Network Strategy and Capacity Planning:
Capability & Capacity Analysis

MetroWest Pase 2 Gloucester Extension
Interim Report

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Abbreviations	
Acronym	**Meaning**
C&CA	Capability & Capacity Analysis
CTP	Concept Train Plan
DA2	Direct Award 2
GWR	Great Western Railway
Jn	Junction
TPS	Train Planning System
WTT	Working Timetable
SRT	Sectional Running Times
TPR	Train Planning Rules
XC	Cross Country
NR	Network Rail

Terminology	
Term	**Definition**
Pathing	Time added into a train's path to ensure Timetable Planning Rule compliance.
Turnround	A turnround is the minimum time required from the time a train terminates at destination till when it can depart again in the opposite direction.
Headway	The minimum time between two trains travelling in the same direction on the same track.
Junction Margins	The minimum time between two conflicting movements at a junction.
Sectional Running Times	The time taken for train to travel from one timed location to another.
Concept Train Plan	A hypothetical service pattern
Great Western Railway Direct Award 2 (DA2) / May 2017 Working Timetable (WTT) hybrid Concept Train Plan (CTP)	A train plan created by overlaying the GWR DA2 timetable with the May 2017 timetable to support the analysis work.

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1. Executive Summary

The MetroWest Phase 2 programme proposes a number of timetable enhancements, including:

- Bristol Temple Meads to Henbury shuttle/loop service
- Additional Bristol Temple Meads to South Gloucester/Gloucester

This study focusses on the viability of a new Gloucester extension service and has been carried out to refresh the work that was undertaken for MetroWest Phase 2 in 2014. This work aims to understand whether it is feasible to timetable an additional service between Bristol Parkway and Gloucester. Proposed services are always assumed to call at Yate, and Cam and Dursley when extended to Gloucester. The feasibility of up to two new stations calls between Yate and Gloucester is also examined for the new and existing services. The key constraint in every scenario of this analysis is the availability of paths over Westerleigh Junction.

The analysis has indicated that in the Great Western Railway (GWR) Direct Award 2 (DA2) / May 2017 Working Timetable (WTT) hybrid Concept Train Plan (CTP), a train plan created by overlaying the GWR DA2 timetable with the May 2017 timetable, there is a potential path across Westerleigh Junction for the Weston-Super-Mare to Bristol Parkway services to be extended to Gloucester (assumed to include calls at Yate and Cam and Dursley) as a method of resolving potential conflicts with Cross Country services. The CTP could form the first timetable step towards a MetroWest Phase 2 service level.

The provision of a half hourly train service to a new station can be considered as being delivered in two component parts, the new MetroWest service provide one half hourly service and the existing service provide the other half hourly service. For the existing service this study has only considered the feasibility of including the new stations within the existing timetable. No consideration has been given to altering the existing timetable as this would be a substantially large piece of work with implications for the wider rail network over a wide geographical area.

The analysis has indicated that:-

- there is a potential train path across Westerleigh Junction for the Weston-super-Mare to Bristol Parkway services to be extended to Yate
- There is a potential train path for the Weston-super-Mare service to be extended to Gloucester (assumed to include calls at Yate and Cam and Dursley).
- There is a potential platforming capacity for a new MetroWest service at Gloucester.
- An extension of the MetroWest Phase 2 service to Cheltenham Spa was found to be unachievable due to lack of capacity at Cheltenham Spa's turnround facility, Alstone

Carriage Sidings.

- There is potential capacity to include one new station in both the Up and Down direction in the new MetroWest service. However further work is required to remove identified service conflicts in the Down direction.
- There is no capacity within the timetable for existing services to stop at a new station.

All findings within this study are dependent upon how the base train plan used in the analysis, is de-conflicted, thereby adding large amounts of uncertainty in the viability of these paths. It is recommended that this project is revisited in June 2018 when the December 2018 timetable has been released. This timetable will allow a more accurate analysis of the extension of the Phase 2 service to Gloucester and the ability to accommodate the new stations in both the new and existing services.

Figure 1 below provides a visual summary of the analysis completed.

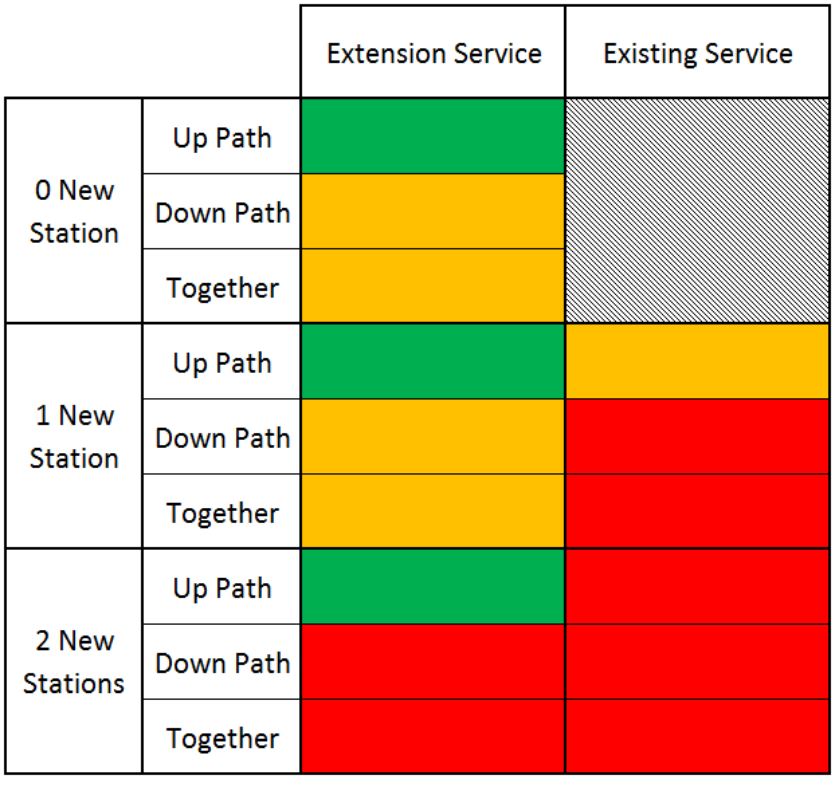


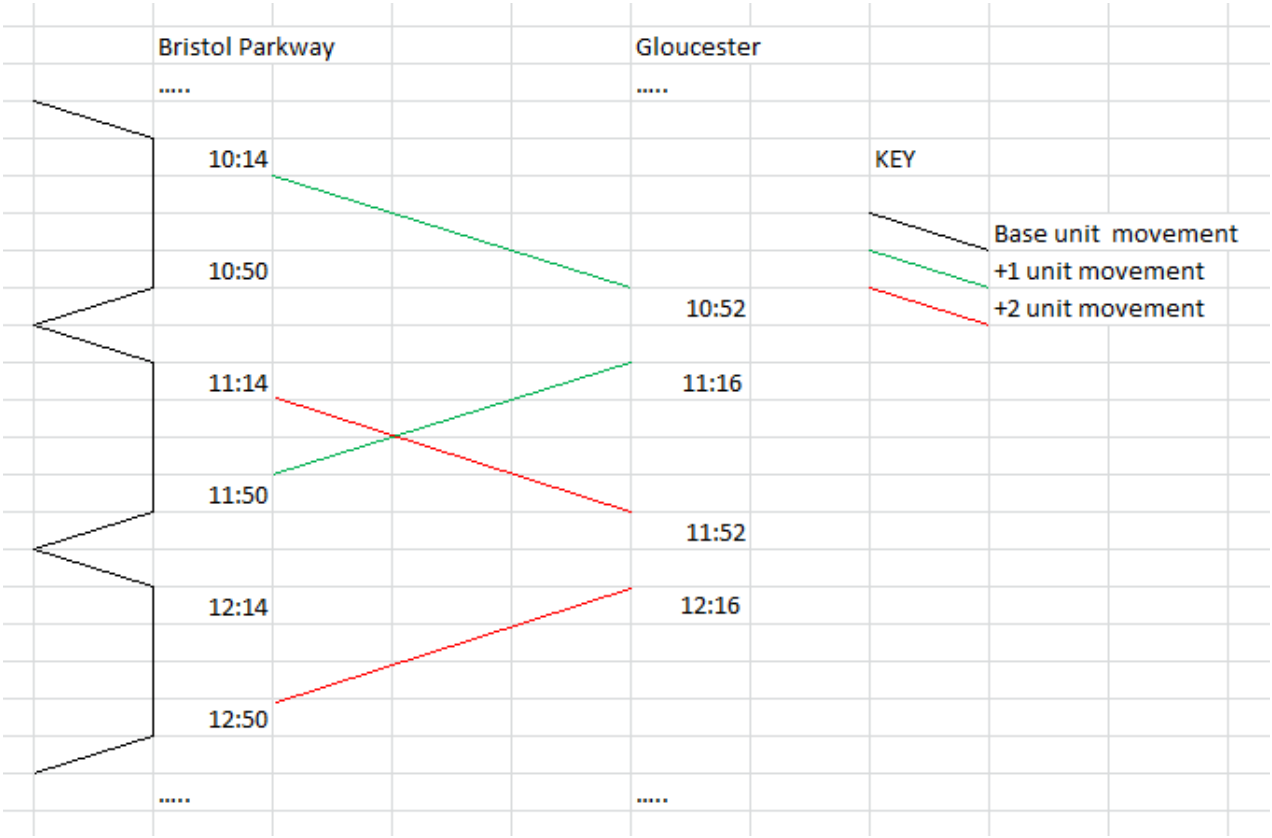
Figure 1: Service Viability

- Green: possible with limited/no constraints preventing
- Orange: possible but constraints present where timetable interventions will be

required.

- Red: Not possible without re-writing large part of the national timetable.

Based on the timings used at Parkway and Gloucester an additional 2 trains (units) would be needed in all Gloucester extension scenarios (as per the diagram below):



It is anticipated that this pattern is repeatable throughout the period of operation. It is unlikely that this requirement could be reduced further without significant additional infrastructure.

2. Introduction

2.1. Background

MetroWest Phase 2 would reopen the Henbury Line to an hourly passenger service, with new stations at Henbury, North Filton and at Ashley Down (on Filton Bank); it would also extend existing Weston-Super-Mare to Bristol Parkway services to Yate and potentially on to Gloucester, improving service frequency in the area.

Previous MetroWest Phase 2 analysis assessed the possibility of extending paths for Weston-Super-Mare – Bristol Parkway services both to Yate and beyond to Gloucester, thereby providing a half hourly local service on this route, in conjunction with the existing Great Malvern service.

The findings of this work are shown in the MetroWest Phase 2 report, issued in December 2014. The viability of paths for the additional MetroWest service was only assessed as far as Westerleigh junction, against the backdrop of the Crossrail Iteration 5 timetable.

This project is an expansion of the original MetroWest Phase 2 work, specifically it looks at the availability of paths across and north of Westerleigh Junction for additional service every hour and augmentation to current services as well as supporting two potential new stations (which would be delivered by separate bespoke projects).

2.2. Aims & Objectives

There are three main aims for this study:

- To identify the potential paths across Westerleigh Junction for an additional service between Weston-Super-Mare and Gloucester and to determine whether these services can stop at any 2 of the 4 proposed stations.
- To identify the possibility of stopping the existing Weston-Super-Mare to Gloucester/Greater Malvern service at any of the newly proposed stations.
- To examine the impact of any proposed service changes on the wider timetable structure.

2.3. Geographical Scope

The figure overleaf shows the area analysed in this project.

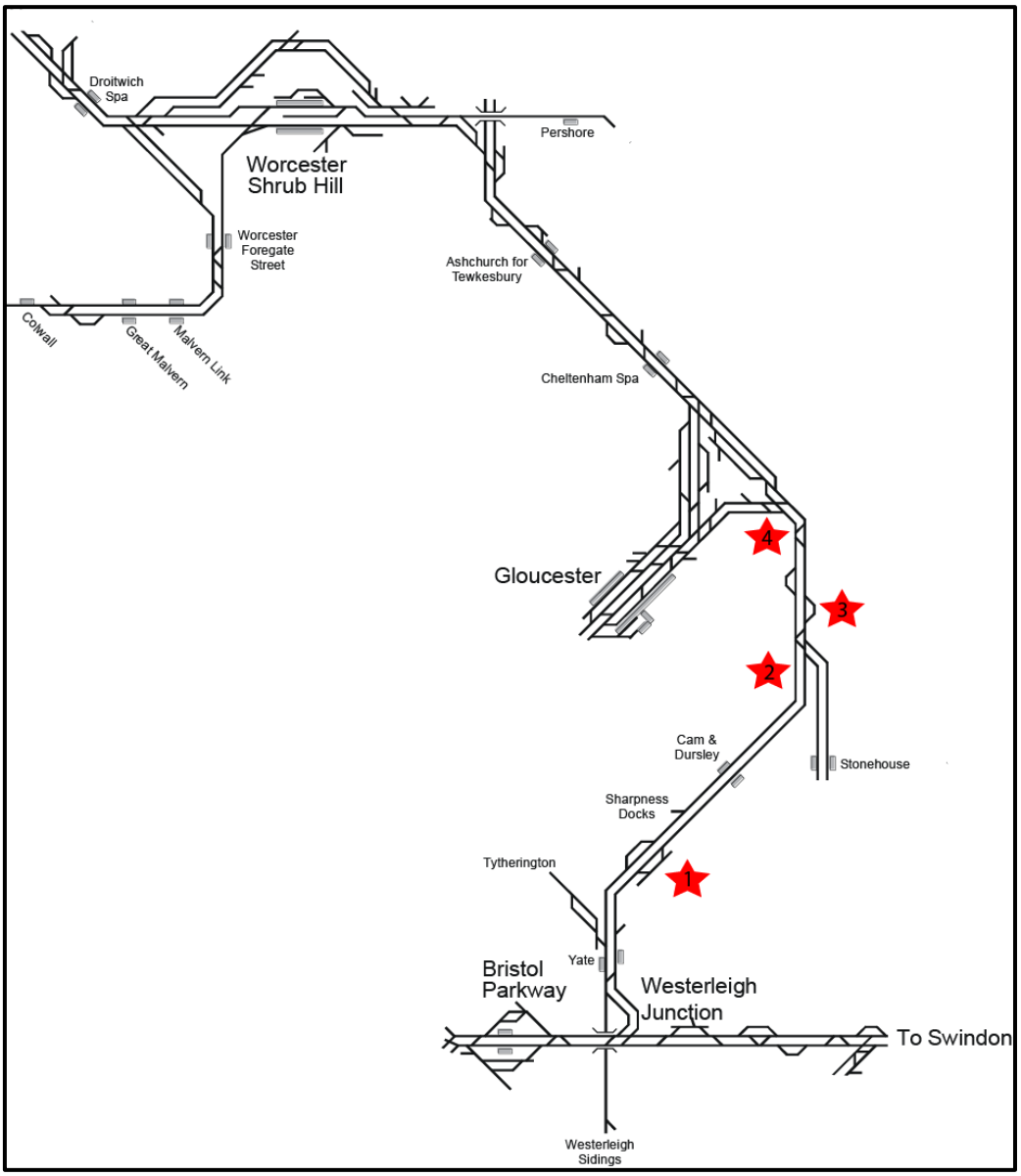


Figure 2: Phase 2 Geographic Scope

The red stars in **Figure 2** show the general locations of the potential new Stations, these being:

1. Charfield - c.113m12ch
2. Stonehouse (Bristol Road) – c.101m58ch (South of Standish Jn)
3. Stonehouse (BGL line) – c.99m10ch (North of Standish Jn)
4. Hunts Grove – c. 97m19ch

3. Methodology

The analysis was split into three parts;

Part 1 looked at the available capacity across Westerleigh Junction.

Part 2 looked at the possibility of accommodating the MetroWest Phase 2 extension of the Weston-Super-Mare to Bristol Parkway services to Gloucester / Cheltenham Spa.

Part 3 looked at possible changes to the proposed GWR Direct Award 2 (DA2) Weston-Super-Mare to Gloucester/Great Malvern service to accommodate new station stops.

3.1. Part 1 – Westerleigh Junction

By analysing a snapshot of the GWR DA2 timetable that was supplemented with the May 2017 Working Timetable (WTT), the off-peak hour of 12:00-13:00 was the chosen snapshot.

Using the Timetable Planning Rules (TPRs), Westerleigh Junction was reviewed to highlight possible paths for the Phase 2 extension of Weston-Super-Mare to Parkway services to Gloucester.

This was accomplished using a mixture of Excel and Train Planning System (TPS).

3.2. Part 2 - Weston-Super-Mare – Bristol Parkway Extension to Gloucester / Cheltenham Spa

After the paths across Westerleigh Junction were highlighted, we expanded upon the DA2/May 2017 WTT hybrid by adding new services that utilised these paths; this was done for both directions.

Once the paths had been extended up to Gloucester and Cheltenham Spa, the turn back facilities and platforms occupation rates at the two locations were analysed using the TPRs.

This was accomplished using a mixture of Excel and Train Planning System (TPS).

3.3. Part 3 - Weston-Super-Mare to Gloucester / Great Malvern Adjustments

Using TPS, additional running time was added to two services from DA2 timetable, these services are the Weston-Super-Mare to Gloucester / Great Malvern services. The additional run time added is intended to slow the service down such that it would mimic how the service would run with the additional stations.

These augmented services were then reviewed in line with the TPRs for the area; this review would either validate or reject the new augmented services based on the timetable compliances.

4. Parameters and Assumptions

4.1. Timetable Planning Rules

The 2018 Western and Wales Timetable Planning Rules (TPR) V2.0 were used for this analysis.

4.1.1. Exceptions to the TPR

One minute dwells were assumed for all new stations.

4.2. Timing Load Assumptions

This analysis has utilised Sectional Running Times (SRTs) extracted from the December 2017 B-Plan, a database containing SRTs for various train types over. It was assumed that the extended MetroWest services will be formed of Class 158 units.

4.2.1. Theoretical Calculation of Running Times

As no SRTs exist for the proposed stations, an extra minute has been added to the journey time for every stop, 30 additional seconds for decelerating and 30 seconds for accelerating.

4.3. Timetable Compatibility

All analysis has been based off of the GWR DA2 / May 2017 WTT hybrid Concept Train Plan (CTP); in the analysis no conflict present has been resolved, although they were highlighted as causes of concern.

As no conflict has been resolved, amendments to the GWR DA2 / May 2017 WTT hybrid CTP will change some services' paths and this will likely affect the results found in this analysis.

5. Findings

5.1. Part 1 – Westerleigh Junction

An initial high-level overview of the May 2017 WTT shows that there is no standard hour. Therefore by extension, the GWR DA2 / May 2017 WTT hybrid CTP doesn't feature a standard hour. However the GWR DA2 timetable does feature a standard hourly pattern.

As the quantum of services in the 12:00-13:00 hour was the closest to that in the Crossrail Iteration 5 CTP. This period has been taken as a 'Standard' hour. However, due to the nature of the freight services along the Western Route, most hours have fluctuations in the quantum of freight services.

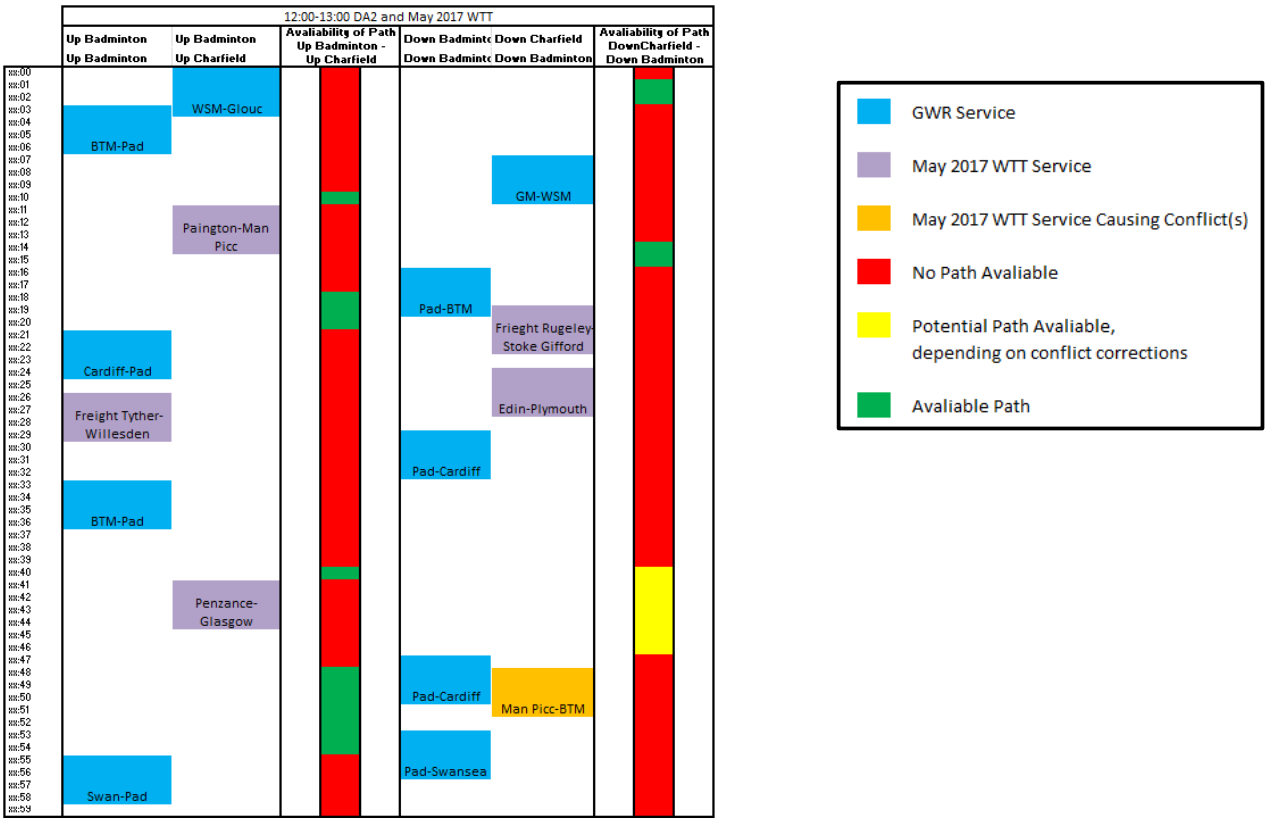


Figure 3: 12:00-13:00 DA2/May 2017 WTT junction report for Westerleigh junction

Figure 3 shows a representation of what the 12:00 – 13:00 hour across Westerleigh Junction looks like. Each coloured block represents a service and the headway (i.e. unusable capacity) behind it, the bottom of the block shows the time the train is physically at the junction.

A number of paths have been identified, along with a potential path, coloured yellow, this potential path is almost certain to be affected by the timetable interventions, such as the

retiming of services which could lead to increased journey times, which are required to make the Paddington to Cardiff and Manchester Piccadilly to Bristol Temple Meads services compliant.

Additionally, two conflicts appear in this hour. One between a freight service and the surrounding passenger services, the other between two passenger services. It is assumed that these conflicts will be resolved in the wider timetable development process.

The first conflict is between a freight service and a passenger service in the Up direction.

The freight service exits Bristol Parkway at 12:18 and reaches Westerleigh Jn at 12:29; the Cardiff-Paddington service exits Bristol Parkway at 12:20½ and reaches Westerleigh Jn at 12:24, passing through the freight service. This freight service may be an anomaly in the 'Standard' hour; however multiple timetabling interventions would be required in order to fit a freight service in compliantly.

The second conflict is between two passenger services in the down direction, this is caused by headway non-compliance between a GWR London Paddington to Bristol Service and a Cross Country Manchester Piccadilly to Bristol service. In order to accommodate these services, a number of timetabling interventions outside the scope of this study are required, timetable interventions such as retiming one of the services, this may lead to increased journey times.

As the timetable under analysis requires interventions, such as the retiming of services, in order to become compliant with the TPRs, the potential paths and available paths identified are liable to change.

The Crossrail Iteration 5 CTP identified an available path on the Up direction at xx: 49 and a path in the Down direction at xx: 45, these match potential paths identified in GWR DA2 CTP.

	Time of available path(s)	
	Iteration 5	DA2/May 2017 hybrid
Up direction	XX:49	12:10
		12:18 -12:20
		12:40
		12:48 – 12:54
Down direction	XX:45	12:01 – 12:02
		12:14 – 12:15
		12:40 – 12:46

Table 1 - Indicative availability of paths over Westerleigh junction

5.2. Part 2 - Weston-Super-Mare – Bristol Parkway Extension to Gloucester / Cheltenham Spa

Using the GWR DA2 / May 2017 hybrid CTP as a base and adding services that utilised the paths across Westerleigh Junction found in Part 1, one path was identified a possible opportunity for a MetroWest Phase 2 Weston-Super-Mare to Gloucester service and its return, no path was found for a continuation to and from Cheltenham Spa.

The viable Up path crossed Westerleigh Junction between XX: 19 and XX: 20, this path could support two additional stops. In the Down direction, the service would have to utilise the XX: 46 path across Westerleigh Junction, to make the path across the junction only 1 stop can be supported.

The Down direction path will also be heavily affected by how the conflicts between XX: 50 and XX: 57 are solved, potentially eliminating the opportunity to cross Westerleigh Junction.

If these two paths are used then the service would have a 25-30 minute turnround time in Gloucester's platform 2.

The route between Westerleigh Junction, Gloucester and Abbotswood Junction features numerous services that travel to, from and through major stations such as Manchester Piccadilly, Birmingham New Street and London Paddington. Changes to the paths of these services that travel through these stations are likely to be needed, and this will cause knock-on effects at these major stations.

The number and severity of changes needed to accommodate this extension is dependent upon the finalised timetable of the area.

5.2.1. Up Paths

Four paths across Westerleigh Junction were identified, using TPS these paths were used to create a train run, Figure 4 below shows the train runs created. The purple lines represent the paths a new Gloucester to Weston-Super-Mare service would take to pass Westerleigh Junctions at the required times.

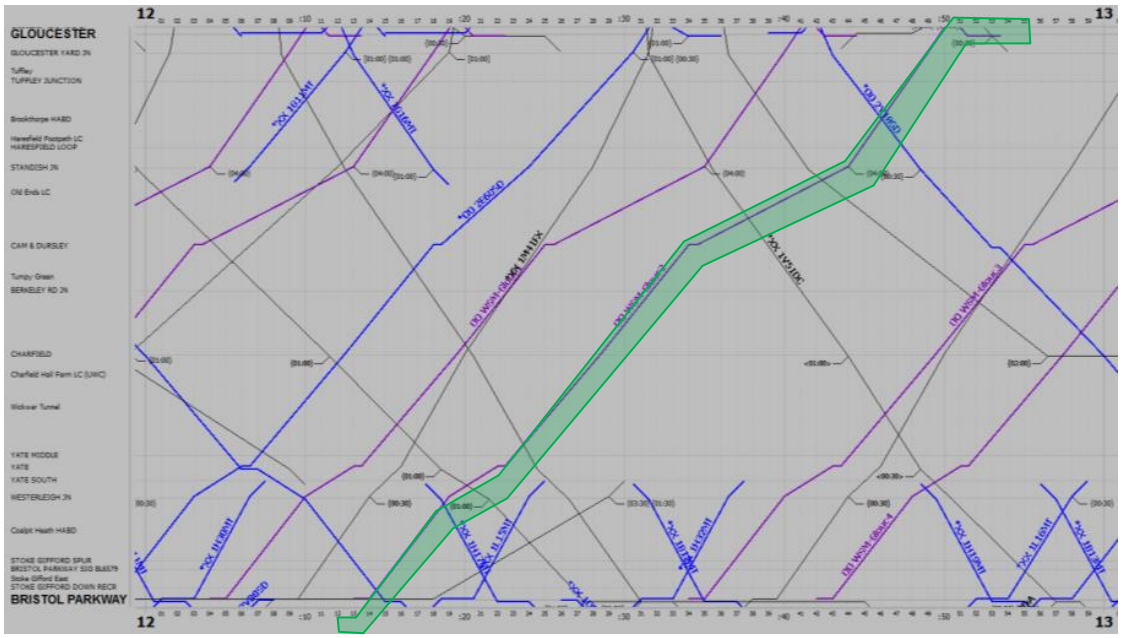


Figure 4: Bristol Parkway to Gloucester Up Paths

The purple services in Figure 4 all incorporate 4 minutes additional running time at Standish Junction, this is to simulate two additional stops enroute to Gloucester. Three of the four paths prove invalid due to either crossing paths with other services or headway incompliances; these were present even without additional stops.

To avoid these conflicts, pathing time upwards of 4 minutes is required in the other services.

One path did prove viable for all station combinations, highlighted in green, if the service took the path that crosses Westerleigh Junction between XX:19 and XX:20 it would be capable of reaching Gloucester, this service could also perform a reversing move and travel towards Cheltenham Spa while remaining compliant with the TPRs.

If the Weston-Super-Mare to Cheltenham Spa service avoids Gloucester, i.e. continues from Gloucester Yard Jn to Cheltenham Spa, the extension would break the headway planning rules with another service on the route. To resolve this conflict pathing time would be needed resulting in longer journey time for the new services and the conflicting services.

5.2.2. Down Paths

Of the three paths crossing Westerleigh Junction in the Down direction, only one was identified as feasible for an hourly service. Figure 5 below shows the train runs created in TPS. The purple lines represent the paths a new MetroWest Gloucester to Weston-Super-Mare service would take to pass Westerleigh Junctions at the required times.

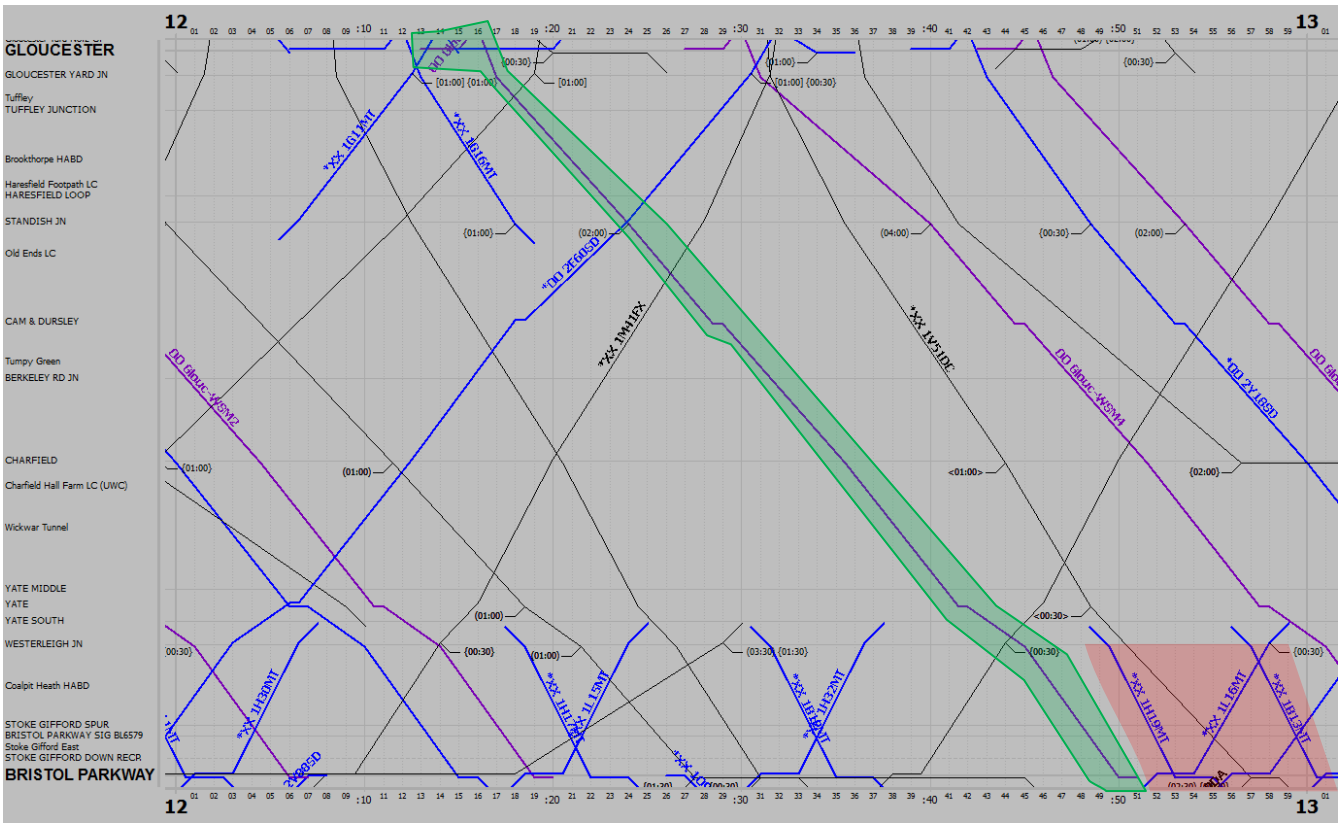


Figure 5: Gloucester to Bristol Parkway Down Paths

Initially, the possibility of stopping at two stations was looked at; with two stops all three of the identified paths across Westerleigh junction cause TPR non-compliance issues, such as failing junction margins and headways. As a result the paths were then reanalysed under the assumption of only stopping once.

With only one additional stop, the XX:46 path across Westerleigh Junction appeared to be a potentially viable path when originating at Gloucester but encountered headway conflicts further north towards Cheltenham Spa with and without a reverse at Gloucester.

This service is highlighted in green. However to make this path work, the conflict at Westerleigh Junction would need to be resolved in such a way that the path identified for the new service wouldn't be affected, this conflict is highlighted in red, this conflict is

mentioned and described in Section 5.1.

5.2.3. Gloucester and Cheltenham Spa Platforming and Turnround

5.2.3.1. Gloucester Station

Assuming all of the paths across Westerleigh Junction can get a service to and from Gloucester, the services would be required to arrive and leave at set and specific times. Figure 6 below represents the dwells at Gloucester in the CTP as well as the arrival and departure time of the new extension service.

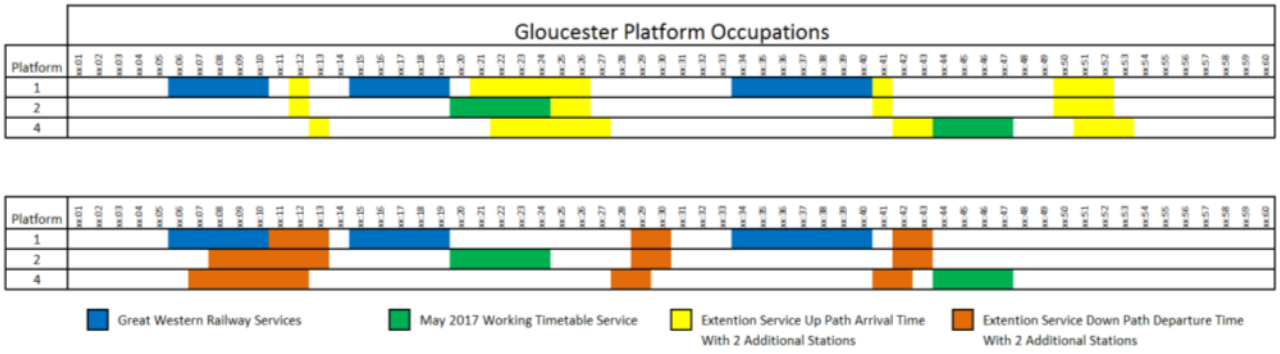


Figure 6: Gloucester Platform Occupation and Arrival/Departure Times

In Figure 6, all arrival and departure times are based off a journey time featuring two additional station stops.

Upon combining these times with the results from 5.2.1 and 5.2.2, the only time the MetroWest Weston-Super-Mare to Gloucester service can arrive at Gloucester is between XX:50 and XX:53 on platforms 1 and 2. Upon exiting Gloucester the service will need to depart at XX: 15 or XX: 16 from Platforms 4 and 2 respectively, this is based on the journey featuring 1 additional station. This is illustrated in Figure 7.

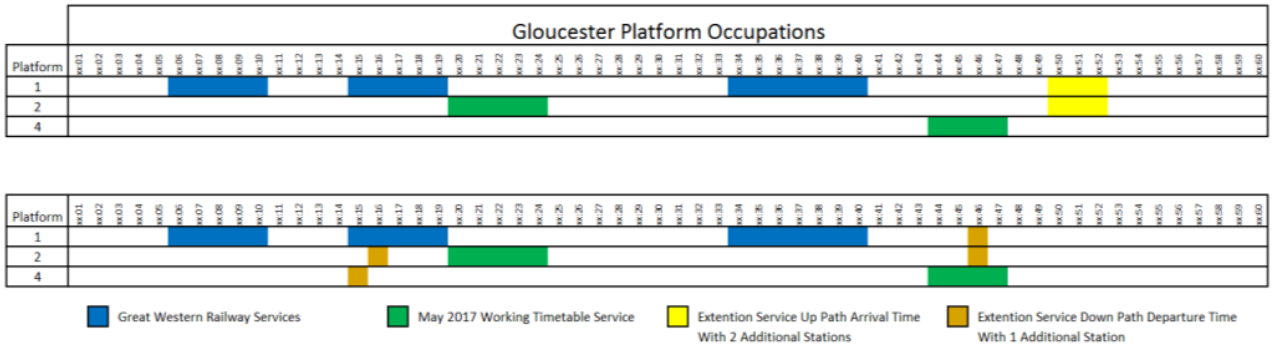


Figure 7: Gloucester Platform Occupation and Compliant Arrival/Departure Times

Using the possible arrival and departure times stated above, the extension service would be required to sit in Platform 2 for up to 25-30 min dwell, dependent on the number of additional stations the service will be stopping at.

It is important to note that some of the turnrounds at Gloucester in the DA2 timetable fall short of the required minimum turnround time of 10 minutes.

5.2.3.2. Cheltenham Spa Station

As stated in section 5.2.1, it is possible to get a service to Cheltenham Spa, however the analysis mentioned in section 5.2.2 found that returning from Cheltenham, Spa created headway incompliances.

However, even assuming the path from Cheltenham Spa to Westerleigh Junction was conflict free, a turnround time of less than 7 minutes would be needed; the minimum stated in the TPRs is 12 minutes, which allows for an ECS move to and from Alstone Sidings.

5.3. Part 3 – Weston-Super-Mare to Gloucester / Great Malvern Adjustments

In the GWR DA2 / May 2017 hybrid CTP, any changes to the Weston-Super-Mare to Gloucester / Great Malvern service will require multiple adjustments to other services, such as the Bristol Temple Meads to Manchester Piccadilly service; this applies in both directions.

Additionally both services show turnround non-compliances at Gloucester and Great Malvern.

5.3.1. Up Path

In Figure 8 below, the service highlighted in green shows the path of a Weston-Super-Mare to Great Malvern service from the GWR DA2 timetable, this service does not stop at any additional stations.

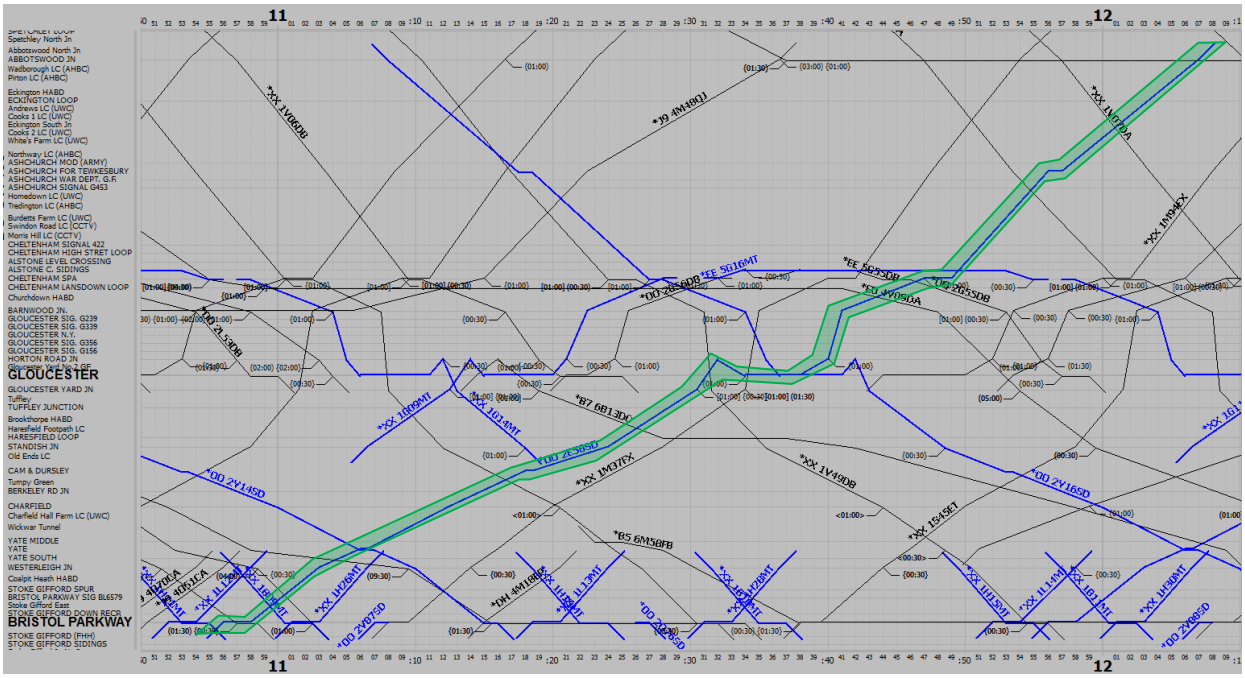


Figure 8: Bristol Parkway to Abbotswood North Jn Up path

Between Bristol Parkway and Westerleigh Junction, the service highlighted in green cannot be adjusted, if the path highlighted is adjusted to be earlier or later by 30 seconds, the service will violate headway with a service either side of it.

Between Charfield and Gloucester, the service in question is on headway, 4 minutes, with the service behind it, a Bristol Temple Meads to Manchester Piccadilly service.

Any additional stops to the service highlighted in green will cause a headway violation, at which point the Cross Country service requires pathing. This will delay its entrance to Birmingham and Manchester, potentially losing its path and disrupting other services in those areas.

Additionally, if the green service is delayed into Gloucester, it will cause a conflict with its returning Down service from another hour. However, if the Up service is delayed due to the extra station, it can be assumed the Down service will also be delayed, later analysis shows that the Down service requires alterations due to the minimum turnround time at Great Malvern not being meet.

The constraints at Westerleigh Junction and with the Cross Country service are identical when looking at making changes to the Weston-Super-Mare to Gloucester service (which runs in alternate hours to Great Malvern).

5.3.2. Great Malvern

As mentioned in section 5.3.1, the service in the GWR DA2 timetable fails to meet the TPR requirements, TPRs require a turnround time of 14 minutes, the Weston-Super-Mare to Great Malvern service in the GWR DA2 timetable performs the manoeuvre in 11 minutes.

Extending the manoeuver time to 14 minutes will cause a conflict with the other service in the area, a Birmingham to Hereford service, this repeats every hour.

5.3.3. Down Path

Figure 9 below shows the path of the Down direction Great Malvern to Weston-Super-Mare service, highlighted in green; the graph shows the path as bid in the GWR DA2 timetable.

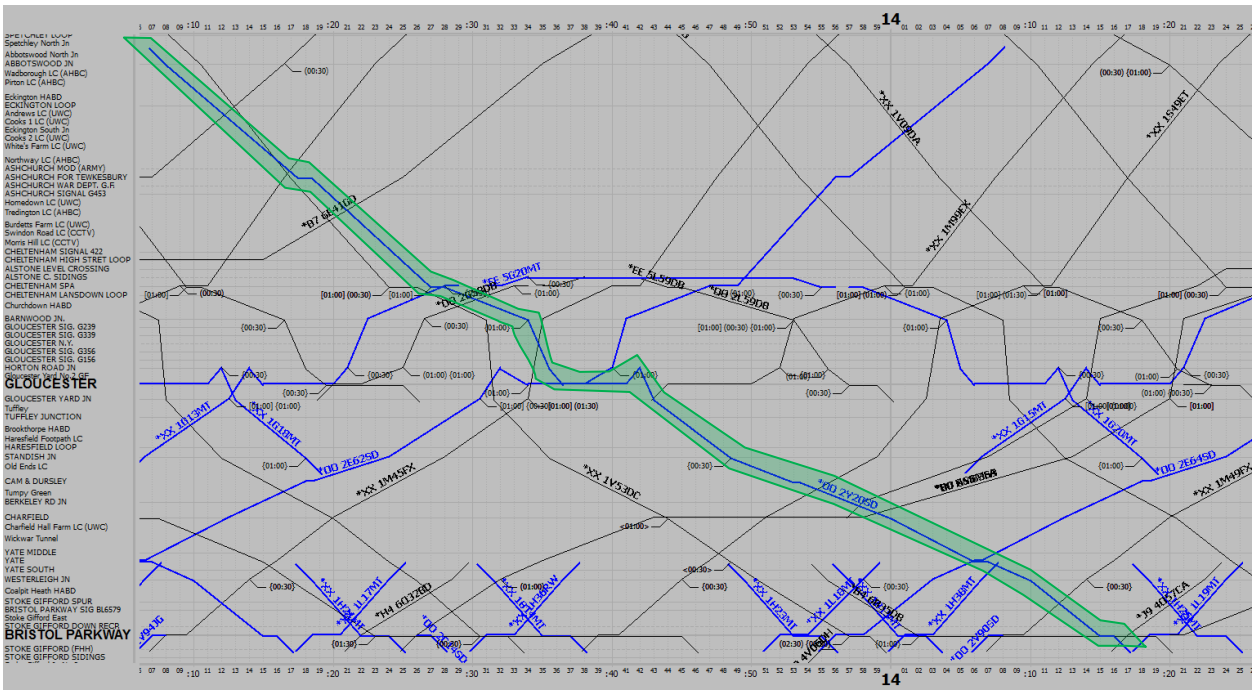


Figure 9: Bristol Parkway to Abbotswood North Jn Down path

This service is caught up and overtaken in the Ashchurch area by a Manchester to Bristol service; this has not been accounted for and can therefore not work without timetable interventions.

Assuming this issue is resolved and the Great Malvern service retains its path, the service has enough spare capacity to stop at any combination of new stations. If two new stations are added to its stopping pattern then upon crossing Westerleigh Junction it will be on headway with the following London Paddington to Bristol Service.

If the turnround time at Great Malvern is extended to be in line with the minimum stated in

the 2018 V2.0 TPRs, the conflict with the Manchester to Bristol service will remain. Additionally with the extended turnround, no new station can be supported; stopping at one new station will cause a headway conflict after Westerleigh Junction.

As with the Great Malvern service, the Gloucester to Weston-Super-Mare service can stop at 2 new stations and remain TPR compliant. However, it also features a turnround time lower than the minimum. If this turnround time is extended to be compliant, then this service cannot stop at any new station without causing a headway conflict from Westerleigh Junction.

6. Conclusions and Recommendations

6.1. Conclusions

Whilst noting the number of different variables that have yet to determined, Figure 10: Service Viability shows a prediction on how viable each adjustment variant is:

- Green: possible with limited/no constraints preventing
- Orange: possible but constraints are present and where timetable interventions will be required.
- Red: Not possible without re-writing large part of the national timetable.

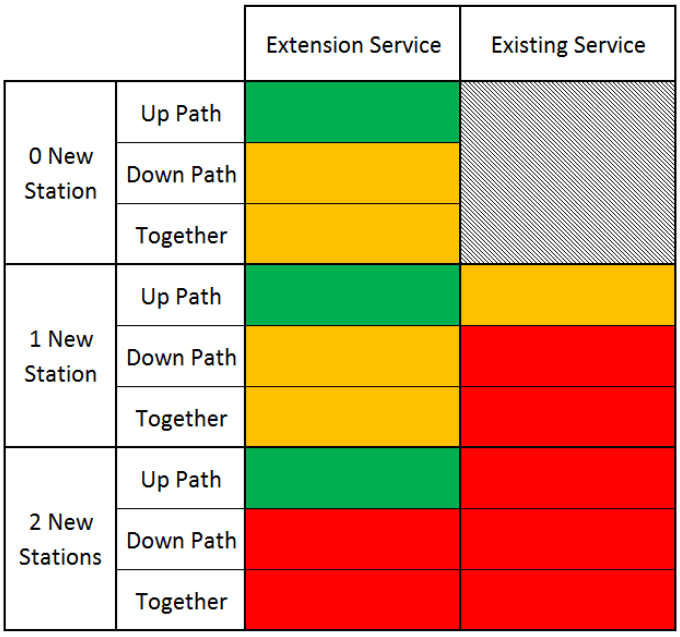


Figure 10: Service Viability

6.1.1. Weston-Super-Mare to Gloucester / Cheltenham Spa

There is the potential for the Weston-Super-Mare to Bristol Parkway service to be extended to Gloucester as part of MetroWest Phase 2; however, this is highly dependent upon how conflicts in the GWR DA2 / May 2017 WTT hybrid CTP are resolved in the final iteration or the timetable.

The one single path in each direction across Westerleigh Junction was identified to enable the extension to Gloucester / Cheltenham Spa, the Up path across Westerleigh Junction is at XX:19 and XX:20, the Down path XX:46. This results in a turnround time of about 25 minutes at Gloucester or 7 minutes at Cheltenham Spa.

The turnround times at Gloucester and Cheltenham Spa station are 10 and 12 minutes, this means that a service cannot terminate at Cheltenham Spa and make its only path across Westerleigh Junction.

With only 1 additional station the Down direction service can depart Gloucester Station from platform 2 at XX: 17, this means the service can maintain headway between Gloucester and Standish Junction with the service ahead of it and still keep headway with the service behind it between Westerleigh Junction and Bristol Parkway. With 2 of the new stations in the Down path, headway would not be maintainable

The Down path across Westerleigh is also highly dependent upon how a conflict in GWR DA2 / May 2017 WTT hybrid CTP is resolved; as such it is possible that resolving this conflict in the final timetable the Down path may be lost.

6.1.2. Weston-Super-Mare to Gloucester / Great Malvern

No additional stations can be added to either the Up or Down path of the Weston-Super-Mare to Gloucester / Great Malvern service, doing so would cause headway conflicts.

In the Up direction, the service is closely followed by a Cross Country train, if any of the new station stop are added the service, pathing will need to be added to the Cross Country service, this will likely disrupt the time it arrives in Birmingham.

The Down path also interacts with a Cross Country, however, this is due to the discrepancies between the GWR DA2 timetable and the May 2017 WTT, in the Ashchurch area the Great Malvern and Cross Country service cross paths in an area with no overtaking facilities.

Additionally, the turnround times at Gloucester and Great Malvern currently scheduled are lower than the minimum stated in the TPRs, in correcting these, all spare capacity in the Down direction that could potentially be used for the service to stop at the new stations is lost.

6.2. Conclusions based on the impact of GWR's May 2019 proposals

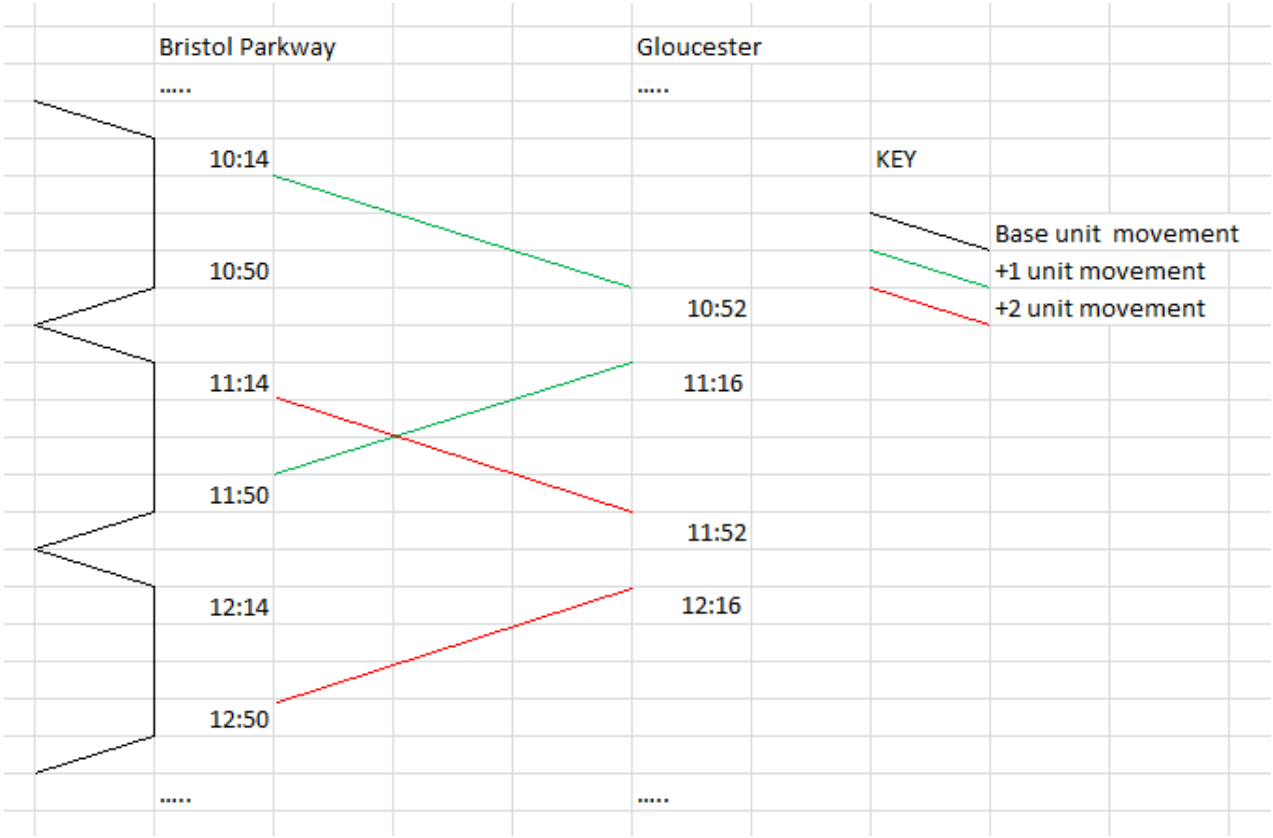
Appendix A summarises the interim high level analysis of services changes proposed by GWR as possible mitigations to the identified conflicts.

Dec 2018 services	May 2019 services
Westbury – Bristol Parkway	Westbury – Gloucester
Weston-Super-Mare – Gloucester	Weston-Super-Mare – Filton Abbey Wood

Table 2 - GWR May 2019 proposals (heavily simplified to show relevant services and routeing sections only)

This sensitivity test has proven to be inconclusive at this stage as further details of December 2018 Crosscountry and freight services are required before potential conflicts can be managed, and is provide for information only.

Based on the timings used at Parkway and Gloucester an additional 2 units would be needed in all Gloucester extension scenarios (as per the diagram below):



It is anticipated that this pattern is repeatable throughout the period of operation; and GWR timetabling work has assumed that they would require +2 units. It is unlikely that this requirement could be reduced further without significant additional infrastructure

6.3. Recommendations

Due to the uncertainty of the timetable structure in the area looked at; it is recommended that further analysis is carried out after the December 2018 timetable is produced, this is due to the December 2018 timetable being built to incorporate the GWR DA2 timetable, thereby eliminating all conflicts present in the base timetable used for this project.

The December 2018 timetable should be available from June 2018. This will be a fully de-conflicted timetable which can be used as a baseline for further MetroWest analysis which will carry a greater level of certainty.

Figure 11 below represents a timeline of this.

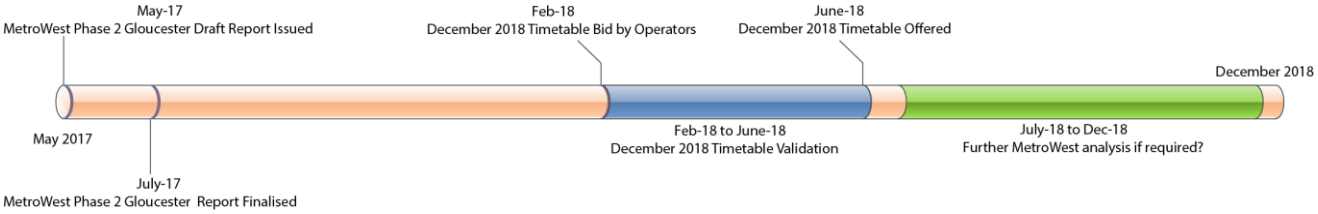


Figure 11: Timeline Graph for MetroWest timetable development work

Appendix 1. MetroWest Phase 2 : GWR Proposals

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Programme Development Manager – Network Rail		

A1. Introduction

A 1.1 Background

During the analysis for MetroWest Phase 2 Gloucester Extension, Great Western Railway (GWR) has proposed changes to their Direct Award 2 (DA2) timetable, the timetable the MetroWest Phase 2 project was based upon, as a possible mitigation to some of the identified conflicts.

This technical note is a sensitivity test intended to identify the effects these changes will cause to the timetable within the study area, particularly with regards to GWR and Cross Country (XC) service interaction. It will also examine the impact of these changes on the Westerleigh Junction to Gloucester line, within the context of the MetroWest Phase 2 Project, including new station call opportunities.

A 1.2 Aims and Objectives

GWR proposed changes to their DA2 timetable from December 2018; these changes involve altering the Weston-Super-Mare to Gloucester / Great Malvern service to a Westbury to Gloucester / Great Malvern as well as changing the timing of the service between Bristol Temple Meads and Gloucester / Great Malvern. These changes are part of wider development work conducted by GWR in the wider Bristol area. Further work is needed to both validate and integrate these proposals with the MetroWest programme.

The effect this has within the analysis is that it changes the potential path (Westerleigh Jct) for extended MetroWest service. If the GWR proposals are looked at in isolation the aspirations for MetroWest Phase 2 will not be met, therefore it has been assumed for this test that the proposed quantum of services for MetroWest Phase 2 under the original analysis on the corridor will not change, and any inherent conflicts in the wider timetable will be resolved. The approach of this additional sensitivity test has been to investigate the impact of the DA2 changes to an extension of the Phase 2 service to Gloucester and then consider the opportunity to stop at new stations.

Within the geographical scope of the MetroWest 2 Gloucester Extension project, the Westbury to Gloucester service would run along these timings hourly:

		From Westbury
Bristol Parkway	Arrive Depart	11:48 11:48
Yate		11:57
Cam & Dursley		12:09
Gloucester	Depart	12:25

Table 3: Westbury to Gloucester Up Path

		To Westbury
Gloucester	Depart	10:45
Cam & Dursley		10:57
Yate		11:10
Bristol Parkway	Arrive Depart	11:19 11:19

Table 4: Gloucester to Westbury Down Path

High-level analysis has been used to analyse whether this service can be supported, with and without the any of the new stations, in the GWR amended DA2 / May 2017 Working Timetable (WTT) hybrid.

A2. Initial observations

Changing the Weston-Super-Mare to Gloucester service to a Westbury to Gloucester service that runs along the times shown in Table 3 and Table 4 causes numerous Timetable Planning Rule (TPR) non-compliances.

These conflicts are due to the interaction with freight services that do not run on a standard hour service pattern. Many of these non-compliances were present before the service structure changes.

The Great Malvern extension causes conflicts with an hourly Cross Country service in both directions, the conflict in the Up direction is worse than the one in the Down direction.

With this specific Concept Train Plan (CTP), two of the new station calls can be accommodated in the Up direction for a Westbury to Gloucester service; however the conflict still remains for the Great Malvern extension. No additional station can be accommodated for the Down direction.

A3. Findings

By re-examining the Timetable Planning System (TPS) model used for the initial MetroWest Phase 2 Gloucester Extension work, the Weston-Super-Mare to Gloucester / Great Malvern service was substituted for a Westbury to Gloucester / Great Malvern service.

Running the Westbury service at the times shown in Table 3 and Table 3: Westbury to Gloucester Up Path Table 4: Gloucester to Westbury Down Path, many of the issues found were similar to those found for the Weston-Super-Mare service such as headway non-compliances and the lack of overtaking opportunities and turnround facilities.

A 3.1 Up Direction

Between Westerleigh Junction and Gloucester the Up direction would feature a headway non-compliance with the freight ahead of the Westbury to Gloucester/Great Malvern service in 5 separate hours throughout the day. Adjustments to either the freight or Westbury service would be required in order to make this CTP TPR compliant. As freight services often cross multiple routes and travel long distances, changes to the freight paths may impact the national timetable.

If the service continues to Great Malvern then the service will be caught up by the following Cross Country service, a Paignton / Bristol Temple Meads to Manchester Piccadilly service, and on two occasions these services will be at the same place at the same time. Unless 8 minutes of pathing time is added to the Paignton / Bristol Temple Meads to Manchester Piccadilly service, re-timetabling will be needed in order to resolve these conflicts.

Between Worcester Foregate Street station and Great Malvern, this service would cause a headway non-compliance with a Dorridge to Great Malvern service; this would require a retiming of either of the services.

If the additional stations from the MetroWest Phase 2 Gloucester Extension project are added to this services stopping pattern, then the headway conflict with the freight between Westerleigh Junction and Gloucester can be mitigated. All other conflicts would remain.

A 3.2 Down Direction

If the Westbury to Gloucester / Great Malvern service ran at the times shown in Table 3: Westbury to Gloucester Up Path Table 4: Gloucester to Westbury Down Path,

then it would be running 4 minutes later than in the initial GWR DA2 CTP. This allows for the service to run along a very similar path to that originally planned.

As this service is to run hourly, then occasionally certain irregular freight paths may cause TPR non-compliances; these non-compliances were present in the initial GWR DA2 / May 2017 WTT hybrid.

If the service returns from Great Malvern, then a conflict arises with a Cross Country Manchester Piccadilly to Bristol Temple Meads service, between Abbotswood Junction and Ashchurch. The two services are less than 4 minutes apart, which is the minimum permissible headway for this route.

This however represents an improvement over the DA2 paths where without the change in timings, the Great Malvern service and the Cross Country service would cross paths at Ashchurch where there are no overtaking facilities.

No new station calls can be added to this path, this is due to the GWR service behind the Westbury to Gloucester / Great Malvern after Westerleigh Junction running on minimum headway; if the Westbury service was any later then timetable changes will need to be made.

A 3.3 Gloucester

In this particular CTP there do not appear to be any constraints preventing the service from using Gloucester as either a reversal point for the Great Malvern service or a termination point for the Gloucester service.

A 3.4 Great Malvern

Extending from the times given in Table 3 and Table 3: Westbury to Gloucester Up Path Table 4: Gloucester to Westbury Down Path, the service would arrive at Great Malvern at XX: 21 and depart at XX: 49; this would require a turnround time of 28 minutes.

By arriving at XX: 21, the service would be 2 minutes ahead of a Dorridge to Great Malvern service. This means two services need to perform the turnround manoeuvre at the same time, which is not possible on the current infrastructure. As a third service passes by in the same direction before either manoeuvre can be performed, it would be impossible for both the Dorridge and Westbury service to terminate at Great Malvern without additional infrastructure

A4. Conclusions

The effect this proposal has within the project is that it changes the potential path for extended MetroWest service. If the GWR proposals are looked at in isolation the aspirations for MetroWest Phase 2 will not be met, therefore it has been assumed with the analysis that the proposed quantum of services under MetroWest Phase 2 on the corridor will not change, and any inherent conflicts in the wider timetable will be resolved.

The changes that GWR have made to the DA2 timetable have not produced a compliant timetable, when the existing services of other operators are taken into account.

The two CTPs tested have only been able to accommodate the station call in the Up direction. The table below summarises the findings of the original analysis and this sensitivity study:

	Number of potential new station calls in MetroWest service	
Timetable scenario	Up direction	Down direction
GWR DA2 / May 2017 hybrid(original)	2	1
GWR amended DA2 / May 2017 hybrid	2	0

Table 5: Number of potential new station calls in each timetable scenario

Further timetable development work is needed to resolve these conflicts once the December 2018 Timetable is released before the viability of proposed new stations within the study area can be conclusively answered.