



Guildford Land Strategy

Timetable Analysis Report

Capability & Capacity Analysis – System Operator

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Abbreviations	
Acronym	Meaning
CP	Control Period
SRT	Sectional Running Time
TPH	Trains Per Hour
TPR	Timetable Planning Rules
TPS	Timetable Planning System
WTT	Working Timetable

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Part A: Executive Summary

The main aim of the analysis was to assess if infrastructure enhancements are required at Guildford Station to deliver aspirations for additional services through control periods CP6, CP7 and CP8. The outputs and recommendations of the analysis will inform the Guildford Land Strategy programme, if land at Guildford Station is to be retained for the future.

The analysis took a phased approach, assessing the control periods in chronological order by implementing the additional services for each period to the base timetable (December 2018 Working Timetable).

The key conclusion is that additional infrastructure will be required by CP8 in the form of a new platform plus the associated track and crossovers.

Additional service specifications described for CP6 and CP7 could be accommodated within the Dec18 timetable, with the current infrastructure at Guildford Station and Shalford Junction. Therefore there will not be any need for new infrastructure during CP6 and CP7. The majority of the aspired services for CP8 could only be accommodated on minimum Timetable Planning Rules (TPR) values, which causes insufficient capacity at Guildford Station in terms of robustness of the timetable, operational performance risks and future service growth.

From a land perspective the key conclusion is that land will need to be retained west of Guildford Station (see [Figure 3](#)). Further investigation and analysis would be needed to firstly establish potential infrastructure and station layout options. This would then inform the quantity of land to be retained, which may vary between different options.

The analysis found that due to their routings, all additional services would mainly use the platforms on the west side of the station. Therefore by CP8 additional infrastructure in the form a new platform, track and crossovers serving the west side of the station would be required to provide more platform capacity.

Additional recommendations which may provide further benefits are:

- **Line Speed Improvements:** Increasing line speeds, with the aim of reducing the current TPR values (e.g. junction margins/headways). Lower TPR values result in greater capacity or providing robustness through enabling more space between trains.
- **Timetable Revision:** Planning the future timetables to make the most efficient use of the platform and station capacity at Guildford, by planning trains into platforms where crossing and conflicting moves are minimised.

Part B: Introduction

B.01 Background

Guildford Borough Council (GBC) has engaged with the System Operator function of Network Rail to discuss the future development of Guildford Station both in terms of operational needs, including growth through future demand, and the opportunity for residential and commercial development in the station area.

B.02 Aims and Objectives

The aim of the project was to determine what the future platform requirement would be to accommodate demand to 2043.

There are three potential step changes in service level associated with the provision of sufficient Main Line capacity in the planning period to 2043; these are:

- The implementation of Woking Grade Separation in CP6 – it is expected that this will enable, in the short-term, the operation of two additional Main Line services in the high peak (arrivals at London Waterloo between 08:00 and 08:59). It was assumed that one of these services originates from Haslemere and calls at Guildford
- The implementation of Digital Railway in CP7 – it is expected that this will deliver the capability to operate an additional four Main Line services in the high peak. It was assumed that one of these services originates at Havant and calls at Guildford, and another starts at Guildford.
- The implementation of Crossrail 2 in CP8 – it is expected that this will unlock seven additional Main Line paths into London Waterloo. It was assumed for the purposes of this study that three of these services operate beyond Guildford and that they all call at Guildford.

Main Suburban services, those terminating or originating at Guildford that utilise the Guildford New Line via Cobham or the line via Leatherhead, were assumed to be as per the SWR franchise bid timetable.

In terms of the North Downs Line there are two potential step changes in service level associated with the provision of sufficient capacity in the planning period to 2043:

- An increase to 3tph all day in each direction; 1tph stopping service between Reading and Redhill (and in the reverse) and 2tph semi-fast services between Reading and Gatwick Airport (and in the reverse) – this was assumed in the CP6 timeframe
- An increase to 4tph all day in each direction; as per 3tph but with the addition of another semi-fast service (this is a local stakeholder aspiration) – this was assumed in the CP8 timeframe.

In addition, provisions are made for the ability to operate 2tph terminating services from the proposed Heathrow Southern Access proposals, in the CP7 timescale

The changes are summarised in the table below:

CP6	<p>Woking Grade Separation: 2 additional Main Line services in the high peak. Assumed that 1 of these originates from Haslemere.</p> <p>North Downs Line: An increase of 1 additional train per hour in each direction.</p>
CP7	<p>Digital Railway: 4x additional mainline services in the high peak. 1 of these starts at Havant and another starts at Guildford.</p> <p>Heathrow Southern Access: 2x additional terminating services in CP7</p>
CP8	<p>Crossrail 2: Expected to unlock 7x Main Line paths to Waterloo. Assumed that 3 of these operate on the Portsmouth Direct Line and will call at Guildford (the remaining 4tph were assumed to operate via Basingstoke and are therefore not part of this work). It was assumed that these services will not terminate at Guildford.</p> <p>North Downs Line: An increase of 1 additional semi-fast train per hour in each direction.</p>

Table 1. Control Period Specifications – additional to Dec18.

A previous study looked at the potential of an additional terminating platform on the east side of the station next to the current platform 1. This is referred to as platform 0 and was considered as an option during the analysis.

The objective of this timetable analysis was to determine if the service levels described above could be accommodated in each of the Control Periods with current infrastructure.

If the service levels could not be accommodated, the constraints would be identified and suitable recommendations made; mainly in terms of what additional platforms would be required.

There were no known exclusions. All known schemes up to and including CP8 are considered as to the impact on service levels at Guildford.

B.03 Geographic Scope and Station Layout

The main geographic scope for the analysis is Guildford Station as shown below.

Outside of Guildford, the analysis considered Shalford Junction which due to its proximity to Guildford is relevant from a timetable compliance perspective.

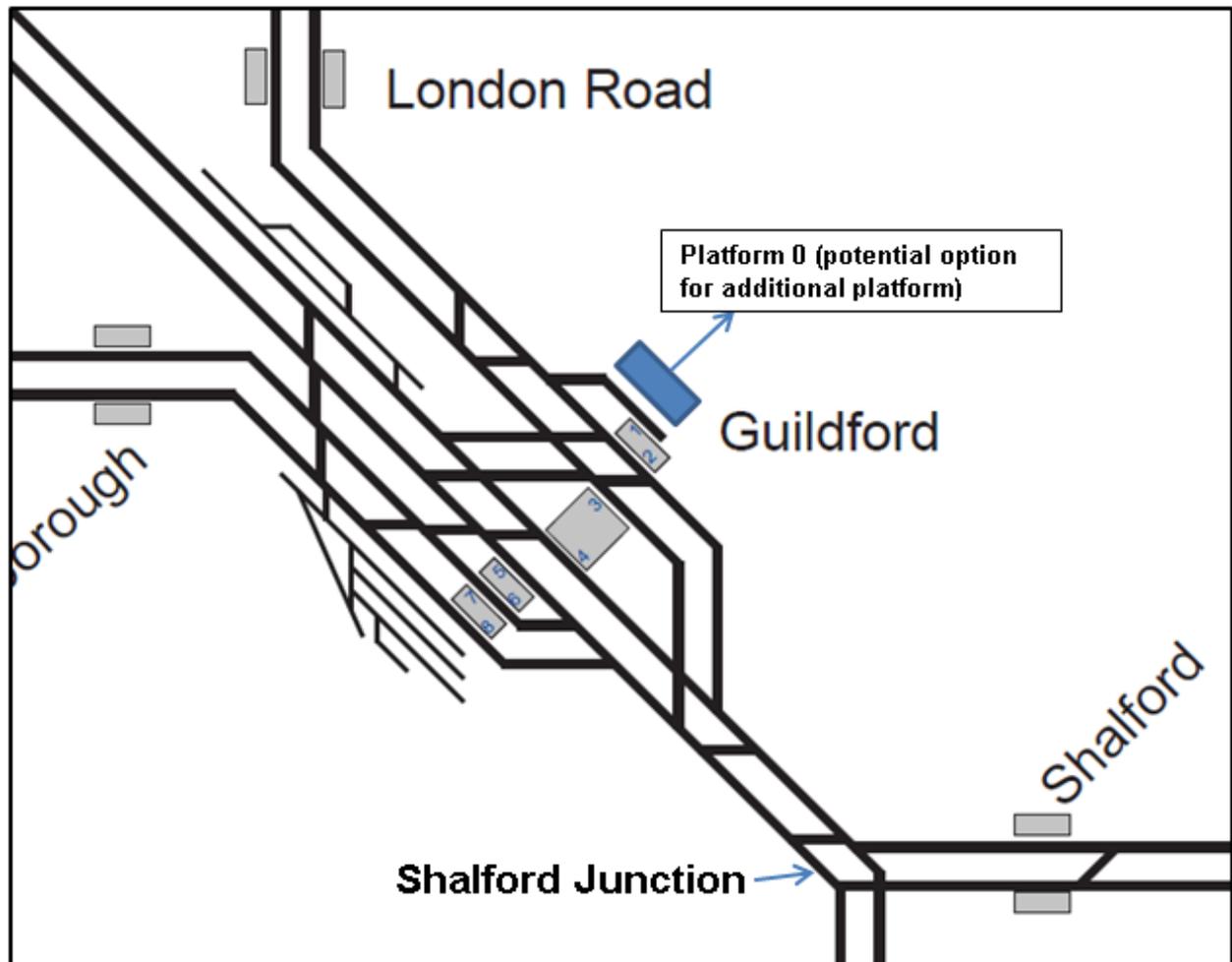


Figure 1: Guildford station and immediate area layout.

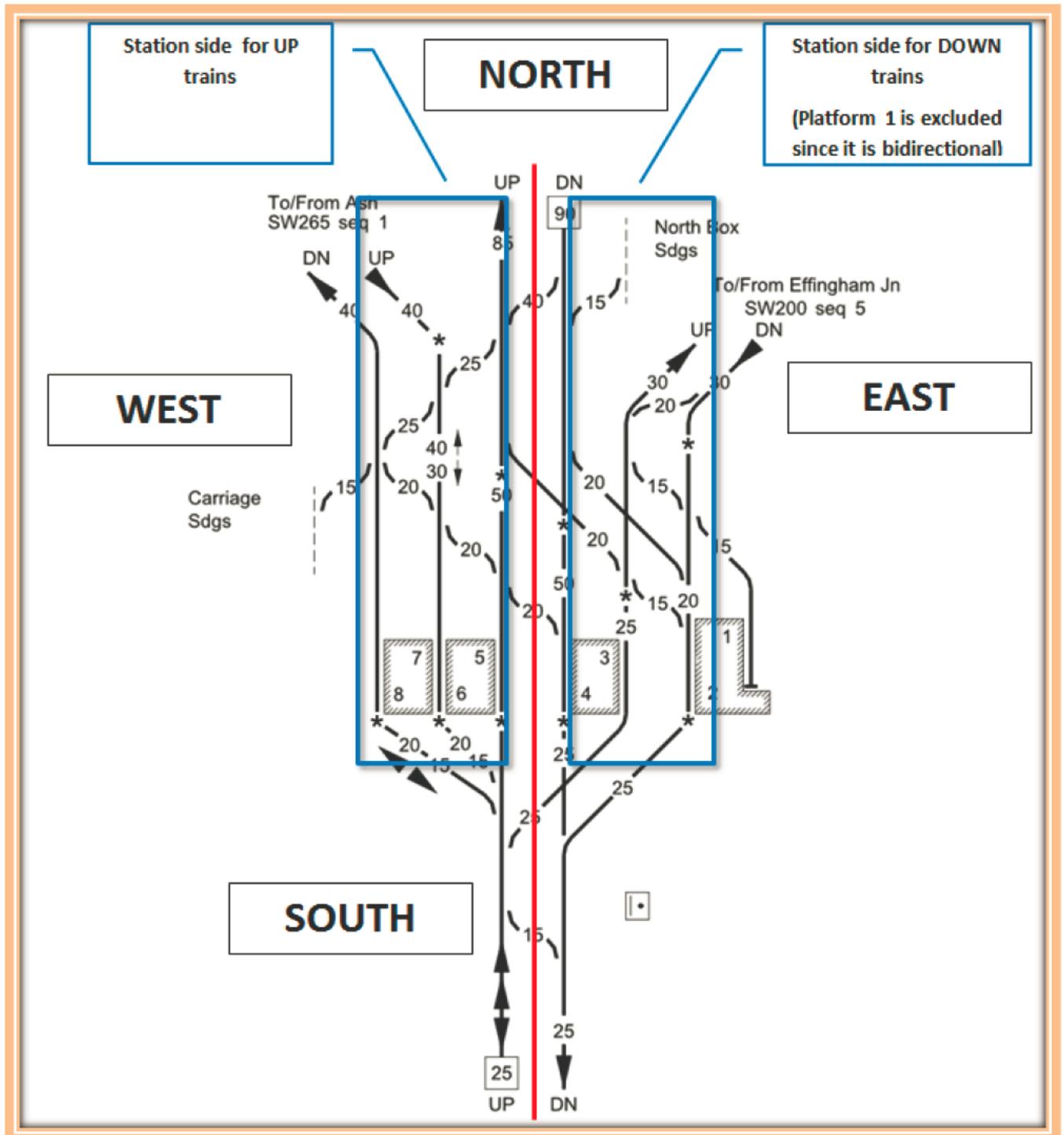


Figure 2: Sides of Guildford Station

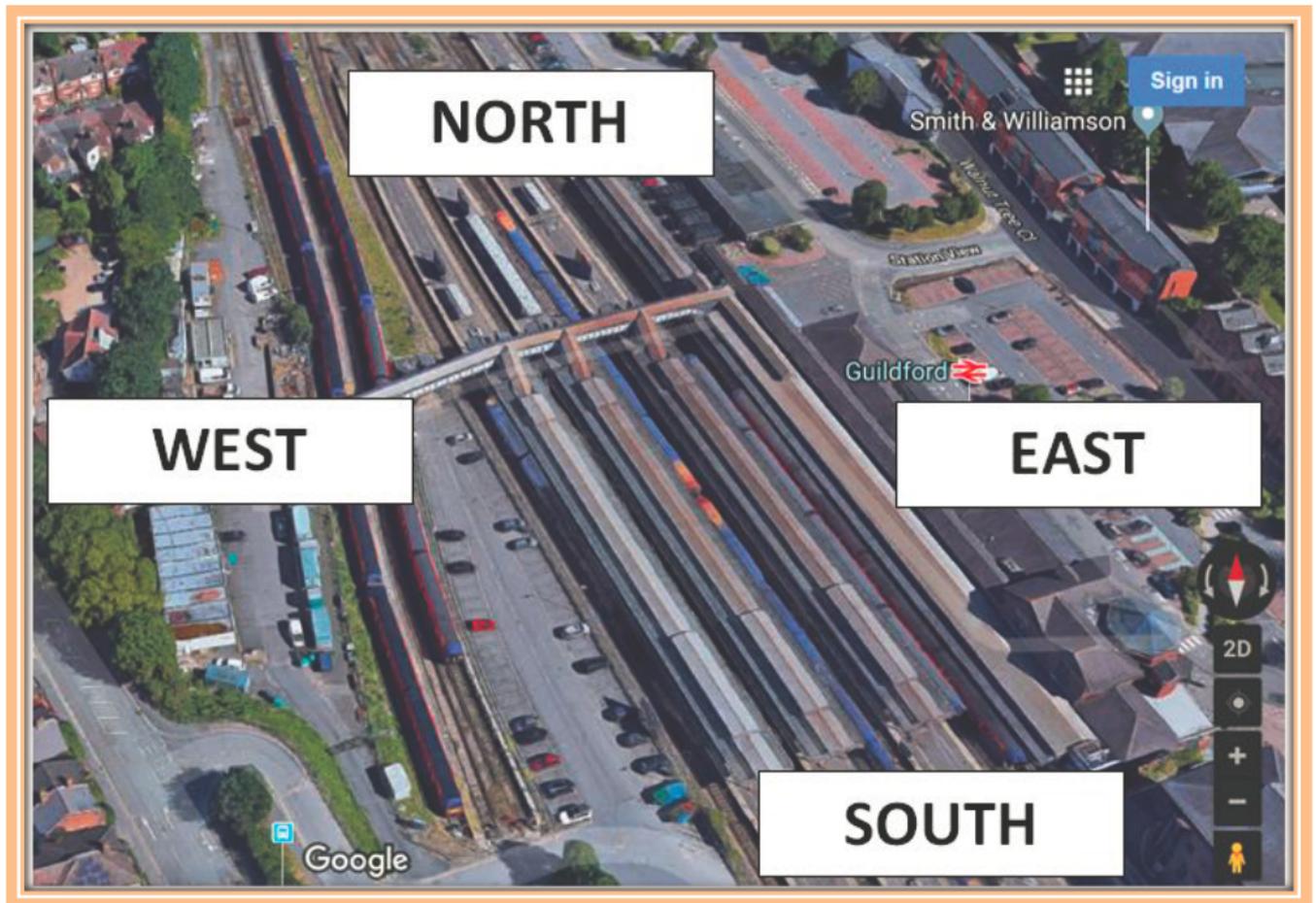


Figure 3 : Guildford Satellite View

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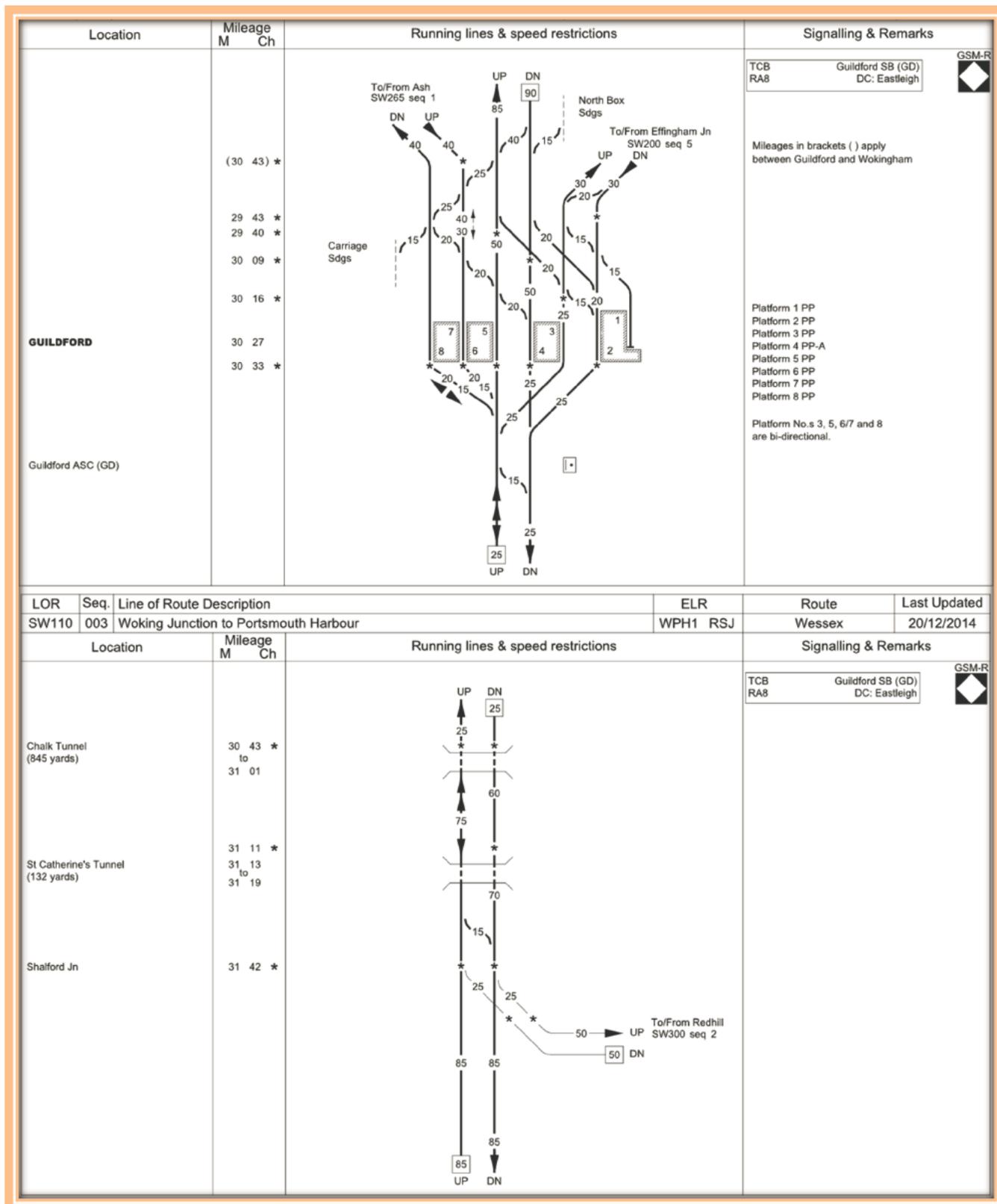


Figure 4: Guildford Station and Shalford Junction Line Speed

Part C: Methodology

The project was setup in TPS using a copy of the Dec18 WTT as a base.

An individual assessment was then made for each of the Control Periods, in chronological order (CP6 > CP7 > CP8). For each assessment, trains were created in the TPS project to meet the additional train specifications as per [Table 1](#) of this report. This was also done in chronological order.

CP6: This was assessed first. The additional trains for the Woking Grade Separation were added to the base for the 3 hour peak period; 0700 to 0959 and North Downs Line were increased 1 additional train per hour in each direction.

The Guildford Station area was analysed to determine if there is capacity to operate the train specifications, firstly with the current infrastructure and if not, what is required to accommodate the trains. As a specific infrastructure enhancement, the proposed Platform 0 was considered as a possibility. The assessment also looked at other possible enhancements and made suitable recommendations.

For the timetable and specifications to be deemed viable, train paths were required to be compliant to the TPRs.

CP7: Once CP6 was assessed, the additional trains for CP7 (Digital Railway and Heathrow Southern Access derived trains) were added to the timetable, on top of the base plus CP6 trains. This was assessed in an identical fashion as to CP6.

For the aspiration of the 2 additional terminating Heathrow Southern Access trains, there is the option within the assumptions for these to be added in CP7 or CP8. These were firstly assessed as part of CP7 with the findings recorded and then assessed as part of CP8.

CP8: The additional trains for the CP8 specifications (Crossrail 2, Heathrow Southern Access and North Downs Line) were added to the project, which contained the base timetable plus both the CP6 and CP7 trains. With all trains up to and including CP8 included the timetable was assessed.

Part D: Assumptions

D.01 Timetable Scope

The analysis focused on the weekday morning peak hour, which was considered to be from 0800 to 0859 at London Waterloo. The average current journey time between Guildford and London Waterloo is approximately 45 minutes. Taking this into account the high peak hour at Guildford was considered to be from 0720 to 0819.

Additionally, to assess a repeated pattern, the analysis considered the full 3 hour morning peak period from 0700 to 0959.

D.02 Timetable Planning Rules

The following TPRs applied to this analysis; 2018 version 4.2.

D.02.01 Exceptions to the TPR

There were no exceptions to the TPR. Existing rules were used for analysis of additional platforms

D.03 Timing Load Assumptions

The timing loads for existing service routes were as per the source timetable (e.g. Wessex Mainline, North Downs Line).

For future schemes, the timing loads were assumed for those specific schemes:

- Heathrow Southern Access: Class 455 (Since there are no SRTs for Class 345 the best comparable rolling stock was used)
- Crossrail 2: Class 450 (Since there are no SRTs for Class 707 the best comparable rolling stock was used)

D.04 Source Timetable

The source timetable for the analysis was the December 2018 timetable. Modification to these services was undertaken where required to assess the feasibility of the future aspirations.

D.04.01 Additional Services

Additional services were added where required to meet the CP6, CP7 and CP8 specifications.

D.05 Infrastructure

The infrastructure for the timetable analysis was as per the current layout. The analysis considered what new infrastructure; particularly additional platforms may be required to accommodate the service aspirations.

Platform 0 was considered as a specific option if required, as an additional terminating platform.

D.06 Known Exclusions

There were no known exclusions. All known schemes up to and including CP8 were considered as to the impact on service levels at Guildford.

Part E: Findings

E.01 CP6 Findings

After implementing the additional services to the Dec18 timetable, the capacity at Guildford Station and Shalford Junction was assessed. The assessment considered if new infrastructure will be required to accommodate the CP6 service specifications.

The capacity was measured against the minimum TPR values. The analysis found that the minimum TPR values were exceeded, with the current infrastructure at Guildford Station providing sufficient capacity for the CP6 service specifications.

A quality planned timetable makes the most efficient use of the platforms and which platforms are used based on the route of a train. Often this is to utilise the use of parallel moves* between trains at different platforms, to minimise crossing moves and to minimise the inclusion of junction margins to the timetable, which can reduce the capacity potential.

* **Parallel move:** Two trains passing each other on adjacent tracks, at a defined location at the same time.

For the CP6 additional trains, the usable platforms are as follows:

- **Working Grade Separation:**

Direction	Platform Number	Comments
UP	5	Most natural platform for straight route, avoiding crossing moves
UP	4	Can be used, but requires two crossing moves and are considered to be on the side of Guildford for DOWN trains. (Please refer to Figure 2)
UP	3	Can be used, but requires three crossing moves and are considered to be on the side of Guildford for DOWN trains. (Please refer to Figure 2)
UP	6	Can be used, but requires one crossing move
UP	8	Can be used, but requires two crossing moves
DOWN	4	Most natural platform for straight route, avoiding crossing moves
DOWN	3	Can be used, but requires one crossing moves
DOWN	2	Can be used, but requires two crossing moves

DOWN	5	Can be used, but requires two crossing moves and are considered to be on the side of Guildford for UP trains. (Please refer to Figure 2)
DOWN	6	Can be used, but requires three crossing moves and are considered to be on the side of Guildford for UP trains. (Please refer to Figure 2)
DOWN	8	Can be used, but requires four crossing moves and are considered to be on the side of Guildford for UP trains. (Please refer to Figure 2)

[Table 2](#): Usable Platforms for Main Line services

There was sufficient capacity at Platform 5 to accommodate the services in the Dec18 timetable after the implementation of the additional Woking Grade Separation trains.

As it can be seen in the above table, due to their routings the additional Woking Grade Separation services do not use platforms 1 and 2.

- **North Downs Line:**

Direction	Platform Number	Comments
UP	8	Most natural platform for straight route, avoiding crossing moves
UP	6	Can be used, but requires one crossing move
UP	5	Can be used, but requires two crossing moves
UP	4	Can be used, but requires four crossing moves
DOWN	6	Most natural platform for straight route, avoiding crossing moves
DOWN	5	Can be used, but requires one crossing move
DOWN	8	Can be used, but requires one crossing move
DOWN	4	Can be used, but requires two crossing moves

[Table 3](#): Usable Platforms for North Downs Line services

As it can be seen in the above table, due to their routings the additional North Down Line services cannot use platforms 1, 2 and 3.

There was sufficient capacity at Platform 8 (for UP trains) and Platform 6 (for DOWN trains) to accommodate the services in the relevant directions of travel in Dec18 timetable after the implementation of the additional North Downs Line trains.

E.02 CP7 Findings

After implementing the additional services, the capacity at Guildford Station and Shalford Junction was assessed. The assessment considered if new infrastructure will be required to accommodate the CP7 service specifications which were implemented to the base timetable (Dec18) plus CP6 additional services.

The capacity was measured against the minimum TPRs. The analysis found that the minimum TPR values were exceeded, with the current infrastructure at Guildford Station providing sufficient capacity for the CP7 service specifications.

Digital Railway released services use the same route as Woking Grade Separation Services. Therefore the usable platforms are as per [Table 2](#).

Heathrow Southern Access Services also use the same route as Woking Grade Separation Services. Therefore the usable platforms are as per [Table 2](#). However since these services are in the DOWN direction they can use platform 2 but can not use platform 1.

There was sufficient capacity at Platform 5 (for UP trains) and Platform 4 (for DOWN trains) to accommodate the services in the Dec18 timetable after the implementation of the additional CP7 trains.

E.03 CP8 Findings

After implementing the additional services, the capacity at Guildford Station and Shalford Junction was assessed. The assessment considered if new infrastructure will be required to accommodate the CP8 service specifications which were implemented to the base timetable (Dec18) plus CP6 and CP7 additional services.

Cross Rail 2 released services use the same route as per the Woking Grade Separation Services. Therefore the usable platforms are as per [Table 2](#).

The capacity was measured against the minimum TPRs. There were 5 additional services per hour for CP8. The analysis found that 80% of the additional CP8 services (4tph) could be accommodated within the timetable, but only on minimum TPRs. The remaining 20% (1tph) could not be accommodated whilst meeting the minimum TPRs.

A timetable planned to only minimum TPR values is not deemed to be robust and presents a risk to performance; as it does not provide sufficient space between trains or recovery opportunities should delays occur.

Overall, with all services up to and including CP8 combined, there would be insufficient capacity at Guildford Station when considering robustness of the timetable, performance risks and train service growth beyond CP8.

Part F: Conclusions & Recommendations

F.01 Conclusions

As per CP6 and CP7 findings, the additional service specifications described for the relevant control periods could be accommodated within the Dec18 timetable, with the current infrastructure at Guildford Station and Shalford Junction. Therefore there would not be any need for new infrastructure such as new platforms or tracks during CP6 and CP7.

However as per the CP8 findings, 20% of the additional services (1tph out of 5tph) could not be accommodated. The remaining additional services (4tph) could only be accommodated on minimum TPR values, which would cause insufficient capacity at Guildford Station in terms of robustness of the timetable, operational performance risks and future service growth. Therefore new infrastructure would be needed for CP8.

As stated in the findings section, due to their routings, the majority of the additional services for CP6, CP7 and CP8 do not use platforms 1, 2 and 3 which are on the east side of the station. This means that the additional services would mainly have an impact on the west side of the station. The option of a terminating Platform 0 on the east side of the station which was considered in a previous study will not be required.

Guildford has 8 numbered platforms, only 7 are usable. This is due to platforms 6 and 7 sharing a single track road through the station. Subsequently only one of these platforms can be used at any one time, which can be considered as another factor that could increase the pressure on the west side of the station.

As a result, by CP8 land on the west side of the station would be needed for additional infrastructure in the form of an additional platform and the associated additional track, to be able to accommodate the aspired service levels. Further investigation and analysis would be needed to firstly establish potential infrastructure and station layout options. This would then inform the quantity of land to be retained, which may vary between different options.

F.02 Recommendations

As stated in the conclusions section new infrastructure would be needed to accommodate the required service specifications by CP8.

- **Additional Platform**

The service specifications described for CP6, CP7 and CP8 would mainly have an impact on the west side of the station due to their natural platform usages on the basis of their routings.

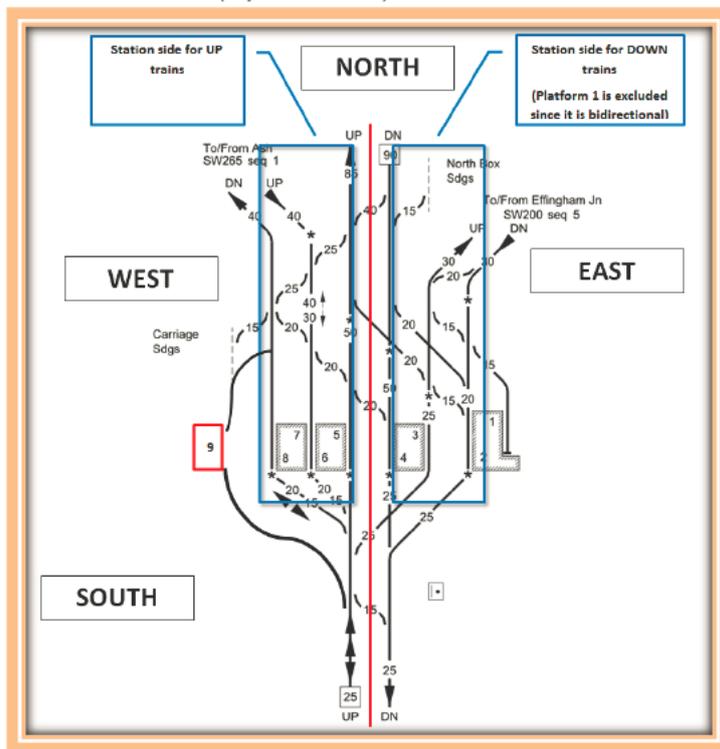
Therefore, additional infrastructure in the form a new platform, track and crossovers serving the west side of the station would be required to provide more platform capacity. This would enable spreading the trains out and ensuring more space in the timetable between trains. The benefits would be to minimise the performance risks by enabling a more robust timetable. Additional infrastructure may also enhance the station for the future train service growth beyond CP8.

An additional platform ideally needs to be accessible to/from the main Up and Down lines through Guildford (known as the Portsmouth lines, to/from Woking and Portsmouth via Guildford), and to/from the North Downs lines (to/from Ash).

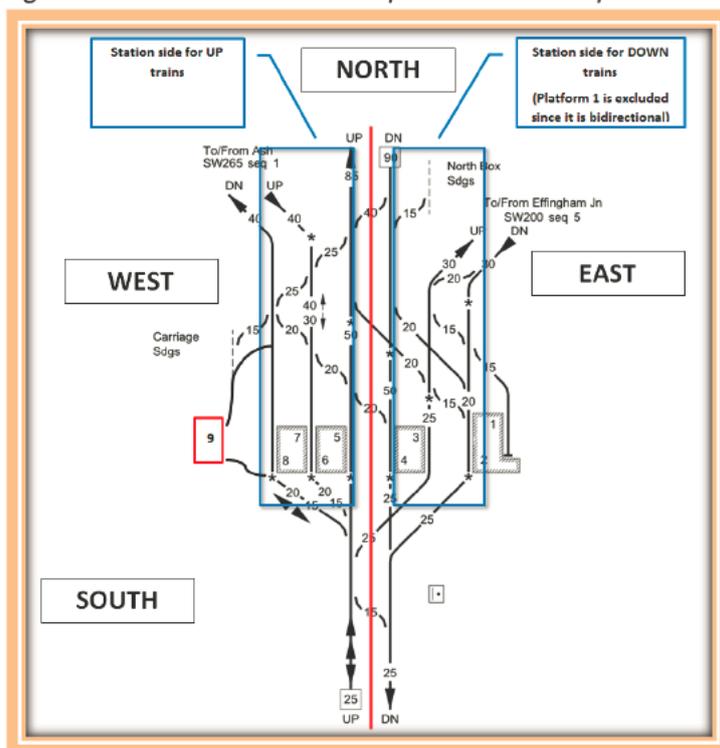
Also, a through platform is assumed to be more advantageous in providing flexibility in both directions. However a terminal platform may provide sufficient capacity for turnback services, whilst allowing through services to be spread across the other existing platforms.

On the following pages are basic drawings showing the potential station layout options for the additional infrastructure to be built by CP8. Further investigation and studies would be needed to detail these and alternative options by specialist Network Rail engineering/ infrastructure teams.

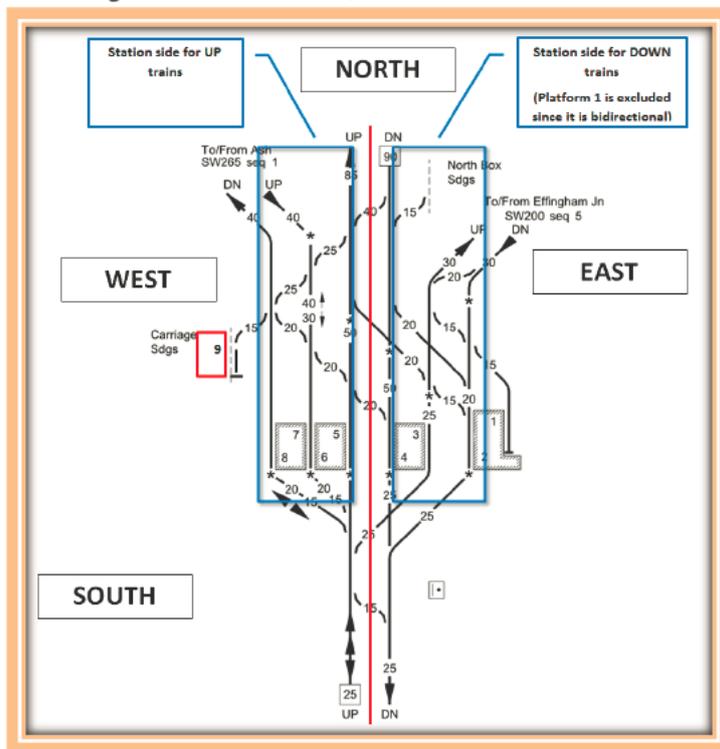
Option 1: An additional through platform independently connecting to the Up main line and North Downs line (Down direction). Existing crossovers north and south of the station allow access to the Down main line and North Downs line (Up direction).



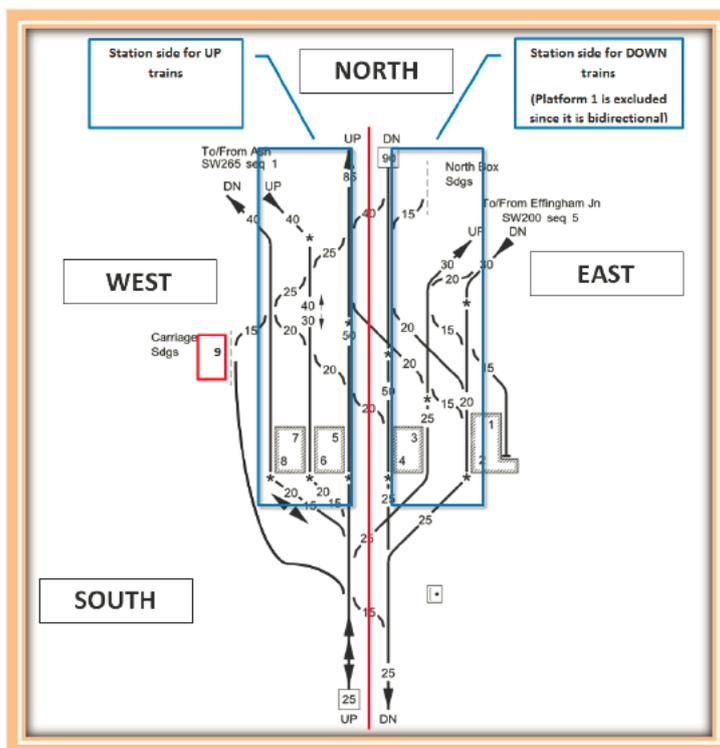
Option 2: An additional through platform similar to Option 1; alternatively connecting south of the station using the existing crossovers between the Up main line and platform 8.



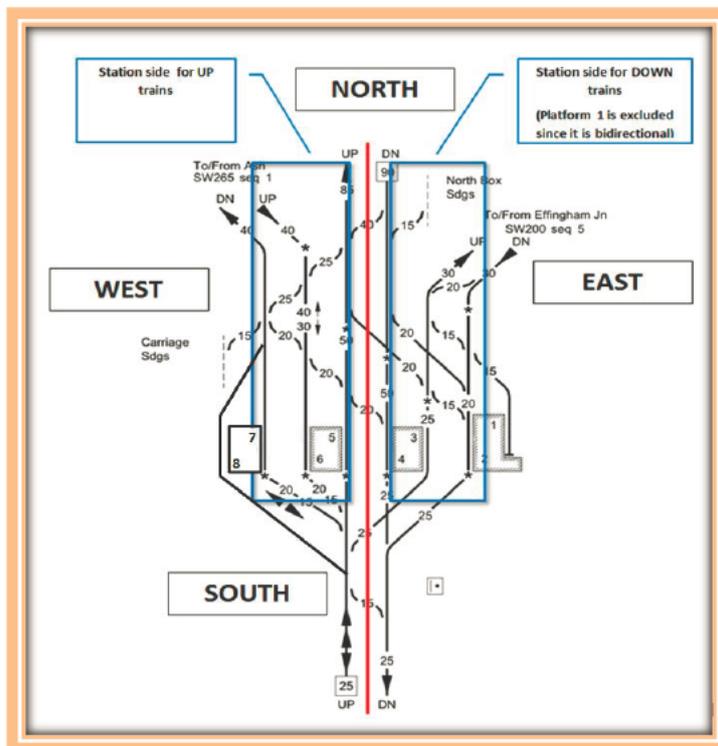
Option 3: An additional terminal platform to be built in the carriage sidings. Offering turnback capability for services travelling to/from the north, both on the main and North Downs lines.



Option 4: An additional through platform to be built in the carriage sidings, offering the same connections as per Option 1.



Option 5: An additional through platform realised by moving 7/8 island to the west and adding a new track, making platform 7 usable.



The capacity benefit of delivering an additional platform would be further increased if combined with Line Speed Improvements.

- **Line Speed Improvements**

[Figure 4](#) shows the distance and the line speeds between Guildford Station and Shalford Junction. Shalford Junction is only 1m and 9ch (or 1.79km) away from Guildford Station. Due to its proximity, Shalford Junction has a natural impact on the timing of trains and subsequently the capacity usage at Guildford Station.

Hypothetically, if the line speeds were increased at Guildford Station and Shalford Junction, lower TPR values (e.g. junction margins/headways) than the current TPR values may be possible. In simple timetable planning terms, lower TPR values result in greater capacity or providing robustness through enabling more space between trains.

This positive impact would be a lower the risk of potential poor performance through delays at Guildford Station and the wider Wessex network.

Further analysis would be recommended to review the existing TPR values in consideration of an increase of the line speeds at Guildford Station and Shalford Junction.

- **Timetable Revision**

A quality planned timetable makes the most efficient use of the platforms depending on which platforms are used on the basis of the routings of the trains. Often this is to minimise crossing moves and the inclusion of junction margins to the timetable, which can reduce the capacity potential.

Please refer to [Table 2](#) and [Table 3](#) which states the usable platforms and the most efficient platforms for the additional service specifications described in CP6, CP7 and CP8.

It is recommended that in the future timetables are planned to make the most efficient use of the platform and station capacity at Guildford, by planning trains into platforms where crossing and conflicting moves are minimised.