FINAL REPORT

MetroWest Phase 2
Gloucestershire Extension Study

Prepared for

Gloucestershire County Council
South Gloucestershire Council

MetroWest

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Executive Summary

The study

The aim of this study is to update and enhance the consideration of the potential for MetroWest Phase 2 train services into Gloucestershire from assessments carried out in preparing the MetroWest Phase 2 Preliminary Business Case (PBC), principally to better assess benefits in Gloucestershire and present a high level financial and economic cases, as well as to consider the additive potential for new stations as further. Note though that should any new stations be pursued, they would not be delivered as part of MetroWest Phase 2, and would be additional bespoke projects, albeit that could potentially make use of the MetroWest Phase 2 train service running to Gloucester. Although separate projects would deliver the potential new stations in these options, opening dates of the new stations are assumed to be common with MetroWest Phase 2 as 2021.

The study builds on the work that underpins the PBC, but (importantly) do not include analysis of timetables (or RailSys simulation) for train services in Gloucestershire, beyond that carried out for the PBC. In particular, the ability of the timetable to sustain stops at new stations between Yate and Gloucester has not been tested (for either existing or MetroWest Phase 2 services).

A series of options were tested that are all based on the MetroWest Phase 2 PBC option that sees MetroWest train services running to Gloucester. Seven options have been considered:

1. Henbury line hourly service; three new stations at Henbury, North Filton and Ashley Down; an additional hourly local service to Gloucester, by extending an existing service turning around at Bristol Parkway, with intermediate calls at Yate and Cam & Dursley;
2. Based on option '1' above – with the additional hourly local service extended to Cheltenham (calling at Yate, Cam & Dursley and Gloucester);
3. Based on option '1' above – plus a new station at Hunts Grove;
4. Based on option '1' above – plus a new station at Charfield (in South Gloucestershire);[1]
5. Based on option '1' above – plus a new station at Stonehouse Bristol Road;
6. Based on option '1' above – plus a new station at Stonehouse North; and
7. Based on option '1' above – with two new stations, at Charfield and Stonehouse Bristol Road.[2]

A key assumption for options 3-7 is that the new stations could have train services provided by existing passing services as well as a MetroWest Phase 2 Gloucester service. For Hunts Grove and Stonehouse North this gives three trains per hour (MetroWest Phase 2 to Gloucester, existing local Bristol-Gloucester and Swindon/London-Cheltenham services). At Charfield and Stonehouse Bristol Road this would be two trains per hour (MetroWest and local Bristol-Gloucester).

Analysis of options 3-7 draws on work that was carried out in developing the Gloucestershire Rail Study[3]. Some additional work has been carried out by Amey to refine and augment this, to provide information to feed into economic assessments consistent with MetroWest Phase 2 analyses.

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[1] Note that since the study was started, Charfield station has been identified in the emerging Joint Spatial Plan (JSP) and Joint Transport Study (JTS) for the West of England. The JSP and JTS set out a prospectus for sustainable growth that will help the area meet its housing and transport needs for the next 20 years, and includes Charfield as a strategic development area, with a proposed station to serve it. There are several stages to go through (including consultation, inquiry and political processes) that may alter the content, but it is anticipated that the JSP and JTS will be adopted in late 2018.

[2] The principal reasons for choosing Charfield and Stonehouse Bristol Road as two stations to be assumed in place in the final option is a combination of logical positioning and support. For instance, Stonehouse Bristol Road complements the existing Stonehouse station (providing new links between Stonehouse and stations towards Bristol and the south west) and has strong local and political support.

[3] 'Gloucestershire Rail Study, Rail Study Report', prepared by Amey for Gloucestershire County Council (report: COGL14R037/Rep01 revision 01, September 2015)

Results

Options 1 & 2 – extending MetroWest Phase 2 train service to Gloucester and Cheltenham

Option 1 and 2 (with MetroWest Phase 2 services extended to Gloucester and Cheltenham Spa respectively) can both generate benefit cost ratios (BCRs) in excess of 2, with Wider Economic Impacts (WIs) included, though these are just below 2 if WIs are not included.

Financial profiles developed for the first three years' operation of either option 1 and 2 indicate a potential requirement of just over £6m to support the service, with a gradual closing of the gap between revenue and operating costs over time. The additional operating costs of services running to Gloucester or Cheltenham Spa are largely responsible for this figure being higher than that forecast for the preferred option in the PBC (services to Yate).

However, there is some uncertainty over the train service that could be provided for option 2, as running to Cheltenham has not been tested for timetabling or RailSys operational simulation.

Options 3-7 – further developments beyond MetroWest Phase 2 with new stations

With any new station between Yate and Gloucester, the demand generated more than off-sets the additional capital cost of the station, and overall BCRs for all new station options (3-7) are accordingly higher than option 1. Unsurprisingly, option 7, with two new stations (at Charfield and Stonehouse Bristol Road) generates the highest BCR of these options (at 3.49 without WIs; 4.72 with). With one station, option 3 (Hunts Grove) generates the highest BCRs, though this is not significantly different to the results for options 4 (Charfield) and 5 (Stonehouse Bristol Road).

A similar outcome is noted with the financial profiles for options with new stations. The first three years of operation options with one new station could require between £3m and £4m of support, much less than options 1 and 2. With two new stations, around £0.5m is required in support over the first three years, with the third year potentially generating an operating surplus.

There is uncertainty over the train service that could be provided at any new station between Yate and Gloucester, as this has not been tested for timetabling or RailSys type operational simulation.

Next Steps

This study has identified that there is potential merit in further consideration of MetroWest Phase 2 services running into Gloucestershire, as well as potentially developing new stations between Yate and Gloucester. However, there is some uncertainty over the train services that could actually be provided, particularly at new stations located between Yate and Gloucester.

It is not clear whether MetroWest Phase 2 services to Gloucester and Cheltenham could serve one or two new stations, or whether existing trains would have time in their schedules to stop at any new stations and/or have constraints on doing so. The economic and financial outcomes of the options would be adversely affected if services are less than those assumed to date.

The key next step should be timetable and operational assessments, to determine what services can be provided, assessing (at minimum) MetroWest Phase 2 services running to Cheltenham, the scope for a MetroWest Phase 2 Gloucester service to stop additionally at new station(s) and the scope for existing services (including Gloucester/Cheltenham services to/from Bristol and Swindon/London).

Train performance will also need to be considered, not least because the intended cascade of Class 165/6 DMUs from the Thames Valley is unlikely to happen as previously anticipated. The Class 165/6 DMUs are both higher capacity and a higher performance than the existing Class 15x DMUs that operate in the West of England and Gloucestershire, and performance characteristics of the Class 165/6 DMUs (in particular acceleration) could help in providing additional station stops

Relating specifically to new stations, understanding and minimising local and engineering problems (such as access, development in the area and the availability of land) will be important in delivering a new station in a timely way. More detail should be identified of infrastructure requirements and costs at any station(s) being taken forward.

SECTION 1

Introduction

1.1 MetroWest Phase 2

MetroWest is an ambitious programme that will improve local rail services across the West of England (WoE). MetroWest comprises of a range of projects from relatively large major schemes, entailing both infrastructure and service enhancement, to smaller scale projects. MetroWest is being jointly promoted and developed by the four WoE councils (Bath & North East Somerset, Bristol City, North Somerset and South Gloucestershire Councils). The programme includes:

- Existing and disused rail corridors feeding into Bristol;
- Broadly half-hourly service frequency (with some variations possible);
- Cross-Bristol service patterns (i.e. Bath to Severn Beach); and
- A Metro-type service appropriate for a city region of 1 million population.

MetroWest is being delivered in phases; Phase 1 brings up to half-hourly train services to the Severn Beach line, local stations between Bristol Temple Meads and Bath Spa, and re-opening the Portishead line. MetroWest Phase 2 builds on Phase 1, going on to offer an hourly service for the re-opened Henbury line with new stations at Henbury and North Filton, with a new station at Ashley Down on the Filton Bank, and a half-hourly service for Yate. Subsequent phases may add further new stations to the network. Figure 1 shows the key elements of MetroWest Phase 2.

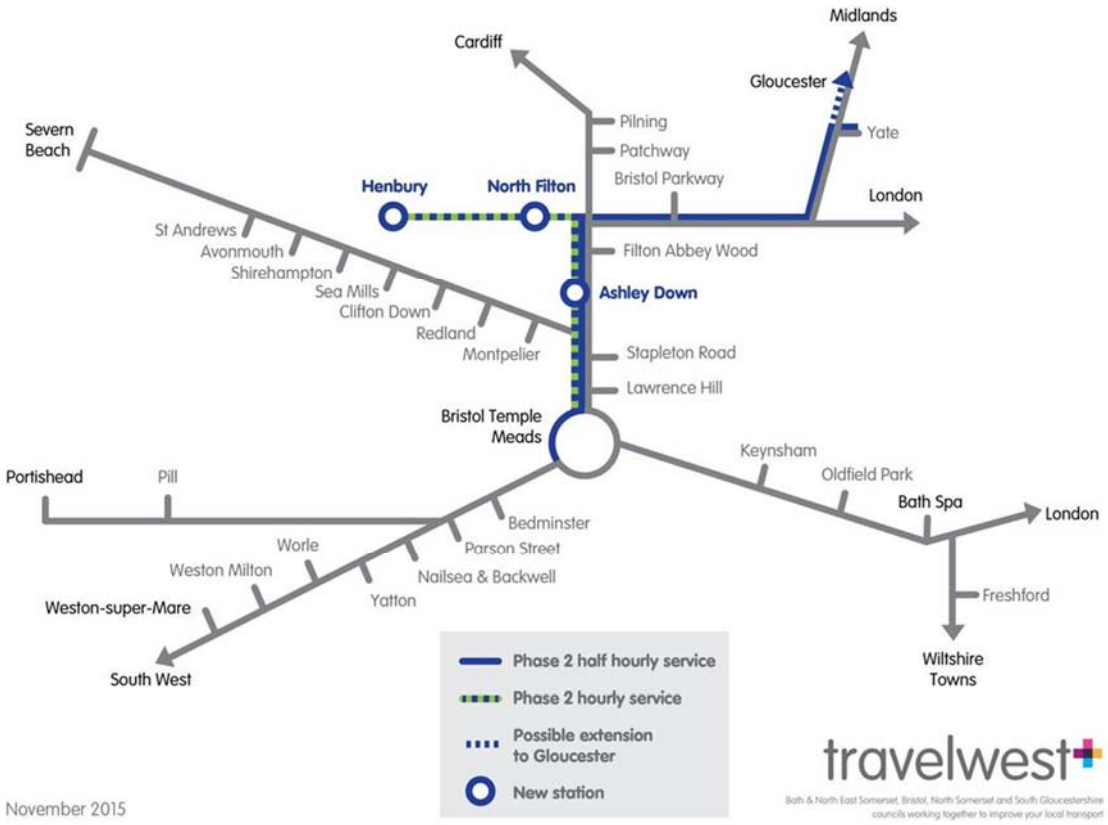

Figure 1. - MetroWest Phase 2

The current MetroWest Phase 2 programme is targeting a project opening year of 2021, and the most significant milestone in the development of MetroWest Phase 2 to date has been the Preliminary Business Case (PBC), which was completed and approved in September 2015. This encompassed assessment of proposed rail elements by Network Rail, taking the feasibility analysis to

GRIP2 (in Network Rail's Guide to Rail Investment Process) which considers solutions for scheme requirements. The PBC included service planning and demand forecasting, which fed into economic and financial analysis of scheme options. This work was carried out by CH2M and Network Rail, making use of both national rail industry and local modelling tools and techniques.

The PBC reported on the assessment of four scheme options (options 1a, 1b, 2a and 2b [4]), from which a fifth option was identified as the preferred option, which was then subsequently approved to be taken forward for further development.[5]

This option (known as Option 1a_x) features an hourly service on a re-opened Henbury line, with new stations at Henbury and North Filton, as well as a new station at Ashley Down on the Filton Bank, and a half hourly service at Yate provided by extension of an existing service that currently terminates at Bristol Parkway. However, while the preferred option was based on terminating and turning back a service at Yate (with the consequent provision of infrastructure required to do so included in the capital costs if the scheme), this does not preclude allowance for a service to pass through Yate and turn back elsewhere (such as at Gloucester).

1.2 Gloucestershire Rail Study

Gloucestershire County Council completed a comprehensive study of rail services in the county in 2015[6], resulting a vision for various enhancements in the future. The study considered the potential to develop rail services and stations in Gloucestershire, including issues and proposals covering the short, medium and longer terms. Proposals include enhancements to services and existing stations, as well as potential new stations (including some on the line between Yate and Gloucester). A key element of the rail network in Gloucestershire identified by the study is its connectivity to the wider rail network, and corresponding dependence on longer distance train services. Related to this, the study recommended that the County Council should aim to contribute to and influence wider area proposals such as HS2 and MetroWest, to make the most of Gloucestershire's opportunities to benefit the proposals. From this there is interest in further understanding the potential for the MetroWest Phase 2 Yate service improvements to enhance services into Gloucestershire.

As such, Gloucestershire County Council have requested a more detailed consideration of the extension of MetroWest Phase 2 services into the county, building on those options considered in the MetroWest Phase 2 PBC, as well as looking at related potential new stations as future developments. Note though that should any new stations be pursued, they would not be delivered as part of MetroWest Phase 2, and would be additional Gloucestershire County Council led improvements, albeit that could potentially make use of a MetroWest Phase 2 train service.

1.3 Gloucestershire extension study

The aim of this study is to update and enhance the consideration of the potential for MetroWest Phase 2 train services into Gloucestershire from assessments carried out in preparing the PBC, principally to better assess benefits in Gloucestershire and present a high level financial and economic cases, as well as to consider the additive potential for new stations as further. The

[4] 1a – Henbury line with hourly service operating as a spur from Bristol Temple Meads and 2 trains per hour at Yate (terminating there); 1b – same as 1a for Henbury line, with 2 trains per hour at Yate provided by a service running on to Gloucester; 2a – same as 1a for Yate service, with Henbury line running as an hourly loop from Bristol Temple Meads, meeting the Severn Beach line near St.Andrews Road; 2b – as option 2a for Henbury line service, with 2 trains per hour at Yate provided by a service running on to Gloucester.

[5] The MetroWest Phase 2 PBC initially considered the four options (1a, 1b, 2a and 2b) in detail, two of which included services running to Gloucester (options 1b and 2b). However, as documented in the PBC, none of the initially considered four options were affordable, so a fifth option was devised that reduced capital costs by removing Constable Road station, previously included in all four options. Option 1a_x (with a Yate turnaround) became the preferred options approved for development as MetroWest Phase 2. Other permutations were considered at a lower level of detail as part optioneering, including links to Gloucestershire. But, no Gloucestershire related options without Constable were assessed to the same level of detail as option 1a_x.

[6] 'Gloucestershire Rail Study, Rail Study Report', prepared by Amey for Gloucestershire County Council (report: COGL14R037/Rep01 revision 01, September 2015)

assessments build on the work that underpins the PBC, but (importantly) do not include analysis of timetables (or RailSys simulation) for train services in Gloucestershire, beyond that carried out for the PBC. In particular, the ability of the timetable to sustain stops at new stations between Yate and Gloucester has not been tested (for existing or MetroWest Phase 2 services).

A series of options have been tested that are all based on a variation of Option 1b from the MetroWest Phase 2 PBC, specifically in the first instance a version of option 1b from which the Constable Road station has been removed ('Option 1b_x' – analogous to the relationship between options 1a and 1a_x).[7] Seven options have therefore been considered in this study, including:

1. Henbury line hourly service (with 2 new stations at Henbury and North Filton, as well as Ashley Down on the Filton Bank); and an additional hourly local service to Gloucester, by extending an existing service turning around at Bristol Parkway, with intermediate calls at Yate and Cam & Dursley (Option 1b_x);
2. Based on option '1' above – with the additional hourly local service extended to Cheltenham (calling at Yate, Cam & Dursley and Gloucester);
3. Based on option '1' above – plus a new station at Hunts Grove;
4. Based on option '1' above – plus a new station at Charfield (in South Gloucestershire);[8]
5. Based on option '1' above – plus a new station at Stonehouse Bristol Road;
6. Based on option '1' above – plus a new station at Stonehouse North; and
7. Based on option '1' above – with two new stations, at Charfield and Stonehouse Bristol Road.[9]

Analysis of options including the new stations in Gloucestershire draws heavily on work that was carried out in developing the Gloucestershire Rail Study, which included demand forecasts and costs for the potential new stations located between Yate and Gloucester that are incorporated into options 3-7. Some additional work has been carried out by Amey to refine and augment the analysis in the Gloucestershire Rail Study Report, in order to provide appropriate levels of information to feed into economic assessments consistent with MetroWest Phase 2 analyses.

1.4 This Report

Building on the MetroWest Phase 2 Preliminary Business Case (PBC), the remainder of this report sets out findings of the economic and financial analysis of extending the new Yate service of MetroWest Phase 2 to Gloucester or Cheltenham and possible subsequent projects incorporating new stations between Yate and Gloucester. Following this introductory chapter, subsequent chapters of the report go on to consider:

- Chapter 2 – the approach to assessments;
- Chapter 3 – results of the analysis including a high level socio-economic appraisal of each of the options and a financial profile for the first few years of operation; and
- Chapter 4 – sets out some next steps.

[7] Note that, while an actual 'option 1b_x' was not reported in the MetroWest Phase 2 PBC, illustrative results for option 1b_x were presented in supporting documentation to the PBC, which were based on results of other options. Hence, the ethos of this study is to update and enhance the analysis of option 1b_x for extending MetroWest Phase 2 into Gloucestershire.

[8] Note that since the study was started, Charfield station has been identified in the emerging Joint Spatial Plan (JSP) and Joint Transport Study (JTS) for the West of England. The JSP and JTS set out a prospectus for sustainable growth that will help the area meet its housing and transport needs for the next 20 years, and includes Charfield as a strategic development area, with a proposed station to serve it. There are several stages to go through (including consultation, inquiry and political processes) that may alter the content, but it is anticipated that the JSP and JTS will be adopted in late 2018.

[9] The principal reasons for choosing Charfield and Stonehouse Bristol Road as two stations to be assumed in place in the final option is a combination of logical positioning and support. For instance, Stonehouse Bristol Road complements the existing Stonehouse station (providing new links between Stonehouse and stations towards Bristol and the south west) and has strong local and political support.

SECTION 2

Approach

2.1 Building on the PBC

The principal ethos of the approach to this study is to build on work previously carried out as part of developing the PBC for MetroWest Phase 2, and the Gloucestershire Rail Study. In the first instance though, options 1 and 2 do not depend on information from the Gloucestershire Rail Study, and as such the analysis of these options uses assumptions, techniques and results from MetroWest Phase 2 PBC. Subsequent options (3-7) are based on option 1, drawing in information from the Gloucestershire Rail Study as required.

2.1.1 Information taken directly from MetroWest Phase 2 PBC

Some of the work that was carried out for the PBC has been used directly, as it pertains to the options extending into Gloucestershire.[10] Elements of PBC analyses used directly include:

- New stations demand forecasts for Henbury, North Filton and Ashley Down are taken directly from the PBC, for both passenger numbers and revenue. These forecasts are based on 2014 data, which uses a growth profile to produce a benefit and revenue stream for required years, but are not sensitive to wider service linkages (such as Gloucester versus Yate turnarounds for the other main service of MetroWest Phase 2).
- As part of the assessment of costs and benefits, specific analysis of highway benefits in the West of England (WoE) area were made using GBATS3[11] and TUBA. Although a revised version of the area multi-modal demand model is now available (GBATS4), it was considered more appropriate to use the GBATS3 based results, for consistency with figures in the PBC. A local assessment of highway benefits generated in the Gloucester and Cheltenham areas has also been made using the Gloucestershire Central Severn Vale (CSV) traffic model (see more on CSV model below).
- Wider (economic) impacts (WIs – as defined in WebTAG unit A2.1) were calculated for MetroWest Phase 2 and reported in the PBC. Being based on the GBATS3 traffic analysis, impacts assessed are from the WoE area. These figures have been incorporated directly into this analysis. A local assessment of WIs has also been made for benefits generated in the Gloucester and Cheltenham areas using the Gloucestershire Central Severn Vale (CSV) traffic model (see more on CSV model below).
- Operating costs calculated for MetroWest Phase 2 services are directly applicable to this study, and have been used accordingly.

2.1.2 Information augmented and/or adapted from PBC

Other elements of MetroWest Phase 2 PBC analyses have been updated and/or adapted:

- Demand and revenue at existing stations has been assessed for all MetroWest schemes by Network Rail using MOIRA[12]. MOIRA is updated twice a year, based on timetable changes and prior ticket sales, and as demand at existing stations for was assessed the PBC using 2013-14 annual figures, the current analysis has been updated using the latest available version of

[10] Further details of the methodologies, assumptions and results from the PBC can be found in the 'MetroWest Phase 2 Preliminary Business Case' (main document), and appendices (in particular: Appendix C, 'Socio-economic Appraisal Report'; Appendix D, 'Forecasting Report' and Appendix E, 'Wider Impacts Report'), published in July 2015.

[11] GBATS3 is a multi-modal demand model for the West of England area which was WebTAG compliant and used to assess a number of schemes in the area that have been given funding approval by the DfT.

[12] MOIRA is used by the rail industry to forecast the impact of service related changes on passenger revenue, including analysing the effect of changes such as stopping patterns, infrastructure and rolling stock on the passenger numbers carried and the revenue impact. MOIRA1 has been used to assess the impacts of MetroWest Phase 2 on existing stations in the WoE as well as the wider rail network.

MOIRA, which incorporates demand and revenue from 2014-15. No changes have been made to assumptions regarding train services (both MetroWest Phase 2 and on the wider network), apart from services stopping at new stations having a one minute increase in journey time per stop, to take into account the potential impact on demand of slightly longer journey times.

- Apart from highway benefits and WIs as noted above, value for money assessments were primarily based on analysis using Network Rail's Discounted Cash Flow (DCF) model. The DCF model incorporates investment costs, operating cost, other government impacts (e.g. indirect taxation), revenue impact, rail demand, benefits/dis-benefits to rail users and benefits/dis-benefits to non-rail users (with highway elements replaced by information from GBATS/TUBA as noted). The DCF is consistent with WebTAG, and as such is constantly updated to reflect changes to economic parameters.[13]
- Rail demand forecasting techniques used for MetroWest Phase 2 (both MOIRA and new stations methodology) operate on current data (2015 and 2014 respectively). The growth profile used for MetroWest assessments (Phase 1 and 2) is based on a combination of observed demand over time and future forecasts. In essence, this starts with an annual growth rate based on historic demand (derived from ORR station usage figures) tending towards figures derived from Network Rail's Long Term Planning Process (LTPP). The growth profile used has been updated to include the most recent historic data (2015).

2.2 Gloucestershire specific analysis

2.2.1 Highway benefits

A specific element of the socio-economic appraisal of MetroWest (phases 1 and 2) has been to capture local highway benefits, as this is an acknowledged weakness within the DCF model. In general, WebTAG recommends using local traffic or multi-modal models if available, and as such the GBATS3 model has been used to capture benefits in the WoE area.

However, while the GBATS3 model includes zones that cover Gloucestershire, the zones in this area are large and network coverage is very limited outside the WoE. Use has therefore been made of the Central Severn Vale (CSV) traffic model. The 2008 base year CSV model is a fully validated highways model co-owned by Gloucestershire County Council and Highways England. Coverage of the CSV model includes a simulation area encompassing Gloucester and Cheltenham and areas immediately around, with a buffer network beyond. In the context of this study, it has been used to assess highway benefits, principally from the congested areas of Gloucester and Cheltenham.

The CSV model represents the AM and PM peak hours for an average weekday in neutral months; modelled hours are 08:00-09:00 and 17:00-18:00 for the AM and PM peaks respectively. In this study, a forecast year 2031 model has been used; specifically this is the version put together by Atkins for 'Joint Core Strategy (JCS) Strategic Allocation Option Testing' (September 2014). This includes anticipated development by 2031 in the Joint Core Strategy, as well as accompanying do minimum network assumptions.

The technique used to capture highway benefits produces results that can be considered a reasonable estimation, as the CSV model is uni-modal (highway), and assumptions have to be incorporated relating to the transfer from road to rail. In essence, the methodology is as follows:

- Rail demand forecasts from MOIRA are interrogated for changes at Gloucester, Cheltenham Spa and Cam & Dursley stations. MOIRA operates on annual figures, so these figures are broken down to AM and PM peaks using a series of factors derived from MOIRA itself as well as rail surveys in the WoE area, and taken to 2031 levels using the future year growth profile.

[13] Note that the version of the DCF used in this study does not reflect the latest changes to value of time calculations, due to come into use in November 2016 (although still 'forthcoming' as of 9th December 2016). In order to preserve consistency with the MetroWest Phase 2 PBC, the DCF uses data consistent with analysis reported in the PBC.

- New rail trips are allocated to CSV zones based on proximity to stations. Zones surrounding each of the stations were identified as the de facto catchments for these new trips, with the distribution of rail trips based on CSV model zonal totals.
- Not all of the new rail trips will be former car trips. Previous analysis using GBATS3 and GBATS4 identifies former car trips, but this varies by time period and details of the options being tested. An assumption of 50% ex-car trips has been used as a broad average. The proportion of rail trips that are ex-car trips are removed from CSV trip matrices and the models re-run.
- TUBA has been used to estimate benefits based on the results from the CSV model. In the first instance this is problematic, in that TUBA requires a do minimum versus do something in more than one modelled year to be able to produce a stream of benefits[14], and the CSV only has the single forecast year. To overcome this limitation, a proxy 2021 model has been used. This is not a true 2021 model, as it uses an unchanged 2031 do minimum model as a basis, but with 2021 rail demand changes applied instead of 2031. In order to ensure that this does not overestimate benefits, the 2021 rail demand has been applied pessimistically (i.e. a lower car to rail mode shift). Also, only annualised benefits from the AM and PM peaks are included.[15]

Highway benefits calculated using the CSV model have been added to the benefits calculated using GBTAS3, to give an overall total of locally derived highway benefits for the Gloucestershire options.

2.2.2 Wider Economic Impacts

Wider economic impacts (WIs) in the Gloucester and Cheltenham area have been estimated using results from the CSV model, substantially the same results as have been derived and used in the TUBA assessments. Impacts calculated include agglomeration impacts (WI1), output change in imperfectly competitive markets (WI2) and tax revenues arising from labour market impacts (WI3). Further details of the methodology followed can be found in the 'Wider Impacts Report' (Appendix E to the Preliminary Business Case, PBC, of MetroWest Phase 2).

WIs calculated using the results from the CSV model have been added to the WIs calculated using GBTAS3 data, to give an overall total of locally derived WIs for the Gloucestershire options.

2.3 Gloucestershire new station forecasts

2.3.1 Methodology

The Gloucestershire Rail Study (carried out by Amey for Gloucestershire County Council) considered potential new stations at five locations on existing railways. Four of these are located on the main line between Gloucester and Bristol and are included in options in this study:

- Hunts Grove – southern edge of Gloucester, approximately 5km from the city centre;
- Charfield – roughly half way between Gloucester and Bristol (33km south of Gloucester, 30km north of Bristol Temple Meads); this station is actually located in South Gloucestershire;
- Stonehouse Bristol Rd – south of Standish Junction (where the route between Swindon and Gloucester leaves the line between Gloucester and Bristol). The existing Stonehouse station is on the Swindon line, and as such does not provide direct links from Stonehouse to services in the Bristol direction; this station would provide those links; and

[14] Single year assessments are possible using TUBA, but will only calculate single year benefits, and not across a full appraisal period.

[15] TUBA assessments are carried out to build up a picture of a year, based on an average day and annualisation factors. This typically uses up to 5 time periods; AM peak 07:00-10:00, inter-peak 10:00-16:00, PM peak 16:00-19:00 and off peak 19:00-07:00 and weekend/holidays period. Average hour model results are factored to represent the full period and annualised accordingly. Inter-peak models are generally used as a proxy for off-peak and weekend/holiday. As there is no inter-peak CSV model (and to avoid over-estimating benefits) the inter-peak, off-peak and weekend/holiday periods were not included.

- Stonehouse North – located north of Standish Junction, potentially allowing calls by trains on both the Bristol and Swindon lines.

Figure 2 shows the locations of these potential station sites.

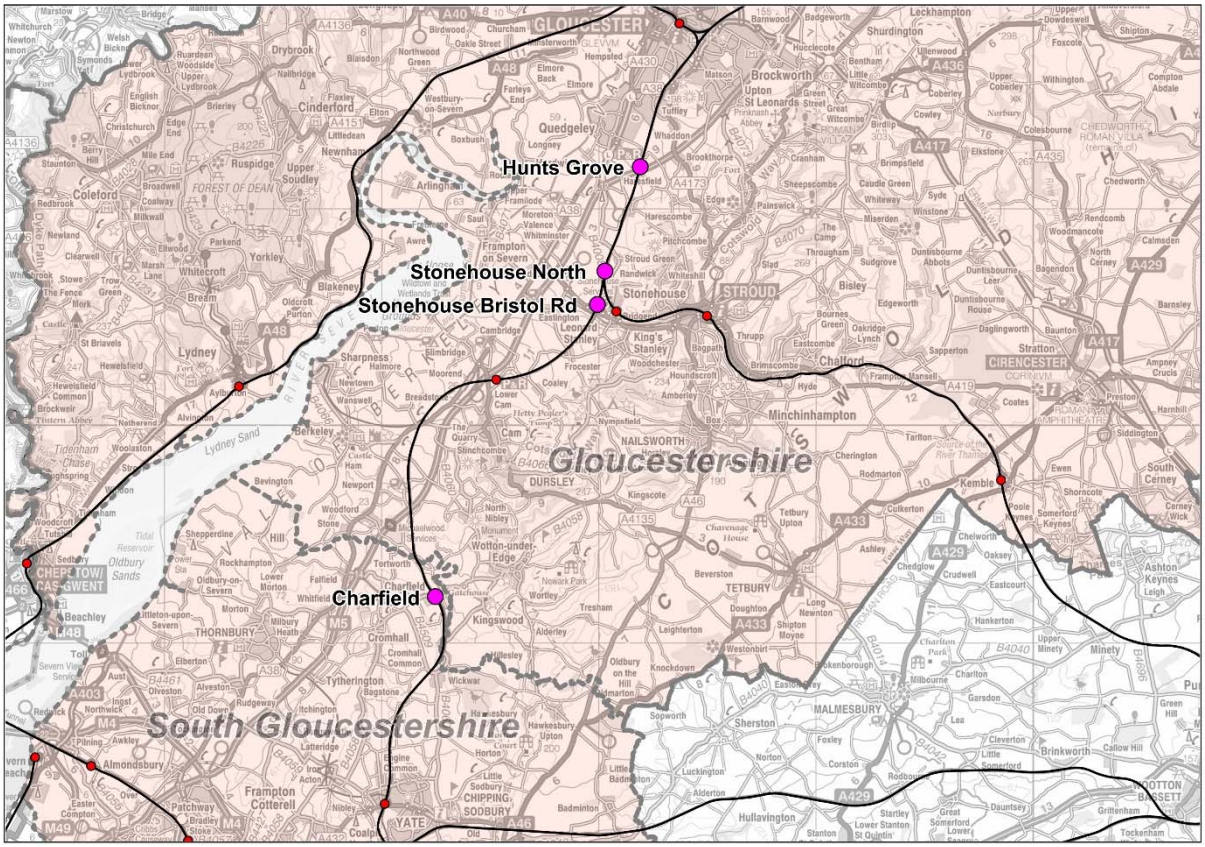

Figure 2. - Potential new station locations in Gloucestershire

The Gloucestershire Rail Study provided an assessment of each of these stations, including appraisal of the stations' general locations, proximity to existing housing and employment, potential for new development in surrounding areas, demand forecasts, outline costs and economic assessment. Recommendations were made for the future short, medium and long term development of the stations based on these assessments. The station demand forecasts were carried out by the Transportation Research Group at the University of Southampton, using a 'trip end' rail demand model. Table 1 shows a brief summary of the analyses from the original report.

Table 1: Gloucestershire Rail Study – new stations summary analysis

Station	Demand (2020)	BCR [16]	Cost	Recommendations
Hunts Grove	174,834	1.93	£5m-£6m	Safeguard site for future
Charfield	105,227	2.31	£5m	Continue to progress delivery
Stonehouse Bristol Rd	104,021	1.34	£5m-£6m	Only with surrounding area development
Stonehouse North	165,123	0.95	£7m	Only with surrounding area development

However, in carrying out these assessments, demand forecasts at the potential new stations were based solely on existing train services, making assumptions about which existing passing services would stop. But no account was taken of a potential new service between Yate and Gloucester that could be provided by the extension of MetroWest Phase 2 services to Gloucester. An additional

[16] Single station assessment (no other new stations in the vicinity)

service at a rail station usually results in more demand, particularly if an additional service increases frequency above hourly, to two or three trains per hour.

As such, in order to take the MetroWest service into account, the demand forecasts have been re-worked to include the potential additional station call by the MetroWest service. In order to ensure a consistency of analysis, and provide further information for future consistent development of rail schemes in Gloucestershire, the analysis has been carried out by the same study team, and using the same methodology, as employed in the Gloucestershire Rail Study. In addition to reviewing the train service assumptions at each station, housing and employment development assumptions in the vicinity of each station have also been reviewed in the light of changes since the initial forecasts were made, in some cases resulting in reasonable changes in anticipated development. Full details of the methodology and more detailed results are given in Appendix A.

A key assumption is the service patterns assumed for each potential new station, which have been augmented from the Gloucestershire Rail Study to include the MetroWest Phase 2 service extended to Gloucester. Service patterns assumed at each station are as follows:

- Hunts Grove:
  - Hourly London/Swindon-Gloucester/Cheltenham (via Stroud); and
  - Half-hourly Gloucester-Bristol (one being the MetroWest Phase 2 service)
- Charfield:
  - Half-hourly Gloucester-Bristol (one being the MetroWest Phase 2 service).
- Stonehouse Bristol Road:
  - Half-hourly Gloucester-Bristol (one being the MetroWest Phase 2 service).
- Stonehouse North:
  - Hourly London/Swindon-Gloucester/Cheltenham (via Stroud); and
  - Half-hourly Gloucester-Bristol (one being the MetroWest Phase 2 service).

It should be noted though that a timetable providing this level of service has not been tested for its operability, using RailSys or equivalent timetabling or train simulation analysis software. [17]

2.3.2 Demand results

Table 2 shows revised demand forecasts for the new stations covered by the Gloucestershire Rail Study, incorporating updated planning assumptions and an additional train service provided by the MetroWest Gloucester extension, for current year (2015) and forecast years of 2020, 2025 and 2030. Accompanying revenue forecasts are shown in Table 3.

The demand and revenue forecasts for the new stations have been incorporated into the socio-economic and financial analyses of options 3-7, which are reported in Chapter 3. In doing this, opening year at all stations is assumed to be 2021, the same as MetroWest Phase 2 overall, demand and revenue for which is interpolated from the forecasts in Tables 2 and 3.

[17] Another issue relating to train performance is the train sets that will be available for the MetroWest Phase 2 service, as well as Great Western Railway franchise services more generally. As a result of deferment to elements of Great Western Mainline electrification, the intended cascade of Class 165/6 DMUs from the Thames Valley is unlikely to happen as previously anticipated. Some units will be available, but the number that move is likely to be lower than previously intended. This has an effect in that the Class 165/6 DMUs are both higher capacity and a higher performance than the existing Class 15x DMUs that operate in the West of England and Gloucestershire. Performance characteristics of the Class 165/6 DMUs (in particular acceleration) can help in providing additional station stops.

Table 2: MetroWest Phase 2 Gloucestershire extension – new stations demand forecasts
Gross (per annum) – total demand generated by new station

Station	Forecast demand – with MetroWest service & updated development				
	2015	2020	2025	2030	% abstracted from existing stations [18]
Hunts Grove	265,369	361,045	437,179	501,654	25%
Charfield	212,414	239,379	262,459	319,447	21%
Stonehouse Bristol Rd	228,715	266,591	302,480	334,338	28%
Stonehouse North	250,078	284,112	315,224	341,776	36%

Table 3: MetroWest Phase 2 Gloucestershire extension – new stations revenue
Gross (£ per annum, 2015 values) – total revenue generated at new station

Station	2015	2020	2025	2030
Hunts Grove	£678,006	£922,454	£1,116,973	£1,281,704
Charfield	£761,916	£858,638	£941,425	£1,145,837
Stonehouse Bristol Rd	£686,609	£800,314	£908,054	£1,003,693
Stonehouse North	£581,795	£660,974	£733,355	£795,127

2.3.3 New stations benefits

The assessment of benefits at the potential new stations draws on the methodology used to assess new stations in the MetroWest Phase 2 PBC, based on the forecasts of demand at the new stations described above.

In outline, the generalised cost (GC) of a comparable car journey is compared against the generalised cost of a new rail journey to calculate the net user benefit to new station users. Key components for rail GC included average yield per passenger journey (converted into equivalent minutes), train in-vehicle journey time, frequency and interchange penalty. WebTAG values are used in this process, and 'rule of the half' is applied in calculating benefits. In-vehicle journey time was based on the (weighted) average service speed on the existing Bristol-Gloucester stopping train and the potential timetable for MetroWest Phase 2 services. Generalised costs of car trips also included parking cost in city centres (weighted averages of potential destination locations), fuel, maintenance and in-vehicle journey time. Weightings are based on a proportion of demand to different destinations (such as Bristol, Cheltenham and Gloucester), using information derived from the demand forecasts.

[18] The proportion abstracted from existing stations is based on the reality that catchments will overlap between existing and potential new stations. This is most acute in Stonehouse, where the potential new station sites are within 1km (Bristol Road) and 2km (North) of the existing Stonehouse station (albeit that this is on the Swindon line) and only 6-7km from Cam & Dursley. Similarly, Hunts Grove is around 7km from Gloucester station and 6km from Stonehouse. Charfield is some 10km from Yate station and 12km from Cam & Dursley.

SECTION 3

Assessment results

3.1 Options 1 & 2

3.1.1 Socio-economic appraisal

The main methodology and assumptions used in the socio-economic appraisal are drawn from the MetroWest Phase 2 PBC, with amendments to the approach set out in chapter 2 of this report.

Results of the socio-economic appraisal of the MetroWest Phase 2 Gloucestershire extension options 1 (MetroWest Phase 2 train service to Gloucester instead of Yate) and 2 (MetroWest Phase 2 train service to Cheltenham) are shown in Table 4. This includes summary information under the main headings of costs and benefits. The table includes comparison between options 1 and 2 from this study and the approved option from the MetroWest Phase 2 PBC (option 1a_x). All cost/benefit values in the table are £m, shown as present values discounted to 2010, in 2010 prices. Further details in the form of the Transport Economic Efficiency (TEE), Public Accounts (PA) and Analysis of Monetised Costs and Benefits (AMCB) tables can be found in the Appendix to this technical note.

The table indicates that both options 1 and 2 can generate benefit cost ratios (BCRs) in excess of 2, with Wider Economic Impacts (WIs) included, though these are just below 2 if WIs are not included.

Table 4: Results of socio-economic appraisal – options 1 & 2

		Option 1 Gloucester	**Option 2** Cheltenham	PBC approved option 1a_x [19]
Net benefits to consumers and private sector (plus tax impacts)				
Rail user journey time benefits		83.91	91.60	71.31
Non user benefits – road decongestion		39.05	39.37	23.70
Non user– noise, air quality, greenhouse gases & accidents		1.66	1.85	1.32
Rail user and non-user disruption dis-benefits during possessions		-0.84	-0.84	-0.87
Indirect taxation impact on government		-4.35	-4.23	-3.39
BENEFITS sub-total (a)		119.44	127.76	92.05
Wider economic impacts (WIs)		42.65	44.33	30.47
BENEFITS sub-total (b)	incl WIs	162.09	172.09	122.52
Costs to government (broad transport budget)				
Capital costs		22.81	22.81	23.83
Non user benefits – road infrastructure cost changes		-0.09	-0.10	-0.07
Revenue transfer		-60.94	-63.32	-53.45
Operating costs transfer		105.25	108.32	68.73
COSTS sub-total (c)		67.04	67.70	39.04
Net Present Value (NPV) (a-c)		52.40	60.06	53.01
Benefit Cost Ratio to Government (BCR) (a/c)		**1.78**	**1.89**	**2.36**
Net Present Value (NPV) (b-c)	incl WIs	95.05	104.38	83.48
Benefit Cost Ratio to Government (BCR) (b/c)	incl WIs	**2.42**	**2.54**	**3.14**

Costs and benefits are £m; present values discounted to 2010, in 2010 prices

[19] Option 1a_x: The approved option from MetroWest Phase 2 PBC, includes Henbury line as a spur service with new stations at Henbury, North Filton and Ashley Down, and a half-hourly service at Yate, delivered by extending an existing service from Bristol Parkway.

3.1.2 Financial profile

To illustrate the potential financial development of MetroWest Phase 2 Gloucestershire extension options 1 and 2 over an initial operating period, financial profiles of costs and revenues for both options over the first three years are shown in Table 5. Also shown in Table 5 for comparison is a similar 3-year profile for the approved option from the MetroWest Phase 2 PBC (option 1a_x). Figures 3 and 4 show a 10-year profile of revenue and operating costs for the two options.

[Option 1 & 2 financial profile assumptions [20]]

Table 5: Financial profile – first three years – options 1 & 2

	Total first 3 years	**2021 opening**	**2022**	**2023**
Option 1 – Gloucester				
Total revenue		£2,132,000	£2,460,000	£2,815,000
Total operating cost		£4,436,000	£4,573,000	£4,716,000
Net (-ve = support, +ve = surplus)	-£6,317,000	-£2,303,000	-£2,113,000	-£1,901,000
Option 2 – Cheltenham Spa				
Total revenue		£2,218,000	£2,557,000	£2,924,000
Total operating cost		£4,605,000	£4,746,000	£4,893,000
Total operating cost		£4,605,000	£4,746,000	£4,893,000
Net (-ve = support, +ve = surplus)	-£6,545,000	-£2,387,000	-£2,189,000	-£1,969,000
Costs and revenues both presented as positive values, rounded to the nearest £'000; nominal values for each year				
PBC approved option (1a_x)				
Total revenue		£2,873,000	£2,963,000	£3,055,000
Total operating cost		£1,548,000	£1,825,000	£2,060,000
Net (-ve = support, +ve = surplus)	-£3,458,000	-£1,325,000	-£1,138,000	-£995,000

The table indicates that the first three years of either options could require just over £6m to support the service, though also shows a gradual closing of the gap between revenue and operating costs (highlighted further in the figures). This compares with the £3.46m reported in the PBC for the preferred option (1a_x), the difference principally accounted for by greater operating costs of running to Gloucester or Cheltenham Spa that are not fully off-set by additional revenue.

More details of the financial profile, including a breakdown of revenue and operating costs, can be found in Appendix B.

3.2 Options 3-7

The main methodology and assumptions used in the socio-economic appraisal are drawn from the MetroWest Phase 2 PBC, with amendments to the approach set out in chapter 2 of this report.

Options 3-7, based on option 1, add potential new stations to the situation where the MetroWest Phase 2 train service runs to Gloucester. Note though that should any new stations be pursued, they

[20] Note that the profiles show real costs and revenues, and include a number of assumptions:
- Demand and revenue changes in line with a combination of the new stations forecasts and MetroWest future year growth rates
- Revenue also changes in real terms by the current annual fares increase formula of RPI+1
- Values in the table are nominal – with inflation projections included
- Early years ramp-up at new stations included (90% year 1, 95% year 2, 100% year 3 onwards)
- Operating costs (except staff) increase by GDP deflator
- Staff-related operating costs change by nominal earnings growth, with changes to real earnings relative to the GDP deflator
- Revenue from MOIRA increased by 10% to allow for weekend travel (which is not included in initial figures)
- The effect of crowding on demand is not included, because it is not anticipated that peak crowding would be an issue within the first 3 years' of operation illustrated

would not be delivered as part of MetroWest Phase 2, and would be additional bespoke projects, albeit that could potentially make use of the MetroWest Phase 2 train service running to Gloucester. Although separate projects would deliver the potential new stations in these options, opening dates of the new stations are assumed to be common with MetroWest Phase 2 as 2021.

The analysis of these options has been carried out at a more illustrative level than options 1 and 2, making use of option 1 assessments as the basis to develop aggregate results for options 3-7. As such, the results should be considered accordingly and, while they provide a comparison between stations, do not necessarily represent full analyses of each situation.

3.2.1 Socio-economic appraisal

Table 6 sets out the results of socio-economic appraisal of the MetroWest Phase 2 Gloucestershire extension options 3, 4 5 and 6 (including new stations at Hunts Grove, Charfield, Stonehouse Bristol Road and Stonehouse North respectively), as well as option 7 (with two new stations at Charfield and Stonehouse Bristol Road). This includes summary information under the main headings of costs and benefits. All cost/benefit values in the table are £m, shown as present values discounted to 2010, in 2010 prices.

Table 6: Results of socio-economic appraisal – options 3-7
All options build on MetroWest Phase 2 train service to Gloucester

	Option 3 Hunts Grove	**Option 4** Charfield	**Option 5** Stonehouse Bristol Rd	**Option 6** Stonehouse North	**Option 7** Charfield & Stonehouse Bristol Road
Net benefits to consumers and private sector (plus tax impacts)					
Rail user journey time benefits	97.30	98.36	101.85	96.35	116.35
Non user benefits – road decongestion	45.29	45.78	47.40	44.84	54.15
Non user– noise, air quality, greenhouse gases & accidents	3.54	2.70	2.78	2.78	3.82
Rail user and non-user disruption dis-benefits during possessions	-1.10	-1.06	-1.10	-1.15	-1.33
Indirect taxation impact on government	-5.04	-5.098	-5.279	-4.99	-6.03
BENEFITS sub-total (a)	139.98	140.69	145.66	137.84	166.97
Wider economic impacts (WIs)	49.46	50.00	51.78	48.98	59.14
BENEFITS sub-total (b) incl WIs	189.44	190.68	197.43	186.81	226.11
Costs to government (broad transport budget)					
Capital costs	30.09	28.87	30.09	31.30	36.15
Non user benefits – road infrastructure cost changes	-0.19	-0.15	-0.15	-0.15	-0.21
Revenue transfer	-86.93	-82.18	-78.56	-73.04	-99.73
Operating costs transfer	108.46	108.46	108.46	108.46	111.68
COSTS sub-total (c)	51.43	55.01	59.85	66.58	47.89
Net Present Value (NPV) (a-c)	88.55	85.68	85.81	71.27	119.07
Benefit Cost Ratio to Govrnmnt (BCR) (a/c)	**2.72**	**2.56**	**2.43**	**2.07**	**3.49**
Net Present Value (NPV) (b-c)	138.01	135.68	137.59	120.24	178.22
Benefit Cost Ratio to Government (BCR) (b/c) incl WIs	**3.68**	**3.47**	**3.30**	**2.81**	**4.72**

Costs and benefits are £m; present values discounted to 2010, in 2010 prices

Note that the analysis of these options has not been carried out to the same level of detail as options 1 and 2. In particular, highway benefits and wider economic impacts were specifically calculated for options 1 and 2, making use of the CSV model to develop figures for the Gloucester and Cheltenham area to augment GBATS3 figures from the WoE area. This has not been done for options 3-7, so non-user (highway) benefits and wider economic impacts for options 3-7 were calculated from option 1, using comparisons with other figures (principally rail user benefits) as the basis for adjustments.

The table indicates that all options can generate benefit cost ratios (BCRs) in excess of 2.0 without Wider Economic Impacts (WIs); and almost all are over 3.0 with WIs included. This is unsurprising when compared to option 1, from which all of these options are derived. While the addition of a new station adds further capital costs to the overall scheme assessed, there is very little additional operating cost (no train operating costs so just the new stations themselves), which is more than off-set by net station revenue.

It should be remembered though that the ability of services assumed to stop at the new stations to actually do so, and at the same time maintain their wider operating schedules, has not been assessed at this stage in terms of timetables and fleet deployment. This could, for instance, result in a need for more rolling stock to maintain the current service with and additional stop, or a reduced service compared to that assumed.

3.2.2 Financial profile

Financial profiles of costs and revenues for options 3-7 over their first three years are shown in Table 7. Figures 5-10 show 10-year profiles of revenue and operating costs for each of the options in turn.

The table indicates that the first three years of operation options with one new station could require between £3m and £4m of support. There is a gradual closing of the gap between revenue and operating costs (highlighted further in the figures) that reaches potential parity before option 1 and 2. With two new stations, around £0.5m is required in support over the first three years, with the third year potentially generating an operating surplus. For all options though, capital costs would be higher, and there is some uncertainty over whether any new stations could be served by existing trains as well as the MetroWest Phase 2 service, which if this proves not to be the case would reduce the overall service level at the new stations from that used in the assessments, and adversely affect economic and financial outcomes.

[Option 3-7 financial profile assumptions [21]]

[21] Note that the profiles show real costs and revenues, and include a number of assumptions:

- Demand and revenue changes in line with a combination of the new stations forecasts and MetroWest future year growth rates
- Revenue also changes in real terms by the current annual fares increase formula of RPI+1
- Values in the table are nominal – with inflation projections included
- Early years ramp-up at new stations included (90% year 1, 95% year 2, 100% year 3 onwards)
- Operating costs (except staff) increase by GDP deflator
- Staff-related operating costs change by nominal earnings growth, with changes to real earnings relative to the GDP deflator
- Revenue from MOIRA increased by 10% to allow for weekend travel (which is not included in initial figures)
- The effect of crowding on demand is not included, because it is not anticipated that peak crowding would be an issue within the first 3 years' of operation illustrated
- The new stations open in the same year (2021) as MetroWest Phase 2 services begin

Table 7: Financial profile – first three years – options 3-7

	Total first 3 years	**2021 opening**	**2022**	**2023**
Option 3 – Hunts Grove				
Total revenue		£3,271,000	£3,764,000	£4,303,000
Total operating cost		£4,590,000	£4,730,000	£4,877,000
Net (-ve = support, +ve = surplus)	-£2,860,000	-£1,319,000	-£966,000	-£574,000
Option 4 – Charfield				
Total revenue		£3,169,000	£3,623,000	£4,115,000
Total operating cost		£4,590,000	£4,730,000	£4,877,000
Net (-ve = support, +ve = surplus)	-£3,290,000	-£1,421,000	-£1,108,000	-£762,000
Option 5 – Stonehouse Bristol Road				
Total revenue		£3,106,000	£3,560,000	£4,053,000
Total operating cost		£4,590,000	£4,730,000	£4,877,000
Net (-ve = support, +ve = surplus)	-£3,479,000	-£1,484,000	-£1,171,000	-£824,000
Option 6 – Stonehouse North				
Total revenue		£2,932,000	£3,359,000	£3,823,000
Total operating cost		£4,590,000	£4,730,000	£4,877,000
Net (-ve = support, +ve = surplus)	-£4,082,000	-£1,657,000	-£1,371,000	-£1,054,000
Option 7 – Charfield & Stonehouse Bristol Road				
Total revenue		£4,143,000	£4,722,000	£5,354,000
Total operating cost		£4,744,000	£4,888,000	£5,038,000
Net (-ve = support, +ve = surplus)	-£452,000	-£602,000	-£166,000	£315,000

Costs and revenues both presented as positive values, rounded to the nearest £'000; nominal values for each year

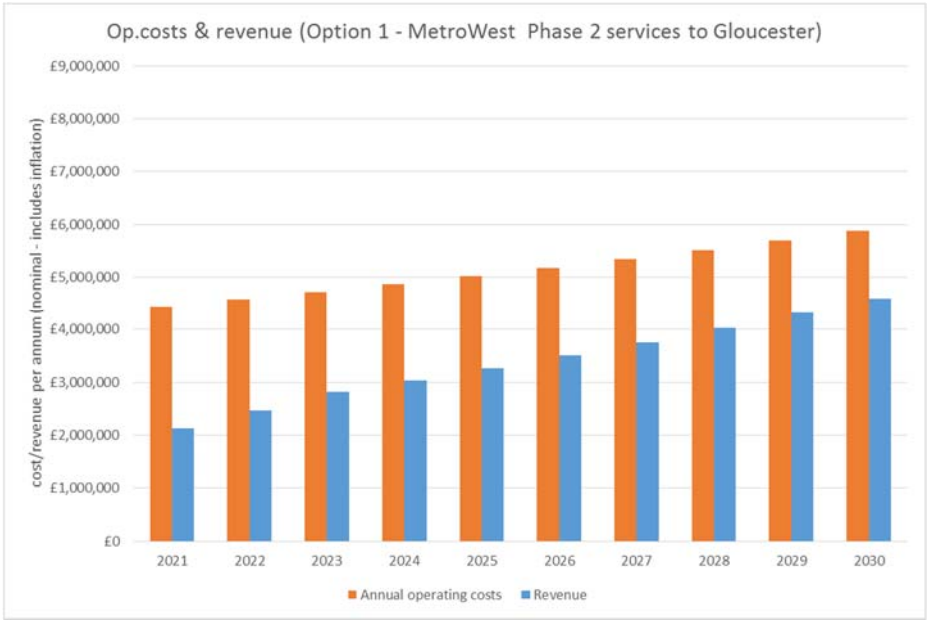

Figure 3. - Revenue and op.costs – option 1 (Gloucester)

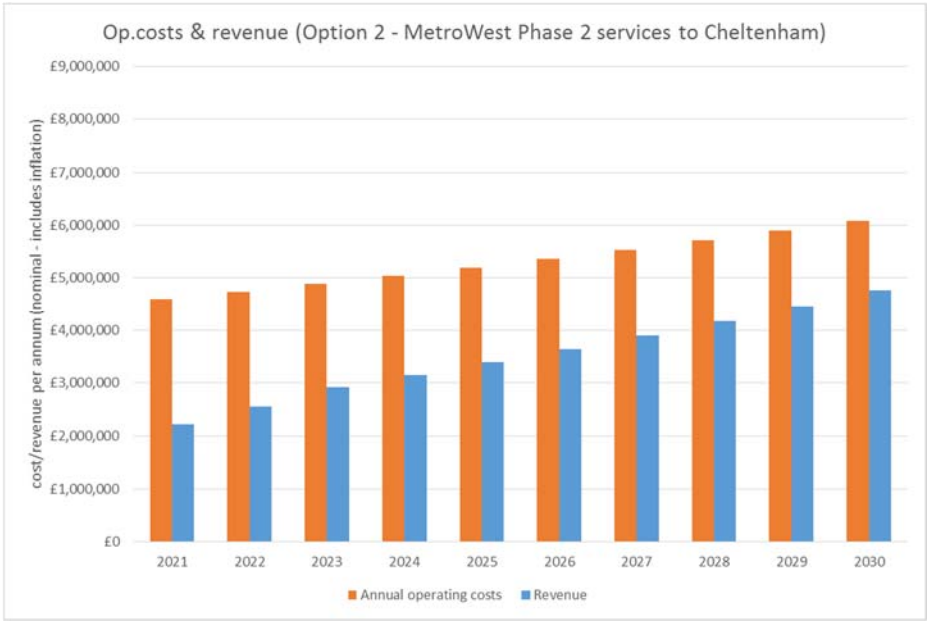

Figure 4. - Revenue and op.costs – option 2 (Cheltenham)

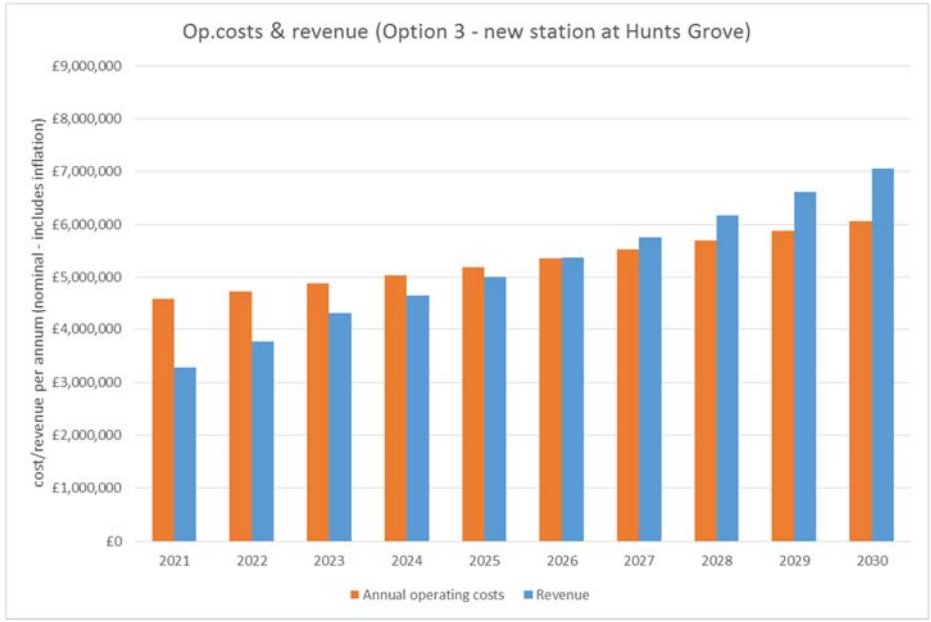

Figure 5. - Revenue and op.costs – option 3 (Hunts Grove)

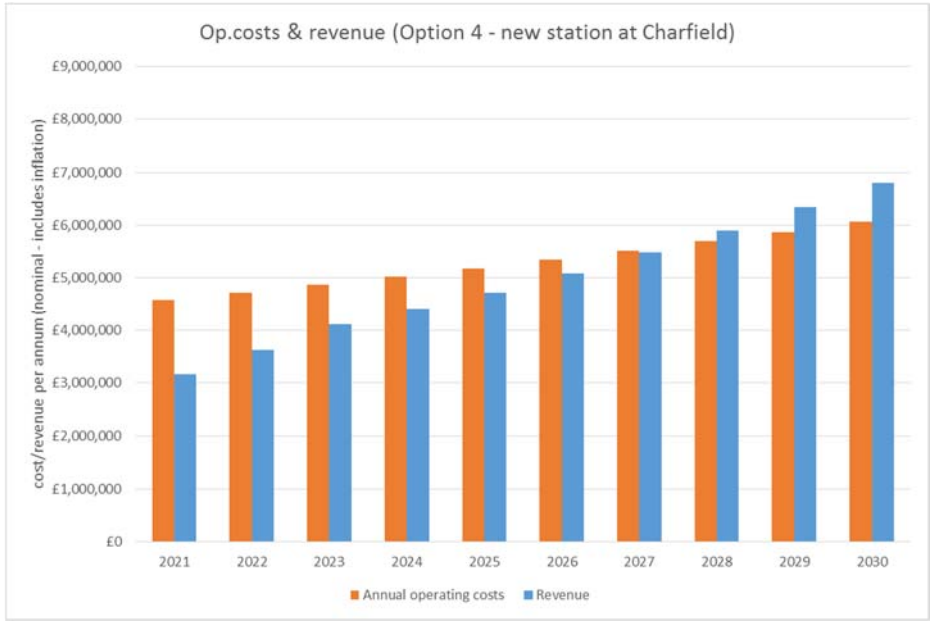

Figure 6. - Revenue and op.costs – option 4 (Charfield)

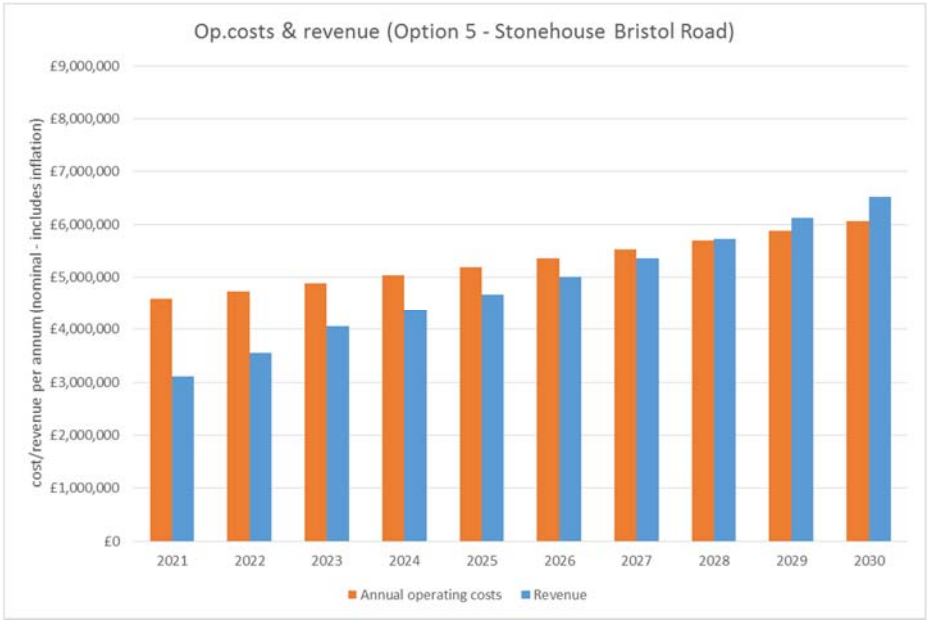

Figure 7. - Revenue and op.costs – option 5 (Stonehouse Bristol Rd)

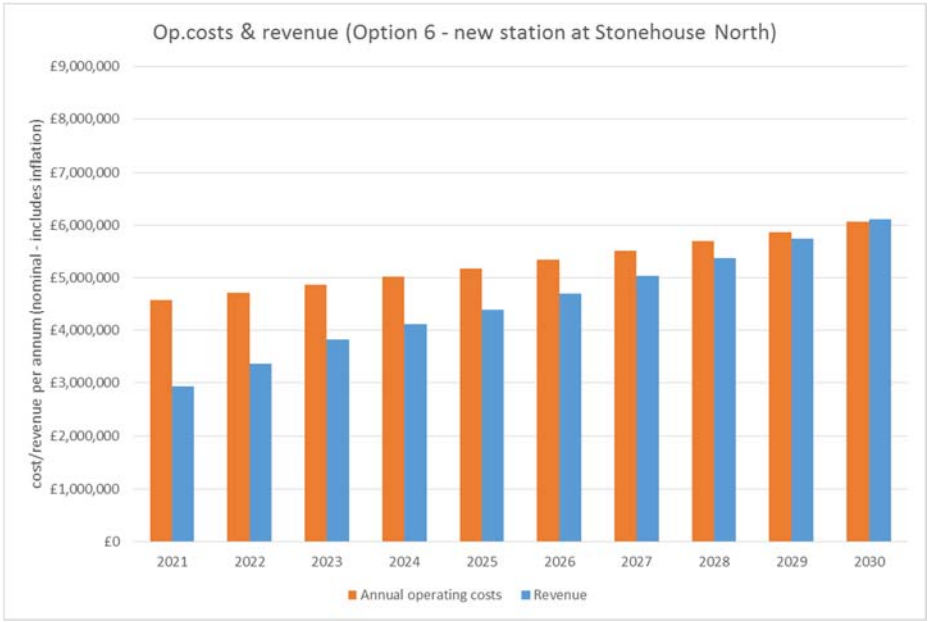

Figure 8. - Revenue and op.costs – option 6 (Stonehouse North)

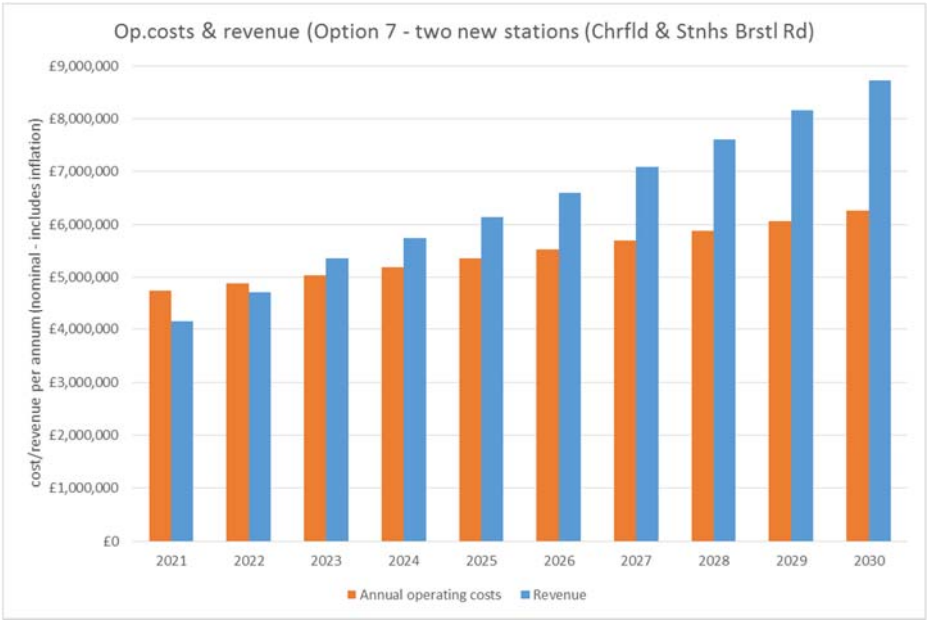

Figure 9. - Revenue and op.costs – option 7 (Charfield & Stonehouse Bristol Rd)

SECTION 4

Next Steps

Overall, this study has identified that there is potential merit in further consideration of MetroWest Phase 2 services running into Gloucestershire, as well as potentially developing new stations between Yate and Gloucester. However, there is some uncertainty over the train services that could actually be provided, particularly at new stations located between Yate and Gloucester, because there has been very limited testing in terms of timetabling or RailSys type operational simulation.

For instance, while there is an apparent theoretical timetable capacity to stop a MetroWest Phase 2 Gloucester service at an extra station with limited or no impact on the overall schedule, it is less clear if this could actually be achieved with one (let alone two) new stations, or if this would still be the case with the MetroWest Phase 2 service running to Cheltenham Spa. As pertinently, because it is inherent in the key assumptions made regarding train services at the new stations, it is also unclear whether existing trains would have time in their schedules to stop at new stations and/or have particular constraints on services that could be provided. If it proves not to be possible to stop all the existing services assumed, and/or there are issues related to stopping MetroWest Phase 2 services, the overall service level at new stations would be lower than assumed in the assessments, adversely affecting demand, and therefore also the economic and financial outcomes of these options.

As such, the key next step should be timetable and operational assessments, to determine what services can be provided, assessing (at minimum) MetroWest Phase 2 services running to Cheltenham, the scope for a MetroWest Phase 2 Gloucester service to stop additionally at new station(s) and the scope for existing services (including Gloucester/Cheltenham services to/from Bristol and Swindon/London).

Performance of the train sets available for the MetroWest Phase 2 service, as well as Great Western Railway franchise services more generally, will need to be considered. As a result of deferment to elements of Great Western Mainline electrification, the intended cascade of Class 165/6 DMUs from the Thames Valley is unlikely to happen as previously anticipated. Some units will be available, but the number that move is likely to be lower. This has an effect in that the Class 165/6 DMUs are both higher capacity and a higher performance than the existing Class 15x DMUs that operate in the West of England and Gloucestershire. Performance characteristics of the Class 165/6 DMUs (in particular acceleration) can help in providing additional station stops.

Relating specifically to new stations, another important assumption in this study was that any new station(s), although delivered through separate project(s), would open at the same time as MetroWest Phase 2 (i.e. 2021). If this cannot happen, this also affects the financial and economic case of station development projects. While 2021 openings are currently still deliverable, it is a challenging timescale that will depend on local circumstances and minimising potential delivery problems (such as access, development in the area and the availability of land). So another step should be to identify any constraints at stations that could delay an opening date. As part of this, more detail should be identified of infrastructure requirements and costs at any station(s) being taken forward.

Appendix A
Gloucestershire New Stations Demand Forecasts

Rail Demand Forecasts for MetroWest in Gloucestershire

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1) Overview of Methodology

This work makes use of 'trip end' rail demand models to forecast the number of passengers expected to use new railway stations. These models were first developed in 2008[22], and then recalibrated using up-to-date data in 2015. These models are capable of producing a high-level forecast of the total passengers per year at a new station on any site. The forecasts produced by this type of model are indicative, and are intended to provide a quick check of the likely viability of a station in a particular site rather than a detailed prediction of travel patterns following station opening. The forecasts from the trip end models do not take into account trip destination, the destinations served by services from a station, or 'atypical' local factors such as sports stadia or tourist attractions whose demand impacts cannot be adequately represented by the model variables. The model results should therefore be considered alongside expert knowledge regarding the local conditions relating to any particular station site. The model used to produce forecasts here is given by Equation 1, with the parameter values used given in Table A-1. When calibrated on 1,513 stations across England and Wales the model had an adjusted R^2 value of 0.822, indicating that it explained 82.2% of the logged variation in the dataset, a very good level of fit for this kind of model.

$$ln\widehat{V}_i = \alpha + \beta_1 ln \sum_a P_a w_a + \beta_2 lnF_i + \beta_3 lnT_i + \beta_4 lnJ_{it2} + \beta_5 lnPk_i + \beta_6 Te_i + \beta_7 El_i + \beta_8 B_i \quad (1)$$

$\widehat{V}_i$ = estimated number of passenger entries and exits per year at station *i*
P_a = resident population in output area *a*
(a,…,n) = output areas whose closest station by car travel time is station *i*
w_a = weight attached to population unit *a*, given by $(t + 1)^{-3.25}$
t = road travel time from population unit *a* to its closest station
F_i = train frequency at station *i* over a normal weekday
T = distance in km from station *i* to the nearest non-local station
J_{i2} = number of jobs located within two minutes' drive of station *i*
Pk_i = number of parking spaces at station *i*
B_i = dummy variable taking the value 1 if Station *i* is a Travelcard boundary station, and 0 otherwise
Te_i = dummy variable taking the value 1 if Station *i* is a terminus, and 0 otherwise
El_i = dummy variable taking the value 1 if Station *i* is served by electric trains, and 0 otherwise
$\alpha, \beta, \delta, \tau, \rho, \eta, \kappa$ and *v* are parameters determined during calibration

Table A-1: Model Parameter Values Used To Produce Forecasts

Variable	Parameter value
Intercept	3.992
Population	0.228
Employment	0.068
Train Frequency	1.294
Distance to Cat A-D Station	0.103
Car Park Size	0.157
Terminus dummy	0.767
Electrification dummy	0.238
Travelcard boundary dummy	0.490

[22] Blainey SP (2010) Trip End Models of Local Rail Demand in England and Wales, *Journal of Transport Geography*, 18(1):153-165

The characteristics of new stations which are therefore required to produce forecasts are as follows:

- Coordinates
- Distance-weighted population
- Jobs within two minutes uncongested drive time
- Service frequency
- Distance to nearest Category A-D station
- Number of car parking spaces

In order to produce demand forecasts these details were entered into an Excel spreadsheet which has been set up to generate trip predictions based on Model (1).

For this project demand forecasts were required for four new stations, at Charfield, Hunts Grove, Stonehouse Bristol Road and Stonehouse North (see Figure 1). Demand forecasts for these stations had previously been produced by TRG in 2015, but these did not take account of the potential extension of the MetroWest project to serve these stations. Revised forecasts have therefore been produced based on an increased level of service on the route following the introduction of these MetroWest services, and using updated planning data on expected future population growth.

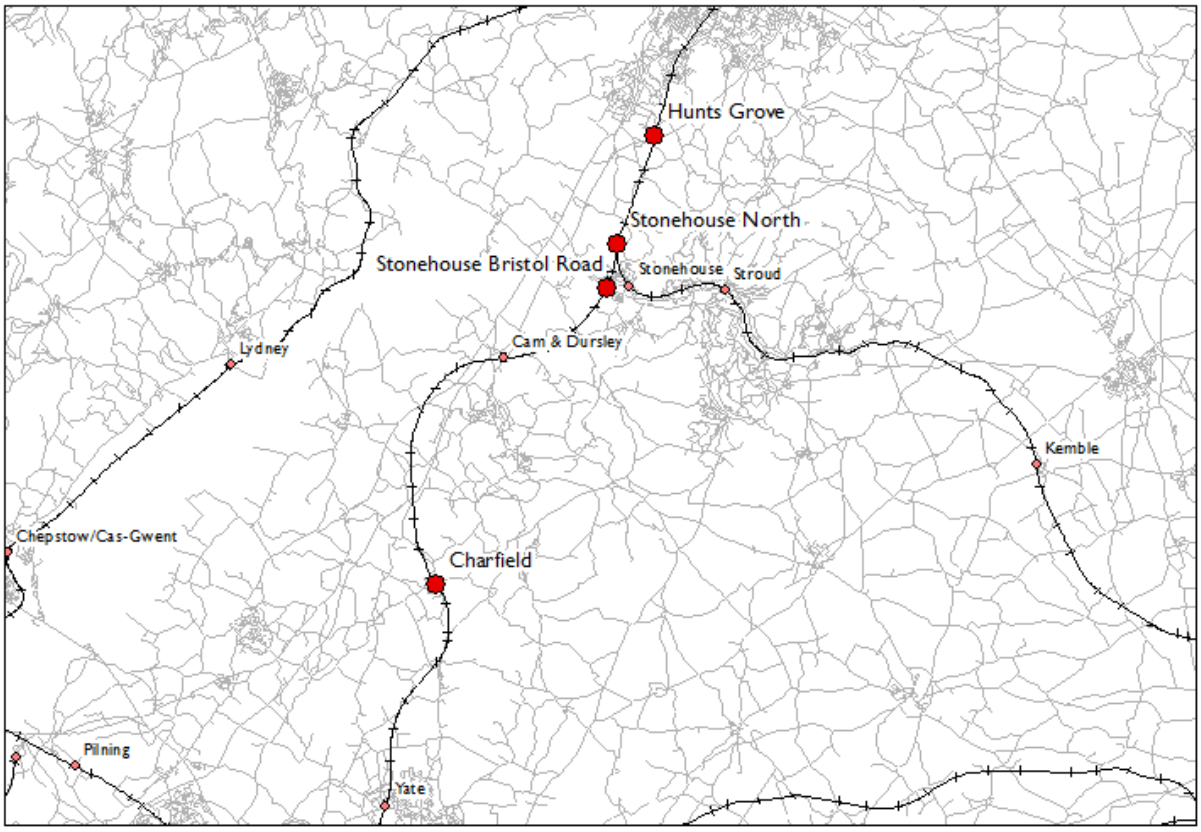

Figure A-1: New Station Locations

2) Demand Forecasts

2.1 Overview

Details of the assumed characteristics of each station are described for each station in turn in the sections below, but there are some features which are common across all six stations:

- All stations are modelled on a mutually exclusive basis (assuming that no other new stations are opened).
- It is assumed that the typical number of trains per hour provided by the client operates from 0600 to 2300 (17 hours per day) when calculating service frequencies.

- Distance-weighted catchment populations for each station were first calculated based on 2011 census data at output area level. In order to provide forecasts for 2015 it was therefore necessary to scale these populations up to 2015 levels. This was done based on data supplied at TEMPRO zone level, although it should be noted that this is extremely coarse scale data, and will therefore not reflect accurately (for example) the effects of a new housing development taking place in the immediate vicinity of a station between 2011 and 2015, as populations will be scaled based on the total population change within the TEMPRO zone that a given output area forms part of. Employment totals for each station catchment were also calculated based on 2011 census data at workplace zone level, and then scaled using TEMPRO data.

Since the previous demand forecasting work for these stations more detailed information on population and employment growth has become available, and this is summarised in Table A-2.

Table A-2: Population and Employment Growth around Proposed Stations

Station	Homes				Jobs			
	<1 km	1-2 km	2-5 km	5-10 km	<1 km	1-2 km	2-5 km	5-10 km
Stonehouse Bristol Rd (2016-2031)	0	1350	0	900	0	2000	0	900
Stonehouse North (2016-2031)	0	0	1350	450	0	0	2000	900
Hunts Grove (2016- 2031)	1750	750	0	0	n/a	n/a	n/a	n/a
Charfield (2026-2036)	1500	0	0	4400	n/a	n/a	n/a	n/a

It has been assumed that the growth in population and employment will be split equally between 2015-2020, 2020-2025, and 2025-2030, with the exception of Charfield where it is assumed that all growth will take place between 2025 and 2030. It was assumed that there would be 2.4 people per home in Charfield (the average household size for South Gloucestershire from the 2011 census), and 2.33 people per home around the Stonehouse stations and Hunts Grove (the average household size for Stroud District from the 2011 census). No new data on employment was available for Hunts Grove and Charfield so TEMPRO data were used as before.

Once an initial demand forecast had been made for 2015, this forecast was then adjusted to account for growth in demand to 2020, 2025 and 2030. These forecasts were made incrementally, with the 2015 figure adjusted first to give a 2020 forecast, and then this latter figure adjusted to give a 2025 forecast (and so on). Underlying growth (see below) was accounted for using a simple multiplier, so for example if aggregate rail demand was predicted to grow by 10% between 2015 and 2020 the 2015 demand figure would be multiplied by 1.1. This demand figure was then further adjusted to account for changes in population and employment using an elasticity-based approach, as recommended in the Passenger Demand Forecasting Handbook[23]. This recommends using an elasticity of 1 for both population and employment, although it should be noted that the employment elasticity relates only to travel by season-ticket holders, with no value given for other types of travel. The change in demand as a result of a change in one of these external factors is given by Equation (2).

$$T_y = T_{y-1}\left(\frac{F_y}{F_{y-1}}\right)^{\eta} \quad (2)$$

Where:

T_y is the number of trips in year y
T_{y-1} is the number of trips in year $y-1$
F_y is the value of external factor F in year y
F_{y-1} is the value of external factor F in year $y-1$
η is the elasticity of demand with respect to external factor F

[23] Association of Train Operating Companies (2013) *Passenger Demand Forecasting Handbook v5.1*, ATOC, London.

As noted above, it was necessary to adjust demand to account for underlying exogenous growth, with the growth rate used based on figures in Network Rail's Regional Urban Market Study[24]. This gives demand growth into regional centres in England for 2022/23 and 2042/43 under four future scenarios, titled 'Prospering in Isolation' (scenario 1), 'Struggling in Isolation' (scenario 2), 'Prospering in Global Stability' (scenario 3) and 'Struggling in Global Turmoil' (scenario 4). It should be noted that these growth forecasts will include the effects of aggregate growth in population and employment, which raises the possibility of double counting, but as no other forecasts were available this appeared unavoidable. Interpolation was used to give growth values for the forecasting years used here (2020, 2025 and 2030), and mean values were also calculated across all four scenarios, allowing five sets of future demand forecasts to be produced for each station. These exogenous demand changes were calculated before elasticities were applied to the results to forecast the effect of changes in population and employment over each five year period, with these forecasts then used as the base for the next five year period of demand change.

The detailed characteristics of the stations and the resulting demand forecasts are summarised in the following sections of this report.

2.2 Hunts Grove

It is assumed that the NE-SW Cross Country services would not call at Hunts Grove, meaning that it would be served by the following services in each direction:

- FGW Cheltenham Spa – Swindon/London (hourly)
- FGW Gloucester – Bristol (half-hourly with MetroWest)

Table A-3: Hunts Grove Station Characteristics

Easting	381900
Northing	212000
Distance-weighted population	98.445
Jobs	231
Service frequency	102
Distance to nearest Category A-D station	8.198
Number of car parking spaces	200

Table A-4: Hunts Grove Population and Employment Change

Year	2015	2020	2025	2030
Population	99.330	224.652	349.974	475.296
Jobs	259.853	257.233	256.302	254.663

Table A-5: Hunts Grove Demand Forecasts

2015	265,369				
Scenario	Mean	1	2	3	4
2020	361,045	344,613	332,208	391,949	375,412
2025	437,179	408,944	379,440	500,402	459,930
2030	501,654	473,658	421,806	592,278	518,875

[24] Network Rail (2013) *Long Term Planning Process: Regional Urban Market Study*, Network Rail, London.

2.3 Stonehouse North

It is assumed that the NE-SW Cross Country services would not call at Stonehouse North, meaning that it would be served by the following services in each direction:

- FGW Cheltenham Spa – Swindon/London (hourly)
- FGW Gloucester – Bristol (half-hourly with MetroWest)

Table A-6: Stonehouse North Station Characteristics

Easting	380200
Northing	207100
Distance-weighted population	79.252
Jobs	279
Service frequency	102
Distance to nearest Category A-D station	6.574
Number of car parking spaces	200

Table A-7: Stonehouse North Population and Employment Change

Year	2015	2020	2025	2030
Population	79.691	84.826	89.961	95.095
Jobs	277.543	277.543	277.543	277.543

Table A-8: Stonehouse North Demand Forecasts

2015	250,078				
Scenario	Mean	1	2	3	4
2020	284,112	271,181	261,419	308,431	295,418
2025	315,224	294,866	273,592	360,811	331,629
2030	341,776	322,702	287,376	403,517	353,508

2.4 Stonehouse Bristol Road

It is assumed that the NE-SW Cross Country services would not call at Stonehouse Bristol Road, meaning that it would be served by the following service in each direction:

- FGW Gloucester – Bristol (half-hourly with MetroWest)

Table A-9: Stonehouse Bristol Road Station Characteristics

Easting	379800
Northing	205400
Distance-weighted population	244.417
Jobs	5102
Service frequency	68
Distance to nearest Category A-D station	5.465
Number of car parking spaces	200

Table A-10: Stonehouse Bristol Road Population and Employment Change

Year	2015	2020	2025	2030
Population	244.806	282.123	319.440	356.756
Jobs	5078.502	5745.169	6411.835	7078.502

Table A-11: Stonehouse Bristol Road Demand Forecasts

2015	228,715				
Scenario	Mean	1	2	3	4
2020	266,591	254,457	245,297	289,410	277,199
2025	302,480	282,945	262,531	346,224	318,222
2030	334,338	315,679	281,122	394,736	345,815

2.5 Charfield

It is assumed that the NE-SW Cross Country services would not call at Charfield, meaning that it would be served by the following service in each direction:

- FGW Gloucester – Bristol (half-hourly with MetroWest)

Table A-12: Charfield Station Characteristics

Easting	372300
Northing	192200
Distance-weighted population	367.972
Jobs	332
Service frequency	68
Distance to nearest Category A-D station	18.826
Number of car parking spaces	100

Table A-13: Charfield Population and Employment Change

Year	2015	2020	2025	2030
Population	379.978	379.978	379.978	663.522
Jobs	320.551	330.709	338.259	344.168

Table A-14: Charfield Demand Forecasts

2015	212,414				
Scenario	Mean	1	2	3	4
2020	239,379	228,484	220,259	259,869	248,905
2025	262,459	245,508	227,795	300,414	276,117
2030	319,447	301,619	268,601	377,155	330,413

Appendix B
Detailed Results Tables

Option 1 & 2

TEE, PA & AMCB

Options 1-7

10-year financial profiles

Option 1: Gloucester turnaround – TEE, PA & AMCB

Economy:Economic Efficiency of the Transport System(TEE)

Consumer - Commuting user benefits	**All Modes**	**Road**	**Bus**	**Rail**
Travel Time	66,603	12,584	0	54,019
Vehicle operating costs	4,009	4,009	0	0
User charges	322	322	0	0
During Construction & Maintenance	-209	-19	0	-190
NET CONSUMER - COMMUTING BENEFITS	**70,725**	**16,896**	**0**	**53,829**
Consumer - Other user benefits	**All Modes**	**Road**	**Bus**	**Rail**
Travel Time	29,582	5,589	0	23,992
Vehicle operating costs	1,781	1,781	0	0
User charges	143	143	0	0
During Construction & Maintenance	-209	-19	0	-190
NET CONSUMER - OTHER BENEFITS	**31,296**	**7,494**	**0**	**23,802**

Business	All Modes	Personal	Freight	Personal	Freight	Personal	Freight
Travel Time	18,850	8,112	4,841	0	0	5,896	0
Vehicle operating costs	1,112	569	543	0	0	0	0
User charges	560	137	423	0	0	0	0
During Construction & Maintenance	-418	-38	0	0	0	-380	0
Subtotal	**20,103**	**8,781**	**5,806**	**0**	**0**	**5,516**	**0**

Private Sector Provider Impacts				
Revenue	0	0	0	0
Operating costs	0	0	0	0
Investment costs	0	0	0	0
Grant/subsidy	0	0	0	0
Subtotal	**0**	**0**	**0**	**0**
Other business Impacts				
Developer contributions	0	0	0	0
NET BUSINESS IMPACT	**20,103**			
TOTAL				
Present Value of Transport Economic **Efficiency Benefits (TEE)**	**122,124**			

Note: Benefits appear as positive numbers, while costs appear as negative numbers.
Note: All entries are present values discounted to 2010, in 2010 prices

Public Accounts

Local Government Funding	**ALL MODES**	**Road**	**Bus**	**Rail**
Revenue	0	0	0	0
Operating Costs	-89	-89	0	0
Investment Costs	0	0	0	0
Developer Contributions	0	0	0	0
Grant/Subsidy Payments	22,808	0	0	22,808
NET IMPACT	**22,719**	**-89**	**0**	**22,808**
Central Government Funding: Transport	**ALL MODES**	**Road**	**Bus**	**Rail**
Revenue	-60,936	0	0	-60,936
Operating costs	105,253	0	0	105,253
Investment costs	0	0	0	0
Developer Contributions	0	0	0	0
Grant/Subsidy Payments	0	0	0	0
NET IMPACT	**44,317**	**0**	**0**	**44,317**
Central Government Funding: Non-Transport				
Indirect Tax Revenues	4,349	4,349	0	0
TOTALS				
Broad Transport Budget	67,036	-89	0	67,125
Wider Public Finances	4,349	4,349	0	0

Note: Costs appear as positive numbers, while revenues and developer contributions appear as negative numbers.
Note: All entries are present values discounted to 2010, in 2010 prices

Analysis of Monetised Costs and Benefits

Noise, air quality & greenhouse gases	1,660
Economic Efficiency: Consumer Users (Commuting)	70,725
Economic Efficiency: Consumer Users (Other)	31,296
Economic Efficiency: Business Users and Providers	20,103
Wider Public Finances (Indirect Taxation Revenues)	-4,349
Present Value of Benefits (PVB)	**119,435**
Broad Transport Budget	67,036
Present Value of Costs (PVC)	**67,036**
OVERALL IMPACTS	
Net Present Value (NPV)	**52,399**
Benefit to Cost Ratio (BCR)	**1.78**

including WIDER IMPACTS

Greenhouse gases	517	
Noise	71	
Local Air Quality	-	not assessed
Journey Ambience	-	not assessed
Accidents	1,073	
Reliability	-	not assessed
Rail environment	-	not assessed
Wider Impacts	42,652	
Final PVB	162,087	
PVC	67,036	
NPV	95,051	
BCR	**2.42**	

Note: This table includes costs and benefits which are regularly or occasionally presented in monetised form in transport appraisals, together with some where monetisation is in prospect. There may also be other significant costs and benefits, some of which cannot be presented in monetised form. Where this is the case, the analysis presented above does NOT provide a good measure of value for money and should not be used as the sole basis for decisions.

Option 2: Cheltenham turnaround – TEE, PA & AMCB

Economy:Economic Efficiency of the Transport System(TEE)

Consumer - Commuting user benefits	**All Modes**	**Road**	**Bus**	**Rail**
Travel Time	69,458	11,287	0	58,171
Vehicle operating costs	4,063	4,063	0	0
User charges	719	719	0	0
During Construction & Maintenance	-209	-19	0	-190
NET CONSUMER - COMMUTING BENEFITS	**74,031**	**16,050**	**0**	**57,980**
Consumer - Other user benefits	**All Modes**	**Road**	**Bus**	**Rail**
Travel Time	32,189	5,231	0	26,958
Vehicle operating costs	1,883	1,883	0	0
User charges	333	333	0	0
During Construction & Maintenance	-209	-19	0	-190
NET CONSUMER - OTHER BENEFITS	**34,196**	**7,428**	**0**	**26,768**

Business	All Modes	Personal	Freight	Personal	Freight	Personal	Freight
Travel Time	20,634	9,048	5,113	0	0	6,473	0
Vehicle operating costs	1,148	538	610	0	0	0	0
User charges	548	241	307	0	0	0	0
During Construction & Maintenance	-418	-38	0	0	0	-380	0
Subtotal	**21,911**	**9,788**	**6,030**	**0**	**0**	**6,093**	**0**

Private Sector Provider Impacts				
Revenue	0	0	0	0
Operating costs	0	0	0	0
Investment costs	0	0	0	0
Grant/subsidy	0	0	0	0
Subtotal	**0**	**0**	**0**	**0**
Other business Impacts				
Developer contributions	0	0	0	0
NET BUSINESS IMPACT	**21,911**			
TOTAL				
Present Value of Transport Economic **Efficiency Benefits (TEE)**	**130,138**			

Note: Benefits appear as positive numbers, while costs appear as negative numbers.
Note: All entries are present values discounted to 2010, in 2010 prices

Public Accounts

Local Government Funding	**ALL MODES**	**Road**	**Bus**	**Rail**
Revenue	0	0	0	0
Operating Costs	-99	-99	0	0
Investment Costs	0	0	0	0
Developer Contributions	0	0	0	0
Grant/Subsidy Payments	22,808	0	0	22,808
NET IMPACT	**22,709**	**-99**	**0**	**22,808**
Central Government Funding: Transport	**ALL MODES**	**Road**	**Bus**	**Rail**
Revenue	-63,322	0	0	-63,322
Operating costs	108,315	0	0	108,315
Investment costs	0	0	0	0
Developer Contributions	0	0	0	0
Grant/Subsidy Payments	0	0	0	0
NET IMPACT	**44,993**	**0**	**0**	**44,993**
Central Government Funding: Non-Transport				
Indirect Tax Revenues	4,226	4,226	0	0
TOTALS				
Broad Transport Budget	67,702	-99	0	67,801
Wider Public Finances	4,226	4,226	0	0

Note: Costs appear as positive numbers, while revenues and developer contributions appear as negative numbers.
Note: All entries are present values discounted to 2010, in 2010 prices

Analysis of Monetised Costs and Benefits

Noise, air quality & greenhouse gases	1,848
Economic Efficiency: Consumer Users (Commuting)	74,031
Economic Efficiency: Consumer Users (Other)	34,196
Economic Efficiency: Business Users and Providers	21,911
Wider Public Finances (Indirect Taxation Revenues)	-4,226
Present Value of Benefits (PVB)	**127,760**
Broad Transport Budget	67,702
Present Value of Costs (PVC)	**67,702**
OVERALL IMPACTS	
Net Present Value (NPV)	**60,059**
Benefit to Cost Ratio (BCR)	**1.89**

including WIDER IMPACTS

Greenhouse gases	575	
Noise	79	
Local Air Quality	-	not assessed
Journey Ambience	-	not assessed
Accidents	1,195	
Reliability	-	not assessed
Rail environment	-	not assessed
Wider Impacts	44,325	
Final PVB	172,085	
PVC	67,702	
NPV	104,384	
BCR	**2.54**	

Note: This table includes costs and benefits which are regularly or occasionally presented in monetised form in transport appraisals, together with some where monetisation is in prospect. There may also be other significant costs and benefits, some of which cannot be presented in monetised form. Where this is the case, the analysis presented above does NOT provide a good measure of value for money and should not be used as the sole basis for decisions.

Option 1: Gloucester turnaround – Financial Profile (nominal)

Option 1 - Gloucester		**first 3 years operation subsidy**	-£6,317,000	*+ve = surplus*						
	YEAR	OPENING YEAR *2021*	*2022*	*2023*	*2024*	*2025*	*2026*	*2027*	*2028*	*2029*	*2030*
REVENUE											
INITIAL	Henbury	£738,000	£791,000	£844,000	£900,000	£960,000	£1,022,000	£1,089,000	£1,159,000	£1,233,000	£1,311,000
including demand growth	North Filton	£643,000	£689,000	£735,000	£784,000	£835,000	£890,000	£948,000	£1,009,000	£1,073,000	£1,141,000
and ticket price growth	Ashley Down	£427,000	£458,000	£488,000	£521,000	£555,000	£592,000	£630,000	£670,000	£713,000	£758,000
	Existing stations (NET)	£780,000	£836,000	£892,000	£952,000	£1,014,000	£1,081,000	£1,151,000	£1,225,000	£1,303,000	£1,385,000
	sub-total	£2,589,000	£2,774,000	£2,960,000	£3,156,000	£3,364,000	£3,584,000	£3,817,000	£4,062,000	£4,322,000	£4,595,000
	ramp-up used in profile	90%	95%	100%	100%	100%	100%	100%	100%	100%	100%
	Henbury CPNN build-out effect	86%	89%	92%	94%	95%	96%	97%	98%	100%	100%
	North Filton - CPNN build-out effect	82%	86%	90%	92%	94%	95%	97%	98%	99%	100%
FINAL	Henbury	£570,000	£667,000	£775,000	£843,000	£910,000	£982,000	£1,059,000	£1,141,000	£1,227,000	£1,311,000
net of ramp-up and	North Filton	£476,000	£563,000	£660,000	£722,000	£782,000	£847,000	£916,000	£989,000	£1,067,000	£1,141,000
CPNN build-out	Ashley Down	£385,000	£435,000	£488,000	£521,000	£555,000	£592,000	£630,000	£670,000	£713,000	£758,000
	Existing stations (NET)	£702,000	£794,000	£892,000	£952,000	£1,014,000	£1,081,000	£1,151,000	£1,225,000	£1,303,000	£1,385,000
TOTAL revenue		£2,132,000	£2,460,000	£2,815,000	£3,038,000	£3,262,000	£3,501,000	£3,755,000	£4,025,000	£4,311,000	£4,595,000
OPERATING COST											
INCORPORATING											
nominal earnings growth and GDP deflator											
TOC staff + Nominal Earnings Growth		£1,735,000	£1,811,000	£1,891,000	£1,975,000	£2,063,000	£2,155,000	£2,251,000	£2,351,000	£2,456,000	£2,565,000
TOC veh lease + GDP Deflator		£1,111,000	£1,136,000	£1,161,000	£1,188,000	£1,215,000	£1,243,000	£1,272,000	£1,301,000	£1,331,000	£1,362,000
TOC veh op costs (mileage) + GDP Deflator		£1,128,000	£1,153,000	£1,179,000	£1,206,000	£1,234,000	£1,263,000	£1,292,000	£1,321,000	£1,352,000	£1,383,000
TOC stations op costs + GDP Deflator		£463,000	£473,000	£484,000	£495,000	£506,000	£518,000	£530,000	£542,000	£554,000	£567,000
Infrastructure maint allocated to WoE + GDP Deflator		£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -
TOTAL operating costs		£4,436,000	£4,573,000	£4,716,000	£4,865,000	£5,019,000	£5,179,000	£5,345,000	£5,516,000	£5,693,000	£5,877,000
NET SUBSIDY		-£2,303,000	-£2,113,000	-£1,901,000	-£1,827,000	-£1,757,000	-£1,678,000	-£1,589,000	-£1,491,000	-£1,383,000	-£1,282,000

Option 2: Cheltenham turnaround – Financial Profile (nominal)

Option 2 - Cheltenham		**first 3 years operation subsidy**	-£6,545,000	*+ve = surplus*						
	YEAR	OPENING YEAR *2021*	*2022*	*2023*	*2024*	*2025*	*2026*	*2027*	*2028*	*2029*	*2030*
REVENUE											
INITIAL	Henbury	£738,000	£791,000	£844,000	£900,000	£960,000	£1,022,000	£1,089,000	£1,159,000	£1,233,000	£1,311,000
including demand growth	North Filton	£643,000	£689,000	£735,000	£784,000	£835,000	£890,000	£948,000	£1,009,000	£1,073,000	£1,141,000
and ticket price growth	Ashley Down	£427,000	£458,000	£488,000	£521,000	£555,000	£592,000	£630,000	£670,000	£713,000	£758,000
	Existing stations (NET)	£876,000	£938,000	£1,001,000	£1,068,000	£1,138,000	£1,213,000	£1,291,000	£1,374,000	£1,462,000	£1,555,000
	sub-total	£2,684,000	£2,876,000	£3,069,000	£3,273,000	£3,488,000	£3,716,000	£3,957,000	£4,212,000	£4,481,000	£4,764,000
	ramp-up used in profile	90%	95%	100%	100%	100%	100%	100%	100%	100%	100%
	Henbury CPNN build-out effect	86%	89%	92%	94%	95%	96%	97%	98%	100%	100%
	North Filton - CPNN build-out effect	82%	86%	90%	92%	94%	95%	97%	98%	99%	100%
FINAL	Henbury	£570,000	£667,000	£775,000	£843,000	£910,000	£982,000	£1,059,000	£1,141,000	£1,227,000	£1,311,000
net of ramp-up and	North Filton	£476,000	£563,000	£660,000	£722,000	£782,000	£847,000	£916,000	£989,000	£1,067,000	£1,141,000
CPNN build-out	Ashley Down	£385,000	£435,000	£488,000	£521,000	£555,000	£592,000	£630,000	£670,000	£713,000	£758,000
	Existing stations (NET)	£788,000	£891,000	£1,001,000	£1,068,000	£1,138,000	£1,213,000	£1,291,000	£1,374,000	£1,462,000	£1,555,000
TOTAL revenue		£2,218,000	£2,557,000	£2,924,000	£3,154,000	£3,386,000	£3,633,000	£3,896,000	£4,175,000	£4,470,000	£4,764,000
OPERATING COST											
INCORPORATING											
nominal earnings growth and GDP deflator											
TOC staff + Nominal Earnings Growth		£1,735,000	£1,811,000	£1,891,000	£1,975,000	£2,063,000	£2,155,000	£2,251,000	£2,351,000	£2,456,000	£2,565,000
TOC veh lease + GDP Deflator		£1,111,000	£1,136,000	£1,161,000	£1,188,000	£1,215,000	£1,243,000	£1,272,000	£1,301,000	£1,331,000	£1,362,000
TOC veh op costs (mileage) + GDP Deflator		£1,297,000	£1,326,000	£1,357,000	£1,388,000	£1,420,000	£1,452,000	£1,486,000	£1,520,000	£1,555,000	£1,591,000
TOC stations op costs + GDP Deflator		£463,000	£473,000	£484,000	£495,000	£506,000	£518,000	£530,000	£542,000	£554,000	£567,000
Infrastructure maint allocated to WoE + GDP Deflator		£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -
TOTAL operating costs		£4,605,000	£4,746,000	£4,893,000	£5,046,000	£5,205,000	£5,369,000	£5,539,000	£5,714,000	£5,896,000	£6,085,000
NET SUBSIDY		-£2,387,000	-£2,189,000	-£1,969,000	-£1,892,000	-£1,819,000	-£1,736,000	-£1,643,000	-£1,540,000	-£1,427,000	-£1,320,000

Option 3: Gloucester turnaround & Hunts Grove station – Financial Profile (nominal)

Option 3 - Gloucester & NEW Stn		**first 3 years operation subsidy**	-£2,386,000	*+ve = surplus*						
Hunts Grove		OPENING YEAR								
	YEAR	*2021*	*2022*	*2023*	*2024*	*2025*	*2026*	*2027*	*2028*	*2029*	*2030*
REVENUE											
INITIAL	Henbury	£738,000	£791,000	£844,000	£900,000	£960,000	£1,022,000	£1,089,000	£1,159,000	£1,233,000	£1,311,000
including demand growth	North Filton	£643,000	£689,000	£735,000	£784,000	£835,000	£890,000	£948,000	£1,009,000	£1,073,000	£1,141,000
and ticket price growth	Ashley Down	£427,000	£458,000	£488,000	£521,000	£555,000	£592,000	£630,000	£670,000	£713,000	£758,000
	Hunts Grove	£1,265,000	£1,373,000	£1,488,000	£1,610,000	£1,740,000	£1,868,000	£2,004,000	£2,148,000	£2,302,000	£2,464,000
	Existing stations (NET)	£780,000	£836,000	£892,000	£952,000	£1,014,000	£1,081,000	£1,151,000	£1,225,000	£1,303,000	£1,385,000
	sub-total	£3,854,000	£4,147,000	£4,447,000	£4,766,000	£5,104,000	£5,452,000	£5,821,000	£6,211,000	£6,623,000	£7,059,000
	ramp-up used in profile	90%	95%	100%	100%	100%	100%	100%	100%	100%	100%
	Henbury CPNN build-out effect	86%	89%	92%	94%	95%	96%	97%	98%	100%	100%
	North Filton - CPNN build-out effect	82%	86%	90%	92%	94%	95%	97%	98%	99%	100%
FINAL	Henbury	£570,000	£667,000	£775,000	£843,000	£910,000	£982,000	£1,059,000	£1,141,000	£1,227,000	£1,311,000
net of ramp-up and	North Filton	£476,000	£563,000	£660,000	£722,000	£782,000	£847,000	£916,000	£989,000	£1,067,000	£1,141,000
CPNN build-out	Ashley Down	£385,000	£435,000	£488,000	£521,000	£555,000	£592,000	£630,000	£670,000	£713,000	£758,000
	Hunts Grove	£1,139,000	£1,304,000	£1,488,000	£1,610,000	£1,740,000	£1,868,000	£2,004,000	£2,148,000	£2,302,000	£2,464,000
	Existing stations (NET)	£702,000	£794,000	£892,000	£952,000	£1,014,000	£1,081,000	£1,151,000	£1,225,000	£1,303,000	£1,385,000
TOTAL revenue		£3,271,000	£3,764,000	£4,303,000	£4,647,000	£5,002,000	£5,369,000	£5,759,000	£6,174,000	£6,612,000	£7,059,000
OPERATING COST											
INCORPORATING											
nominal earnings growth and GDP deflator											
TOC staff + Nominal Earnings Growth		£1,735,000	£1,811,000	£1,891,000	£1,975,000	£2,063,000	£2,155,000	£2,251,000	£2,351,000	£2,456,000	£2,565,000
TOC veh lease + GDP Deflator		£1,111,000	£1,136,000	£1,161,000	£1,188,000	£1,215,000	£1,243,000	£1,272,000	£1,301,000	£1,331,000	£1,362,000
TOC veh op costs (mileage) + GDP Deflator		£1,128,000	£1,153,000	£1,179,000	£1,206,000	£1,234,000	£1,263,000	£1,292,000	£1,321,000	£1,352,000	£1,383,000
TOC stations op costs + GDP Deflator		£463,000	£473,000	£484,000	£495,000	£506,000	£518,000	£530,000	£542,000	£554,000	£567,000
Infrastructure maint allocated to WoE + GDP Deflator		£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -
TOTAL operating costs		£4,436,000	£4,573,000	£4,716,000	£4,865,000	£5,019,000	£5,179,000	£5,345,000	£5,516,000	£5,693,000	£5,877,000
NET SUBSIDY		-£1,165,000	-£809,000	-£413,000	-£217,000	-£18,000	£190,000	£415,000	£658,000	£919,000	£1,182,000

Option 4: Gloucester turnaround & Charfield station – Financial Profile (nominal)

Option 4 - Gloucester & NEW Stn		**first 3 years operation subsidy**	-£2,817,000	*+ve = surplus*						
Charfield		OPENING YEAR								
	YEAR	*2021*	*2022*	*2023*	*2024*	*2025*	*2026*	*2027*	*2028*	*2029*	*2030*
REVENUE											
INITIAL	Henbury	£738,000	£791,000	£844,000	£900,000	£960,000	£1,022,000	£1,089,000	£1,159,000	£1,233,000	£1,311,000
including demand growth	North Filton	£643,000	£689,000	£735,000	£784,000	£835,000	£890,000	£948,000	£1,009,000	£1,073,000	£1,141,000
and ticket price growth	Ashley Down	£427,000	£458,000	£488,000	£521,000	£555,000	£592,000	£630,000	£670,000	£713,000	£758,000
	Charfield	£1,152,000	£1,224,000	£1,300,000	£1,381,000	£1,466,000	£1,596,000	£1,734,000	£1,880,000	£2,036,000	£2,203,000
	Existing stations (NET)	£780,000	£836,000	£892,000	£952,000	£1,014,000	£1,081,000	£1,151,000	£1,225,000	£1,303,000	£1,385,000
	sub-total	£3,740,000	£3,998,000	£4,260,000	£4,537,000	£4,830,000	£5,180,000	£5,550,000	£5,943,000	£6,358,000	£6,798,000
	ramp-up used in profile	90%	95%	100%	100%	100%	100%	100%	100%	100%	100%
	Henbury CPNN build-out effect	86%	89%	92%	94%	95%	96%	97%	98%	100%	100%
	North Filton - CPNN build-out effect	82%	86%	90%	92%	94%	95%	97%	98%	99%	100%
FINAL	Henbury	£570,000	£667,000	£775,000	£843,000	£910,000	£982,000	£1,059,000	£1,141,000	£1,227,000	£1,311,000
net of ramp-up and	North Filton	£476,000	£563,000	£660,000	£722,000	£782,000	£847,000	£916,000	£989,000	£1,067,000	£1,141,000
CPNN build-out	Ashley Down	£385,000	£435,000	£488,000	£521,000	£555,000	£592,000	£630,000	£670,000	£713,000	£758,000
	Charfield	£1,037,000	£1,163,000	£1,300,000	£1,381,000	£1,466,000	£1,596,000	£1,734,000	£1,880,000	£2,036,000	£2,203,000
	Existing stations (NET)	£702,000	£794,000	£892,000	£952,000	£1,014,000	£1,081,000	£1,151,000	£1,225,000	£1,303,000	£1,385,000
TOTAL revenue		£3,169,000	£3,623,000	£4,115,000	£4,419,000	£4,728,000	£5,097,000	£5,489,000	£5,905,000	£6,347,000	£6,798,000
OPERATING COST											
INCORPORATING											
nominal earnings growth and GDP deflator											
TOC staff + Nominal Earnings Growth		£1,735,000	£1,811,000	£1,891,000	£1,975,000	£2,063,000	£2,155,000	£2,251,000	£2,351,000	£2,456,000	£2,565,000
TOC veh lease + GDP Deflator		£1,111,000	£1,136,000	£1,161,000	£1,188,000	£1,215,000	£1,243,000	£1,272,000	£1,301,000	£1,331,000	£1,362,000
TOC veh op costs (mileage) + GDP Deflator		£1,128,000	£1,153,000	£1,179,000	£1,206,000	£1,234,000	£1,263,000	£1,292,000	£1,321,000	£1,352,000	£1,383,000
TOC stations op costs + GDP Deflator		£463,000	£473,000	£484,000	£495,000	£506,000	£518,000	£530,000	£542,000	£554,000	£567,000
Infrastructure maint allocated to WoE + GDP Deflator		£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -
TOTAL operating costs		£4,436,000	£4,573,000	£4,716,000	£4,865,000	£5,019,000	£5,179,000	£5,345,000	£5,516,000	£5,693,000	£5,877,000
NET SUBSIDY		-£1,267,000	-£950,000	-£600,000	-£446,000	-£291,000	-£82,000	£144,000	£390,000	£654,000	£921,000

Option 5: Gloucester turnaround & Stonehouse Bristol Road station – Financial Profile (nominal)

Option 5 - Gloucester & NEW Stn		**first 3 years operation subsidy**	-£3,006,000	*+ve = surplus*						
Stonehouse Bristol Rd		OPENING YEAR								
	YEAR	*2021*	*2022*	*2023*	*2024*	*2025*	*2026*	*2027*	*2028*	*2029*	*2030*
REVENUE											
INITIAL	Henbury	£738,000	£791,000	£844,000	£900,000	£960,000	£1,022,000	£1,089,000	£1,159,000	£1,233,000	£1,311,000
including demand growth	North Filton	£643,000	£689,000	£735,000	£784,000	£835,000	£890,000	£948,000	£1,009,000	£1,073,000	£1,141,000
and ticket price growth	Ashley Down	£427,000	£458,000	£488,000	£521,000	£555,000	£592,000	£630,000	£670,000	£713,000	£758,000
	Stonehouse Bristol Rd	£1,082,000	£1,158,000	£1,238,000	£1,324,000	£1,414,000	£1,506,000	£1,603,000	£1,706,000	£1,815,000	£1,929,000
	Existing stations (NET)	£780,000	£836,000	£892,000	£952,000	£1,014,000	£1,081,000	£1,151,000	£1,225,000	£1,303,000	£1,385,000
	sub-total	£3,670,000	£3,932,000	£4,198,000	£4,480,000	£4,778,000	£5,090,000	£5,420,000	£5,768,000	£6,136,000	£6,525,000
	ramp-up used in profile	90%	95%	100%	100%	100%	100%	100%	100%	100%	100%
	Henbury CPNN build-out effect	86%	89%	92%	94%	95%	96%	97%	98%	100%	100%
	North Filton - CPNN build-out effect	82%	86%	90%	92%	94%	95%	97%	98%	99%	100%
FINAL	Henbury	£570,000	£667,000	£775,000	£843,000	£910,000	£982,000	£1,059,000	£1,141,000	£1,227,000	£1,311,000
net of ramp-up and	North Filton	£476,000	£563,000	£660,000	£722,000	£782,000	£847,000	£916,000	£989,000	£1,067,000	£1,141,000
CPNN build-out	Ashley Down	£385,000	£435,000	£488,000	£521,000	£555,000	£592,000	£630,000	£670,000	£713,000	£758,000
	Stonehouse Bristol Rd	£973,000	£1,100,000	£1,238,000	£1,324,000	£1,414,000	£1,506,000	£1,603,000	£1,706,000	£1,815,000	£1,929,000
	Existing stations (NET)	£702,000	£794,000	£892,000	£952,000	£1,014,000	£1,081,000	£1,151,000	£1,225,000	£1,303,000	£1,385,000
TOTAL revenue		£3,106,000	£3,560,000	£4,053,000	£4,361,000	£4,676,000	£5,007,000	£5,358,000	£5,731,000	£6,125,000	£6,525,000
OPERATING COST											
INCORPORATING											
nominal earnings growth and GDP deflator											
TOC staff + Nominal Earnings Growth		£1,735,000	£1,811,000	£1,891,000	£1,975,000	£2,063,000	£2,155,000	£2,251,000	£2,351,000	£2,456,000	£2,565,000
TOC veh lease + GDP Deflator		£1,111,000	£1,136,000	£1,161,000	£1,188,000	£1,215,000	£1,243,000	£1,272,000	£1,301,000	£1,331,000	£1,362,000
TOC veh op costs (mileage) + GDP Deflator		£1,128,000	£1,153,000	£1,179,000	£1,206,000	£1,234,000	£1,263,000	£1,292,000	£1,321,000	£1,352,000	£1,383,000
TOC stations op costs + GDP Deflator		£463,000	£473,000	£484,000	£495,000	£506,000	£518,000	£530,000	£542,000	£554,000	£567,000
Infrastructure maint allocated to WoE + GDP Deflator		£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -
TOTAL operating costs		£4,436,000	£4,573,000	£4,716,000	£4,865,000	£5,019,000	£5,179,000	£5,345,000	£5,516,000	£5,693,000	£5,877,000
NET SUBSIDY		-£1,330,000	-£1,013,000	-£662,000	-£504,000	-£343,000	-£172,000	£14,000	£215,000	£432,000	£648,000

Option 6: Gloucester turnaround & Stonehouse North station – Financial Profile (nominal)

Option 6 - Gloucester & NEW Stn		**first 3 years operation subsidy**	-£3,609,000	*+ve = surplus*						
Stonehouse North		OPENING YEAR								
	YEAR	*2021*	*2022*	*2023*	*2024*	*2025*	*2026*	*2027*	*2028*	*2029*	*2030*
REVENUE											
INITIAL	Henbury	£738,000	£791,000	£844,000	£900,000	£960,000	£1,022,000	£1,089,000	£1,159,000	£1,233,000	£1,311,000
including demand growth	North Filton	£643,000	£689,000	£735,000	£784,000	£835,000	£890,000	£948,000	£1,009,000	£1,073,000	£1,141,000
and ticket price growth	Ashley Down	£427,000	£458,000	£488,000	£521,000	£555,000	£592,000	£630,000	£670,000	£713,000	£758,000
	Stonehouse North	£889,000	£947,000	£1,008,000	£1,073,000	£1,142,000	£1,211,000	£1,284,000	£1,361,000	£1,443,000	£1,528,000
	Existing stations (NET)	£780,000	£836,000	£892,000	£952,000	£1,014,000	£1,081,000	£1,151,000	£1,225,000	£1,303,000	£1,385,000
	sub-total	£3,478,000	£3,721,000	£3,968,000	£4,230,000	£4,506,000	£4,796,000	£5,101,000	£5,424,000	£5,764,000	£6,124,000
	ramp-up used in profile	90%	95%	100%	100%	100%	100%	100%	100%	100%	100%
	Henbury CPNN build-out effect	86%	89%	92%	94%	95%	96%	97%	98%	100%	100%
	North Filton - CPNN build-out effect	82%	86%	90%	92%	94%	95%	97%	98%	99%	100%
FINAL	Henbury	£570,000	£667,000	£775,000	£843,000	£910,000	£982,000	£1,059,000	£1,141,000	£1,227,000	£1,311,000
net of ramp-up and	North Filton	£476,000	£563,000	£660,000	£722,000	£782,000	£847,000	£916,000	£989,000	£1,067,000	£1,141,000
CPNN build-out	Ashley Down	£385,000	£435,000	£488,000	£521,000	£555,000	£592,000	£630,000	£670,000	£713,000	£758,000
	Stonehouse North	£800,000	£900,000	£1,008,000	£1,073,000	£1,142,000	£1,211,000	£1,284,000	£1,361,000	£1,443,000	£1,528,000
	Existing stations (NET)	£702,000	£794,000	£892,000	£952,000	£1,014,000	£1,081,000	£1,151,000	£1,225,000	£1,303,000	£1,385,000
TOTAL revenue		£2,932,000	£3,359,000	£3,823,000	£4,111,000	£4,404,000	£4,713,000	£5,039,000	£5,387,000	£5,753,000	£6,124,000
OPERATING COST											
INCORPORATING											
nominal earnings growth and GDP deflator											
TOC staff + Nominal Earnings Growth		£1,735,000	£1,811,000	£1,891,000	£1,975,000	£2,063,000	£2,155,000	£2,251,000	£2,351,000	£2,456,000	£2,565,000
TOC veh lease + GDP Deflator		£1,111,000	£1,136,000	£1,161,000	£1,188,000	£1,215,000	£1,243,000	£1,272,000	£1,301,000	£1,331,000	£1,362,000
TOC veh op costs (mileage) + GDP Deflator		£1,128,000	£1,153,000	£1,179,000	£1,206,000	£1,234,000	£1,263,000	£1,292,000	£1,321,000	£1,352,000	£1,383,000
TOC stations op costs + GDP Deflator		£463,000	£473,000	£484,000	£495,000	£506,000	£518,000	£530,000	£542,000	£554,000	£567,000
Infrastructure maint allocated to WoE + GDP Deflator		£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -
TOTAL operating costs		£4,436,000	£4,573,000	£4,716,000	£4,865,000	£5,019,000	£5,179,000	£5,345,000	£5,516,000	£5,693,000	£5,877,000
NET SUBSIDY		-£1,503,000	-£1,213,000	-£892,000	-£754,000	-£615,000	-£467,000	-£305,000	-£129,000	£60,000	£247,000

Option 7: Gloucester turnaround & two stations (Charfield & Stonehouse Bristol Road) – Financial Profile (nominal)

Option 7 - Glos & 2 x NEW Stns		**first 3 years operation subsidy**	£494,000	*+ve = surplus*						
Charfield & Stonehouse Bristol Rd		OPENING YEAR								
	YEAR	*2021*	*2022*	*2023*	*2024*	*2025*	*2026*	*2027*	*2028*	*2029*	*2030*
REVENUE											
INITIAL	Henbury	£738,000	£791,000	£844,000	£900,000	£960,000	£1,022,000	£1,089,000	£1,159,000	£1,233,000	£1,311,000
including demand growth	North Filton	£643,000	£689,000	£735,000	£784,000	£835,000	£890,000	£948,000	£1,009,000	£1,073,000	£1,141,000
and ticket price growth	Ashley Down	£427,000	£458,000	£488,000	£521,000	£555,000	£592,000	£630,000	£670,000	£713,000	£758,000
	Charfield & Stonehouse Bristol Rd	£2,233,000	£2,382,000	£2,539,000	£2,705,000	£2,880,000	£3,102,000	£3,337,000	£3,586,000	£3,851,000	£4,132,000
	Existing stations (NET)	£780,000	£836,000	£892,000	£952,000	£1,014,000	£1,081,000	£1,151,000	£1,225,000	£1,303,000	£1,385,000
	sub-total	£4,822,000	£5,156,000	£5,498,000	£5,861,000	£6,245,000	£6,686,000	£7,154,000	£7,649,000	£8,173,000	£8,727,000
	ramp-up used in profile	90%	95%	100%	100%	100%	100%	100%	100%	100%	100%
	Henbury CPNN build-out effect	86%	89%	92%	94%	95%	96%	97%	98%	100%	100%
	North Filton - CPNN build-out effect	82%	86%	90%	92%	94%	95%	97%	98%	99%	100%
FINAL	Henbury	£570,000	£667,000	£775,000	£843,000	£910,000	£982,000	£1,059,000	£1,141,000	£1,227,000	£1,311,000
net of ramp-up and	North Filton	£476,000	£563,000	£660,000	£722,000	£782,000	£847,000	£916,000	£989,000	£1,067,000	£1,141,000
CPNN build-out	Ashley Down	£385,000	£435,000	£488,000	£521,000	£555,000	£592,000	£630,000	£670,000	£713,000	£758,000
	Charfield & Stonehouse Bristol Rd	£2,010,000	£2,263,000	£2,539,000	£2,705,000	£2,880,000	£3,102,000	£3,337,000	£3,586,000	£3,851,000	£4,132,000
	Existing stations (NET)	£702,000	£794,000	£892,000	£952,000	£1,014,000	£1,081,000	£1,151,000	£1,225,000	£1,303,000	£1,385,000
TOTAL revenue		£4,143,000	£4,722,000	£5,354,000	£5,742,000	£6,142,000	£6,603,000	£7,092,000	£7,611,000	£8,162,000	£8,727,000
OPERATING COST											
INCORPORATING											
nominal earnings growth and GDP deflator											
TOC staff + Nominal Earnings Growth		£1,735,000	£1,811,000	£1,891,000	£1,975,000	£2,063,000	£2,155,000	£2,251,000	£2,351,000	£2,456,000	£2,565,000
TOC veh lease + GDP Deflator		£1,111,000	£1,136,000	£1,161,000	£1,188,000	£1,215,000	£1,243,000	£1,272,000	£1,301,000	£1,331,000	£1,362,000
TOC veh op costs (mileage) + GDP Deflator		£1,128,000	£1,153,000	£1,179,000	£1,206,000	£1,234,000	£1,263,000	£1,292,000	£1,321,000	£1,352,000	£1,383,000
TOC stations op costs + GDP Deflator		£463,000	£473,000	£484,000	£495,000	£506,000	£518,000	£530,000	£542,000	£554,000	£567,000
Infrastructure maint allocated to WoE + GDP Deflator		£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -
TOTAL operating costs		£4,436,000	£4,573,000	£4,716,000	£4,865,000	£5,019,000	£5,179,000	£5,345,000	£5,516,000	£5,693,000	£5,877,000
NET SUBSIDY		-£293,000	£150,000	£638,000	£877,000	£1,123,000	£1,424,000	£1,747,000	£2,096,000	£2,468,000	£2,850,000