible Line, and future development proposals in the area, modifications to the existing substructure, in order to support two 12-car sidings and associated walkways, is not possible until 2030 without remodelling the tracks at Cannon Street.

5.3.8. As with the single siding option, in order to provide standage length for a 12-car train, it is considered that the connection to Metropolitan Junction cannot be retained.

5.3.9. This option provides a buffer stop arrangement at the termination of both sidings, a full risk assessment would be required as part of the future design phases, however at this stage fixed buffer stops have been considered a suitable solution.

5.3.10. The radii of both sidings has been kept to the minimum siding design value of 150m and they are therefore not parallel along the length of the viaduct but a compliant minimum interval between the sidings of 2150mm has been provided. Continuous checking and gauge widening would be required throughout.

5.3.11. Siding 1 retains the connectivity discussed in the single siding option and is largely unchanged, commencing clear of the existing scissors layout. Siding 2 can only be connected to Platform 7 unless significant remodelling is undertaken on the approaches to Cannon Street

5.3.12. A driver's walkway would be required to facilitate both sidings and would be accessible so that sufficient space can be provided at the Cannon Street end to enable access between two stabled trains, thus keeping drivers away from the running lines, particularly the Cannon Street Reversible which runs adjacent to the proposed siding 1.

5.3.13. The viaduct would need to be widened for a length of approximately 100m to enable this solution to be feasible. The width of the required widening hasn't been assessed at this stage.

Diagrams of the single 12-car siding can be found in the Kent Route Study - **Figure 5.6** - whilst a diagram of the two siding option can be found in the Metroisation Concept chapter of this document - **Figure X.**

A train passing through London Bridge from Cannon Street. These services will stop at London Bridge from 2018

6 Marshlink High Speed (CO13)

6.1 Background

6.1.1. From the outset of the Route Study development, the Department for Transport instructed that High Speed services to Hastings and Bexhill should be incorporated in the Kent Route Study.

6.1.2. This scheme is seen as vital to the prosperity and future growth of the coastal toens of Hastings and Bexhill as it could reduce the journey time to London, making the area attractive to City workers, following on from the success of Margate's regeneration.

6.1.3. A number of parties have been calling for the upgrade of the Marshlink line for many years. The 1963 Beeching Report originally proposed closing the line completely due to low passenger numbers and high running costs. However it was argued that the parallel A259 road route was too poor to operate replacement bus services.

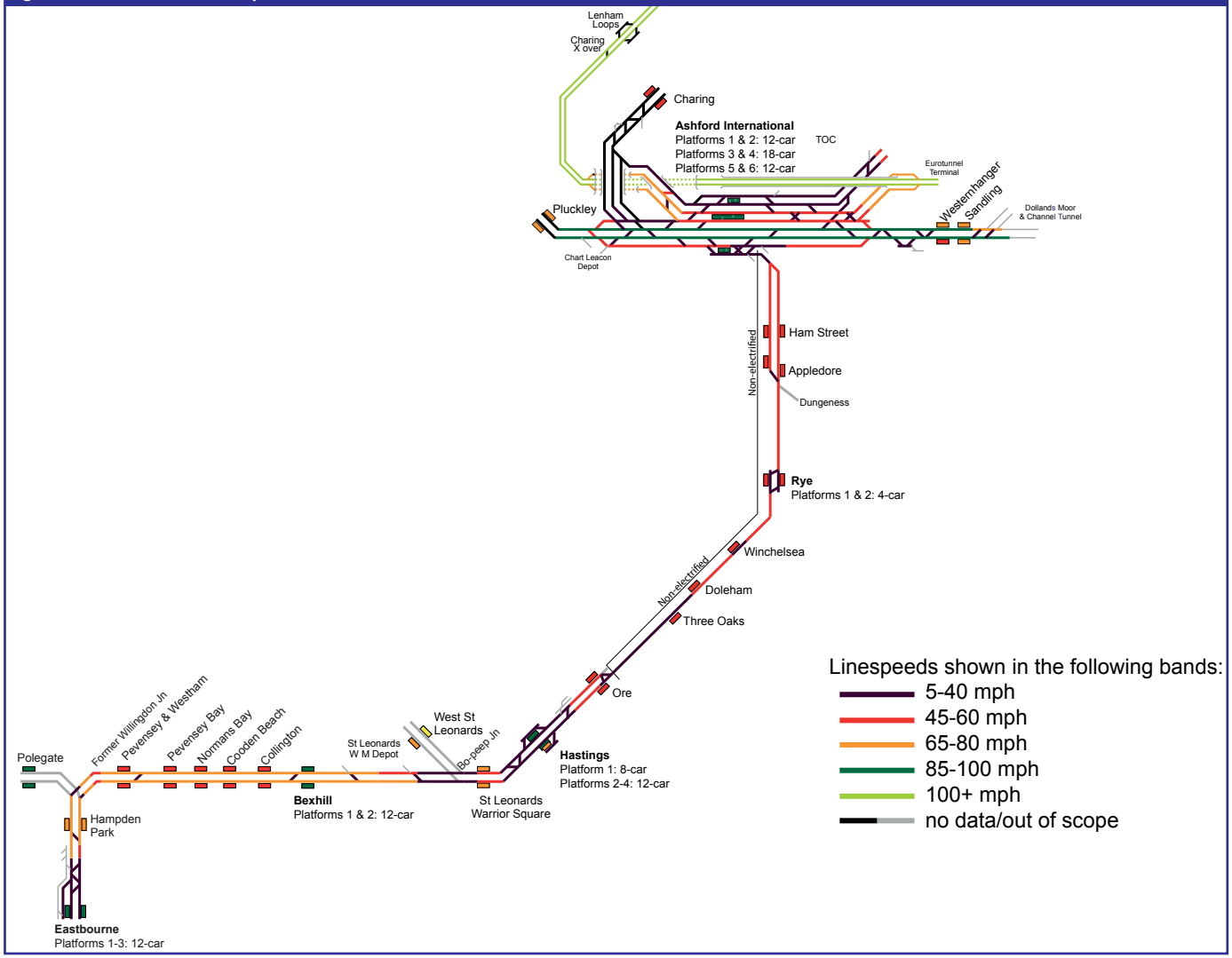
6.1.4. Sections of the line were reduced to single track in 1979. This was to reduce the maintenance and operations costs to allow the railway to remain operational. To acheive this, British Rail removed sections of track between very slow crossovers. The linespeed was also reduced to 60 mph from 85 mph. This has lead to slow journey times and does not make best use of the modern diesel rolling stock currently operating the line, which have a top speed of 100 mph.

6.1.5. In June 2011, URS Scott Wilson prepared a Journey Time Improvement feasibility report for Network Rail and this was subsequently supplemented by the Kent LTPP Route Study Hastings and Bexhill High Speed Services Pre-GRIP Feasibility Report published in June 2015 for the Kent Route Study process.

6.1.6. The following pages summarise the report and the choices for funders going forward. The flowchart in **Figure X**, shows that the linespeed improvement schemes can go ahead with or without electrification or High Speed services and would deliver journey time improvements.

6.1.7. At the regular meetings with Amber Rudd MP (for Hastings) and Huw Merriman MP (for Bexhill), an incremental approach to the line upgrade and High Speed services has been discussed and is also explained in this section.

Figure 6.1 - Marshlink line speeds - Eastbourne to Ashford International



6.1.8. **Figure 6.1** shows a detailed map of the line from Eastbourne through to Ashford International. ine colours represent the line speeds and there is an indication of the non-electrified section of line.

6.2 Electrification options

6.2.1. The majority of the Kent Area is electrified with just a few freight lines, sidings and the Marshlink line being the exceptions. There are three options for the electrification of the line:

- **Option 1** - 750V dc conductor/third rail
- **Option 2** - 25kV ac overhead line (wires)
- **Option 3** - no electrification.

6.2.2. Third rail electrification is the most widespread form of electrification in the Kent Area. The maximum speed for third rail equipment is 100 mph.

6.2.3. Overhead line electrification is the typical modern installaion and allows for higher line speeds than third rail. It is used on High Speed 1 and is provided in Platforms 3-6 at Ashford International. It requires a significant amount of physical equipment, such as masts and cables, but is less 'lossy' in the transmission of power so requires fewer sub-stations than third rail. Operating practices, repairs and maintenance would be impacted by the use of a new power supply system that current staff are unused to.

6.2.4. Safety is essential so third rail electrification is often cited as dangerous as it involves an uninsulated conductor being placed close to ground level and is dangerous to touch or come in contact with. DC electrification contracts muscles so if you touch it you will grab it and not let go. AC electrification however, uses higher voltages and has the ability to jump several metres to make the circuit back to ground, this means that you do not have to touch it to be electrocuted, it can strike you down if you are too close.

6.2.5. The third option maintains the status quo and would require rolling stock capable of working from the overhead line as well as on non-eletrified lines such as a bi-mode train.

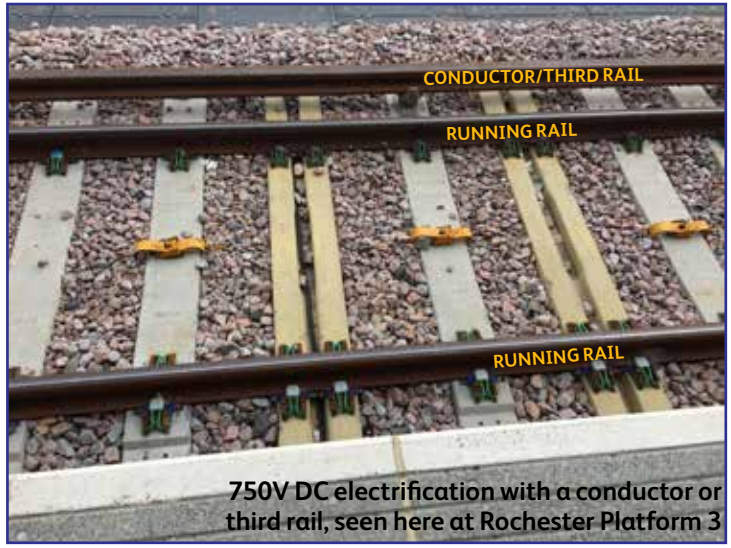
6.2.6. The options are expected to cost:

- **Option 1** - dc electrification £100-250M
- **Option 2** - ac electrification £250-500M
- **Option 3** - no direct cost.

Table 6.1 - Marshlink electrification options - 750V DC third rail

Proposed Work Element	Construction Discipline	Details / measurables
Provide new 3rd rail Conductor Rail	Track / E&P	54517m of existing track miles to be 3rd Rail electrified.
Amend Bridge Parapets.	Civils	10No. overbridges require the parapets reviewing and potentially amending to provide a combination of solid and steeple coper profiles to be compliant with 3rd DC electrification.
Rye Signalling Immunisation	Signalling	The Signalling at Rye will require replacing or immunising as part of the 3rd rail installation works. 4No. Signal posts and 1No. Banner repeater.
Trackside 33kV feeder cable	Civils / E&P	Install a trackside 33kV feeder cable along the length of the currently non-electrified length of railway within troughing or buried. 40500m total length of route.
Upgrade Grid Supply Points	E&P	Ashford and Hastings Grid supply points may require upgrading due to the limit of harmonic distortion levels. To be confirmed at the later grip stages

7.2.7. **Tables 6.1 and 6.2** show the proposed work for third rail and overhead line electrification respectively.



750V DC electrification with a conductor or third rail, seen here at Rochester Platform 3

25kV AC electrification uses overhead wires to power the trains, as shown here at Ebbsfleet International

Table 6.2 - Marshlink electrification options - 25kV AC overhead line

Proposed Work Element	Construction Discipline	Details / measurables
New Overhead Line Electrification	E&P	54517m of existing track miles to be overhead electrified with 25kV AC.
Rye Signalling Immunisation	Signalling	The Signalling at Rye will require replacing or immunising as part of the Overhead Electrification installation works. 4No. Signal posts and 1No. Banner repeater.
3rd Rail electrification requirements	E&P	Install 3rd rail electrification at the Ashford end of the line to both running lines and to the single line section of line at Ore. Assume 2.5km required in total to allow the proposed high speed and stopping services to change power source on the move.
Amend Bridge Parapets.	Civils	14No. overbridges require the parapets reviewing and potentially amending to provide a combination of solid and steeple coper profiles to be compliant with 25kV AC electrification.
Increase Bridge Clearances	Civils	9No. overbridges will require the headroom clearance checking to ensure that there is sufficient clearance for Overhead Electrification. Assume 4 No. overbridges require replacing or the tracks track lowering.
3 New 25kV Feeder Stations	E&P	Provide a new feeder station in the region where the high voltage transmission line from Dungeness power station passes over the railway to the north east of Rye. There may be a further requirement for feeder stations at both Ashford and Hastings to provide sufficient power in event of failure. There is currently a feeder at Ashford used for HS1, and at future GRIP stages it may be deemed possible to use or upgrade this rather than provide an additional feeder.
AC / DC interfaces	E&P	Upgrade the AC/DC interface at Ashford and provide new interface at Hastings (Ore) to prevent DC stray current immunisation issues.

WHAT IS... AN IPEMU?

In 2015, industry partners worked together to investigate battery-electric traction and this culminated with a practical demonstration of the Independently Powered Electric Multiple Unit IPEMU concept on the Harwich Branch line in Anglia Route. At the industry launch event, the train manufacturers explained that battery technology is being developed to enable trains to run further, at line speeds, on battery power, indeed, some tram lines use this technology in the city centres and many London buses are completely electric powered.

The IPEMU project looked at the feasibility of battery power on the Marshlink service and found that battery was sufficient for the train to run from Brighton to Ashford International and back but there was insufficient charge to return to Ashford International on a second round trip. A solution to this could be that the unit arrives from Ashford International at Brighton and forms a service to Seaford and back before returning to Ashford International with a charged battery.

The IPEMU demonstration train was a Class 379, a similar type to the Class 377 units currently operated by Southern, it was found that the best use of the battery power was to restrict the acceleration rate to that of a modern diesel multiple unit, such as a Class 171 (the current unit type operating the line) when in battery mode and normal acceleration on electrified lines.

6.3 Rolling stock options

6.3.1. There are a few options for rolling stock (trains) depending on whether or not the line has been electrified. The Route Study has focussed on the following:

- **Class 171** - the current 2-car 100 mph diesel units operated by Southern
- **Class 395** - the current 140 mph High Speed 6-car electric units operated by Southeastern
- **Class 375/377** - the current 'main line' 100 mph 4-car electric units operated by Southeastern and Southern
- **Class 802** - the new 140 mph bi-mode (electro-diesel) units currently being built for Great Western, Hull Trains and Trans Pennine Express.

6.3.2. The choice of rolling stock will be influenced by potential jounrey time improvement. Two services were modelled in the RouteRunner tool using the current infrastructure and then with each linespeed improvement option and a mix of options to provide an incremental approach combined option. The whole length of the route from Eastbourne to Ashford International and vice-versa was modelled.

6.3.3. The baseline services were designated:

- **Fast** - calling Eastbourne, Bexhill, St Leonard's Warrior Square, Hastings, Rye & Ashford International
- **Slow** - calling at all station between Eastbourne and Ashford International.

6.3.4. Class 171s are also used to represent Independently Powered Electric Multiple Unit (IPEMU) trains.

6.3.5. Class 802 bi-mode units are powered from the overhead line and diesel when 'off the wires' but the model shows some journey time improvement in diesel mode. These units are based on the Intercity Express Programme units currently being tested on the Great Western Main Line.

6.3.6. The choice of rolling stock will be made by the Department for Transport and the winning South Eastern Franchise bidder.

WHAT IS... A CLASS 802?

In the main Kent Route Study document there is an explanation of rolling stock used in the Kent Area, however, these trains are currently on order for Great Western's London to Devon & Cornwall services, Transpennine Express and Hull Trains..

They are based on Hitachi's 'A Train' family of trains so have more than a passing similarity to the Class 395 High Speed units.

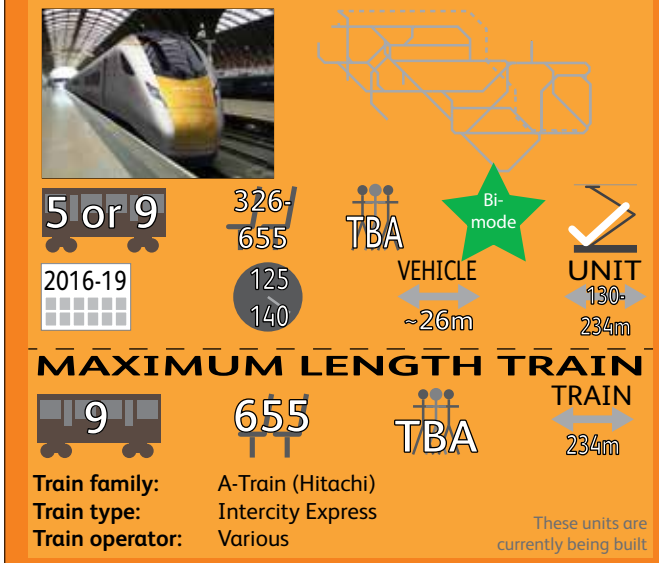
The biggest difference though, is in vehicle length -

Class 395s have 20m vehicles

Class 171s have 23m vehicles

Class 802s have 26m vehicles.

Further work could be required to develop a 6-car, 20m vehicle length, bi-mode train capable of 140 mph.



6.4 Connecting HS1 to Marshlink

6.4.1. A number of options were developed by Network Rail's Infrastructure Projects team. **Figure 6.2** shows the existing track layout at Ashford International and the connections to HS1 on the Maidstone-side of the station. It also shows the electrification supplies throughout the Ashford International area.

6.4.2. Currently, Marshlink services terminate in Platforms 1 or 2, Eurostar services serve Platforms 3 & 4 and Southeastern services use Platforms 5 & 6 - all High Speed services have to use these platforms to access HS1. Therefore, High Speed services from Dover and Folkestone cross to Platforms 5 and then HS1.

HS1 to Platform 2

6.4.3. **Figure 6.3** show that this option provides a new connection from Platform 2 and the Up & Down Fast lines. The report assumes that the overhead electrification is extended through Platform 2 and the new crossovers have dual power supplies.

6.4.4. Although this seems a fairly simple proposal, the technicalities of installing the crossovers, power supplies and signalling enhancements add significantly to the challenges of the scheme, which would cost in the region of £15-35M.

HS1 to Marshlink via Platform 3

6.4.5. This option looks to repurpose Platform 3 for domestic services rather than international services, leaving just Platform 4 for international trains.

6.4.6. International passengers use a bridges access to the platforms rather than the domestic platforms access subway. This enables the passenger to pass through passport control, customs and security before descedning to the platforms.

6.4.7. To utilise Platform 3 a new solid security fence/barrier would be required to segregate the two platforms, a new lift from the platform to the subway, amended fire exit door location, footbridge alterations, track gauge clearance changes and new rail access from Marshlink. **Figure 6.4** shows the reconfiguration of the junction from Marshlink into Ashford International station.

6.4.8. This scheme could cost £20-50M but is likely to be not favoured by other stakeholders due to operational constraints.

Figure 6.2 - Ashford International track layout with power supply formats - baseline (2017)

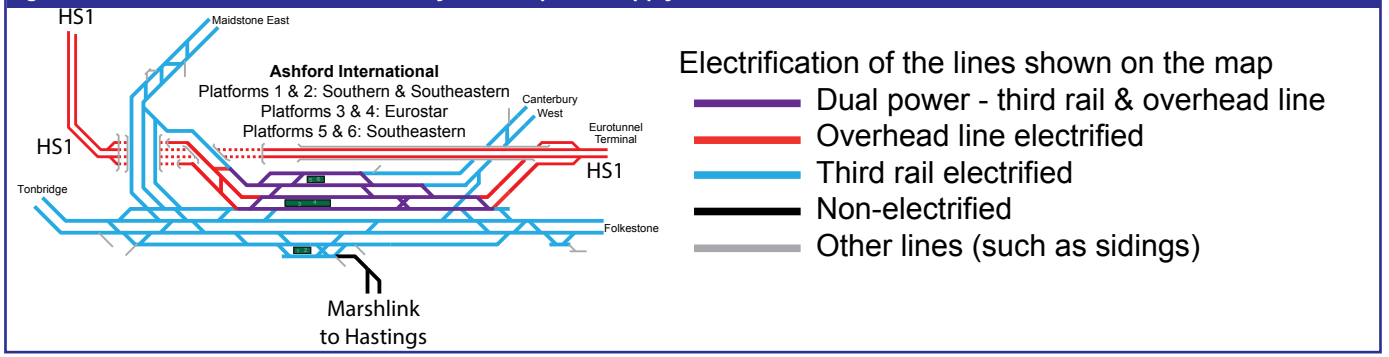


Figure 6.3 - Ashford International track layout with power supply formats - HS1 to Platform 2 connection

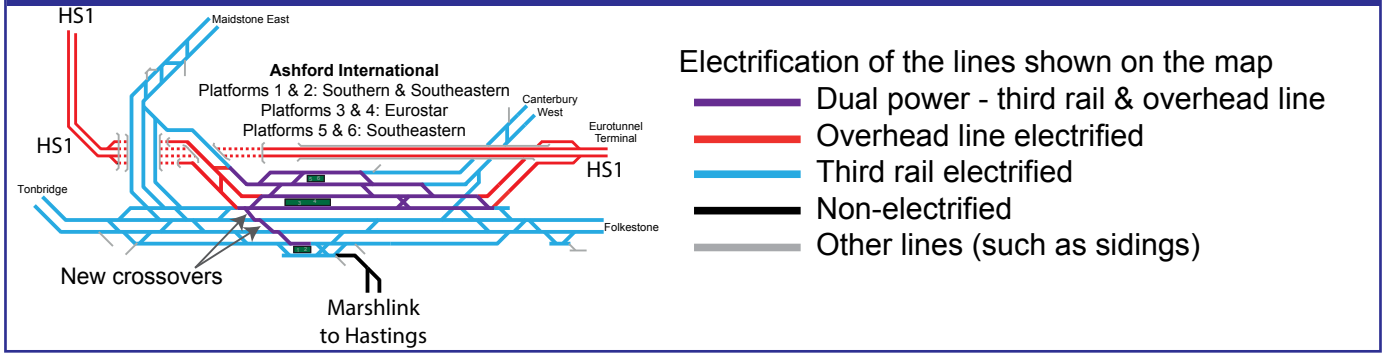


Figure 6.4 - Ashford International track layout with power supply formats - HS1 to Marshlink via Platform 3

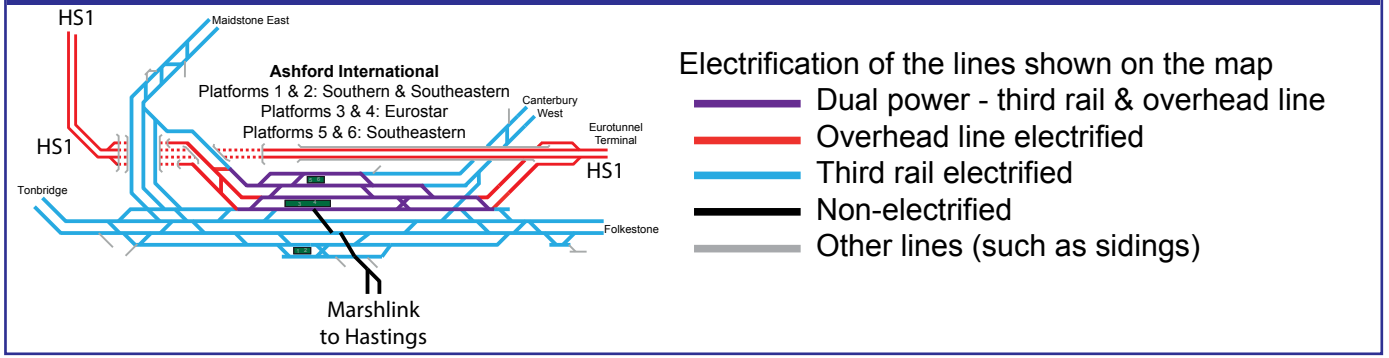


Table 6.3 - Proposed work elements - Ashford International Platform 2 option

Proposed Work Element	Construction Discipline	Sub-option	Details / measurables
New Switch & Crossing Equipment to Ashford C Junction.	Track	1	Remove 2No. existing S&C units (4 No. turnouts)
			Provide 2No. turnouts, 1 No. diamond crossover unit and 1 No. Single Slip Crossover unit within Ashford C Junction to enable trains from platform 2 to access the HS1 connecting line.
		2	As above with an additional 2No. point ends.
Land Purchase Required			Approx area required 170m^2 approx adjacent to the up side of the alignment to allow the new portal structure foundation bases to be constructed away from existing buried services.
Convert 5 No. OLE cantilever structures into Portal Structures.	Civils		Construct 5 no. foundation bases within the up cess and install steelwork columns and portal structures which either connect onto the adjacent cantilever steelwork or replaces the cantilever steelwork as a single portal frame.
Provide 12 No. new OLE portal structures.			12No. new OLE portal structures to be constructed within Ashford Station, 7No. to span 4No. running lines and 5No. to span 6No. running lines
Provide OLE wire tensioning structures.			Construct 2No. OLE tension support structures / columns, 1 at either end of the newly electrified section.
Install OLE above the required line into Platform 2	E&P		Install and connect approximately 400m length of OLE wires and the necessary bonding to allow the running line into platform 2 to be energised.
Signalling requirements to the revised Ashford C Junction	Signalling		Interlocking modification strategy is preferred over an interlocking renewal. Assessment required to determine the required intervention at the later GRIP stages.

Table 6.4 - Proposed work elements - Ashford International Platform 2 option - potential Platform 1 overhead electrification works

Proposed Work Element	Construction Discipline	Sub-option	Details / measurables
Install OLE into Platform 1	Civils / E&P		Install OLE equipment into Platform 1 to allow the existing stopper service from Brighton to Ashford to operate into the platform if the route to Hastings is electrified with OLE.
			7No. cantilever supports to be installed on the platform canopy roof as per platform 3 and 4.
3rd Rail electrify the route towards Hastings	E&P		Install a length of 3rd rail onto the lines to and from Hastings to allow the existing stopper service between Brighton and Ashford to Change power source on the move which removes the requirement to install OLE in platform 1. Assume 2kM of 3rd rail.

Table 6.5 - Proposed work elements - Ashford International Platform 3 option

Proposed Work Element	Construction Discipline	Sub-option	Details / measurables
Install solid security fence / barrier along the centre of platforms 3 and 4.	Civils / Building		Provide a solid security fence / barrier along the centre of platforms 3 and 4 extending approximately 50m beyond the platform ends. Access doors onto the platform to provide a secure entrance point which can be locked to segregate passengers from the platforms at the required time
Provide a lift from subway to platform level.			Install a new lift from the existing domestic passenger subway upto platform 3 and 4 with secured access doors onto the platform. Provision for the future installation of a lift appears to have been constructed into the subway construction.
Amend Platform 3 / 4 Fire exit into Subway			Amend the existing Fire Exit doors from platforms 3 and 4 into the subway to cater for the new passenger usage of the platform.
Hastings Line to Platform 3 connection	Track	1	Amend Ashford D Junction, Relocate 4no. point ends towards Ashford E junction, remove 3No. point ends within the D Junction area and move 1No. point end into the sidings. Provide 6No. new point ends within the straight section of track. Provide 1No. new single slip and 1No. new Diamond Crossing.
		2	Amend Ashford D Junction, Relocate 4 No. Point ends towards Ashford E Junction, remove 2No. Point ends. Provide 1No. new Diamond Crossing. Provide 6No. New point ends.
Amend Footbridge Support Column	Civils	1 only	Amend the configuration of the existing footbridge to allow the stair support column to be removed, therefore creating space to allow an additional running line to be laid.

Table 6.6 - Proposed work elements - Ashford International Platform 3 option

Proposed Work Element	Construction Discipline	Sub-option	Details / measurables
3rd Rail electrification to revised Ashford D Junction.	E&P / Track		Install 3rd Rail electrification across the revised Ashford D Junction to ensure that the new S&C equipment can be utilised by all existing 3rd rail powered trains regardless of the electrification type chosen for the Hastings line.
Provide OLE from Platform 3 to the Hastings Line.	Civils and E&P		Provide foundations and OLE Portal structures spanning all 5 no. running lines across the Ashford D junction area. OLE on the line towards Hastings will continue as standard single track cantilever support structures.
Install OLE into Platforms 1 and 2.	Civils / E&P		Install OLE equipment into Platform 1 and 2 to allow the existing stopper service from Brighton to Ashford to operate into the platforms if the route to Hastings is electrified with OLE.
			7No. cantilever supports to be installed on the platform canopy roof as per platform 3 and 4.
3rd Rail electrify the route towards Hastings	E&P		Install approximately a 2kM total length of 3rd rail onto the lines to and from Hastings to allow the existing stopper service between Brighton and Ashford to Change power source on the move which removes the requirement to install OLE in platforms 1 & 2.

6.5 Linespeed Improvements

6.5.1. Irrespecitve of the High Speed services, line speed improvements can reduce journey times. In this section the line is split into sections and the options detailed, **Figure 6.5** shows this graphically.

6.5.2. **Table 6.7** shows all of the 45 level crossings (foot and road crossings) between Ashford International and Ore, many of which will have to be enhanced, merged or closed for higher linespeeds.

6.5.3. Network Rail would like to work with local stakeholders on the closure and diversion of footpaths and roads at level crossings, particularly between Star and East Guldeford where the A259 road crosses the line, only to cross back again about three-quarters of a mile further on. The more level crossings that are closed, the cheaper the Marshlink High Speed scheme will be and the safer the railway will be.

6.5.4. There are some footcrossings that are close together, it could be that one crossing is closed and the footpaths connected by a new path running parallel to the track on Network Rail land. Others could be diverted via a nearby bridge or underpass.

6.5.5. **Table 6.8** lists all of the 31 structures between Ashford International and Ore that would need to be assessed for linespeed improvements and electrification works. This list does not include the structures that would need to be assessed for the linespeed improvements between St Leonards Warrior Square and Pevensey & Westham.

6.5.6. The structures shown in green require no further work for redoubling or an increase in linespeed, leaving 13 where enhancements may be required.

Figure 7.5 - Eastbourne to Ashford International line speed improvements in journey time minutes saved

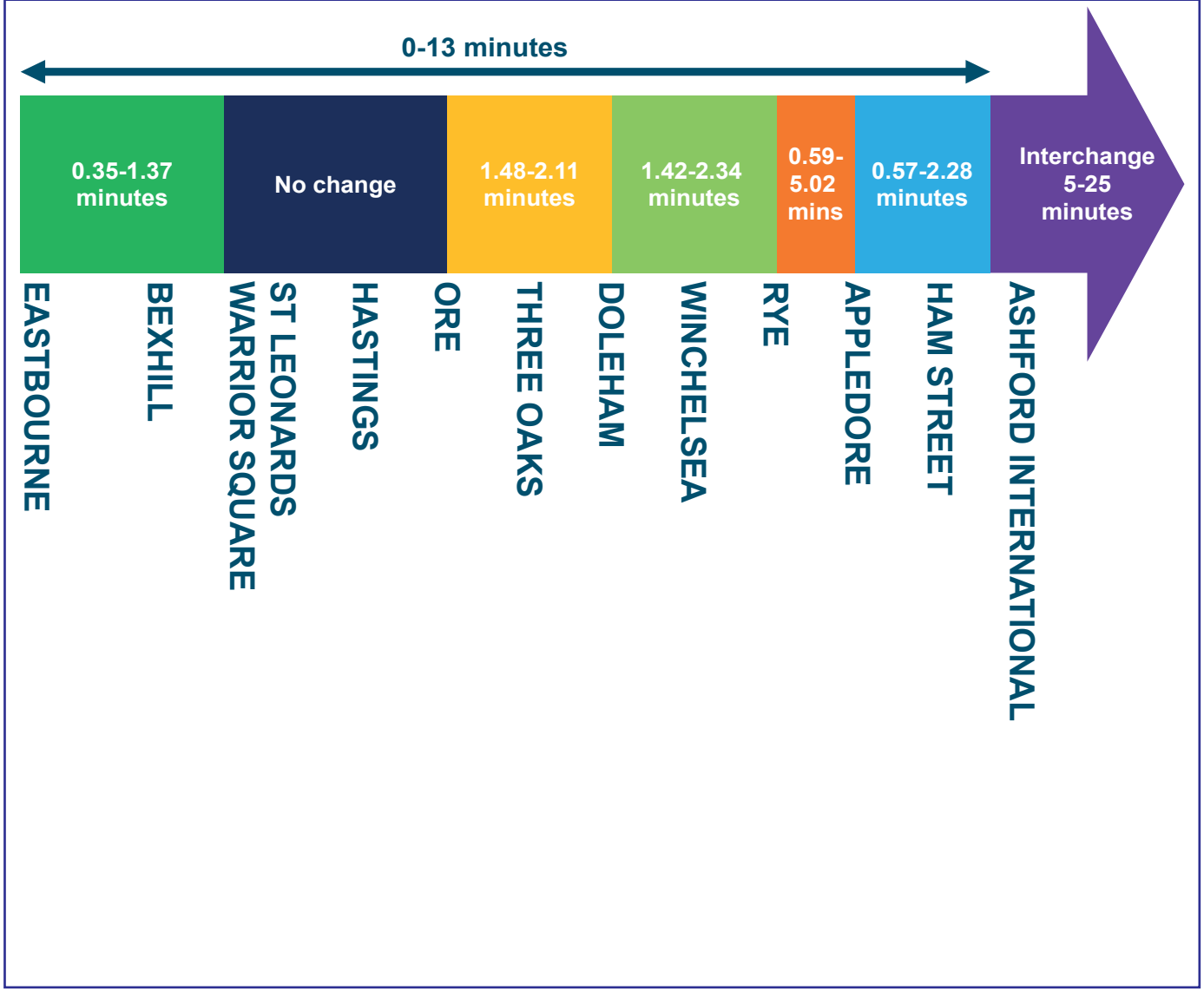


Table 6.7 - Marshlink level crossings (all types)

Section	Level Crossing Name	Type	Mileage	Distance between crossings (chains)	Distance between crossings (feet)	Current Linespeed	Potential Mitigation Measure(s)
Ashford International - Ham Street	Ashford UDC1	Accomodation	56m 77ch			60	
Ashford International - Ham Street	East Stour	Footpath	57m 58ch	61	4026	60	
Ashford International - Ham Street	Steeds Lane	Accomodation	58m 77ch	99	6534	60	
Ashford International - Ham Street	Golden Wood	Footpath	59m 35ch	38	2508	60	
Ashford International - Ham Street	Hardings Bridge	Accomodation	59m 70ch	35	2310	60	
Ham Street - Appledore	Packing Wood	Footpath	61m 35ch	125	8250	60	
Ham Street - Appledore	Ham Street	Footpath	61m 51ch	16	1056	60	
Ham Street - Appledore	Moores	Accomodation	62m 28ch	57	3762	60	
Ham Street - Appledore	Warehorne	AHBC	62m 60ch	32	2112	60	
Ham Street - Appledore	Goodmans	Accomodation	62m 78ch	18	1188	60	Incorporate in the new Block House & Military Canal bridge and close crossing
Ham Street - Appledore	Kenardington	AHBC	63m 73ch	75	4950	60	
Appledore - Rye	Appledore	AHBC	64m 54ch	61	4026	60	
Appledore - Rye	Wilsons	Accomodation	64m 70ch	16	1056	60	
Appledore - Rye	Fleet	Accomodation	65m 11ch	21	1386	60	
Appledore - Rye	Bodys	Accomodation	65m 23ch	12	792	60	
Appledore - Rye	Waterhouse	Footpath	65m 36ch	13	858	60	
Appledore - Rye	Cats Tail	Accomodation	65m 78ch	42	2772	60	
Appledore - Rye	Swallow Tail Bridge	Accomodation	66m 20ch	22	1452	60	
Appledore - Rye	Becketts	AHBC	66m 47ch	27	1782	60	
Appledore - Rye	Becketts	Footpath	67m 07ch	40	2640	60	
Appledore - Rye	Willow House	Accomodation	67m 61ch	54	3564	60	
Appledore - Rye	Barts	Accomodation	68m 77ch	96	6336	60	
Appledore - Rye	Dartnall	Accomodation	69m 29ch	32	2112	60	
Appledore - Rye	Bakers	Accomodation	69m 33ch	4	264	60	
Appledore - Rye	Star	AHBC	69m 40ch	7	462	60	Divert road to East Guldeford and close this crossing
Appledore - Rye	Pear Tree	Accomodation	69m 77ch	37	2442	60	Combine with East Guldeford?
Appledore - Rye	East Guldeford	AHBC	70m 19ch	22	1452	60	Divert road to Star and keep this level crossing
Appledore - Rye	Cookes	Accomodation	70m 39ch	20	1320	60	
Appledore - Rye	Middle Salts	Footpath	71m 05ch	46	3036	60	
Appledore - Rye	Grove Road	CCTV	71m 24ch	19	1254	60	
Rye - Winchelsea	Ferry Road	CCTV	71m 46ch	22	1452	60	
Rye - Winchelsea	Mill Bridge No.1	Footpath	71m 53ch	7	462	60	
Rye - Winchelsea	Mill Bridge No.2	Footpath	71m 54ch	1	66	60	
Rye - Winchelsea	Selmes	Accomodation	72m 17ch	43	2838	60	
Rye - Winchelsea	Cadborough Farmm	Accomodation	72m 44ch	27	1782	60	
Rye - Winchelsea	Winchelsea	AOCL+B	73m 16ch	52	3432	25	
Winchelsea - Doleham	Mair No.2	Accomodation	73m 73ch	57	3762	60	
Winchelsea - Doleham	Channel Bridge	Footpath	74m 35ch	42	2772	60	
Winchelsea - Doleham	Jury's No.1	Footpath	74m 40ch	5	330	60	
Winchelsea - Doleham	Corke	Accomodation	74m 52ch	12	792	60	
Winchelsea - Doleham	Merrick No.2	Accomodation	75m 21ch	49	3234	60	
Winchelsea - Doleham	Merrick No.3	Accomodation	75m 44ch	23	1518	60	
Winchelsea - Doleham	Snailham	Accomodation	75m 71ch	27	1782	60	
Winchelsea - Doleham	Coopers Crossing		76m 47ch	56	3696	60	
Doleham - Three Oaks	Doleham Crossing	Footpath	77m 60ch	93	6138	40	Divert footpath to bridge or underpass

AHBC = Automatic Half Barrier Crossing CCTV = Closed Circuit TeleVision monitored crossing AOCL+B = Automatic Open Crossing Locally monitored with Barriers

This table details the 45 level crossings between Ashford International and Ore (25 miles 22 chains (there are 80 chains to a mile)).

The distance between crossings is detailed in both chains and feet.

Table 6.8 - Marshlink structures (bridges, culverts etc)

Section	Structure Number	Mileage / Name	RA Rating / Speed	Potential Mitigation Measure(s)
Ashford International - Ham Street	1825	56m 36ch, New Town Road	RA10 / 125mph	None required. New underbridge structure with CPB's installed
Ashford International - Ham Street	1824	56m 68ch, Water Bridge and Footpath	RA10 / 60mph	Confirm Assessment Capacity for higher line speed.
Ashford International - Ham Street	1823	57m 13ch, East Stour	RA10 / 60mph	Confirm Assessment capacity for higher line speed. Currently in work bank to be refurbished and strengthened.
Ashford International - Ham Street	1816A	58m 65ch, 6' Brick Arch Culvert	RA10 / Arch	None Required.
Ashford International - Ham Street	1816	59m 13ch, Flat Top A (7' 6" Arch)	RA10 / Arch	None Required.
Ashford International - Ham Street	1813A	59m 73ch, Hardings Culvert	RA10 / Arch	None Required.
Ashford International - Ham Street	1808	61m 25ch, Lower Crossing	Infilled Arch	None Required.
Ham Street - Appledore	1805	61m 57ch, Ham Street	RA6 / 60mph	Provide CPB's to the elevations and provide strengthening measures to the girders or reconstruct with standard Design U-Type structures providing ballasted track.
Ham Street - Appledore	1804	61m 66ch, Orchard	RA10 / 60mph	Arch Structure, None Required.
Ham Street - Appledore	1802	61m 76ch, Warehorne.	RA10 / 60mph	Arch Structure, None Required.
Ham Street - Appledore	1800B	62m 77ch, Block House	RA3 / 60mph	Steelwork strengthening required to meet the line speed aspirations. Currently in work bank to be refurbished, consider adding strengthening aspects to the works or reconstruct with a concrete portal structure with ballasted track.
Ham Street - Appledore	1800	62m 78ch, Military Canal.	RA2 / 60mph	Steelwork strengthening required to meet the line speed aspirations. Currently in work bank to be refurbished and strengthened. Confirm capacity following the strengthening works. Consider replacing with a concrete portal structure in conjunction Block House and the closure of the adjacent Goodmans UWC.
Ham Street - Appledore	1800A	63m 01ch, Military Culvert	RA10 / 60mph	Arch Structure, None Required, consider infilling in conjunction with structure 1800 proposal.
Ham Street - Appledore	1799	63m 20ch, Sheeps Dyke	RA9 / 60mph	None Required, consider providing a ballasted track structure in place of the proposed painting works within the existing work bank.
Ham Street - Appledore	1798	63m 54ch, Springbrook Watering	RA10 / 60mph	None Required.
Ham Street - Appledore	1797	63m 67ch, Kennardington	RA7 / 60mph	Over slab to provide a thicker section with increased capacity or consider installing a midspan support within the structure to half the span length.
Ham Street - Appledore	1796	64m 44ch, Appledore	RA7 / 60mph	Over slab to provide a thicker section with increased capacity or consider installing a midspan support within the structure to half the span length.
Appledore - Rye	1795	65m 05ch, Fleet	RA7 / 60mph	Over slab to provide a thicker section with increased capacity.
Appledore - Rye	1793	66m 15ch, Swallowtail	RA7 / 60mph	Install a mid span support or replace the concrete deck elements with new pre-stressed concrete beam sections to increase the RA capacity only.
Appledore - Rye	1790	69m 30ch, Star Bridge	RA15 / 60mph	None required, consider providing a ballasted track structure in the long term.
Appledore - Rye	1789	70m 40ch, 5' Armco Barrel Culvert	RA10	None Required.
Appledore - Rye	1788	71m 00ch, Rye Bridge	RA0 / 60mph	Confirm Revised Assessed capacity, potentially no works required.
Rye - Winchelsea	1783	71m 53ch, Mill Bridge	RA10 / 60mph	None Required.
Rye - Winchelsea	1771	73m 20ch, Winchelsea Culvert	RA10 / 60mph	Arch Structure, None Required.
Winchelsea - Doleham	1768	73m 76ch, White Water Sewer	RA10 / 60mph	Arch Structure, None Required.
Winchelsea - Doleham	1767	74m 32ch, Brede Channel	RA10 / 60mph	Confirm assessed capacity of the bridge and strengthen where necessary. Consider undertaking any strengthening works as part of the repainting and steelwork repairs within the current work bank. Consider providing ballasted track structure in the long term.
Winchelsea - Doleham	1765	74m 54ch, Meericks Culvert	RA10 / 60mph	Arch Structure, None Required.
Winchelsea - Doleham	1763	75m 22ch, Bell Marsh Culvert	RA10 / 60mph	Arch Structure, None Required.
Winchelsea - Doleham	1747	77m 27ch, Lidham	RA10 / 60mph	Arch Structure, None Required.
Three Oaks - Ore	1737	79m 13ch, Coghurst	RA10 / 60mph	Arch Structure, None Required.
Three Oaks - Ore	1736	79m 37ch, Rock Bridge	RA10	Line speed improvements currently being undertaken, confirm proposed works to the structure. Provide CPB's to both elevations of the structure to reduce the impact force of vehicle collisions. Consider providing a ballasted track deck with the track slewed to the other side of the alignment space as this will maximise the available headroom clearance.

Structures shown in green require no further work for redoubling or an increase in linespeed, leaving 13 where enhancements may be required.

Ashford International to Appledore (approx. 7 miles)

6.5.7. Apart from the junction onto the main line at Ashford International, this section of line is double-track and currently has a line speed of 60 mph. In recent years, some speed restrictions have been removed, giving a standard 60 mph throughout.

6.5.8. It is proposed that this linespeed is raised to 90 mph. Further work will be required to risk assess the track, signalling, geotechnical and structures on the line to enable the linespeed to be raised.

Appledore Junction to Rye (approx. 7 miles)

6.5.9. At the Rye-end of Appledore station, there is a junction where the two-track railway merges to become a single track to just before Rye station. The single line section has a top speed of 60 mph whilst the points from the single line into Platform 1 have a restriction of just 20 mph, as mentioned in **Section 7.1**.

6.5.10. It is proposed that the 'plain line' section is raised to 90 mph. The points should be upgraded to enable a higher speed, the report suggests a 60-75 mph turnout but the length of this would prevent freight trains to come off the Dungeness Branch so an additional crossover would be required at the Ashford-end of the station to enable the freight trains to regain the 'right line'. The cost for the scheme is £10-20M and also requires the moving of a telecoms mast and some land purchase.

6.5.11. An alternative scheme would be to double-track the entire line, between Appledore and Rye, for 90 mph running and upgrade the 20 mph points to a crossover (this would be for freight access from the Dungeness Branch). This could cost £35-75M.

6.5.12. **Figure 6.6** compares the options visually.

Figure 6.6 - Comparison of track layouts Appledore to Rye

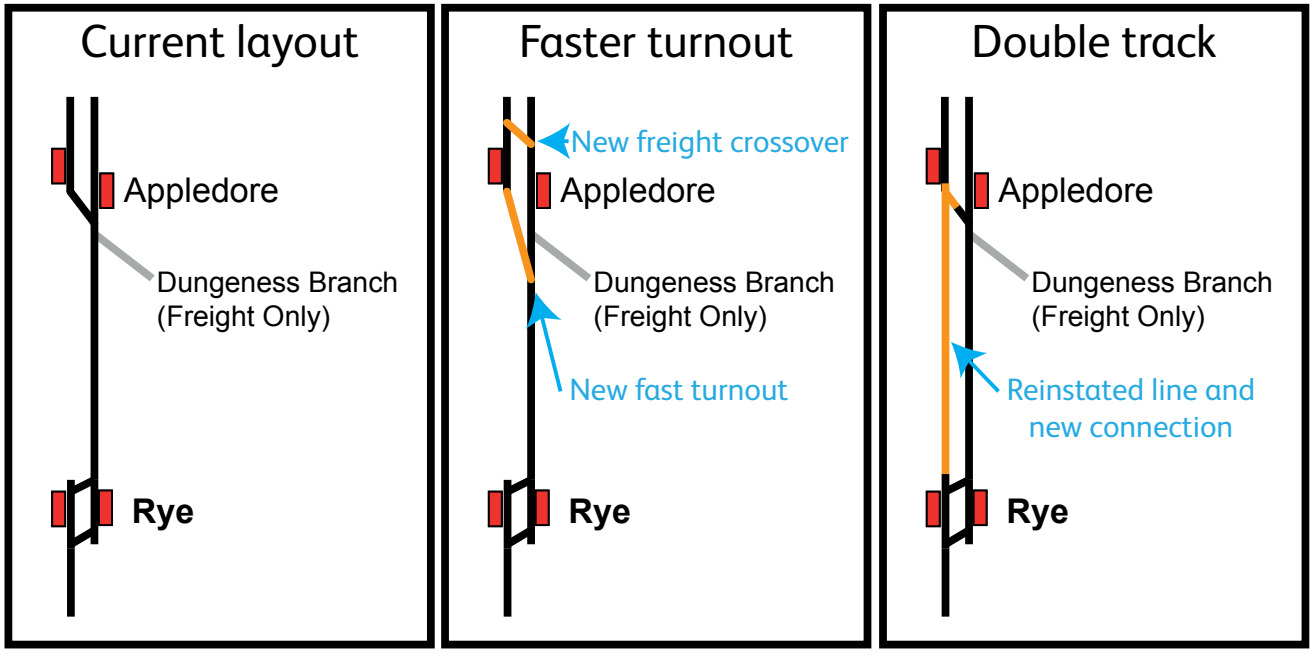


Table 6.9 - Proposed work elements - Appledore Junction renewal/alterations

Proposed Work Element	Construction Discipline	Sub-option	Details / measurables
Relocate GSM-R mast.	Civils / Signalling		Relocate the existing GSM-R mast from within the former up line formation to the south of Appledore Junction to allow a revised junction arrangement to be provided. The relocated mast should be positioned sufficient distance away from the former Up alignment.
Renew existing Appledore Junction S&C	Track		Replace the existing S&C equipment at Appledore Junction and provide 1 no. trailing point to the Up line.
Provide 60mph or 75mph Turnout.			Provide a new turnout from the Rye Single line onto the Up line which is capable of either 60mph or 75mph operating speed.
Land Purchase Required			Approx 70m x 3m of land will require purchasing to allow the new up line to be reinstated.

Table 6.9 - Proposed work elements - infrastructure enhancements - Rye double-tracking to Appledore

Proposed Work Element	Construction Discipline	Sub-option	Details / measurables
Divert Station Footpath	Civils		Divert the existing station access footpath from The Grove to allow the up line to be reinstated.
Reconfigure The Grove / Rope Walk Level Crossing	Civils / Signalling		Reposition the crossing barriers to the required distance away from the proposed running line location at the north side of the crossing. New foundations will be required for the barriers.
Amend 3 no. AHB level crossings			Star, East Guldeford and Becketts AHB level crossings will require the signage and barrier supports relocating to allow the additional up line to be reinstated. Consider replacing the AHB with bridges as part of a wider programme to close level crossings and user worked crossings along the length of the railway.
Additional Electrification	E&P		Approximately 10700m of additional 3rd rail or Overhead line electrification will require installing along the length of reinstated track.
Reposition Signal	Signalling		Signal RY4 is located within the Down line formation where the track alignment passes from the up to the down side. The signal will require relocating into cess to allow the up line to be reinstated and the track alignments slewed.
New Signalling			Provide the required track signalling to allow the up line to be reinstated to Appledore.
Remove S&C unit	Track		The existing S&C unit at the east end of Rye station will require removal and plain line reinstating within the down line formation.
New plain line track			Provide approximately 10700m of plain line track to connect the limit of the up line in Rye to the limit of the up line at Appledore.
Alignment formation works	Track / Civils		Clear the former alignment space and re-grade to enable the up line to be reinstated. 10700m of minor vegetation clearance and formation re-grading.

Rye station

6.5.9. The platforms at Rye are currently four coaches long so may need to be extended to fit 6-car trains, although selective door opening may be deemed acceptable for this station.

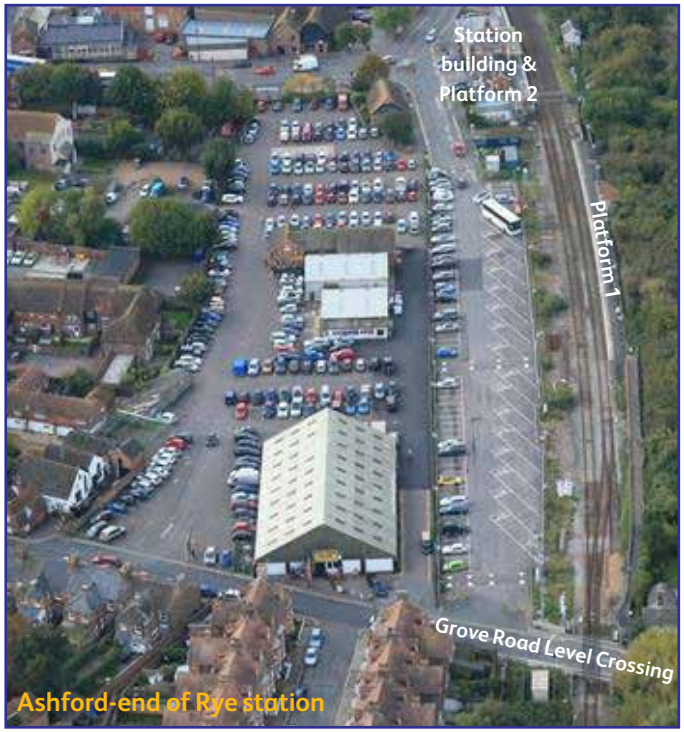
6.5.10. The station site is restricted at either end by level crossings which are controlled by Rye Signal Box:

- Grove Road at the Ashford-end
- Ferry Road at the Hastings-end

6.5.11. The crossings are single line so may require some work to move barrier equipment to make room for the additional line.

Table 6.9 - Proposed work elements - infrastructure enhancements - Rye double-tracking to Appledore

Proposed Work Element	Construction Discipline	Sub-option	Details / measurables
Amend Crystal Place Road alignment	Civils		Revise the road junction alignment between Crystal Place and Ferry Road to enable the down line to be reinstated.
Reconfigure Ferry Road Level Crossing	Civils / Signalling		Reposition the crossing barriers to the required distance away from the proposed running line location at the south side of the crossing. New foundations will be required for the barriers.
Relocate CCTV	E&P		Construct new pad foundation and relocate the existing CCTV camera and column to the opposite side of the railway alignment.
Additional Electrification			Approximately 900m of additional 3rd rail or Overhead line electrification will require installing along the length of reinstated track.
Reposition Signal	Signalling		Signal RY27 appears to be in the process of being relocated into the footprint of the down line formation. The signal will require relocating back into its original position to allow the down line to be reinstated.
New Signalling			Provide the required track signalling to allow the down line to be extended by ½ mile. Relocate signal RY5 to the required limit of the new down line.
Remove S&C unit	Track		The existing S&C unit at the west end of Rye station will require removal and plain line reinstating within the up line formation.
New plain line track			Provide approximately 900m of plain line track to connect the new point end to the end of the down line within the confines of Rye station.
Install new 60-75mph point end.			1 No. point end capable of 60-75mph located on the straight section of track approximately ½ mile to the west of Rye Station.
Alignment formation works	Track / Civils		Clear the former alignment space and re-grade to enable the up line to be reinstated. 900m of vegetation clearance and formation re- grading.



6.5.12. The double track layout allows for train to pass as the lines on both sides are single track. This causes timetable restrictions and operational pressures as a delayed train will have a knock-on effect on the train travelling in the opposite direction.

6.5.13. Double tracking between Appledore and Rye is detailed in **Paragraph 6.5.7**.

6.5.14. An alternative solution, detailed in the report, would be to extend the platform lines to become 'dynamic loops' so trains can leave the station and clear the level crossings quicker than today. This would require an extra half-mile of track in either direction to extend and the new pointwork to complete the loops.

Rye - Winchelsea (approx. 2 miles)

6.5.15. Double-tracking between Rye and Winchelsea has also been investigated in the Report at a cost of around £5-15M. This requires an upgrade of the level crossing at Winchelsea (which would be a substantial benefit as the line speed is currently restricted to 25 mph over the level crossing). and could reduce the 'down time' of Ferry Road Level Crossing.

6.5.16. Even if the line is not redoubled, the level crossing issue at Winchelsea needs to be addressed. The traffic levels are insufficient for the level crossing to be more than is currently provided. It is an automatic level crossing that is locally monitored, by the driver observing an indicator on approach to the station. In recent years, barriers have been added to the crossing but this has only allowed the linespeed to be raised to 25 mph.

6.5.17. The upgrading of Winchelsea Level Crossing to CCTV or obstacle detection will be an expensive part of the scheme..

6.5.18. An additional platform would be required on the reinstated line at Winchelsea. The former platform and station building is now a private residence so a new location would have to be found for the new platform, possibly Rye-side of the level crossing.

Winchelsea - Doleham (approx. 4 miles)

6.5.19. The former trackbed is still extant all the way to Doleham apart from the bridge over the River Brede which would require a new deck structure.

6.5.20. Redoubling at Doleham would require a new platform to be built or the line reduced to single track on the Winchelsea side of the platform.

6.5.21. The platform at Doleham station is just one vehicle long and is used by 6,496 passengers (2015-16 entries & exits) per year.

Doleham - Ore (approx. 4 miles)

6.5.22. There are two options for this section of the line:

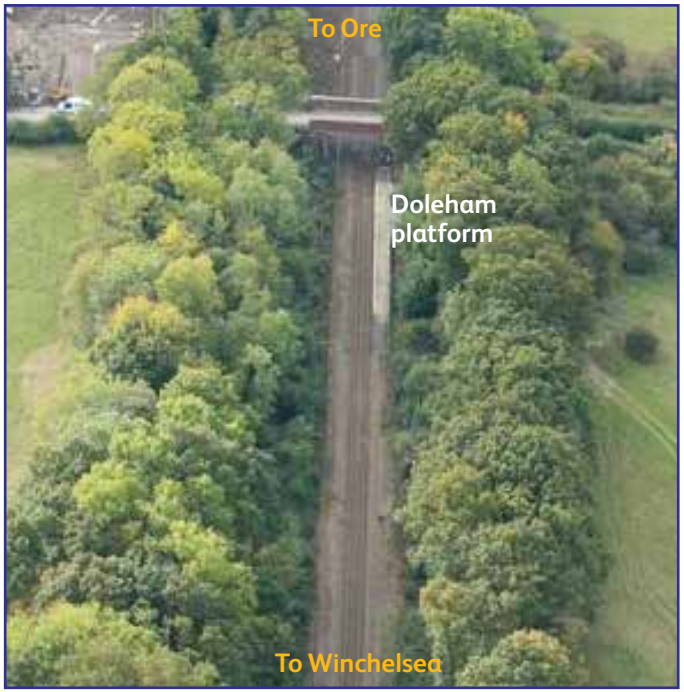
- redoubling
- line speed improvement.

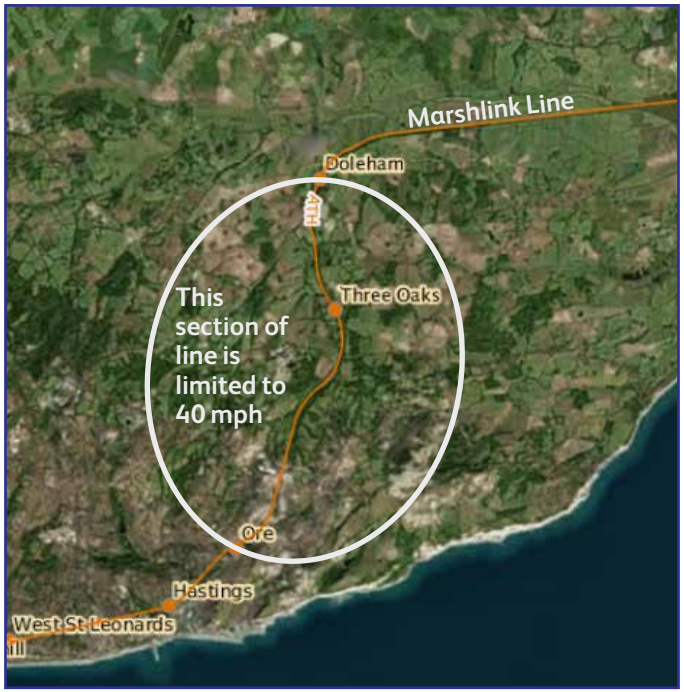
6.5.23. The issue with this section is that it is curvy with a low linespeed of 40 mph, as can be seen from the aerial view in the photograph below. Doubling the track will remove the pinch-point of the single line section but the 40 mph linespeed would remain.

6.5.24. The linespeed could be raised to 60 mph by realigning the single track to make full use of the former double-track trackbed. Work has been carried out on early stage development but further work is needed, it is thought that it will cost £1-10M.

6.5.25. Previous work has shown that trees and bushes will need to be cut back on the approaches to Doleham foot crossing to provide improved sight lines for 60 mph linespeed.

6.5.26. Digital Railway solutions such as the Traffic Management System should help resolve/manage issues with the single line section, prioritising the London-bound train as it has to arrive at Ashford International on time to utilise the booked path on HS1.





6.6 Destination stations

6.6.1. This section looks at the merits of terminating trains at the three key stations of:

- Hastings
- Bexhill
- Eastbourne.

Hastings

6.6.2. Terminating the High Speed services at Hastings would have the benefit of not requiring a pathway between Hastings and Bo-peep Jn where all Southern and Southeastern services to Hastings and Ore share a two-track railway with some severe speed restrictions through two tunnels.

6.6.3. The Report highlighted the benefits of terminating in Platform 1 as it provides a cross-platform interchange for trains departing the west end of the station.

6.6.4. Another advantage is that it will require minimal signalling or track enhancements although the buffer stop may need renewing.

6.6.5. It may be possible to terminate in one of the other platforms to provide cross-platform interchange but this would need to be timetabled correctly due to the dwell time of the train, which effectively blocks the platform until departure time.

6.6.6. The dwell time for the train is likely to be 25-30 minutes which provides resilience in the timetable as the train may be able to return on time despite a late arrival.

6.6.7. The disadvantage of tunring back at Hastings is that the trains will not directly serve Bexhill.

Bexhill

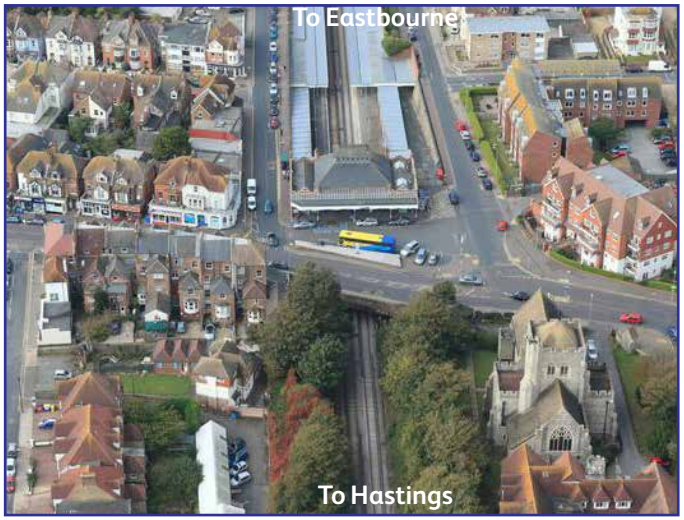
6.6.8. Stakeholders would like the High Speed service to run to Bexhill so the Infrastructure Projects report investigated this.

6.6.9. There are two options for turning trains back at this station:

- terminate in Platform 1 and start back from Platform 2
- terminate and turn back in Platform 2.

6.6.10. The picture on the right shows the station, Hastings reached from the tracks under the station building and road bridge and Eastbourne uses the tracks off the bottom of the picture. The picture below shows the Hastings-end approach to the station and the drawing bottom right, shows the signalling arrangement at Bexhill. **Figure 6.7** shows the current track and signalling layout.

6.6.11. After arriving in Platform 1 the train would terminate (**A** in **Figure 6.8**) and shunt forward until it is clear of 718 points (**B**), the driver would then change ends and await for 1435 shunt signal across 718 points in Platform 2. The train would be held either at 1435 shunt signal or in Platform 2 (**C**) for its pathway. Either way, it is blocking a running line.



6.6.12. It is expected that 7-10 minutes would be required for the whole process at Bexhill. Therefore, when trains are running even a few minutes late, it is likely that the train would be turned back at Hastings instead.

6.6.13. None of the above operation requires additional infrastructure so would be a timetable issue.

6.6.14.However, with some additional infrastructure such as a crossover or even a scissors crossover and associated signals, trains could arrive and depart from the same platform but this comes with a platform occupation penalty whilst the driver changes ends and the passengers unload and load.

6.6.15. As with the shunting move, any delay is likely to see the train curtailed at Hastings with the return trip starting from there.

Figure 6.8 - Proposed Bexhill operations

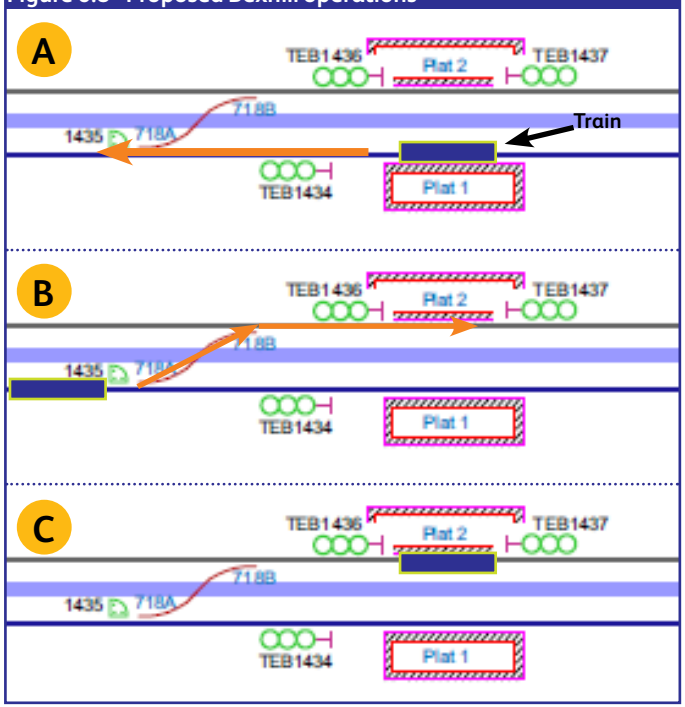
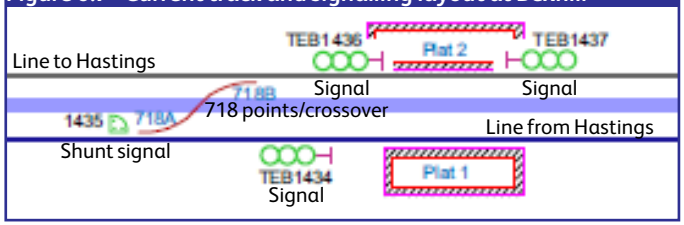


Figure 6.7 - Current track and signalling layout at Bexhill



Eastbourne

6.6.16. An alternative to the short turn round at Bexhill could be to run the train to Eastbourne where it would probably have 20-25 minutes dwell time, reducing the chances of it being terminated short at Hastings.

6.6.17. The timetable would have to be looked at to operate these trains but at six coaches they would provide siginificant additional capacity between Hastings, Bexhill and Eastbourne which would be a big benefit as this is the busiest section of the Brighton - Ashford International service.

6.6.18. The whole line between Bexhill and Eastbourne was resignalled in 2015 with provision for 90 mph operations between Bo-Peep Jn and the former Stonecross Jn (between Pevensey & Westham and Hampden Park), **Figure 6.X**. The current linespeed is 70 mph. Further work is required to ensure the track, structures and embankments/cuttings are able to withstand the higher linespeed.

6.6.19. The improved journey time will probably not be sufficient to woo passengers from existing services to London but may provide a useful alternative at times of perturbation.

6.6.20. This option will, however, require an additional 6-car unit to operate the extended service.

6.6.21. In the longer term, to provide faster links to Gatwick Airport and Brighton it could be possible to reconstruct Hampden Park station with modern facilities and a central platform to enable cross-platform interchange to be timetabled.

6.7 Next steps

6.7.1. As mentioned in this chapter, between the publication of the Draft for Consultation and Final Route Study documents, Network Rail will be looking at the timetabling permutations of the outputs.

6.7.2. **Figure 6.9** is a flowchart of how the options can be taken forward.

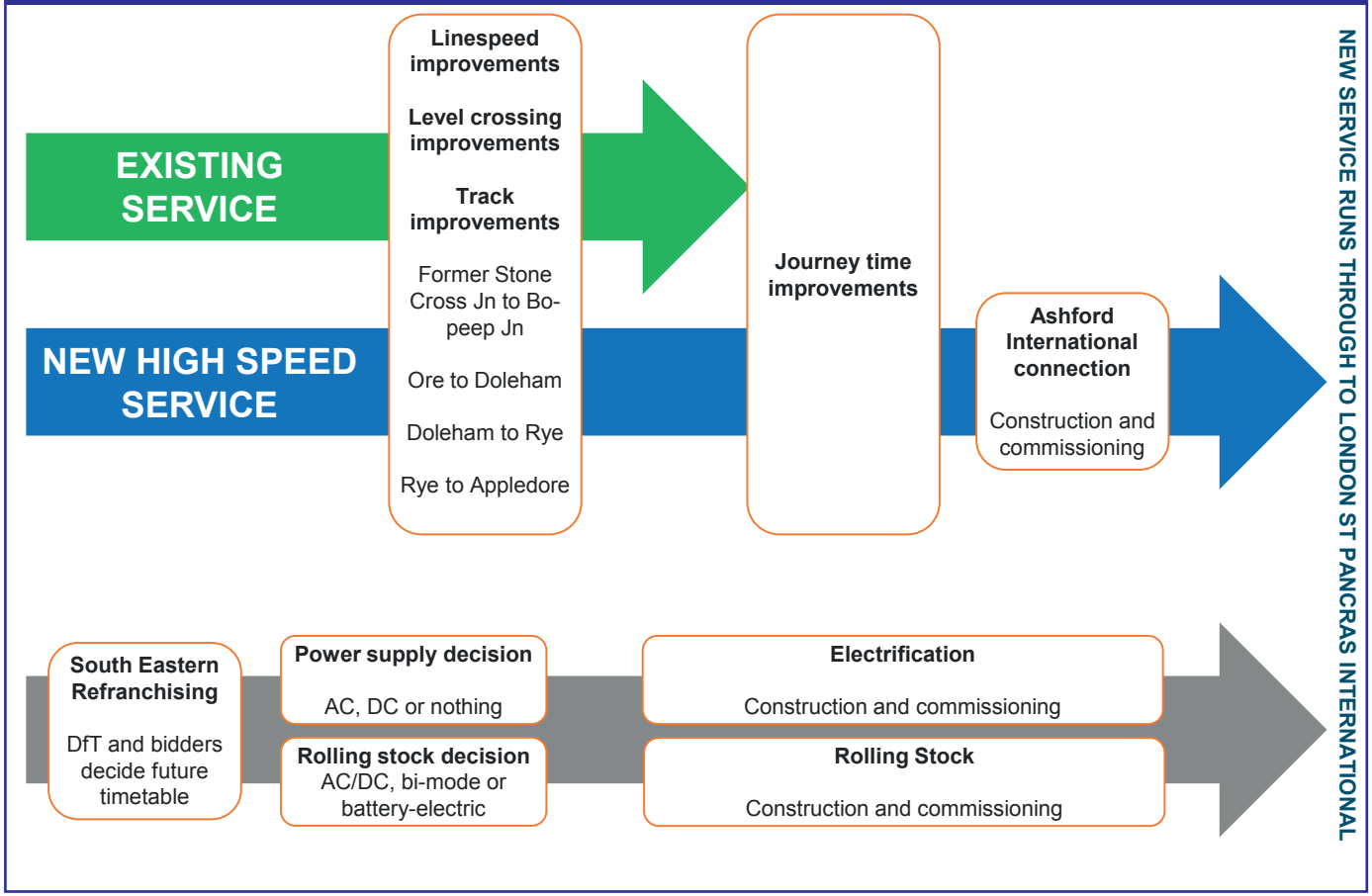
6.7.3. The Department for Transport and bidders for the South Eastern Franchise will be looking at the reponses to this Route Study Draft for Consultation and those to the Refranchising Consultation document.

6.7.4. The linespeed improvements can be delivered through level crossing and track improvements independently of the electrification and rolling stock decisions although adding electrification at the same time as improving the infrastructure could reduce the overall cost of the scheme.

6.7.5. The cost of the 'do everything' option is very high so there is an incremental approach that may make the cost more palatable although third party funding may be essential for some schemes

6.7.6. Even if Marshlink High Speed services do not form part of the next South Eastern franchise, the linespeed improvements would still enable the existing service to be improved, allowing house building etc to be carried out in the meantime, ahead of the next South Eastern franchise, making the business and social case stronger.

Figure 6.9 - Flowchart showing how the choices for funders can be taken forward



7 Ebbsfleet Southern Link

7.1. This aim of the Pre-GRIP study is to identify infrastructure requirements to provide a new connection between Swanley and Ebbsfleet International to provide 12-car services from South London to support predicted passenger uplift demands due to the proposed Ebbsfleet Garden City and London Resort Theme Park developments.

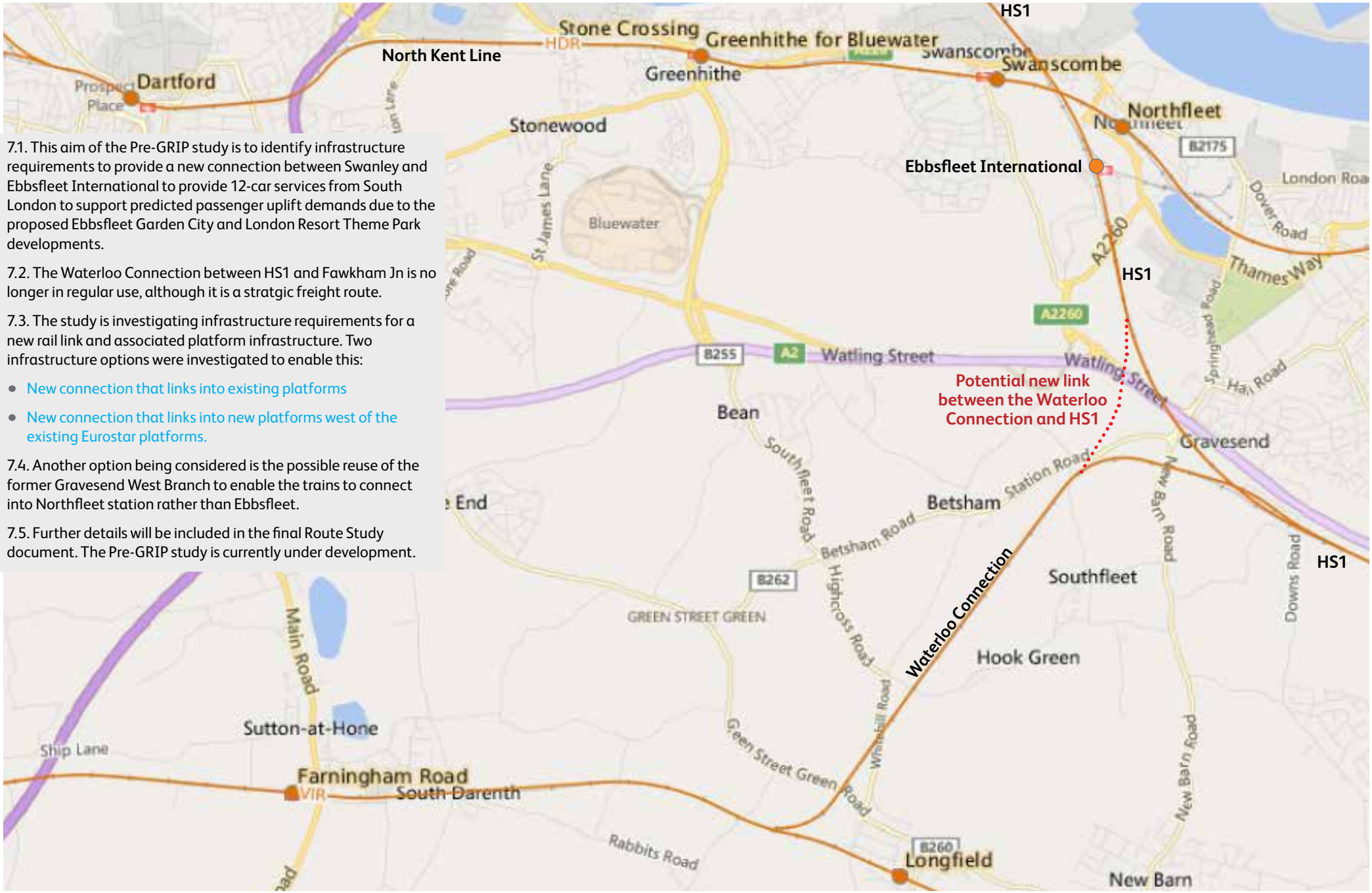
7.2. The Waterloo Connection between HS1 and Fawkham Jn is no longer in regular use, although it is a stratgic freight route.

7.3. The study is investigating infrastructure requirements for a new rail link and associated platform infrastructure. Two infrastructure options were investigated to enable this:

- New connection that links into existing platforms
- New connection that links into new platforms west of the existing Eurostar platforms.

7.4. Another option being considered is the possible reuse of the former Gravesend West Branch to enable the trains to connect into Northfleet station rather than Ebbsfleet.

7.5. Further details will be included in the final Route Study document. The Pre-GRIP study is currently under development.



8 Freight

8.1. The tables on the following pages detail the over line structures between the Channel Tunnel & Swanley Junction, Fawkham Junction (for train from High Speed 1) & Swanley Junction and Swanley to the West London Line via the Catford Loop.

8.2. Currently, container trains have to use a specialist 'pocket' or low profile wagon to carry high-cube containers because at 2,9m high (9ft 6in) they are 30cm (1ft) taller than the usual shipping containers and that makes all the difference for gauge clearance.

8.3. Being a box, the containers do not have profiled roofs similar to a passenger coach or a typical wagon, so they require extra clearances otherwise they will come into contact with platform canopies, tunnel walls, bridge portals etc.

8.4. High-cube containers are becoming the new standard container but hiring in these specialist wagons is costly for the freight operators so these containers are often moved by road. This is an inefficient way of transporting containers as at 12,2m (40ft) long they can only be carried singly on the UK road network.

8.5. A train load of high cube containers would reduce the number of heavy goods vehicles on the roads running in parallel to the railway.

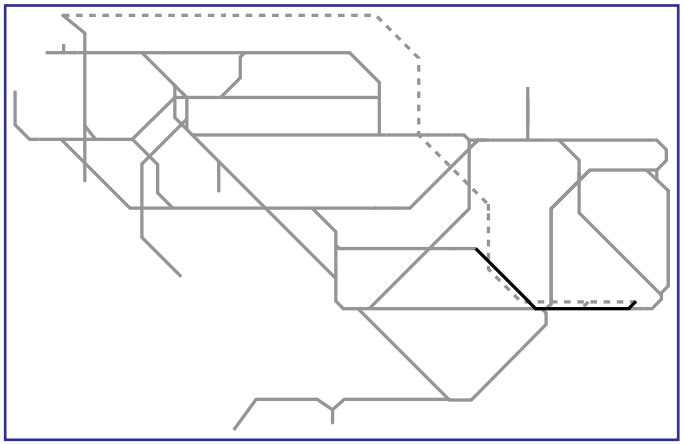


Table 8.1 - Overline structures (Saltwood Junctions - Bearstead)

From/At	To	ELR	Bridge no.	Name	Road	Type
Folkestone West	Sandling	XTD	472	Bargrove	B2065	Road bridge
Folkestone West	Sandling	XTD	468#B1	Saltwood Tunnel		Tunnel
Sandling		XTD	464	Station footbridge		Footbridge
Sandling	Westenhanger	XTD	461	Sandling Tunnel		Tunnel
Sandling	Westenhanger	XTD	457B	Stanford By Pass		Road bridge
Westenhanger		XTD	453D	Station bridge		Road bridge
Westenhanger	Ashford International	XTD	440	Herringe Road		Road bridge
Westenhanger	Ashford International	XTD	431C	Station bridge		Road bridge
Westenhanger	Ashford International	XTD		Unknown farm access bridge		Road bridge
Westenhanger	Ashford International	XTD	924	Mersham Tunnel		Tunnel
Westenhanger	Ashford International	XTD	914	Highfield Lane		Road bridge
Westenhanger	Ashford International	XTD		Bad Munsterfeifel Road		Road bridge
Westenhanger	Ashford International	XTD		Boys Hall Footbridge		Footbridge
Westenhanger	Ashford International	XTD		Canterbury Road		Road bridge
Westenhanger	Ashford International	XTD	561606	Waterbrook Crossing Footbridge		Footbridge
Westenhanger	Ashford International	XTD		Unknown footbridge		Footbridge
Ashford International		XTD	403F	Ashford (Country End) Staff Footbridge		Footbridge
Ashford International		XTD	401F	Footbridge from Platforms 3/4 to International		Footbridge
Ashford International		XTD	401AA	Beaver Road (Southbound carriageway)		Road bridge
Ashford International		XTD	401	Beaver Road (Northbound carriageway)		Road bridge
Ashford International	Charing	XTD	399	Market Footbridge		Footbridge
Ashford International	Charing	SBJ	597A	Godinton Road (new)		Road bridge
Ashford International	Charing	SBJ	697	Chart Road		Road bridge
Ashford International	Charing	SBJ	696	Repton Farm		Road bridge
Ashford International	Charing	SBJ	695A	Rowcroft Barracks (new construction)	A28	Road bridge
Ashford International	Charing	SBJ	695	Maidstone Road	A20	Road bridge
Ashford International	Charing	SBJ		Sandyhurst Lane		Road bridge
Ashford International	Charing	SBJ	684A	Woolpack Lane (shown on Bing as Westwell Lane)		Road bridge
Ashford International	Charing	SBJ	679	Westwell Leacon (shown on Bing as Maidstone Road)	A20	Road bridge
Charing		SBJ	673	Pluckley Road		Road bridge
Charing		SBJ	672A	Charing Station Footbridge		Footbridge
Charing	Lenham	SBJ	670	Hook Farm (shown on Bing as Hook Lane)		Road bridge
Charing	Lenham	SBJ	669	Tile Lodge Road		Road bridge
Charing	Lenham	SBJ	663	Maylum		Road bridge
Charing	Lenham	SBJ	661	Powells Bridge		Road bridge
Charing	Lenham	SBJ	658	Lenham Road (shown on Bing as Headcorn Road)		Road bridge
Lenham		SBJ	657A	Lenham Station Footbridge		Footbridge
Lenham	Harrietsham	SBJ	657	Ham Lane		Road bridge
Harrietsham		SBJ	652B	Harrietsham Station Footbridge		Footbridge
Harrietsham	Hollingbourne	SBJ	648	Hospital Road		Road bridge
Hollingbourne		SBJ	642A	Hollingbourne Station Footbridge		Footbridge
Hollingbourne	Bearstead	SBJ	637A	CTRL/HS1 flyover		Rail bridge
Hollingbourne	Bearstead	SBJ	637B	M20 overbridge	M20	Road bridge
Hollingbourne	Bearstead	SBJ	637	Brickfield (shown on Bing as Crismill Lane)		Road bridge
Bearstead		SBJ	628A	Bearstead Station Footbridge		Footbridge

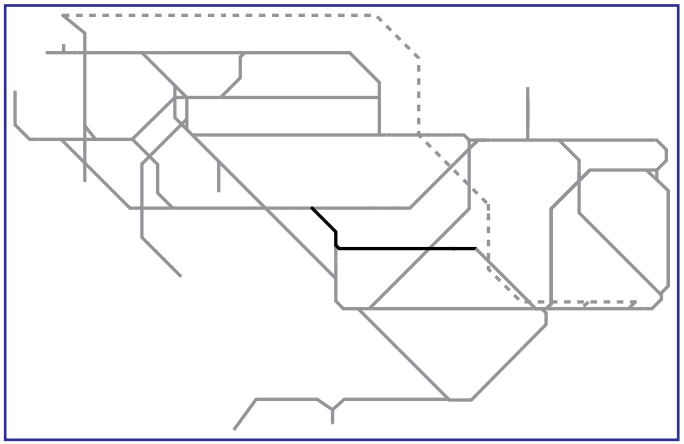


Table 8.2 - Overline structures (Bearstead -Swanley)

From/At	To	ELR	Bridge no.	Name	Road	Type
Bearstead	Maidstone East	SBJ	628	Allotment		Road bridge
Bearstead	Maidstone East	SBJ	623	Public footbridge		Footbridge
Bearstead	Maidstone East	SBJ	622	Killicks (redundant)		Road bridge
Bearstead	Maidstone East	SBJ	621	Weavering Street		Road bridge
Bearstead	Maidstone East	SBJ	620	Raigersfield (shown on Bing as Ashford Road)	A20	Road bridge
Bearstead	Maidstone East	SBJ	615	Vinters		Road bridge
Bearstead	Maidstone East	SBJ	614	Sittingbourne Road	A249	Road bridge
Bearstead	Maidstone East	SBJ	613	Wheeler Street Tunnel		Tunnel
Bearstead	Maidstone East	SBJ	612	Week Street Tunnel		Tunnel
Maidstone East	Barming	SBJ	610	River Medway		River bridge
Maidstone East	Barming	SBJ	606	Great Bucklands		Road bridge
Maidstone East	Barming	SBJ	606A	School Access		Road bridge
Maidstone East	Barming	SBJ	601	Bunyards/Castle Road		Road bridge
Barming		SBJ	597A	Barming Station Footbridge		Footbridge
Barming	East Malling	SBJ	597	Barming Road (shown on Bing as Hermitage Lane)		Road bridge
Barming	East Malling	SBJ	596	Preston Hall B Footbridge		Footbridge
East Malling	West Malling	SBJ	589	Springate Hill/Broadwater Road		Road bridge
East Malling	West Malling	SBJ	587B	West Malling By-pass	A228	Road bridge
West Malling		SBJ	587A	West Malling Station Footbridge		Footbridge
West Malling	Borough Green & Wrotham	SBJ	585	Police Court (shown on Bing as Meadow Bank)		Road bridge
West Malling	Borough Green & Wrotham	SBJ	584	Bull Bridge/High Street		Road bridge
West Malling	Borough Green & Wrotham	SBJ	582	Stubblesdown Footbridge		Footbridge
West Malling	Borough Green & Wrotham	SBJ	579	Aldon Farm (shown on Bing as Aldon Lane)		Road bridge
West Malling	Borough Green & Wrotham	SBJ	576	Wrotham Heath (shown on Bing as Windmill Hill)		Road bridge
West Malling	Borough Green & Wrotham	SBJ	573	Walmisleys		Road bridge
West Malling	Borough Green & Wrotham	SBJ	569A	Public footbridge		Footbridge
West Malling	Borough Green & Wrotham	SBJ	569	Wrotham Road	A227	Road bridge
Borough Green & Wrotham		SBJ	568B	Borough Green Station Footbridge		Footbridge
Borough Green & Wrotham	Kemsing	SBJ	565	Col. James - replaced by new by-pass bridge (Fen Pond Road)		Road bridge
Kemsing		SBJ	558B	Kemsing Station Footbridge		Footbridge
Kemsing	Otford	SBJ	558	Noahs Ark		Road bridge
Kemsing	Otford	SBJ	554	Childbridge Lane		Road bridge
Kemsing	Otford	SBJ	553F	Nash's Footbridge		Footbridge
Otford		SBJ	542	Otford Station Footbridge		Footbridge
Otford		SBJ	541	Otford Road (shown on Bing as Station Road)	A225	Road bridge
Otford	Shoreham	SBJ	540	Bowles Bridge		Road bridge
Shoreham		SBJ	538A	Shoreham Station Footbridge		Footbridge
Shoreham	Eynsford	SBJ	537	Castle Farm		Road bridge
Shoreham	Eynsford	SBJ	536	Beech Road		Road bridge
Eynsford		SBJ	535	Eynsford Station Footbridge		Footbridge
Eynsford	Swanley	SBJ	532	Eynsford Tunnel		Tunnel
Eynsford	Swanley	SBJ	531A	M25 overbridge	M25	Road bridge
Eynsford	Swanley	SBJ	531	Wested Lane		Road bridge
Eynsford	Swanley	SBJ	529/529A	Crockenhill Road (shown on Bing as Goldsel Road)		Road bridge

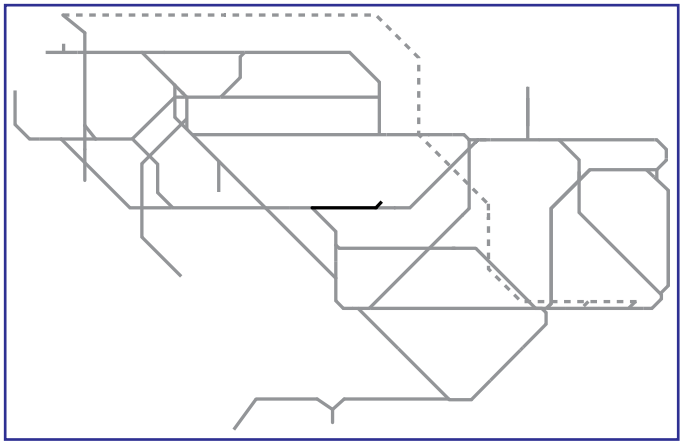


Table 8.3 - Overline structures (Fawkham Junction -Swanley)

From/At	To	ELR	Bridge no.	Name	Road	Type
Fawkham Jn	Farningham Road	VIR	108	Rabbits (shown on Bing as Wilson Lane)		Road bridge
Fawkham Jn	Farningham Road	VIR	107	Gills Bridge		Road bridge
Fawkham Jn	Farningham Road	VIR	106	Home Bridge (shown on Bing as East Hill/Gorringe Avenue)		Road bridge
Farningham Road		VIR	102	Station footbridge		Footbridge
Farningham Road	Swanley	VIR	101	Homefield House (shown on Bing as Homefield Farm)		Road bridge
Farningham Road	Swanley	VIR	100A	M25 overbridge	M25	Road bridge
Farningham Road	Swanley	VIR	99	Park Lane		Road bridge
Farningham Road	Swanley	VIR	98	Alice Dean/Beechenlea Lane		Road bridge
Farningham Road	Swanley	VIR	97A	Footbridge		Footbridge
Farningham Road	Swanley	VIR	97	London Road (shown on Bing as High Street)		Road bridge
Farningham Road	Swanley	VIR	96A	Footbridge		Footbridge

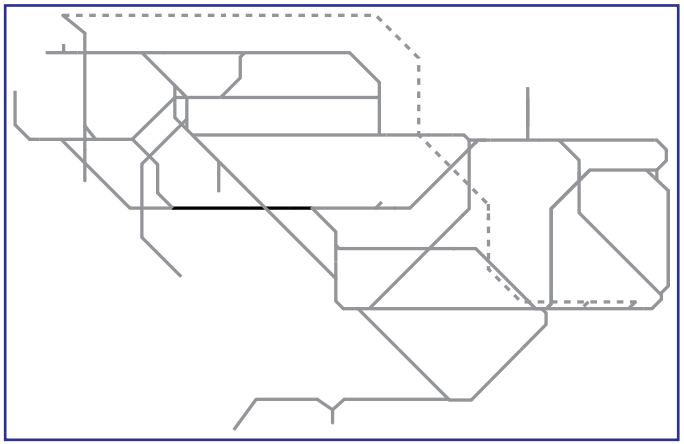


Table 8.4 - Overline structures (Swanley - Bromley South)

From/At	To	ELR	Bridge no.	Name	Road	Type
Swanley		VIR	96	Footbridge		Footbridge
Swanley		VIR	95C	Public footbridge		Footbridge
Swanley	St Mary Cray	VIR	95B	Swanley By-pass	A20	Road bridge
Swanley	St Mary Cray	VIR	95A	Brickfields Footbridge		Footbridge
Swanley	St Mary Cray	VIR	93	Sheepcote Farm		Road bridge
Swanley	St Mary Cray	VIR	92	Birchwood Road/Sweeps Lane		Road bridge
St Mary Cray		VIR	89	St Mary Cray Station Footbridge		Footbridge
St Mary Cray	Bickley	VIR	85	Chislehurst Road	A208	Road bridge
St Mary Cray	Bickley	VIR	82A	Public footbridge		Footbridge
St Mary Cray	Bickley	VIR	80	Intersection XTD over VIR		Rail bridge
St Mary Cray	Bickley	VIR	121260	Intersection Bridge 154A CSM2 over VIR		Rail bridge
St Mary Cray	Bickley	VIR	78	Blackbrook Lane		Road bridge
St Mary Cray	Bickley	VIR	77	St Georges (Private Road)		Road bridge
Bickley		VIR	76	Southborough Road		Road bridge
Bickley		VIR	76	Bickley Station		Building
Bickley		VIR	76A	Bickley Station Footbridge		Footbridge
Bickley	Bromley South	VIR	75	Clarence Road (Private Road)		Road bridge
Bickley	Bromley South	VIR	70	Wendover Road/Ivy (shown on Bing as Murray Avenue)		Road bridge
Bickley	Bromley South	VIR		Footbridge (adjacent to Structure 70)		Footbridge
Bromley South		VIR	69	Kentish Way	A21	Road bridge
Bromley South		VIR	67B	Station footbridge		Footbridge
Bromley South		VIR	67A	Station footbridge		Footbridge
Bromley South		VIR	67	Bromley South Station		Building
Bromley South		VIR	67	Bromley High Street		Road bridge
Bromley South		VIR	66A	High Street Raft (shops over)		Building
Bromley South	Shortlands	VIR	64	Mill Pond Footbridge		Footbridge
Bromley South	Shortlands	VIR	61	Mill Stream Footbridge		Footbridge
Bromley South	Shortlands	VIR	59	Waterworks Footbridge		Footbridge

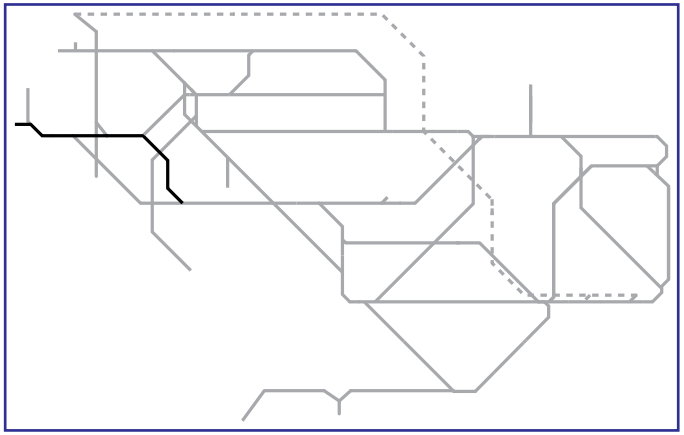


Table 8.5 - Overline structures (Shortlands - Longhedge Junction)

From/At	To	ELR	Bridge no.	Name	Road	Type
Shortlands	Ravensbourne	RVC		Ravensbourne Chord dive-under (VIR over)		Rail bridge
Shortlands	Ravensbourne	CAT	490	Downs Hill		Road bridge
Shortlands	Ravensbourne	RVC	490	Downs Hill		Road bridge
Ravensbourne		CAT	489	Footbridge		Footbridge
Ravensbourne		CAT	488	Crab Hill		Road bridge
Ravensbourne	Beckenham Hill	CAT	485	Beckenham Place		Road bridge
Ravensbourne	Beckenham Hill	CAT	484	Beckenham Hill Road	A2015	Road bridge
Beckenham Hill		CAT	483	Footbridge		Footbridge
Beckenham Hill	Bellingham	CAT	482	Southend Lane	A2218	Road bridge
Bellingham		CAT	480	Station Road (Randlesdown Road)		Road bridge
Bellingham		CAT	479	Station footbridge		Footbridge
Bellingham	Catford	CAT	No over line structures			
Catford	Crofton Park	CAT	464	Brockley Grove		Road bridge
Crofton Park		CAT	463	Footbridge		Footbridge
Crofton Park		CAT	462	Brockley Road	B218	Road bridge
Crofton Park	Nunhead	CAT	461	Dalrymple Road		Footbridge
Crofton Park	Nunhead	CAT	455	St Asaph Road		Road bridge
Nunhead	Peckham Rye	CAT	No over line structures			
Peckham Rye	Denmark Hill	CAT/ATL		Grove Tunnel		Tunnel
Denmark Hill		CAT/ATL		Station footbridge		Footbridge
Denmark Hill		CAT/ATL		Denmark Hill Station		Building
Denmark Hill		CAT/ATL		Windsor Walk		Road bridge
Denmark Hill	Brixton/Clapham High Street	CAT/ATL		Denmark Hill Tunnel/Denmark Hill Road	A215	Tunnel
Denmark Hill/Brixton	London Victoria/Clapham High Street	VIR/ATL	19	Hubert Grove Footbridge		Footbridge
Clapham High Street/Brixton	London Victoria/Wandsworth Road	VIR/ATL	15	Larkhall Rise		Road bridge
Wandsworth Road		ATL	344A	Wandsworth Road Station Footbridge		Footbridge
Wandsworth Road	Longhedge Jn	FLL1		Intersection: ATL over FLL1		Rail bridge
Wandsworth Road	Longhedge Jn	FLL1		Intersection: VTB1 over FLL1		Rail bridge

9 Passenger circulation at stations

9.1.1. Station capacity is an important consideration in accommodating demand across the Kent area. Stations form an integral part of a passengers' journey and if sufficient capacity is compromised, walk times, inconvenience and congestion can impact on running an efficient operation. Providing the necessary space at stations is crucial to achieving higher frequency services, maintaining performance levels, running longer trains and ensuring passenger comfort.

9.1.2. An initial list of stations was drawn out at a Working Group (WG2 session in order to highlight the capacity constraints in the baseline This list was then validated by reviewing the passenger demand estimates as per MOIRA. Other sources of information where also used for developing the final shortlist:

- stations previously identified within the 2011 Network RUS – Stations.
- station capacity assessments and passenger surveys at high priority stations.
- ORR's annual footfall figures.
- market study growth forecasts.
- current station capacity constraints (e.g. entrance, footbridge, stairs,
- platforms, gatelines, run-offs).
- train service level changes
- planned renewals and enhancements
- the potential impact of the Thameslink Programme.

9.1.3. As part of this shortlisting exercise, passenger count surveys and site visits were carried out at the high priority stations during peak times. The evidence gathered from surveys and capacity analysis is captured in datasheets in this Appendix. This information was used, together with the data listed above, to identify the potential impact of future capacity issues and the requirement for interventions (alphabetically by station).

9.1.4. A total of 12 stations were shortlisted across the Route Study area, each with different capacity constraints. The prioritisation exercise was based on the current and anticipated capacity constraints identified. This prioritisation process also took into account the strategy and themes emerging from the Route Study option development work.

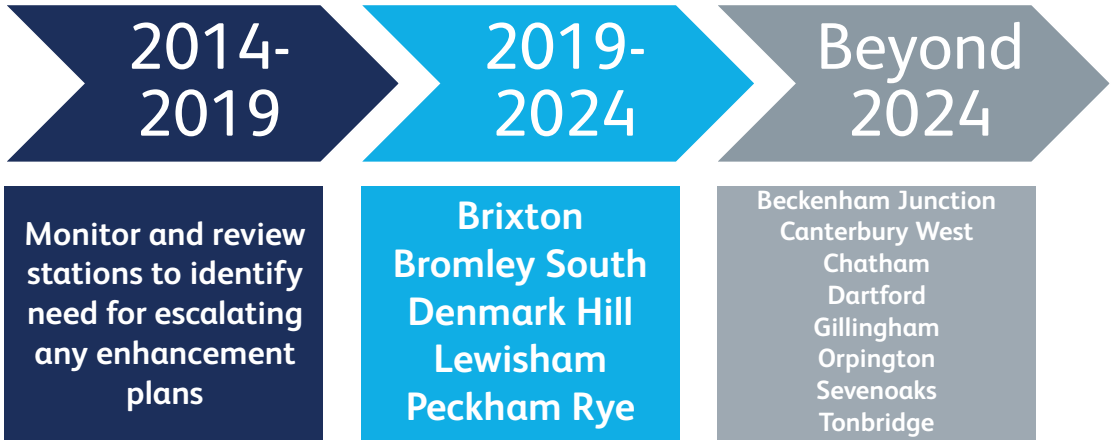
9.1.5. To evaluate and compare the shortlisted stations, a high level methodology was developed based primarily on passenger safety. This process produced a high level recommendation and timeline to when interventions may be required at the station.

9.1.6. Based on this methodology each station was categorised into the following timelines:

- **By 2019** - there are a number of stations on the network that experience high levels of passenger congestion at peak times and need manual interventions on a regular basis. Such stations will be reviewed periodically by the Network Rail Station Capacity team to identify the need for escalating any enhancement plans.
- **2019-24** – stations to be placed within the national list to be recommended for funding during the next control period.
- **Longer Term (beyond 2024)** - stations to remain on the shortlist and reassessed during the next planning cycle.

9.1.7. Station performance across the area will be reviewed by Network Rail and Train Operators during CP5 and CP6 to identify capacity issues that have not been highlighted here. This includes stations where passenger demand may exceed the Market Study high growth forecasts. Such impacts from change in land-use on station capacity will be reviewed on a station by station basis during CP5 in order to identify any further station interventions that are required in CP6.

9.1.8. In addition to those stations with congestion issues identified in the table below, there are a number of stations that, depending on the infrastructure choices selected, may be directly affected. Proposed interventions at these stations may, therefore, be necessary to support the growth in passenger numbers.



9.2 Brixton

Above - passengers on Platform 1 queuing to descend staircase to street level.

Below - the staircase from Platform 1 at street level

9.2.1 Background

Brixton station is a commuter station in South London (Zone 2). It is served by Southeastern trains between London Victoria and Orpington, It is closely situated to Brixton London Underground station.

9.2.2 Current Capacity Constraints

Stairs – Egress capacity from Platform 1 is severely restricted and results in queues backing up to the coper edge, which poses safety and performance risks.

The issue is compounded by the location of two ticket validators on either side of the exit doorway resulting in slow egress.

9.2.3 Possible Interventions and Timeframe

CP6 – Install a second staircase to street level from Platform 1. Additional ticket validators should be provided.

Since many alighters intend to access the Victoria Line from Brixton, the interchange journey times should be considered for locating the new staircase.

Brixton		
Annual footfall		
ORR Estimates of Station Usage	2014/2015	1.0 million
2015 Passenger Count Survey		
AM Peak 3 Hours (07:00 – 10:00)	Count survey not done	Count survey not done
PM Peak 4 Hours (16:00 – 20:00)	Count survey not done	Count survey not done
Forecast Growth		
London and South East Market Study	**2014 – 2023**	**2014 – 2043**
	11.1 %	46.2 %
Interventions summary		
	CP6	**Longer Term**
Ticket Hall (Gatelines, Station Entrance)	✓	
Circulation (Stairs, Subway, Footbridge)	✓	
Platforms (widen, lengthen, declutter)		✓

9.3 Bromley South

Above - passengers await their train on Platform 3

Below left - the platform width between the buildings and trains reduces capacity

Below right - circultation is difficult for passengers alighting

9.3.1 Background

Bromley South is a suburban station in South East London (Zone 5), served by Southeastern and Thameslink services. It is located on the Chatham Main Line and served by a mixture of fast and stopping trains between London Victoria, Bedford and Kent.

There are a number of buildings on the platforms and an interchange footbridge located approximately in the middle of the platforms.

Bromley South is a popular commuter station; it is the final stop for fast Southeastern services to London Victoria. This leads to Platform 3 being the busiest platform in the AM Peak as it is served by fast services. The platform is very narrow in some sections due to the station buildings, the narrow points are towards the London-end of the platform, where the stopping position for all trains is located.

Passengers tend to dwell towards the London-end to make sure they can board any train that arrives , whatever its length, and to reduce the distance they need to walk at both Bromley South and London Victoria.

Bromley South		
Annual footfall		
ORR Estimates of Station Usage	2014/2015	7.4 million
2015 Passenger Count Survey		
AM Peak 3 Hours (07:00 – 10:00)	5,600 Boarders	3,200 Alighters
PM Peak 4 Hours (16:00 – 20:00)	3,900 Boarders	5,500 Alighters
Forecast Growth		
London and South East Market Study	**2014 – 2023**	**2014 – 2043**
	11.1 %	46.2 %
Interventions summary		
	CP6	**Longer Term**
Ticket Hall (Gatelines, Station Entrance)		✓
Circulation (Stairs, Subway, Footbridge)		✓
Platforms (widen, lengthen, declutter)	✓	

9.3.2 Current Capacity Constraints

Platforms - buildings on Platforms 3 & 4 reduce the usable width and force passenger to dwell close to the platform edge, which poses a safety risk.

Stairs - insufficent stair width for Platforms 3 & 4 results in queuing on the platform level close to the platform edge, which poses a safety and performance risk.

9.3.3 Possible Interventions and Timeframe

CP6 – remove buildings on Platforms 3 & 4.

Longer term - construct a transfer deck above the platforms and introduce new staircases.

9.4 Denmark Hill

Above - passengers waiting on Platform 1 for a train to London Victoria or Clapham Junction .

Below - passengers boarding and alighting on Platform 1 with a London Victoria train in the platform, the narrow staircases can be seen in th epicture.

9.4.1 Background

Denmark Hill Station is a suburban station in South East London (Zone 2), served by Thameslink services connecting destinations north and south of London via St Pancras, Southeastern services between Kent and London Victoria, and London Overground services between Clapham Junction and Highbury and Islington.

Denmark Hill has two overbridges, with the second bridge having been installed in 2013 by the Access for All (AfA) programme. The AfA overbridge is at the country end of the platforms, with both bridges linked to an entrance on the south side of the station (above Platform 1). A set of stairs drops from each bridge to each platform island, with lifts on the AfA overbridge. We understand this portion of the station to have 'listed' status.

9.4.2 Current Capacity Constraints

Station access - Insufficient entrance and overbridge provision leads to passenger congestion at peak times.

Stairs - Queuing also occurs at the bottom of the stairs at platform level close to the platform edge.

Gateline – Due to insufficient number of gates the barriers are left open.

Denmark Hill		
Annual footfall		
ORR Estimates of Station Usage	2014/2015	5.6 million
2015 Passenger Count Survey		
AM Peak 3 Hours (07:00 – 10:00)	4,300 Boarders	4,700 Alighters
PM Peak 4 Hours (16:00 – 20:00)	4,700 Boarders	3,000 Alighters
Forecast Growth		
London and South East Market Study	**2014 – 2023**	**2014 – 2043**
	11.1 %	46.2 %
Interventions summary		
	CP6	**Longer Term**
Ticket Hall (Gatelines, Station Entrance)	✓	
Circulation (Stairs, Subway, Footbridge)	✓	
Platforms (widen, lengthen, declutter)	✓	

9.4.3 Possible Interventions and Timeframe

CP6 - Provide a new station entrance onto Windsor Walk, linked to the AfA footbridge. Encourage increased passenger use by:

-Relocating existing station entrance nearer to the AfA footbridge.

-Lengthen platforms to terminate services closer to the AfA footbridge.

-Provide cover to the AfA footbridge and associated walkway.

CP6 - Additional gates on existing entrance / exit gatelines.

9.5 Lewisham

Above - passengers queue to exit Platform 1 at the barrier line at the top of the stairs to the subway.

Below - queuing in the original subway (between all platforms);

9.5.1 Background

Lewisham is a suburban station in South London (Zone 2/3), served by Southeastern services. It is located in the middle of a junction complex, to the north trains diverge towards either London Cannon Street or London Charing Cross via London Bridge or to London Victoria or London Blackfriars via Denmark Hill.

Lewisham is a major interchange station; the DLR provides the main link between South-East London, Kent and the London Docklands. In addition, there are a number of schemes and developments proposed or under construction around the station, including the Bakerloo Line Extension and Lewisham Gateway masterplan. Following the introduction of the final Thameslink timetable in 2018, capacity at Lewisham will be reviewed to validate requirements.

Recent work includes the addition of extra gates in main and DLR gatelines and the demolition work took place earlier in 2015 to widen the accesses to Platforms 2 and 3 by removing some rooms in the building.

Lewisham		
Annual footfall		
ORR Estimates of Station Usage	2014/2015	9.2 million
2015 Passenger Count Survey		
AM Peak 3 Hours (07:00 – 10:00)	4,900 Boarders	6,800 Alighters
PM Peak 4 Hours (16:00 – 20:00)	6,800 Boarders	6,300 Alighters
Forecast Growth		
London and South East Market Study	**2014 – 2023**	**2014 – 2043**
	11.1 %	46.2 %
Interventions summary		
	CP6	**Longer Term**
Ticket Hall (Gatelines, Station Entrance)	✓	
Circulation (Stairs, Subway, Footbridge)	✓	
Platforms (widen, lengthen, declutter)	✓	

9.5.2 Current Capacity Constraints

Gatelines - Insufficient provision of gates leading to queues backing on to the coper edge on Platform 1. Other gatelines also experience queuing.

Stairs - Queuing occurs at the top and bottom of the interchange subway stairs on Platform 1.

Platforms – There are large stepping distances on Platforms 1 and 2 resulting in passenger incidents at the platform-train interface. These platforms have a width less than 2.5m (standard minimum) for more than half of their lengths. This results in high passenger densities and constrains the flows at peak times.

9.5.3 Possible Interventions and Timeframe

CP6 - Additional gates required and the relocation of the gateline on Platform 1

Increase interchange and platform egress capacity by widening existing stairs or providing new staircases.

Widen platforms to encourage better passenger distribution and improve passenger safety at platform train interface.

9.6 Peckham Rye

Above - passengers queue to exit Platform 4 to descend the narrow stairs to the connecting walkway linking all the platforms.

Below - passengers from all four passengers exit the station through the booking hall.

9.6.1 Background

Peckham Rye Station is a suburban station in South East London (Zone 2), served by Thameslink services connecting destinations north and south of London via St Panc

ras, Southeastern services between Kent and London Victoria, London Overground services between Clapham Junction and Highbury and Islington and Southern services between West Croydon, Beckenham Junction and London Bridge via Tulse Hill. Peckham Rye Station consists of 4 platforms. Platforms 1 and 2 share an island whereas Platform 3 and 4 are single face platforms.

Recent works at the station include and Access for All (AfA) scheme to install lifts and the removal of station buildings on Platform 1&2, with a view to increase the space available for passengers. There is also a masterplan to redevelop area to front and rear of station buildings.

Peckham Rye		
Annual footfall		
ORR Estimates of Station Usage	2014/2015	5.0 million
2015 Passenger Count Survey		
AM Peak 3 Hours (07:00 – 10:00)	5,500 Boarders	1,900 Alighters
PM Peak 4 Hours (16:00 – 20:00)	2,400 Boarders	5,300 Alighters
Forecast Growth		
London and South East Market Study	**2014 – 2023**	**2014 – 2043**
	11.1 %	46.2 %
Interventions summary		
	CP6	**Longer Term**
Ticket Hall (Gatelines, Station Entrance)	✓	
Circulation (Stairs, Subway, Footbridge)	✓	
Platforms (widen, lengthen, declutter)	✓	

9.6.2 Current Capacity Constraints

Gatelines - Insufficient gateline provision results in queuing on stairs in both peaks.

Stairs - Insufficient staircase width from Platform 4 results in queues extending onto the platform during peak periods, posing a safety risk. Platform 1 & 2 stairs is also congested at these times.

Platforms - Platforms 3 & 4 have narrow sections that impede passenger circulation at peak times. Passengers unable to board crowded Up Thameslink services in the AM peak on Platform 3 are left behind contributing to platform crowding. Platforms 1 & 2 become congested during the AM peak, impeding passenger circulation.

9.6.3 Possible Interventions and Timeframe

CP6 – Reconfiguration to ticket hall and provide additional gate.

Widen existing platform stairs or provide additional platform access stairs.

Remove buildings and de-clutter Platforms 3&4.

Provide canopies along platforms to encourage better passenger distribution.

10 TfL's Metroisation concept

10.1. The proposals contained in this section are those of Transport for London (TfL), and have been developed independently to the Route Study process.

Options Summary

10.2. Metroisation is a Transport for London (TfL) concept which facilitates significant improvements to train length, frequency and customer experience on London's suburban rail network. North London has a dense network of London Underground routes in addition to suburban rail services, whereas few Underground lines reach into south or south east London, resulting in a greater dependency on rail services.

10.3. Despite this dependency, there is evidence to suggest that the Underground network in south and south east London experiences higher use than would otherwise be expected. Underground stations in south and south east London are substantially busier than equivalent suburban rail stations, with large volumes of bus demand between rail-served areas and Underground stations. These stations include Brixton, Tooting Broadway, North Greenwich, Canada Water, Elephant & Castle and Morden.

10.4.The suburban rail network is therefore potentially under-utilised and could deliver far more for passengers if major changes were made.

10.5. TfL believes that by bringing the simplicity and dependability of the Underground to the suburban rail network in south and south east London, capacity could be increased, helping to accommodate the expected growth in passenger demand across the region. To do this, six key areas would need to be addressed:

- **Predictable services:**
  - Identifiable "lines" that operate all day every day, with consistent stopping patterns and even intervals;
  - Turn-up-and-go frequencies maintained from early morning to late evening;
  - Additional peak services to meet demand and maintain connectivity.
- **Better connections:**
  - Higher frequency train services, including off-peak improvements;
  - Short wait times at stations, so no need to plan journeys in advance;
  - This is particularly useful for those making local connections across south and south east London, who currently have to plan around half hourly services and long waits;
  - New and upgraded interchanges to boost connectivity, not just to / from central London.
- **More capacity:**
  - Longer trains to take full advantage of previous platform lengthening schemes;
  - Making full use of the true capability of existing infrastructure;
  - Consistent train lengths;
  - Metro-style rolling stock on inner suburban services;
  - Infrastructure investment to relieve key bottlenecks on tracks and at junctions that currently constrain both inner and outer suburban services.
- **Shorter journey times:**
  - Higher performance trains that accelerate and brake faster, and have plenty of room to board and alight;
  - Staff actively managing dwell times at key locations;
  - Investment in signalling enhancements;
  - New infrastructure at key bottlenecks to reduce the need for padding in the timetable.
- **Reliability:**
  - Incentivise reliability within contracts as has been done for London Overground and the DLR;
  - Simplification of service patterns to reduce conflicts at junctions and mitigate against the cumulative impact of delays elsewhere;
  - Infrastructure investment to relieve key bottlenecks will allow more reliable services, both inner suburban and outer suburban.
- **Better customer service:**
  - All day station staffing with ticket barriers in operation;
  - Improved information provision;
  - Station and train deep cleans and refurbishment;
  - Better stations with consistent wayfinding;
  - Reliable ticket machines which sell both National Rail and TfL tickets;
  - Consistent and easily understood fares across the whole network;
  - More modern station facilities and shops.

10.6. TfL's Metroisation scheme was developed to increase capacity in the south east London suburban area by up to 25%. The package builds on previous work undertaken in south London for the Sussex Route Study with more frequent services throughout the day, better interchanges and increased train lengths. In some cases, this also means simplifying service patterns within the London area to unlock operating capacity. Further refinement work then took place on the preferred option to produce a more even spread of trains on each branch. TfL's proposal for Metroisation in south east London can be summarised as follows:

South East London Metroisation Service Specification

10.7. All day metro services:

- Cannon Street – Greenwich – Slade Green – Sidcup – Hither Green – Lewisham – Charing Cross circular service (six trains per hour);
- Cannon Street – Lewisham – Bexleyheath – Dartford (six trains per hour);
- Victoria – Denmark Hill – Lewisham (six trains per hour, continuing to / from the Bexleyheath and Sidcup routes at three trains per hour each);
- Victoria – Herne Hill – Bromley South – Orpington (six trains per hour);
- Charing Cross – Lewisham – Hither Green – Orpington – Sevenoaks (four trains per hour);
- Grove Park – Bromley North (four trains per hour);
- Charing Cross / Cannon Street – Hayes (four trains per hour to / from London Bridge);
- Dartford and beyond semi-fast services (four trains per hour);
- Blackfriars – Catford Loop services (four trains per hour).

Additional services may operate at peak times on each route (except Bromley North). Origin, destination and calling points are indicative only.

Enhancements required to deliver full Metroisation

10.8. Analysis undertaken by TfL has identified the following infrastructure enhancements as being necessary to deliver Metroisation on the south east London suburban network:

- Expansion of existing Thameslink European Train Control System (ETCS)/Automatic Train Operations (ATO) section of railway to an area bounded by Charing Cross, Cannon Street, Deptford, Blackheath, Hither Green and Ladywell;
- Provision of two stabling / turnback sidings on Park Street Viaduct, accessible from Platforms 5 – 7 at Cannon Street;
- Provision of an additional track to the west of Platform 1 at Dartford;
- Re-arrangement of the tracks and pointwork to the east of Dartford to provide two central reversing sidings;
- Extension of the Kent House loops to Penge East to provide a four track section between these two stations;
- Improvements to interchange facilities at Lewisham;
- Traction power supply upgrades;
- Additional 300 vehicles to lengthen existing services to their maximum possible length and provide additional services;
- Additional stabling and depot capability
- Station refurbishment and gating.

Detail on Enhancements Required to Deliver Full Metroisation

ATO in South East London

10.9. There are various stretches of railway, both plain line and junctions, that will need to handle up to 30 trains per hour. To achieve this, it will be important to optimise the signalling locations (or European Train Control System (ETCS) beacons, or Automatic Train Operation (ATO) sections where appropriate). To accommodate this level of service reliably for 3 hours of the peak, ATO is thought to be required at the London end of routes serving Charing Cross and Cannon Street. ATO is not necessary at this stage on routes serving Victoria.

10.10. Automatic Train Control (ATC) provides a closer train separation than with lineside signals. It provides an additional level of rail capacity but the driver is still in control. The upper level of ATC is ATO where the driver is still in his cab (mainly for emergency purposes) but he does not drive. The driver is then able, at the end station of the ATO zone, to take back the control of the train either with an ATC system or with the basic lineside signalling.

10.11. Any ATO system has two components:

- A trackside component;
- An on-board component.

Ground issues:

10.12. The boundary points for the South East Metro ATO should be:

- Charing Cross;
- Cannon Street;
- Deptford;
- Blackheath;
- Hither Green;
- Ladywell.

10.13. Taking account of the number of tracks on each route section inside the boundary points, the overall length of single track to be equipped with ATO is around 85km.

On-board issues:

10.14. Southeastern has a current fleet of rolling stock operating on Metro routes of 226 trainsets divided into:

- 36 Class 376 trains (ten years old);
- 147 Class 465 trains (more than 20 years old);
- 43 Class 466 trains (more than 20 years old).

10.15. It has been assumed that the newer Class 376 units will remain on the network for the foreseeable future and ATO would be retrofitted, while the 190 older Class 465 and 466 units will be replaced by modern rolling stock. Additional new units will make up the fleet required to deliver Metroisation. ATO would form part of the specification for the future rolling stock.

Carriage Sidings South of Cannon Street

10.16. Assessment of the terminal capability in the Cannon Street area demonstrated the benefits of being able to avoid returning all Cannon Street arrivals through London Bridge. However, with it no longer being possible to reverse empty coaching stock to the south of Blackfriars and thence via Elephant and Castle, an innovative solution was required to maintain peak frequencies.

10.17. Two aspects of the track layout should be noted:

- Two sidings accessed from Platform 7 (only 4 -car length and cannot be extended without property purchase);
- The single line track to/from Waterloo East/Blackfriars Jn (leads to Metropolitan Junction where it will join the pair of tracks being installed for Thameslink trains between Blackfriars and London Bridge).

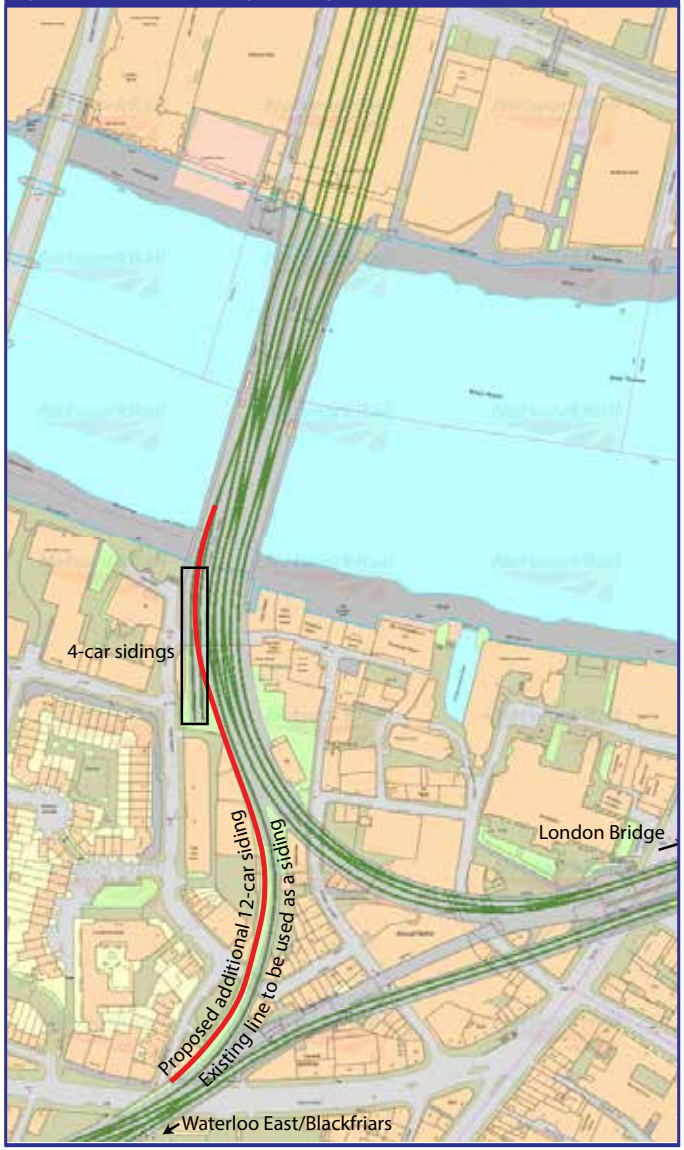
10.18. The existing structure leading to Metropolitan Junction is a viaduct (Park Street viaduct) bearing only one line, although it was built for a double line. This will become the first siding and it will be adapted to accommodate a 12-car train.

10.19. For the second siding, the solution will be to reintroduce a second siding track capable of stabling a twelve car train. The existing siding will be reachable from Platforms 5 to 7. The second siding will be established west of the existing one with a link with Platform 7 only in Cannon Street station as shown on the scheme plan in **Figure 10.1.**.

10.20. Due to the angle between the existing Park Street viaduct and the new one, it will no longer be possible to connect the existing siding with Thameslink lines at Metropolitan Junction. Only the new siding on the West side could perhaps get the connection but this has to be checked at a later stage. For the current study, TfL has considered that no link is available.

10.21. With two twelve car trains stabled on Park Street viaduct and a further two 12-car arrivals stabled in Platforms 6 and 7, TfL believes it is possible to maintain 27tph at Cannon Street during the high peak, with the lower frequency off-peak service operated using the remaining five platforms.

Figure 10.1 - Two carriage siding scheme at Cannon Street



Dartford Additional Track West of Platform 1

10.22. Working arrangements at Dartford are complex:

- The four platforms have to handle both terminating and through trains;
- The three track layout to the west of the station constrains the flexibility to make parallel moves, particularly when using Platforms 1 and 2 (the lower two platforms);
- The potential to use carriage sidings to the east to facilitate reversing trains is constrained by such moves conflicting with through trains;
- The adjacent triangular junctions at Crayford and Slade Green further constrain the ability to timetable trains to optimise capacity at Dartford.

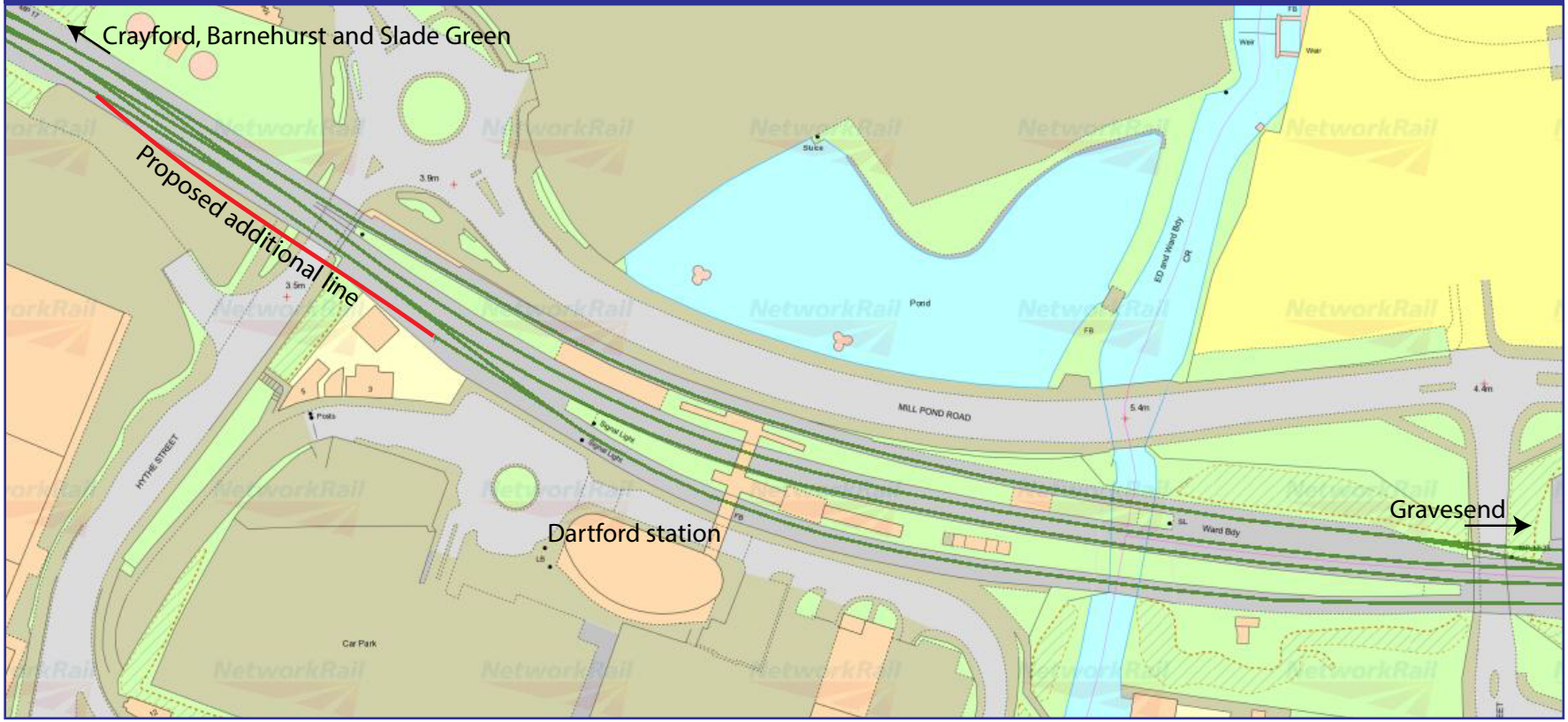
10.23. Increasing the number of trains terminating at this station presents a number of challenges, none of which appear to work efficiently with the current layout.

10.24. Improving the flexibility of access to Platforms 1 and 2 from the west of the station would require construction of an additional bridge and associated track connections immediately to the east of Platform 1. This would then permit parallel workings with these two platforms. The following layout shown in **Figure 10.2** is proposed.

10.25. This would require the following interventions:

- Widening of the Dartford Viaduct by creating a new single line bridge (length = +/- 100 m). The new bridge would support the elongated platform 1 line towards the west;
- Permanent land purchase required for the site of the new bridge;
- Temporary access to property outside of railway ownership;
- Demolition and relocation (if required) of the "DARTFORD E.T.M." building located on the alignment of the new track;
- Installation of approximately 200m of new track equipped with a third rail;
- Removal of the existing trap points and its associated buffer stop, replaced with a 20mph set of points. At the west end of the new track, a 20mph set of points would also be required to connect the Up main line;
- Installation of new signal routes;
- Modification to the existing communications network to adapt it to the new layout.

Figure 10.2 - Proposed additional track west of Dartford



Dartford – Central Reversing Sidings at East End

10.26. The station working at Dartford is complicated and difficult:

- The four platforms have to handle both terminating and through trains;
- The three track layout to the west of the station constrains the flexibility to make parallel moves, particularly when using Platforms 1 and 2 (the lower two platforms on the plan above);
- The potential to use carriage sidings to the east to facilitate reversing trains is constrained by such moves conflicting with through trains;
- The adjacent triangular junctions at Crayford and Slade Green further constrain the ability to timetable trains to optimise capacity at Dartford.

10.27. Increasing the number of trains terminating there presents a number of challenges and none appear to work well with the current layout.

10.28. Reorganising the track layout to the east: Move the through running lines to be the most northerly and southerly tracks placing the siding tracks between them so that reversals can be undertaken with minimal interference to the through trains. In this format, all eastbound trains would use Platforms 3 and 4 and westbound Platforms 1 and 2.

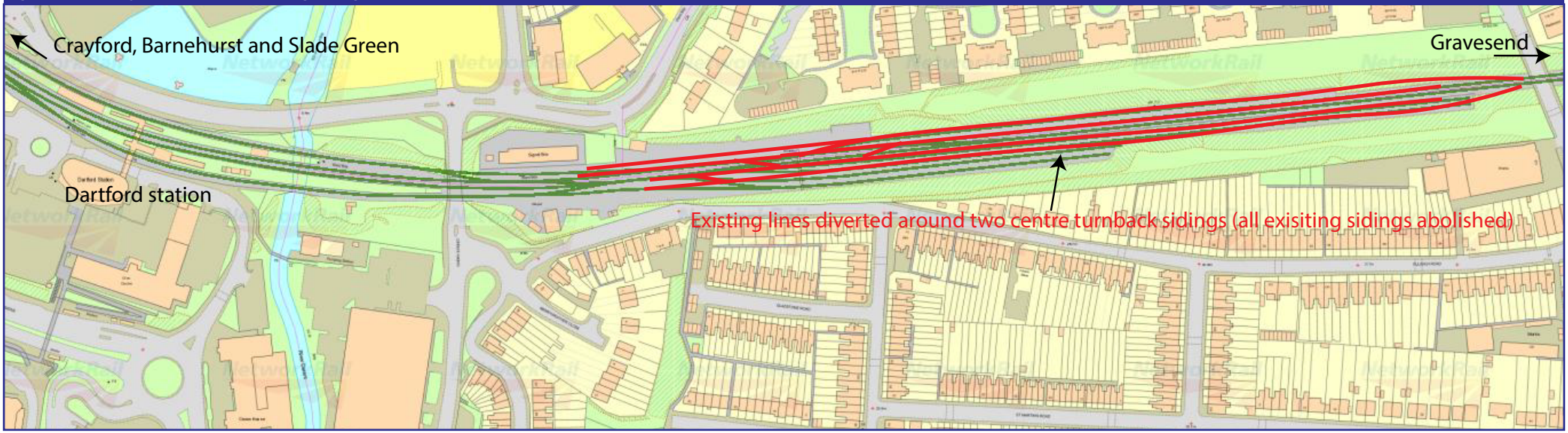
10.29. The new layout is shown in **Figure 1.4**, and described as follows:

- The Down main line towards Gravesend will be moved aside at the location of the actual reception siding;
- The Up line will be moved aside at the location of the actual sidings no 1 and 2;
- Sidings 3 and 4 will be retained;
- The intervention is limited on its east side by the St Vincent Road Bridge.

10.30. This would require the following interventions:

- Construction of graded embankment and retaining walls to follow the incline of the line between Dartford and Gravesend;
- Construction of a train drivers footway between sidings;
- Removal of 300m of track, slewing of 300m of track and installation of 1,200m of new track equipped with third rail;
- Installation of two buffer stops;
- Removal of four sets of trap points, installation of five sets of 20mph points, a diamond crossing and two trap points;
- Installation of four main signals and two block signals, modifications to existing signal routes;
- Modification to the existing communications network to adapt it to the new layout.

Figure 10.3 - Proposed central reversing sidings east of Dartford



Penge East and Kent House – Additional Lines

10.31. The route via Beckenham Junction and Herne Hill shows significant capacity issues, primarily because a fast train is 7 minutes faster between Shortlands and Herne Hill than a stopping train. There would seem to be three possible solutions:

- **Option i**. Slow down the fast trains so that they have to follow the stopping trains signal by signal;
- **Option ii**. Reduce the number of trains running – probably close to the levels running today;
- **Option iii**. Introduce an overtaking opportunity in the route.

10.32. Option i would be unacceptable to longer distance passengers to/from Kent.

10.33. Option ii would fail to meet TfL's Metro standard.

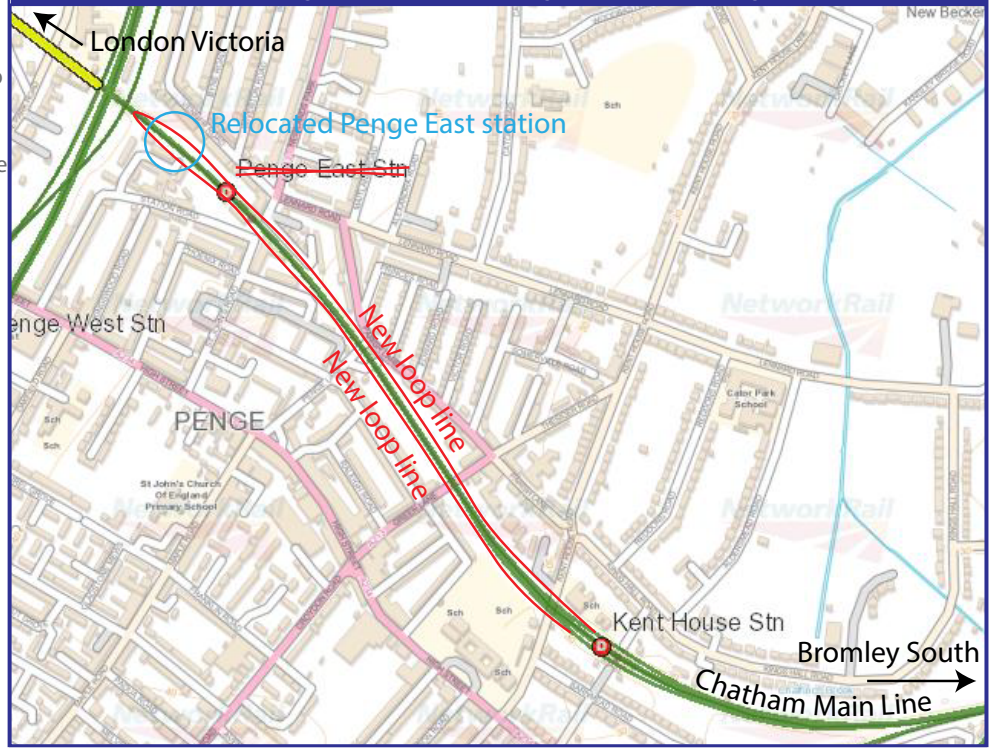
10.34. Option iii merits further study. Loops do currently exist at Kent House which enable fast trains to pass stopping ones. However these are not routinely used as the consequential time penalty for stopping trains is high. Best practice for overtaking loops is that they should have two stations within them so that the combined dwell times give enough time for a faster train to pass without significant extended times to the stopping trains. It may be possible (though may require land purchase) to extend the Kent House overtaking loops west to include Penge East station which may be achievable if the Penge East platforms were moved west closer to Penge Tunnel.

10.35. **Figure 10.4** shows the proposed track layout between Penge East and Kent House .

10.36. This would require the following interventions:

- Construction of a wider embankment would be required to support the new 4 track infrastructure. The embankment could be supported by retaining walls on either side to minimise impact on adjacent land and any potential land purchases required to facilitate the scheme;
- Construction of a retaining wall (and earth fill being) from Penge East Platform to Penge Lane, from Bycroft Street to Green Lane and from Green Lane to Kent House Road;
- Installation of noise barriers on the embankment;
- Construction of new platforms (and installation of a temporary platform during construction);
- Construction of a new station building at Penge East;
- Widening of two bridges from two to four tracks. As the main lines will not be moved, additional bridge decks would be required on each side of the existing ones;
- Demolition of the existing platforms and buildings at Penge Eaststation;
- If required, land purchase on the up side for approximately 70m, where the railway property is around 17 metres wide;
- Rebuild of the footbridge linking platforms 1 and 2 at Penge East Station;
- Installation of 2,500m of new track equipped with third rail;
- Slewing of the lines south of Penge East Station by approximately 1m (to avoid land purchase on the down side of the line;
- Installation of two sets of 40mph points and one set of 15 mph points;
- Installation of new signals and routes;
- Modification to the existing communications network to adapt it to the new layout;
- Removal of the set of points situated at the London end of Kent House station for entering DPL and leaving UPL.

Figure 10.4 - Four-tracking Kent House to Penge East



Lewisham – Station Interchange Improvements

10.37. There are multiple inter-related flat junctions in the Lewisham area. The capacity analysis indicates that, even with the proposed growth in services, the individual junctions have the capability to handle the predicted increase in traffic. However, the close proximity of the junctions means that overall network capacity will be constrained as it will be challenging to timetable parallel moves across each junction, even with ATO. A reduction in station dwell time at Lewisham will be required to help mitigate against this.

10.38. To enable the proposed Metroisation service pattern, as well as to cope with increased customer numbers changing between different services and the DLR, the station at Lewisham would need to be configured to maximise the ability to interchange. This could mean wider platforms, broader staircases, escalators and a wide interchange concourse above or below the platforms.

10.39. Lewisham station has 4 platforms, all of them already being able to be served by twelve car trains. Their width varies as follows (approximate taken from aerial photographs):

- Platforms 1 and 2: from 3.0 m (country end) to 4.0 m (London end);
- Platform 3: from 2.5 m (country end) to 4.0 m (London end);
- Platform 4: from 1.5 m (London end) to 2.5 m (country end) with a 6.0 m part in the middle.

10.40. Due to its configuration with platforms close to each other on the London side and rapidly diverging towards the country side (until 200 metres from platform ends as the crow flies), "natural" interchange is performed on the London side of the platforms. Unfortunately, the London side is also the one where trains are the most crowded because it reduces the journey time by foot in London terminal stations.

10.41. The platforms are connected by 3 subways:

- Connecting platforms 1 and 2;
- Connecting platforms 3 and 4;
- Connecting all four platforms.

10.42. Only the last one can provide an interchange facility between platforms 1 and 3 and between platforms 2 and 4.

10.43. If the existing subway were to be widened, the impact on customers during the construction period would be an important consideration as the subway would need to be closed during this time. This would put additional pressure on the other two subways, as well as platforms and the station concourse area. For this reason, the construction of a second subway parallel to the existing one, with its own stairs and lifts, is the preferred option.

10.44. The subway works would entail temporary works on the station building, on platforms, on cable ways and on the tracks. Due to an increased number of commuters, platforms should also be widened by 1.5 metre on their London side.

10.45. An alternative solution could be to build a footbridge but, without plans and cross sections of the station and its outbuildings, this potential solution has not currently been assessed.

Traction Power Supply Upgrades

10.46. South east London Metroisation will require a high number of additional trains, the traction power supply should be upgraded in order to provide trains with sufficient power to operate to the revised timetable.

10.47. At this stage no traction power surveys have been performed to understand the requirements.

10.48. The number of existing substations powering the South East London Metro area is around 35. The number of running trains is anticipated to be increased by 15% for Metroisation.

10.49. Based on these increases, the available electric power should be increased in the same proportion. In practice, the upgrade can either be by implementing new substations, or increasing the power of existing ones.

10.50. Assuming that 50% of the requirement will lead to increases in the number of substations and 50% will lead to upgrade existing substations three new substations and upgrades to two substations will be required for Metroisation.

Other Key Points to Note

10.51. An incremental approach to Metroisation is intended, with the various components of the six key areas listed in **Paragraph 10.5** to be delivered over a number of years/control periods. In addition:

- The overall BCR of the scheme is calculated at 2.3:1, including provision for installation of ETCS/ATO in the area between Lewisham and Charing Cross/Cannon Street
- Minimum frequencies on each core route would generally be at least 6tph in inner London (roughly zones 2 to 4) and at least 4tph in outer London (zones 5 and 6);
- A simplified network would, in some cases, result in a reduced choice of London terminals for some south east London stations, so easy to reach strategic interchange stations would be developed and promoted so customers can change trains quickly and confidently.
- A simplified network would have performance benefits where conflicting movements could be reduced or eliminated, and infrastructure enhancements would enable reliable operation of higher frequencies;
- It is recognised that some passengers would not welcome the loss of journey options, for example if they no longer had a choice of travelling directly to both Charing Cross and Cannon Street all day. However, TfL considers that provided the benefit to passengers is sufficiently large (higher frequencies, simple interchanges, improved journey experience), then this disadvantage can be overcome, with most passengers benefiting in economic terms despite the loss of some direct routes. A comprehensive stakeholder engagement campaign would be needed
- Further work would be required to ascertain how stabling and depot capability could be increased across the network to accommodate the larger train fleet required to deliver Metroisation
- TfL recognises that there will be challenges to delivering Metroisation, and that it will be necessary to not adversely affect longer distance services from outside London, freight services or the availability of diversionary routes for trains during planned or unplanned disruption;
- The Metroisation concept detailed here has been developed as a free-standing project, but has been designed with flexibility in mind to complement other proposals where appropriate.

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