MetroWest

METROWEST PHASE 1

Outline Business Case

Appendix 2.2

Economic Assessment Report

December 2017

travelwest

Bath & North East Somerset, Bristol, North Somerset and South Gloucestershire councils working together to improve your local transport

MetroWest Phase 1
Economic Assessment Report

Prepared for

West of England Councils

December 2017

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FINAL REPORT

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Acronyms and Abbreviations

AQMA	Air Quality Management Area
B&NES	Bath and North-East Somerset Council
BCC	Bristol City Council
BRITES	Bristol Integrated Transport and Environment Study
CP5	Control Period 5
CRD	City Region Deal
DCO	Development Consent Order
DfT	Department for Transport
EAST	Early Assessment Summary Tool
GLT	Guided Light Transit
GRIP	Governance for Railway Infrastructure Projects
GVA	Gross Value Added
GWR	Great Western Railway
GWML	Great Western Main Line
IEP	Intercity Express Programme
JLTP	Joint Local Transport Plan
JSP	Joint Spatial Plan
JTB	Joint Transport Board
JTS	Joint Transport Study
LEP	Local Enterprise Partnership
LTPP	Long Term Planning Process
NCN	National Cycle Network
NMU	Non-Motorised User
NR	Network Rail
NSC	North Somerset Council
OAR	Option Assessment Report
OBC	Outline Business Case
PBC	Preliminary Business Case
PEIR	Preliminary Environmental Impact Report
RUS	Route Utilisation Strategy
SEP	Strategic Economic Plan
SGC	South Gloucestershire Council
TAG	Transport Appraisal Guidance
TQEZ	Temple Quay Enterprise Zone
WoE	West of England

SECTION 1

Introduction

1.1 Background

CH2M has been appointed to prepare an Economic Assessment Report (EAR) for MetroWest Phase 1. This forms part of the Department for Transport's (DfT) Transport Appraisal Process, as part of the development of an Outline Business Case (OBC). The OBC is being prepared in support of a submission to the Large Major Scheme fund in December 2017.

1.2 The MetroWest Programme

The West of England (WoE) councils are progressing plans to invest in the local rail network over the next ten years through the MetroWest programme. The MetroWest programme comprises:

- The MetroWest Phase 1 project;
- The MetroWest Phase 2 project;
- A range of station re-opening/new station projects; and
- Smaller scale enhancements projects for the WoE local rail network.

MetroWest is being jointly promoted and developed by the four WoE councils: Bath & North-East Somerset Council (B&NES), Bristol City Council (BCC), North Somerset Council (NSC) and South Gloucestershire Council (SGC). The MetroWest programme will address the core issue of transport network resilience, through targeted investment to increase both the capacity and accessibility of the local rail network. The MetroWest concept is to deliver an enhanced local rail offer for the sub-region comprising:

- Existing and disused rail corridors feeding into Bristol;
- Increased service frequency; cross-Bristol service patterns (e.g. Bath to Severn Beach); and
- A Metro-type service appropriate for a city region.

The MetroWest programme will complement the investment being made by Network Rail (NR) and extend the benefits of projects such as the electrification of the Great Western main line. The programme is to be delivered over the next five to ten years during Network Rail Control Period 5 (2014 to 2019) and Control Period 6 (2019 to 2024).

1.3 MetroWest Phase 1

The MetroWest Phase 1 project includes the delivery of infrastructure and passenger train operations to provide:

- Half hourly service for the Severn Beach Line as far as Avonmouth (hourly for St. Andrews Road and Severn Beach stations);
- Half hourly service for the Keynsham and Oldfield Park local stations on the Bath Spa to Bristol Line; and
- Hourly service (or an hourly service plus) for a reopened Portishead Line, with new stations at Portishead and Pill.

The whole of MetroWest Phase 1 will be operational in 2021. Enhanced services on the Severn Beach line could begin in 2020 and re-opening of the Portishead line will follow in 2021.

For the Portishead Line either an hourly or an hourly plus passenger train service is proposed. The difference between an hourly service and an hourly service plus is:

- Hourly service – Passenger trains operating hourly all day between Portishead and Bristol Temple Meads, calling at Pill, Parson Street, and Bedminster. Providing up to 18 trains in each direction per day (Mon-Sat), and up to 10 trains on Sundays, utilising one train set all day.
- Hourly service plus – trains operating every 45 minutes during the am and pm peak and hourly off peak, between Portishead and Bristol Temple Meads, calling at Pill, Parson Street, and Bedminster. Providing up to 20 trains in each direction per day (Mon-Sat), and up to 10 trains on Sundays, utilising one train set all day and an additional set during the am and pm peaks.

Note though that, while the infrastructure required to deliver the 'hourly service plus' on the Portishead line is identical to that required for an hourly service, it has not been appraised as part of the OBC. Only the hourly service has been considered at this stage, because analysis to confirm the shape of an 'hourly service plus' is still on-going. Note also that, although infrastructure for an hourly service (or hourly service plus) is being provided at this stage, it remains the aspiration of the promoting authorities to develop a 30 minute service in the future.

Figure 1.1 shows the proposed MetroWest Phase 1 passenger network with a more harmonised service frequency, providing the foundation for 'Metro' local rail network.

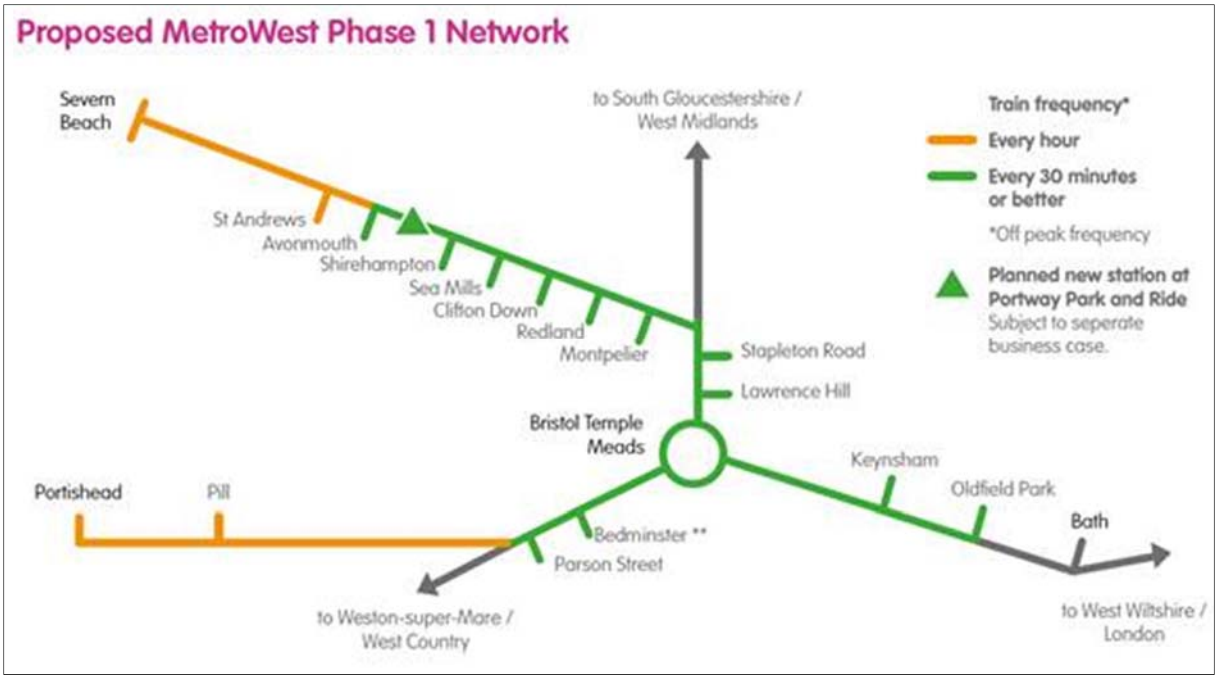

Figure 1-1: MetroWest Phase 1 network

1.4 Scheme Objectives

The MetroWest Phase 1 principal business objectives are:

- To support economic growth, through enhancing the transport links to the Temple Quarter Enterprise Zone (TQEZ) and into and across Bristol city centre, from the Portishead, Bath and Avonmouth and Severn Beach arterial corridors;
- To deliver a more resilient transport offer, providing more attractive and guaranteed (future-proofed) journey times for commuters, business and residents into and across Bristol, through better utilisation of strategic heavy rail corridors from Portishead, Bath and Avonmouth, and Severn Beach;
- To improve accessibility to the rail network with new and reopened rail stations and reduce the cost (generalised cost) of travel for commuters, business and residents; and
- To make a positive contribution to social well-being, life opportunities and improving quality of life, across the three arterial corridors.

In addition, the MetroWest Phase 1 supporting objectives are:

- To contribute to reducing traffic congestion relative to a 'Do Minimum' scenario (as opposed to current levels of congestion) on the Portishead, Bath and Avonmouth, and Severn Beach arterial corridors;
- To contribute to enhancing the capacity of the local rail network, in terms of seats per hour in the AM and PM peak; and
- To contribute to reducing the overall environmental impact of the transport network.

1.5 Summary of Scheme Impacts

MetroWest Phase 1 will deliver the following benefits:

- Increase the local economy by generating £264M of Gross Value Added (GVA) in first ten years from opening) and creating 514 net new permanent jobs;
- Enhance rail capacity by delivering over 600 additional seats per hour for the local rail network, which in turn will extend the benefits of Network Rail's Western Route Modernisation Programme;
- Deliver a reliable and more frequent public transport service, directly benefitting 180,000 people within 1km of 16 existing stations, with enhanced train service frequency;
- Increase the number of people living within 30 minutes travel time of key employment areas, such as TQEZ;
- Reduce highway congestion on arterial corridors, including A369 between Portishead and Bristol, significantly improving network resilience;
- Provide competitive journey times from Portishead and Pill to Bristol Temple Meads;
- Improve accessibility to sites for new homes and employment development in proximity to the rail corridors and bring an additional 50,000+ people within the immediate catchment of the rail network with new stations at Portishead and Pill;
- Reduce overall environmental impact, resulting in improved air quality, on key arterial highway routes;
- Provide attractive mode choice and capacity for journeys to work (alternatives to single occupancy car-based travel) addressing long-term car dependency; and
- Provide wide ranging social/health benefits.

In summary, the MetroWest Phase 1 scheme could add a net total of over 950,000 new rail journeys to the network in 2021 (rising to almost 1.3m in 2036). Service improvements at existing stations are forecast to generate over 600,000 new rail trips in 2021 (over 800,000 in 2036). New stations demand forecasts indicate that around 320,000 passengers would use the proposed station at Portishead in 2021, rising to over 430,000 by 2036. Pill station generates over 53,000 users in 2021, and over 72,000 in 2036. Benchmarking indicates that the demand forecast for Portishead and Pill is in line with expectations for stations of their size and catchment, with the services provide. With an hourly service, while initially there is sufficient capacity, there is however scope for crowding from 2030 onwards. This could be alleviated though if proposals to run 'infill' peak time services are achieved.

The MetroWest Phase 1 OBC Forecasting Report provides details of forecasting and modelling work undertaken to assess the proposed MetroWest Phase 1 OBC scheme.

1.6 Structure of this Economic Assessment Report

After this introductory chapter, the remainder of the economic assessment report is structured as follows:

- Chapter 2 describes the overall economic assessment approach, including identifying the models used and scenarios assessed;
- Chapter 3 goes on to outline the scheme's costs, capital and operating costs;
- Chapter 4 sets out the scheme benefits that have been identified and appraised;
- Chapter 5 brings together the result so the assessment, including monetised results where available, and presenting the Transport Economic Efficiency (TEE) tables, Public Accounts (PA) and Analysis of Monetised Costs and Benefits (AMCB);
- Chapter 6 summarises the assessment, including the Appraisal Summary Table (AST).

SECTION 2

Economic Assessment Approach

2.1 Overall process

The overall economic assessment approach makes best use of available assessment tools. In particular, it uses approaches accepted by the rail industry such as MOIRA and the existing GBATS4 multi-modal model, as well as TUBA and a Network Rail appraisal model. The methodology used is in accordance with both WebTAG and Governance of Railway Investment Projects (GRIP) demand forecasting requirements. Rail demand forecasts provide the framework for other assessments.

Elements included in the assessment of monetised impacts include:

- Costs:
  - Scheme investment costs
  - Operating costs
- Benefits:
  - Passenger revenue
  - Travel time saving, vehicle operating costs & taxes
  - Reliability
  - Accident benefits
  - Environmental benefits
  - Option values
  - Wider economic impacts
  - Regeneration and GVA impacts

Where appropriate, these elements are included in Economic Efficiency of the Transport System (TEE table), Analysis of Monetised Costs and Benefits (AMCB) and Public Accounts (PA) tables.

2.2 Transport models used

A combination of bespoke spreadsheet models and MOIRA were used to assess demand for rail enhancements offered by MetroWest Phase 1, before bringing the results together in an aggregate forecast for use in subsequent analyses. Collectively, the results of rail demand forecasting are referred to as the Rail Demand Model (RDM), and consists of separate elements to assess demand at existing and new station.

MOIRA has been used to assess the impacts of MetroWest Phase a on existing stations in the WoE as well as the wider rail network. In addition, generalised journey time, demand and revenue figures have been extracted from MOIRA for stations in the MetroWest area to use in the forecasts of the new stations. [1]

Forecasts of demand for the new stations proposed as part of MetroWest Phase 1 have been carried out using a methodology derived previous studies associated with the development of MetroWest Phase 1, as well as work to assess MetroWest Phase 2 and other potential new stations in the WoE area. The methodology makes use of rail industry data (from MOIRA, ORR station usage information

[1] MOIRA is updated several times a year, based on ticket sales. MetroWest Phase 1 demand at existing stations has been assessed by Network Rail using MOIRA containing 2015-16 annual figures. MOIRA1 has been used; an augmented version with greater functionality, (MOIRA2) is only just coming into regular use, after a significant period of testing.

and WoE surveys) and derived techniques to forecast demand at new stations broadly based on relationships at existing stations elsewhere.

A Discounted Cash Flow (DCF) model developed by Network Rail provides the main rail appraisal results. This model is used for socio-economic appraisal and was developed in accordance with WebTAG. More information about the DCF assessment is contained in the Network Rail technical note, 'MetroWest Phase 1, Socio-economic impacts for rail users', in Appendix A of this report.

The GBATS4 multi-modal demand model of the WoE area has been used to assess highway impacts of MetroWest Phase 1. This is a hybrid approach where rail demand forecasts (RDM) are used to calibrate the inputs to GBATS4 modelling, to ensure that changes in highway demand adequately reflect anticipated rail demand. Subsequently, TUBA has been utilised as the mechanism for calculating highway benefits.[2]

More details of the models used and the processes involved, including analysis and results, is contained in the MetroWest Phase 1 OBC Economic Case 'Forecasting Report'.

2.3 Modelled scenarios

The core scenario, as the basis for the analysis, represents the best basis for decision-making given current evidence. It is based on published plans that have been approved/adopted and includes a do minimum and single do something option. Sensitivity testing is also included in the appraisal.

2.3.1 Do minimum

The do minimum is scenario in railway terms is defined as the situation with Great Western Main Line (GWML) electrification and Intercity Express Programme (IEP) delivered in end of Network Rail's Control Period 5 (CP5). The service specification of these programmes includes providing two additional trains per hour (each way) from London Paddington to Bristol Temple Meads via Bristol Parkway. The Do Minimum includes CP5 committed schemes. The do minimum does not include the proposed enhanced Bristol East Junction.

The GBATS4 model includes all modes, so reflects changes in the rail network as noted above. It also reflects anticipated changes to bus services and the highway network. Full details of the future year do minimum GBATS4M model can be found in the 'GBATS4M Future Year Do Minimum Model Report', February 2016, appended to the MetroWest Phase 1 OBC.

2.3.2 Do something – MetroWest Phase 1

The MetroWest Phase 1 project comprises the delivery of infrastructure and passenger train operations to provide:

- Half hourly service for the Severn Beach line (hourly for St.Andrews Road and Severn Beach stations), by enhancing the current approximately 40 minute interval service on the line (2 hourly to Severn Beach);
- Half hourly service for Keynsham and Oldfield Park stations on the Bath Spa to Bristol line (through an additional local stopping service per hour); and
- Hourly service for a reopened Portishead Branch Line with stations at Portishead and Pill (shuttle service from Bristol Temple Meads).

There are no significant elements of highway infrastructure included in MetroWest Phase 1, only local changes around Portishead and Pill stations, and amendments to the operation of the signal junction incorporating Ashton Vale Road level crossing.

[2] TUBA is the DfT's appraisal software, that takes output trips, time and cost matrices from local/regional models and calculates benefits. It can be used to assess any mode (or modes) but has only been used to assess highway impacts for MetroWest Phase 1. TUBA version 1.9.9 has been used, which incorporates the latest advice into the use of values of time that vary with trip distance.

2.4 Appraisal period and opening year

The overall opening year for MetroWest Phase 1 is 2021. It is likely that enhancements to services on the Severn Beach line will open in 2020 and the re-opening of the Portishead line will follow in 2021. This has been reflected in the appraisal process.

A 60-year appraisal period has been used, in line with WebTAG guidelines for infrastructure projects, starting with the first year of benefits in 2021. The standard price base and base year of 2010 has been assumed, with discounting at 3.5% for the first 30 years and 3.0% thereafter

In the calculation of benefits, rail demand growth based on the profile of future year growth is assumed to continue for 20 years from the current day. Sensitivity tests (discussed below) adjust the levels and horizons of growth.

2.5 Sensitivity testing

Sensitivity testing has been carried out to consider the socio-economic performance of MetroWest Phase 1 in the event that some of the key assumptions vary. Drawing on WebTAG unit M4, these are mostly based future year growth, and include:

- High demand – an increase growth profile assumptions in line with WebTAG recommendations (TAG unit M4);[3]
- Low demand – decrease growth profile assumptions in line with WebTAG recommendations (methodology as per footnote alongside 'high demand');
- Fare/demand growth cap at 10 years (instead of 20 years);
- Fare/demand growth cap at 30 years (instead of 20 years); and
- Operating cost risk – include all risk elements identified (by GWR) –operating costs are described further in the next chapter of this report.

The high and low demand sensitivity tests include some changes to forecast models in order to assess highway related benefits. The other tests are directly related to assumptions that feed into the appraisal process.

In addition, a further sensitivity test has been conducted to specifically consider the benefits that could be generated by the changes to Ashton Vale Road junction with Winterstoke Road, associated with the level crossing at Ashton Vale Road. This has not been included in the core scheme assessment, because the modelling work carried out is very localised and only considers the current year in detail. As such, it does not take into account the potential for wider area impacts that would be associated with this scheme, some of which may be disbenefits, or temporal changes in demand that are reflected in the business case more generally.

[3] A proportion of base year demand is added to the growth profile assumed for the core scenario. The proportion to be added is based on a parameter p which varies by mode. The parameter 'p' for rail schemes is +2.0% for high demand sensitivity and -2.0% for low demand. For 1 year after the base year, proportion p of base year demand added to the core scenario. For 36 or more years after the base year, proportion 6*p of base year demand added to the core scenario. Between 1 and 36 years after the base year, the proportion of base year demand should rise from p to 6*p in proportion with the square root of the years.

SECTION 3

Scheme Costs

This chapter briefly sets out the investment/capital and operating costs used in the economic appraisal of MetroWest Phase 1. Further details of the derivation and allocation of investment costs can be found in the financial case in the OBC document.

3.1 Investment costs

Network Rail has issued GRIP3 capital costs for MetroWest Phase 1. Initially based on taking forward the PBC scheme for the provision of infrastructure for a 2 train per hour service on the Portishead line, subsequent changes in requirements (and costs) for infrastructure needed to support a 1 train per hour service to Portishead have been prepared. Table 3.1 sets out the capital costs of the scheme, including identification of risk elements; total scheme out-turn cost of a 1 train per hour to Portishead is £106m. This identification of risk elements is important in the cost benefit appraisal, as optimism bias has to be applied to capital costs. This is applied to GRIP3 cost estimates to the 'point estimate' of cost, which does not include risk elements or inflation. Optimism bias of 18% is applied over and above cost including quantified risks and/or general contingency.

Table 3.1: Capital costs MetroWest Phase 1

Source: Network Rail; all costs £m; 2017 prices (except inflation and final total, which are 2021 prices)

Cost (£m)	**OBC scheme** Severn Beach & Bath Spa local services and 1tph Portishead
Preparation Costs	£12.75
Railway construction costs	£53.60
Risk & Fee fund [4]	£2.00
Highway construction costs	£6.98
Land costs	£3.18
Mitigation works & Misc costs	£2.58
Sub-total	£81.09
Risk	£20.22
Inflation (to 2021)	£4.81
Total (2021 prices)	£106.12

Source: MetroWest Phase 1 OBC Finance Case; initial costs based on GRIP stage 3 Option Selection Approval in Principle (AIP) design, and subject to independent review via Mott MacDonald appointed by the WoE authorities as Independent Cost Estimation Reviewer. Inflation based on Building Cost Information Service (BCIS) central forecast to 2021 Q2, based on the BCIS Price Adjustment Formulae Indices, from the Royal Institute of Chartered Surveyors (RICS).

3.1.1 Renewal costs

MetroWest Phase 1 will effectively bring forward renewal that is planned for the Portbury freight-only line, and lower the overall unit renewal costs in the future. However, the proportion of these renewal costs that should attribute to MetroWest Phase 1 project is unclear. As such, only costs known to be attributable to the project (at present) are included in the appraisal.

[4] All third party funded rail projects are subjected to a Network Rail Risk & Industry Fee, payable to Network Rail as an insurance cover. For MetroWest phase 1, this cost is estimated at £2m in 2017 prices. However, on-going discussion between North Somerset Council and Network Rail means that the final value is subject to change.

3.2 Operating and maintenance costs

The key elements of operating and maintenance costs included in the assessment include:

- Network Rail operating costs to operate and maintain new assets and infrastructure; and
- Train Operating Company (TOC) costs, including staff costs, vehicle leasing costs, vehicle mileage related operating costs and new stations' operating costs (at Portishead and Pill).

GRIP 3 optimism bias of 1% has been applied to all maintenance and operating costs when estimating the present value over the appraisal period.

3.2.1 Network Rail maintenance costs

High level Network Rail maintenance costs for the new infrastructure are estimated as below, these costs are in 2015 factor prices at GRIP stage 3:

- New crossover at Bathampton: £30k per annum (from 2020);
- Avonmouth: £20k per annum (from 2020); and
- Pill to Portishead: £200k per annum (from 2021).

Maintenance costs will initially be low, and increases as the infrastructure ages; more detailed costs will become available as the project progress.

3.2.2 Train operating costs

The train operational costs comprise two main elements:

- Pre-opening mobilisation costs, leading up to the start of the train services; and
- Post opening train service costs, during the first three years of operation;

3.2.2.1 Pre-opening mobilisation costs

Prior to scheme opening there will be some train operator costs (pre-opening mobilisation costs) comprising of recruitment and training of train drivers and train managers, training of additional staff (depot pool) operational commissioning and testing cost (new rail infrastructure, stations, ticketing etc). The initial estimate for these mobilisation costs is £1.74m, with costs commencing T-18 months to T-0 scheme opening. GWR provisionally estimate that mobilisation costs could be 20% of staff costs two years before opening (opening year -2) and 50% of staff costs in the year before opening (opening year -1), plus 25% each of train leasing and mileage costs in the year before opening. This is used in financial profiles.

3.2.2.2 Post opening train service costs

Enhancement of the Severn Beach Line service and the Bath Spa to Bristol service requires two additional train sets (based on Railsys modelling to date). Reopening of the Portishead Line with an hourly service requires one train set.[5] Table 3.2 sets out a summary of the composition of train operator costs, provided by GWR. Table 3.2 also shows the costs estimated for the 2014 Preliminary Business Case option 5B (previous central case), for comparative purposes.

[5] Note that an hourly plus option (basic hourly service with additional services in peak periods) needs an additional train set in the peak.

Table 3.2: Annual operating costs

Source: GWR estimates; all costs £m; 2017 prices

Operational expenditure	**OBC scheme** Severn Beach & Bath Spa local services and 1tph Portishead 9 x Cl165	**Original PBC scheme** (Option 5B) 12 x Cl165
Mileage costs		
Fuel	£0.636	£0.855
Light maintenance	£0.200	£0.270
Track access	£0.070	£0.093
Capacity charge	£0.223	-
Sub-total	£1.129	£1.218
Lease costs		
Base capital	£1.019	£1.358
Non-capital maint. reserve	£0.463	£0.618
Sub-total	£1.482	£1.976
Staff costs		
Train crew	£1.548	£2.064
Station staff	tbc	tbc
Depot staff	tbc	tbc
Sub-total	£1.548	£2.064
Station costs		
Long term access charge	£0.151	£0.151
Operations & maintenance	£0.120	£0.120
Sub-total	£0.271	£0.271
BASE ESTIMATE TOTAL	£4.430	£5.529
Mobilisation [1]	£1.74	2
Risks		
Fuel price (+50%)	£0.319	£0.427
Spare unit (maintenance)	-	£0.494
More conductors per turn	£0.162	£0.216
Gate-line staff (Portishead)	-	£0.241
Depot staff	£0.379	tbc
Sub-total	£0.860	£1.378
RISK ADJUSTED TOTAL	£5.290	£6.907
Mobilisation [1]	£2.19	2

Notes:

1: Mobilisation costs shown in this table are totals for the two years prior to opening

2: Mobilisation costs were not calculated for estimates of operating cost in the PBC

3.2.2.3 Potential constraints – train crew

There are number of potential constraints in resourcing additional train crew:

- Shifts for members of train crew including rest periods and booking on and off may only last eight hours. Therefore, to cover an eighteen hour service, three shifts are typically required.

- Opportunities may present to create efficient diagrams by integration with existing. However, this cannot be assumed at present, as there may be no savings, and additional interworking creates inherent performance risks.
- Each member of train crew works four days in seven, so, allowing for leave and sickness, two heads are required to cover each driver turn and 1.5 to cover each conductor turn. Across a large train crew pool there may be minor efficiencies available but these will be limited.

Therefore, it can be assumed that the likely net additional train crew requirement is effectively 18 train drivers (3 trains x 3 shifts x 2 heads) and 13.5 conductors (3 trains x 3 shifts x 1.5 heads).

3.2.2.4 Potential constraints – rolling stock

It should also be noted that there are potential constraints in respect of rolling stock:

- The train path modelling (Railsys) indicates that MetroWest Phase 1 requires three additional train sets in three car formations (nine train units in total), however the large number of enhancement and renewal schemes currently being delivered in a relatively short period in late control period 5 and early control period 6, is causing a degree of uncertainty in the modelling undertaken to date. This will be clarified by further Railsys modelling based on the final December 2018, which is expected to be available around Easter 2018.
- The commercial rolling stock market via the rolling stock operating companies (ROSCOs) can fluctuate in accordance with demand, therefore the costs set out in Table 3.2 should be considered indicative.

SECTION 4

Scheme Benefits

4.1 Introduction

A series of monetised benefits have been assessed for the scheme, that are subsequently reported in the transport economic efficiency (TEE), public accounts (PA) and analysis of monetised costs and benefits (AMCB) tables, as well as reflected in the appraisal summary table (AST).

Included in the calculations are:

- Travel time saving, vehicle operating costs & taxes (which are the main transport economic impacts driven directly by changes in trip making, both by rail and by road, so includes benefits generated by new rail users and reductions in highway traffic);
- Reliability (as a result of reductions in highway traffic);
- Accident benefits (as a result of reductions in highway traffic);
- Selected monetised environmental benefits (as a result of reductions in highway traffic impacts);
- Passenger revenue (from new rail journeys at existing stations as well as new rail journeys at the new stations of Portishead and Pill);
- Option and non-use values (reflecting that the scheme will introduce a step change in public transport provision in Portishead and Pill);
- Wider impacts assessment (economic impacts that are not specifically based on the transport impacts of the scheme, including agglomeration, imperfect markets and labour supply); and
- Economic development and regeneration (understanding the potential for the scheme to promote regeneration and job creation across the WoE).

This chapter discusses the derivation of monetised impacts, drawing on work reported in more detail in the MetroWest Phase 1 OBC Forecasting Report. Sensitivity testing has also been carried; this is discussed in the next chapter of this report.

4.2 Travel time saving, vehicle operating costs & taxes

4.2.1 Rail users

The journey time improvement to the new rail passengers at Portishead and Pill stations are estimated by comparing the generalised costs of travel by car and by rail. Average fares are applied to demand forecasts to determine generalised journey time and revenue. MOIRA has been used to calculate rail users' journey time benefits, for passengers using existing stations.

The values of time benefits for both new and existing passengers, on the existing and re-opened lines are shown in Table 4.1, for opening years. Note that a build-up profile has been applied to new passengers benefits which considers only 90% at year 1, 95% at year 2 and full benefits at year 3 from opening.

Table 4.1: Value of time benefits for new and existing rail passengers
Source: Network Rail calculations (£m, 2010 prices and values)

Value of time benefits	2020	2021
Existing passengers	£3.35	£3.49m
New passengers		£0.42m

Note: For new passengers, full benefits are assumed from year 3 after opening, building-up

Table 4.2 shows total rail user benefits for the 60-year appraisal period, present values discounted to 2010. The table includes the OBC scheme, as well as four of the sensitivity tests that affect rail demand; high demand growth, low demand growth, 10-year growth cap and 30-year growth cap.

Table 4.2: Value of time benefits for new and existing rail passengers
Source: Network Rail calculations (£m, 2010 present values)

Value of time benefits (£m PV)	OBC scheme	Sensitivity tests			
		High demand growth	Low demand growth	10-year growth cap	30-year growth cap
Rail user journey time benefits	£195.56	£209.28	£179.06	£169.84	£218.41

More information about the assessment of rail benefits is contained in the Network Rail technical note, 'MetroWest Phase 1, Socio-economic impacts for rail users', in Appendix A of this report.

4.2.2 Highway related impacts

Highway benefits (including travel time saving, vehicle operating costs & taxes) have been calculated using GBATS4 and TUBA, using a hybrid approach to fully reflect rail demand forecasts that are the principal driver of the travel effects of MetroWest Phase 1.

Total highway (non-user) benefits for the core OBC scheme were calculated at £50.16m over the 60-year appraisal period, with some 55% being attributed to commuting/other users. Indirect tax effects were calculated at a reduction of £12.68m. Sensitivity tests for high and low demand growth were also run through the same GBATS4/TUBA assessment of highway impacts, generating total benefits of £50.06m and £48.57m for high and low demand respectively.

Table 4.3 shows the total TUBA highway benefits identified.

Table 4.3: TUBA highway benefits

Highway benefits (£'000s)	OBC scheme	High demand sensitivity	Low demand sensitivity
Commuting / Other user benefit	£27,857	£26,572	£26,857
Business user benefit	£22,301	£26,488	£21,713
Total user (highway) benefit	£50,158	£53,060	£48,569
Wider public finances (Indirect taxation revenues)	-£12,678	-£12,031	£11,567

More details of the models used and the processes involved, including analysis and results, is contained in the MetroWest Phase 1 OBC Economic Case 'Forecasting Report'.

4.3 Reliability

The overall reduction in congestion on the highway network is likely to have a positive impact on journey time reliability, so highway reliability has therefore been considered. This makes reference to WebTAG unit A1.3 section 6, based on variation in journey times caused by events unpredictable by the users such as incidents or recurring congestion in certain days (day-to-day variability). Predictable elements like varying levels of demand by time of day, day of week or seasonal effects are excluded, as travellers are assumed to be aware of them.

The variability of journey times can be measured by standard deviation of the journey time – the bigger the spread of values around the mean, the less reliable the transport system is. Evidence in WebTAG (Unit A1.3, section 6.3.2) suggests that it is possible to derive the change in the standard deviation delivered by the scheme inside urban areas with using modelled time and distance values as in the formula:

$$\Delta\sigma_{ij} = 0.0018 \cdot (t_{ij2}^{2.02} - t_{ij1}^{2.02}) \cdot d_{ij}^{-1.41}$$

where:

- $\Delta\sigma_{ij}$ – the change in standard deviation of journey time between i and j [seconds];
- t_{ij1} and t_{ij2} – the journey times between i and j, prior (1) and post (2) scheme introduction [seconds]; and
- d_{ij} – the journey distance between i and j [kilometres].

To measure the potential savings or costs of the scheme impact on the journey time variability, reference from time to money values is needed. Section 6.3.4 of WebTAG unit A1.3, introduces a benefit formula, similar to the rule of half used in economical assessment of transport schemes:

$$Benefit = -\sum_{ij} \Delta\sigma_{ij} \cdot \left(\frac{T_{ij2} + T_{ij1}}{2}\right) \cdot VOR$$

where:

- T_{ij2} and T_{ij1} – number of trips between i and j in the Do-Minimum (1) and Do-Something (2) scenarios; and
- VOR – Value of Reliability – product of Value of Time (VoT) and reliability ratio (0.8).

Combining two of above mentioned equations leads to the following final formulation:

$$Benefit = -\sum_{ij} (C_{ij2} - C_{ij1}) \cdot (\frac{T_{ij2} + T_{ij1}}{2}) \cdot VOT$$

where:

$$C_{ijX} = 0.000144 d_{ij}^{-1.41} \cdot t_{ijX}^{2.02}$$

The benefit is calculated using rule of half, so TUBA can be used, thud employing standard values of time, discount rates, etc. The only elements that need to be calculated prior to TUBA analysis are the C_{ij2} and C_{ij1} values. Extracts were taken from GBATS4 to estimate the change in standard deviation of journey time using the above formula. Highway trip matrices for all time periods (AM, IP and PM), analysis years (2021 and 2036), and scenarios (do minimum and do something) incorporating rail demand forecasts (as for highway benefits calculations) were used. Post assignment time and distance skim matrices were extracted and fit appropriately into the formula above to receive the C_{ijX} values. These values, along with trip and other skim matrices, were fed into TUBA, with the following general assumptions:

- Benefits are analysed for five time periods (AM peak, Inter-peak, PM peak, off peak and weekends & bank holidays, the latter two periods using Inter-peak skim matrices);
- Annualisation factors used for each time period are the same as used in highway benefits calculations in TUBA (AM peak, 645; Inter peak, 1518; PM peak, 648; off peak, 175; and weekends & bank holidays, 340); and
- Four car user classes were considered including; one business user class (employer's business) and three combined 'commuting and other' trips user classes (low, medium and high income).

The reliability benefits for all time periods extracted from TUBA were adjusted using the same methodology as highway benefits from TUBA, to eliminate inappropriate benefits from the results, and align figures with anticipated changes from MetroWest Phase 1 rail demand.

Results of the analysis indicate that highway reliability benefits of £1.823m could be realised. This does not distinguish between business users and commuting or other users. Sensitivity tests for high and low demand growth were also run through the reliability assessment process, generating benefits of £1.936m and £1.763m for high and low demand respectively.

4.4 Accident benefits

Assessment of accident benefits has been carried out using the DfT's Cost and Benefit to Accidents – Light Touch (COBA-LT) software, drawing on outputs from the GBATS4 model used to generate highway benefits (as described earlier). Additionally, speed limit and accident data (2012-2016) for the WoE region was incorporated.

Overall, COBA-LT analysis indicates that some 130 accidents could be saved by the scheme over the 60-year appraisal period, generating some £5.846m of accident benefits. Further discussion of the calculation of accident benefits can be found in the MetroWest Phase 1 OBC 'Social Impacts Assessment Report'.

4.5 Monetised environmental benefits

Monetised impacts on greenhouse gases have been calculated using the GBATS4 Saturn model and TUBA, as part of the highway impacts assessments (section 4.1). As a result in the overall decrease in vehicle kilometers travelled across the road network, there is a reduction in CO2 emissions, that generates a benefit of £251,000. However, this benefit is offset by an increase in rail emissions, and noise impacts.

More details of the models used and the processes involved in highway benefits assessment, including analysis and results, is contained in the MetroWest Phase 1 OBC 'Forecasting Report'.

4.6 Passenger revenue

The revenue benefits for both new and existing passengers, on the existing and re-opened lines are shown in Table 4.4, for opening years. Note that a build-up profile has been applied to new passengers benefits which considers only 90% at year 1, 95% at year 2 and full benefits at year 3 from opening. [6]

Table 4.4: Revenue benefits for new and existing rail passengers
Source: Network Rail calculations (£m, 2010 prices and values)

Revenue benefits	2020	2021
Existing passengers	£1.33	£1.39m
New passengers		£1.72m

Note: For new passengers, full benefits are assumed from year 3 after opening, building-up

Table 4.5 shows total rail user benefits for the 60-year appraisal period, present values discounted to 2010. The table includes the OBC scheme, as well as four of the sensitivity tests that affect rail demand; high demand growth, low demand growth, 10-year growth cap and 30-year growth cap.

Table 4.5: Value of time benefits for new and existing rail passengers
Source: Network Rail calculations (£m, 2010 present values)

Revenue benefits (£m PV)	OBC scheme	Sensitivity tests			
		High demand growth	Low demand growth	10-year growth cap	30-year growth cap
Revenue benefits	£126.77	£135.44	£116.31	£111.30	£139.06

[6] Revenue at new stations is calculated from the total number of journeys and potential geographical distribution of trips, generating a total passenger mile figure. An effective average revenue per passenger mile of 26.5p is applied, which takes into account the mix of ticket types (full price, reduced and seasons). This is based on a local comparison of revenue and demand, and does not include Severn Beach line fares, as these are out of step with surrounding fares (much cheaper).

More information about the assessment of revenue is contained in the MetroWest Phase 1 OBC 'Forecasting Report', as well as the Network Rail technical note, 'MetroWest Phase 1, Socio-economic impacts for rail users', in Appendix A of this report.

4.7 Option Values

The calculation of monetised option values is based on WebTAG Unit A4.1 section 7, using parameters from Table A4.1.8 from the WebTAG databook (July 2017). The methodology follows the calculations based on monetising the reopening of a local rail station, in a location with an existing bus service. This uses the difference between the 'train' and 'bus' values excluding non-use.

The total MetroWest Phase 1 option value calculated is £25.48m over a 60-year appraisal period. This is not included in the AMCB table for the scheme, but is reflected in the adjusted BCR.

More information about the assessment of option values is discussed in the MetroWest Phase 1 OBC 'Social Impact Appraisal Report'.

4.8 Wider impacts assessment

The methodology adopted in assessing wider economic impacts is in line with guidance in WebTAG Unit A2.1 and follows a similar process used in the Preliminary Business Cases (PBC) of both MetroWest Phases 1 and 2. The Wider Impacts Assessment is focused on the following three areas:

- Agglomeration – By reducing journey times across the West of England (WoE), the relative agglomeration[7] of business in this area will increase. This will have a direct impact on the productivity and GDP of the UK and is a central element to the estimation of Wider Impacts;
- Output change in imperfectly competitive markets – A reduction in the costs of transport allows businesses to operate more efficiently, improves their output and intensity of business practices, and hence allows for benefits; and
- Labour supply impacts – This captures tax revenues arising from the welfare effects to the UK economy of having a wider human resource pool.

This assessment captures the wider impacts accrued over a 60-year appraisal period from the scheme opening year 2021 to 2081. Separate analysis has been carried out for the high and low demand sensitivity tests, in addition to the central OBC scheme case.

Table 4.14 shows summary and total values of wider impacts for the Wider Impact Assessment for the Preliminary Business Case of MetroWest Phase 1. More details of the methodology and results of the wider economic impacts assessment are contained in Appendix B of this report.

Table 4.6: Summary total Wider Impacts (2021-80)
Source: CH2M calculations

(£000s)	OBC Scheme	HIGH demand sensitivity	LOW demand sensitivity
Agglomeration impacts	£68.44m	£71.42m	£57.73m
Imperfect competition impacts	£4.56m	£5.00m	£4.53m
Labour supply impacts	£1.03m	£1.09m	£0.75m
TOTAL Wider Impacts	£74.03m	£77.49m	£63.01m

[7] Agglomeration is a term used to infer the ability of an economy to act through the density of companies to interact with one another.

4.9 Economic Development and Regeneration

The assessment adopts a bespoke methodology to estimate the economic development and wider regeneration impacts of the Scheme. The methodology attempts to reconcile the West of England LEP's economic impact guidance with DfT's emerging Wider Economic Impact guidance and labour market modelling that is consistent with previous analysis undertaken for previous stages of the MetroWest project.

In particular, the West of England LEP's economic impact guidance was utilised to inform construction stage job creation and GVA uplift, as well as providing the overall framework for analysis encompassing treatment of wider 'operational stage' impacts and treatment of additionality. The DfT's emerging Wider Economic Impact guidance was consulted to establish the narrative linking transport investment to economic externalities. Existing labour market modelling, in the form of spatial labour market balance sheets that were used extensively on the MetroWest project, was retained as the primary model driving analysis of wider economic development impacts.

The economic development and regeneration analysis outlined above demonstrates that the scheme has the potential to facilitate significant positive economic impacts across the West of England, in both the construction and operational phases. The analysis is consolidated and summarised in the table below, which suggests that the Scheme could generate more than 1,400 jobs and £57m in GVA during the construction stage as well as more than 500 permanent jobs and £32m in GVA per annum during the operational stage, as shown in Table 4.7.

Table 4.7: Economic Development and Regeneration benefits
Source: CH2M calculations

Economic Indicator	Value
GVA £M temporary impact during construction	£57,122,715
No of additional temporary new jobs during construction	1,441
GVA £M permanent impact per annum	£31,862,915
No of additional permanent new jobs	514
GVA £M Temporary (during construction) and permanent impact during first 10 years post scheme opening (discounted)	£264,781,565

Note that all monetised figures in the table above reflect 2017 prices and values. Also note that the results in the table above reflect the following calculations:

- 'GVA £m temporary impact during construction' – discounted values based on direct and indirect GVA;
- 'No of additional temporary new jobs during construction' – direct and indirect employment;
- 'GVA £m permanent impact per annum' – gross direct GVA per annum in 2036, from operational and wider job creation; and
- 'GVA £m Temporary (during construction) and permanent impact during first 10 years post scheme opening (discounted)' – assumes construction GVA plus ten years of annual permanent GVA from operational and wider sources.

More details of the economic development and regeneration assessment methodology can be found in the MetroWest Phase 1 OBC 'Economic Development/Regeneration Assessment' technical note in Appendix C of this report.

SECTION 5

Economic Assessment

5.1 Overview

The overall economic assessment methodology used is in accordance with both WebTAG and Governance of Railway Investment Projects (GRIP) requirements. Elements included in the assessment of monetised impacts include:

- Costs – scheme investment costs and operating costs; and
- Benefits – passenger revenue, travel time saving, vehicle operating costs & taxes, reliability, accident benefits, some environmental benefits, option values, wider economic impacts, and regeneration and GVA impacts.

Where appropriate, these elements are included in Economic Efficiency of the Transport System (TEE table), Analysis of Monetised Costs and Benefits (AMCB) and Public Accounts (PA) tables.

5.2 Transport Economic Efficiency (TEE)

The Economic Efficiency of the Transport System (TEE table) for the MetroWest Phase 1 OBC scheme is shown in Table 5.1.

Table 5.1: MetroWest Phase 1 OBC Scheme, Economic Efficiency of the Transport System (TEE)

Consumer - Commuting user benefits	**All Modes**	**Road**		**Rail**	
Travel Time	143,130	18,809		124,321	
Vehicle operating costs	1,420	1,420		0	
User charges	0	0		0	
During Construction & Maintenance	-106	0		-106	
NET CONSUMER - COMMUTING BENEFITS	**144,444**	**20,229**		**124,215**	
Consumer - Other user benefits	**All Modes**	**Road**		**Rail**	
Travel Time	53,969	7,092		46,877	
Vehicle operating costs	536	536		0	
User charges	0	0		0	
During Construction & Maintenance	-106	0		-106	
NET CONSUMER - OTHER BENEFITS	**54,398**	**7,628**		**46,771**	
Business	All Modes	Personal	Freight	Personal	Freight
Travel Time	43,662	3,678	15,626	24,358	0
Vehicle operating costs	2,996	706	2,290	0	0
User charges	0	0	0	0	0
During Construction & Maintenance	-212	0	0	-212	0
Subtotal	**46,447**	**4,385**	**17,916**	**24,146**	**0**
Private Sector Provider Impacts					
Revenue	0	0		0	
Operating costs	0	0		0	
Investment costs	0	0		0	
Grant/subsidy	0	0		0	
Subtotal	**0**	**0**		**0**	
Other business Impacts					
Developer contributions	0	0		0	
NET BUSINESS IMPACT	**46,447**				
TOTAL					
Present Value of Transport Economic **Efficiency Benefits (TEE)**	**245,290**				

Notes:

Benefits appear as positive numbers, while costs appear as negative numbers.

All entries are £'000s present values discounted to 2010, in 2010 prices

5.3 Public Accounts (PA)

Table 5.2 shows the Public Accounts (PA) table for the MetroWest Phase 1 OBC scheme.

Table 5.2: MetroWest Phase 1 OBC Scheme, Public Accounts (PA)

Local Government Funding	**ALL MODES**	**Road**	**Rail**
Revenue	0	0	0
Operating Costs	-177	-177	0
Investment Costs	0	0	0
Developer Contributions	0	0	0
Grant/Subsidy Payments	94,369	0	94,369
NET IMPACT	**94,192**	**-177**	**94,369**
Central Government Funding: Transport	**ALL MODES**	**Road**	**Rail**
Revenue	-126,770	0	-126,770
Operating costs	126,221	0	126,221
Investment costs	0	0	0
Developer Contributions	0	0	0
Grant/Subsidy Payments	0	0	0
NET IMPACT	**-549**	**0**	**-549**
Central Government Funding: Non-Transport			
Indirect Tax Revenues	12,678	12,678	0
TOTALS			
Broad Transport Budget	93,643	-177	93,820
Wider Public Finances	12,678	12,678	0

Notes:

Costs appear as positive numbers, while revenues and developer contributions appear as negative numbers.

All entries are £'000s present values discounted to 2010, in 2010 prices

5.4 Analysis of Monetised Costs and Benefits (AMCB)

Table 5.3 shows the Analysis of Monetised Costs and Benefits (AMCB) Table for the MetroWest Phase 1 OBC scheme, including summary information; total present values of costs (PVC) and benefits (PVB), net present value (NPV) and benefit-cost ratio (BCR) for both the initial appraisal and adjusted appraisal including monetised wider economic impacts and option values. In summary, the MetroWest Phase 1 OBC scheme generates a BCR of 2.55, which represents high value for money. If wider economic impacts and option values are included in the calculations, the BCR rises to 3.61, also representing high value for money.

Table 5.3: MetroWest Phase 1 OBC Scheme, Analysis of Monetised Costs and Benefits (AMCB)

Accidents, noise, air quality & greenhouse gases	6,286
Economic Efficiency: Consumer Users (Commuting)	144,444
Economic Efficiency: Consumer Users (Other)	54,398
Economic Efficiency: Business Users and Providers	46,447
Wider Public Finances (Indirect Taxation Revenues)	-12,678
Present Value of Benefits (PVB)	**238,897**

Broad Transport Budget	93,643
Present Value of Costs (PVC)	**93,643**

OVERALL IMPACTS	
Net Present Value (NPV)	**145,254**
Benefit to Cost Ratio (BCR)	**2.55**

Accidents, noise, air quality & greenhouse gases	6,286
Reliability	1,823
Wider Impacts	74,025
Option values	25,481
including Wider Impacts & Option Values	
PVB	338,403
PVC	93,643
NPV	244,760
BCR	**3.61**

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.

Costs and benefits are £'000s, present values discounted to 2010, in 2010 prices

5.5 Sensitivity testing

Sensitivity testing has been carried out to consider the socio-economic performance of MetroWest Phase 1 in the event that some of the key assumptions vary. Drawing on WebTAG unit M4, these are mostly based future year growth assumptions, and include:

- Sensitivity 1 – High demand growth, an increase growth profile assumptions;
- Sensitivity 2 – Low demand growth, a decrease growth profile assumptions;
- Sensitivity 3 – Fare/demand growth cap at 10 years (instead of 20 years);
- Sensitivity 4 – Fare/demand growth cap at 30 years (instead of 20 years);
- Sensitivity 5 – Operating cost risk, including all risk elements identified by GWR; and
- Sensitivity 6 – Ashton Vale Road junction effects added to highway benefits.

The high and low demand sensitivity tests include some changes to forecast models in order to assess highway related benefits. The other tests are directly related to assumptions that feed into the appraisal process.

Table 5.4 sets out summary socio-economic appraisal results for the six sensitivity tests, alongside the core MetroWest Phase 1 OBC scheme, with more detailed results in Table 5.5. Appendix D contains TEE, PA and AMCB tables for all of the sensitivity tests (as well as the OBC scheme).

Table 5.4: Results of socio-economic appraisal – sensitivity tests

Scheme scenario		**Present Values**			**BCR**
capital costs	Benefits & BCR	**Costs (PVC)**	**Benefits (PVB)**	**Net Present Value (NPV)**	benefit/cost ratio
OBC scheme	main	93.64	238.90	145.25	2.55
	adjusted	93.64	338.40	244.76	3.61
Sensitivity 1	main	84.98	256.53	171.56	3.02
	adjusted	84.98	359.50	274.53	4.23
Sensitivity 2	main	104.11	222.06	117.95	2.13
	adjusted	104.11	310.55	206.44	2.98
Sensitivity 3	main	109.11	212.83	103.72	1.95
	adjusted	109.11	301.32	192.21	2.76
Sensitivity 4	main	81.35	265.67	184.32	3.27
	adjusted	81.35	368.64	287.29	4.53
Sensitivity 5	main	120.20	238.90	118.70	1.99
	adjusted	120.20	338.40	218.20	2.82
Sensitivity 6	main	93.64	247.69	154.05	2.65
	adjusted	93.64	347.20	253.55	3.71

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

'Adjusted' benefits and BCR includes monetised wider economic impacts and option values

The tables indicate that the scheme BCR could drop to just under 2 if the worst-case sensitivity tests for growth and operating costs are achieved, though in all of these cases the adjusted BCRs (including wider economic impacts and option values) are still nearer to 3 than 2.

It is worth considering alongside the sensitivity test results shown that the basic growth profile derived for and used in OBC appraisal is based on historic trends and future projections in rail

industry planning documents. There are, however, competing features and challenges that link with these key drivers, that could mean the basic profile is potentially pessimistic.

For instance, the potential specification of the new GWR franchise is unknown at present, and indeed elements of the next franchise are currently out for consultation, but it is arguable that there is scope for a new franchise to increase generic demand for rail in the Bristol area through the operating regime of the new operator (such as new services and trains, and ticketing initiatives, etc). Ticketing initiatives may be more widely applicable than just the local franchise, but are typically boosted through franchise commitments. For instance, smart ticketing is becoming the norm, and this can drive demand up, especially off-peak (evidence in TfL suggests off-peak demand increases have been around 20% as a result of the Oyster system). Linked to this, new sales channels are very effective at revenue management and passenger choice, again potential factors for extra revenue. These are all unknowns that have the potential to be upside effects on future demand.

However, while historic demand growth rates have been high, there is some evidence that this is slowing down, and indeed rail demand growth stagnating in some areas (ORR station usage figures). Hence, the growth profile follows a decrementing path from current (recent) local growth rates, to (lower) future industry projected rates. The local WoE area has hitherto though resisted this slow-down, and local surveys indicated demand may be more than recorded in industry data such as ORR station usage figures.

Overall therefore, the forecast growth rates assumed can be considered comparatively conservative, and it is arguable that growth in demand closer to the ‘high demand growth’ (sensitivity 1) could be achieved.

Table 5.5: Detailed results of socio-economic appraisal – sensitivity tests

Element	MetroWest Phase 1 OBC Scheme	Sensitivity 1 High demand growth	Sensitivity 2 Low demand growth	Sensitivity 3 10-year fare/growth cap	Sensitivity 4 30-year fare/growth cap	Sensitivity 5 Operating cost risk elements	Sensitivity 6 Ashton Vale Road junction benefits
Net benefits to consumers and private sector (plus tax impacts)							
Rail user journey time benefits	195.56	209.28	179.06	169.84	218.41	195.56	195.56
Non-user benefits – road decongestion	50.16	53.06	48.57	48.57	53.06	50.16	58.95
Non-user– noise, air quality, greenhouse gases & accidents	6.29	6.65	6.42	6.41	6.66	6.29	6.29
Rail user and non-user disruption dis-benefits during possessions	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42
Indirect taxation impact on government	-12.68	-12.03	-11.57	-11.57	-12.03	-12.68	-12.68
BENEFITS sub-total (a)	*238.90*	*256.53*	*222.06*	*212.83*	*265.67*	*238.90*	*247.69*
Wider economic impacts (WI)	74.03	77.49	63.01	63.01	77.49	74.03	74.03
Option values (OV)	25.48	25.48	25.48	25.48	25.48	25.48	25.48
BENEFITS sub-total (b) inc WI & OV	*338.40*	*359.50*	*310.55*	*301.32*	*368.64*	*338.40*	*347.20*
Costs to government (broad transport budget)							
Capital costs	94.37	94.37	94.37	94.37	94.37	94.37	94.37
Non-user benefits – road infrastructure cost changes	-0.18	-0.18	-0.18	-0.18	-0.18	-0.18	-0.18
Revenue transfer	-126.77	-135.44	-116.31	-111.30	-139.06	-126.77	-126.77
Operating costs transfer	126.22	126.22	126.22	126.22	126.22	152.78	126.22
COSTS sub-total (c)	*93.64*	*84.98*	*104.11*	*109.11*	*81.35*	*120.20*	*93.64*
Net Present Value (NPV) (a-c)	145.25	171.56	117.95	103.72	184.32	118.70	154.05
Benefit Cost Ratio to Government (BCR) (a/c)	**2.55**	**3.02**	**2.13**	**1.95**	**3.27**	**1.99**	**2.62**
Net Present Value (NPV) (b-c) Adjusted	244.76	274.53	206.44	192.21	287.29	218.20	253.55
Benefit Cost Ratio to Government (BCR) (b/c) (inc WI & OV)	**3.61**	**4.23**	**2.98**	**2.76**	**4.53**	**2.82**	**3.71**

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

SECTION 6

Summary and Conclusions

6.1 Summary of economic assessment

Table 6.1 sets out the Value for Money Statement for the MetroWest Phase 1 OBC scheme.

Table 6.1: MetroWest Phase 1 OBC Scheme, Value for Money Statement

Criteria	Description
Value for Money/Value for Money when wider impacts are included	High/High
NPV	£145.25 million
Initial BCR	2.55
Adjusted BCR (With Wider Impacts)	3.61
Summary of the benefits and costs	• Rail transport user benefits (around 82% of the total benefits excluding wider impacts) • Highway transport user benefits (21% of total excluding benefits excluding wider impacts) • Wider Economic Impacts £74.0 million • Option Values £25.5m Operating costs are more significant than capital costs in the economic case, though not by much (56% operating cost versus 44% capital cost).
Significant non-monetised impacts	No significant non-monetised impacts. The most significant non-monetised impact is a moderate beneficial impact on journey quality. Other impacts are either slight beneficial (physical activity, access to services), slight adverse (historic environment, biodiversity, severance) or neutral.
Key risks, sensitivities and uncertainties underlying the appraisal	• Operating cost assumptions - potential scope for greater synergies with existing services to reduce staffing and maintenance costs • Rail demand forecasts, in particular future year growth in demand at new and existing stations • Future year fare assumptions
Significant social distributional impacts	Analysis indicates that scheme impacts are relatively evenly distributed across income, social and user groups. User benefit distributional impact is moderate beneficial, noise and air quality are minor adverse, other impacts are all neutral.

The assessment work presented in the economic case shows that there is a clear case for the MetroWest Phase 1 OBC scheme. The scheme demonstrates **high value for money**, largely due to the rail user benefits of the scheme. When wider impacts and option values are included, the scheme also offers **high value for money**.

As noted in the value for money statement, the scheme has clear merit, in that it generates benefits that more than outweigh the costs to an extent that the value for money assessment of the scheme is high. It is worth considering that most of the benefits are generated by improving the journeys of rail users, either through new journey opportunities or by changes to existing services that offer improvements in terms of journey time and frequency. The sensitivity tests surrounding demand growth are key to the scheme's potential. Discussion of sensitivity tests in the previous chapter of this report highlighted that growth projections could be considered pessimistic, for a variety of reasons relating to changes in the way that rail services will operate in the WoE area, in particular as

a result of new franchise bidding and negotiations delivering changes to services across the wider franchise area, as well as (perhaps more importantly) innovative ticketing initiatives that have the potential to generate demand, potentially significant at off-peak times. As such, higher demand growth could be considered a reasonably high probability.

The scheme will have a targeted effect on highway use, attracting some current car trips to rail. While rail will still remain a 'minority mode' in the WoE area, a number of benefit elements are generated by a reduction in car traffic, accounting for over 20% of total benefits (albeit this is slightly off-set by indirect tax impacts). Highway benefits are aligned with the likely rail trip distribution.

Operating costs are a significant feature of the overall stream of present values, though these are more or less cancelled out by revenue benefits generated from new rail trips. There is some risk inherent in operating cost assessments, which could result in decreasing the project's value for money. However, it is considered that, while this is illustrated as such in the sensitivity tests, extra demand (as also illustrated in the sensitivity tests) could have a restorative effect on the calculated value for money.

6.2 Appraisal Summary Table (AST)

The Appraisal Summary Table is set out in Appendix E. As well as economic impacts, this includes results of environmental impact, social impact and distributional impact appraisal, reported in the MetroWest Phase 1 OBC Chapter 2 'Economic Case', MetroWest Phase 1 OBC 'Social Impacts Appraisal Report' and MetroWest Phase 1 OBC 'Distributional Impacts Assessment Report' respectively.

Appendix A
Network Rail technical note:
Socio-economic Impacts for Rail Users

MetroWest Phase 1

Technical note: Socio-economic impacts for rail users

18 December 2017

System Operator Planning a better network for you

Contents

Part A: Introduction

A.01 Background

The West of England Councils has appointed CH2M to prepare a Outline Business Case (OBC) for the MetroWest Phase 1 project. Network Rail has been cooridnating with CH2M to understand the socio-economic impacts for rail users of the proposed scheme. The findings of this analysis are summaried in this report. CH2M has taken these findings forward to feed into the econimc case for the OBC.

The proposed MetroWest Phase 1 project aims to enhance capacity and service frequency on the Severn Beach line and for stations between Bristol Temple Meads and Bath Spa, together with the re-opening of the Portishead line. Two new stations at Portishead and Pill are proposed and provide direct rail services to Bristol Temple Meads, Avonmouth, Bath Spa and intermediate stations.

MetroWest Phase 1 is being led by North Somerset Council on behalf of the four West of England Councils, as a third party promoted rail project.

A.02 Scheme objectives

The MetroWest project is being jointly promoted and developed by the four West of England Councils. It will address the core issue of transport network resilience, through targeted investment to increase both the capacity and accessibility of the local rail network. The concept is to deliver an enhanced local rail offer for the sub-region comprising:

- existing and disused rail corridors feeding into Bristol;
- increased service frequency, cross Bristol service patterns (i.e. Bath to Seven Beach); and
- a Metro type service appropriate for a City Region with a population exceeded 1 million.

Details of the MetroWest Phase 1 objectives are discussed within the main business case document.

Part B: Socio-economic impacts analysis

The analysis is carried out in the same manner as conducting the standard WebTAG appraisal, except that the estimation of non-user benefits and benefit cost ratio are not covered.

The non-user benefits are analysed through CH2M's highway modelling workstream. The economic case prepared by CH2M takes into account both rail users and non-users information and calculates the benefit cost ratio (BCR) to inform the value for money category of the project.

This analysis use the same set of appraisal assumptions as in the main business case work, ensures the results are compatiable. A 60-year appraisal period has been considered when estimating the present value of benefits and costs. The assumptions used in this exercise are discussed in more detail in following sections and in the Appendix (Table D.1).

The socio-economic impacts are estimated in accordance with the Department for Transport's (DfT) appraisal guidance, in particular WebTAG (July 2017). The benefits and costs of the scheme are relative to the Do Minimum, in accordance with WebTAG.

In this report, all years refer to financial years (i.e. 2015 = 2015/16) unless stated otherwise.

B.01 Scenarios

B.01.01 Do minimum

The do-minimum is defined as the situation with Great Western Main line electrification and Intercity Express Programme (IEP) delivered in end of Network Rail's Control Period Five (CP5). The service specification of these programmes includes providing two additional trains per hour (each way) from London Paddington to Bristol Temple Meads via Bristol Parkway. The Do Minimum includes CP5 committed schemes. The do minimum does not include the proposed enhanced Bristol East Junction.

B.01.02 Do something – MetroWest Phase 1

The MetroWest Phase 1 project comprises the delivery of infrastructure and passenger train operations to provide:

- A half hourly service for the Severn Beach line (hourly for St. Andrews Road station and Severn Beach station);
- A half hourly service for Keynsham and Oldfield Park stations on the Bath Spa to Bristol line; and
- An hourly service for a reopened Portishead Branch Line with stations at Portishead and Pill.

Enhancements to services on the Severn Beach line will open in 2020 and re-opening of the Portishead line will follow in 2021.

B.02 Benefits calculations

This section addresses value of time improvement to new and existing passengers. It also discusses revenue benefits as well as tax costs.

The present value of the benefits over the 60-year period are presented in Table C.1.

B.02.01 Journey time saving /value of time benefits

Improving frequency and connectivity on the Severn Beach line, Portishead line and between Bristol Temple Meads and Bath Spa, will improve the generalised journey time for existing rail passengers. It also encourages modal shift from road and other public transport to rail. Generalised Journey Time (GJT) defined in Passenger Demand Forecasting Handbook (PDFH 5.1) comprises the following components:

- rail in-vehicle journey time;
- frequency (which is converted into equivalent minutes);and
- interchange penalty (which is converted into equivalent minutes).

The service specification provided by the project team is modelled in MOIRA – a rail industry demand forecasting model that assesses the impact of timetable changes on rail demand and revenue. In the model, WebTAG and Passenger Demand Forecasting Handbook (PDFH 5.1) values and parameters are used to estimate the journey time improvement to passengers on the existing lines.

The demand forecasting approach used in MOIRA is based on an elasticity approach as outlined in PDFH 5.1 and it is not capable of predicting demand to and from new stations. In order to estimate the value of time improvement to the new passengers at Portishead and Pill, the new station forecasts provided by CH2M are used.

The demand forecasts for the new stations at Portishead and Pill are presented in Table B.1. New passenger demand is assumed to build up within 3 years from opening, 90% at year 1, 95% at year 2 and full demand at year 3.

Table B.1: Demand forecast at new Station (2021)

New station forecast	
Station	**Forecasted journeys**
Portishead	321,014
Pill	53,511

*Full demand assumed to be materialised by year 3 from openin

The journey time improvement to the new rail passengers at Portishead and Pill stations are estimated by comparing the generalised costs of travel by car and by rail. Average fares are applied to demand forecasts to determine generalised journey time and revenue. An average fare of 26.5p per journey mile is assumed for Portishead and Pill passengers (based on the average revenue accrued per journey mile at local stations, without direct links to London, in the MetroWest area). The generalised cost of travel by car includes in-vehicle journey time in the peak and road costs such as parking cost in Bristol city centre. The generalised costs of travel by rail include the estimated rail fare. These costs are then

converted into equivalent generalised journey times using rail passengers' value of time outlined in WebTAG.

The values of time benefits for both new and existing passengers, on the existing and re-opened lines are shown in Table B.2. A build up profile has been applied to new passengers benefits which considers only 90% at year 1, 95% at year 2 and full benefits at year 3 from opening.

Table B.2: Passengers value of time benefits

Values of time benefits for new and existing passengers		
£m in 2010 prices	**2020**	**2021**
Existing passengers	3.35	3.49
New passengers*	-	0.42

*Full benefits assumed to be materialised by year 3 from opening

B.02.02 Revenue benefits

Revenue benefits are based on an estimation of the additional passengers generated by the scheme, the total revenue predicted is presented in Table B.3. A build up profile has been applied to new passengers benefits which considers only 90% at year 1, 95% at year 2 and full benefits at year 3 from opening.

Table B.3: Revenue benefits

Revenue benefits from new and existing passengers		
£m in 2016 prices	**2020**	**2021**
Existing passengers	1.33	1.39
New passengers*	-	1.72

*Full benefits assumed to be materialised by year 3 from opening

As the current franchise is expected to end in 2019, before the project's open day, the revenue benefits will be assumed to transfer to the government account.

B.02.03 Rail user and non-user disruption disbenefits during possessions

As a working assumption, the disruption costs during construction is assumed as 10% of the investment costs as a disbenefit, to mirror potential revenue lost during possessions. Rail users disbenefits are assumed to be 100% while non-users disbenefits are assumed to be 25%. This would be refined as the project develops.

B.02.04 Non-users benefits and indirect tax costs

The additional rail journeys result in non-user benefits and tax costs associated with a reduction in the number of cars on the roads. These are analysed through CH2M's highway modelling workstream.

B.03 Costs calculations

The costs analysis uses the same set of appraisal assumptions as in the main business case work to make sure results are compatiable. A 60-year appraisal period has been considered when estimating the present value of costs.

The present value of the costs over the 60-year period are presented in Table C.1.

B.03.01 Capital costs

Capital costs are estimated at £106m, at GRIP 3, in 2017 prices as advised by the project team. The capital costs is assumed to be funded by public fundings from the West of England councils. The itemaised capital costs is presented in Table B.4.

Table B.4: Capital costs

Cost Element (£m)	£m (2017 prices)
Preparation Costs	12.75
Railway construction costs	53.60
Risk & Fee Fund	2.00
Highway construction costs	6.98
Land costs	3.18
Mitigation works & Misc costs	2.58
Sub-total	**81.09**
Risk	20.22
Inflation	4.81
Total including Prep Costs	**106.12**

The costs will be spent according to the profile in Table B.5:

Table B.5: Capital costs spend profile

Estimated spend profile	
Financial Year	**Spending**
2017/18	2.8%
2018/19	4.6%
2019/20	10.9%
2020/21	41.4%
2021/22	40.3%

While the capital costs is at GRIP 3, a optimisim bias of 18% is applied over and above cost including QRA/general contingency, as outlined in WebTAG.

All third party funded projects are subjected to a Risk & Industry Fee, payable to Network Rail as an insurance cover. For MetroWest phase 1, this costs is estimated at £2m in 2017 prices. The promoter is having on-going discussion with Network Rail, and the final value is subject to change.

B.03.02 Renewal costs

The project team acknowledged that there will be renewal costs associated with MetroWest phase 1, however it is unclear on the magnitude of this.

It is considered that the MetroWest Phase 1 work will effectively bring forward renewal that is planned for the freight-only line, and also lower the overall unit renewal costs going forward. But it is unclear on what proportion of these renewal costs should attribute to the MetroWest project.

The project team has decided to include only known costs attributable to the project at the time of conducting this analysis, and renewal costs are not considered in this analysis.

B.03.03 Operating and maintenance costs

The MetroWest project requires ongoing operating and maintenance costs and the key cost components are summarised as follows:

- Network Rail operating costs: to operate and maintain new assets and infrastructure;
- Train Operating Company (TOC) staff costs: additional drivers and train managers are required to operate the new and enhanced rail services;
- TOC vehicle leasing costs for the additional units of Class 165/166 DMUs;
- TOC vehicle mileage related operating costs: includes increased track access charges, fuel costs and vehicle maintenance costs as a result of the additional vehicle mileages; and
- TOC operating costs (new stations): operating and maintenance costs associated with the new stations at Portishead and Pill.

These costs are high level etsimate and need to be refined further as the project develops to the next stage.

The assumptions of each cost component are discussed in turn. In line witn the project GRIP stage, the GRIP 3 optimism bias of 1% has been applied to all maintenance and operating costs when estimating the present value over the appraisal period.

a) Network Rail maintenance costs

High level Network Rail maintenance costs for the new infrastructure are estimated as below, these costs are in 2015 factor prices at GRIP stage 3:

- New crossover at Bathampton: £30k per annum (from 2020)
- Avonmouth: £20k per annum (from 2020)
- Pill to Portishead: £200k per annum (from 2021)

Maintenance costs will initially be low, and increases as the infrastructure ages; more detailed costs will become available as the project progress.

b) Vehicle leasing costs and mileage related operating costs

The operating costs are provided by the project team, in 2015 prices and at GRIP3, are summarised in Table B.6.

Table B.6: TOC related operating costs

Operating costs		
£m in 2015 prices	**2020**	**2021**
Staff costs	1.03	1.55
Vehicle leasing costs	0.99	1.48
Vehicle operating costs	0.76	1.13
Other operating costs	-	0.27

Part C: Summary and sensitivity tests

C.01 Benefits and costs summary

The analysis use the same set of appraisal assumptions that is used in the main business case work to make sure the results are compatiable. A 60-year appraisal period has been considered when estimating the present value of benefits and costs.

The PVs of the benefits and costs over the 60-year period are presented below:

Table C.1: Benefits and Costs summary

Results of benefits and costs analysis		
£m (PV 2010)	**MetroWest phase 1**	**MetroWest phase 1 with Industry & Risk Fee**
Rail users only		
Rail user journey time benefits	195.56	195.56
Indirect taxation impact on government (excl. road)	0.00	0.00
Rail and non-rail users		
Rail user and non-user disruption disbenefits during possessions	-0.42	-0.42
Costs to government		
Initial capital costs (c')	94.37	94.37
Renewal costs (c")	0.00	0.00
Revenue transfer	-126.77	-126.77
NR operating costs and TOC operating costs transfer	126.22	126.22
Other non-rail users benefits	Estimated from highway modelling work	

A set of sensitivity tests on demand growth and operating costs have been carried out and discussed in the following sections.

C.02 Sensitivity tests on demand growth

Four different demand growth scenarios have been tested :

- Increased growth profile on passenger demand
- Decreased growth profile on passenger demand
- Fare and demand cap at 10 years (instead of 20 years)
- Fare and demand cap at 30 years (instead of 20 years)

Table C.2 summarises the growth rates tested.

Table C.2: Growth profile for sensitivity tests

Demand growth profile assumptions			
Average (p.a.)	**Central case**	**Increased growth**	**Decreased growth**
now to 2019 inclusive	4.64%	5.44%	3.34%
2020 to 2025 inclusive	2.48%	2.86%	2.06%
2026 to 2037 inclusive	1.87%	2.12%	1.58%

These changes in demand growth assumptions mainly affect the rail user journey time benefits and the revenue over the 60 years period. The benefits outputs for these scenarios are presented in Table B.1

Table C.3: Compare benefits estimation from different demand growth scenarios

Benefits calculations					
£m (PV 2010)	Central case	Sensitivity tests			
		Increased demand growth	Decreased demand growth	Growth cap at 10 years	Growth cap at 30 years
Rail user journey time benefits	195.56	209.28	179.06	169.84	218.41
Revenue	126.77	135.44	116.31	111.30	139.06

C.03 Sensitivty test on operating costs

An alternative operating costs scenario has been tested to include all operational risk elements identified by GWR. A 35% uplift on staff costs and 28% uplift on vehicle operating costs have been assumed in the test.

The following Table C.4 summarise the differences on operating costs over the 60 years period.

Table C.4: Compare operating costs from sensitivity test

Opex calculations		
£m (PV 2010)	Central case	Sensitivity on operating costs risks
NR and TOC operating costs	126.22	152.78

Part D: Appendix

D.01 Futher information on assumptions

Table D.1: Further appraisal assumptions

Further appraisal assumptions Assumptions apply to central case unless stated. Further assumptions are in tables in main text. All years refer to financial years e.g. 2014 refers to 2014/15 F/Y.			
Assumption	**Value**	**Source**	**Comment**
General assumptions:			
Current year	2017	WebTAG	
Model base year	2017	WebTAG	
First year of benefits	2021	Project Team	100% of benefits realised from this year
Benefits profile by year	% of total		
2022	100%	Project Team	
2023	100%	Project Team	
Appraisal period (years)	60	Project Team	The maximum is 60 years under WebTAG
Price base year	2010	WebTAG (Unit A1.1, Para 2.6.3)	Values converted from model base year to price base year using GDP deflator
Base year for discounting	2010	WebTAG (Unit A1.1, Para 2.7.6)	
Discount rate (Social Time Preference Rate)	3.5% for 30 years from the current year and 3.0% thereafter	WebTAG (July 2017 databook, Table A1.1.1) & HM Treasury Green Book	
Unit of account	Market prices	WebTAG (Unit A1.1, Para 2.5.2)	19% added to convert factor prices to market prices
Capital and operating cost assumptions:			
Changes in capital costs in real terms during appraisal period	Not applied		
Changes in operating costs costs in real terms during appraisal period	Labour costs are assumed to increase in real terms (relative to GDP deflator) during appraisal period. Increases are c. 2% per annum between 2015 and end of appraisal period.	DfT	No other real terms changes in operating costs are assumed.
Cost of TOC profit as percentage of any change in operating costs	8%	DfT	
Optimism bias for:			
Capital costs	18% at GRIP stage 3	0	Optimism bias is not applied to cost savings
Operating costs	1% at GRIP stage 3	0	Optimism bias is not applied to cost savings
Passenger benefit-related assumptions			
Passenger demand growth			
Passenger set or all services	4.6% p.a. in 2015 to 2019 inclusive, 2.5% p.a. in 2020 to 2025 inclusive , 1.9% p.a. in 2026 to 2037 inclusive and 0% thereafter.	Based on CH2M growth profile. Under the central scenario, growth is capped 20 years after the current year, in accordance with WebTAG (Unit A5.3, Para 2.3.1).	Growth rates are all relative to the previous financial year.
Year in which underlying demand growth is capped (20 years from current year)	2037	WebTAG (Unit A5.3, 3.3.1)	This cap year also applies to fare increases applied (see below) and any real terms cost increases applied (see above).
Type/area of journey:	Proportion of total journeys		
Within the London Travelcard Area	0%		
Rest of South East to/from London	0%		
Within the South East (excl London	0%		
Outside South East to/from London (<100	0%		
Outside South East to/from London (100+	0%		
Outside South East <20 miles (excl within	96%		
Outside South East 20-100 miles	4%		
Outside South East 100+ miles	0%		
To/From Airports	0%		

Appraisal assumptions (continued)			
Values of time (VoT) by user type: Business (work) users Commuters Others	 £11.5 per hour in 2010 prices £9.95 per hour in 2010 prices £4.54 per hour in 2010 prices	 WebTAG (July 2017 databook, Table A1.3.1)	All data are in market prices
"Rule of the half"	50%	WebTAG (Unit A.1.3 Para 2.1.6)	Time savings applied to new users at half the rate applied to existing users
VoT growth (per annum) by user type: Business (work) users Non-work	 GDP (real terms) per person GDP (real terms) per person	 July 2017 version of WebTAG databook, Annual Parameters (for 2010 onwards).	
Average fare increases (% per annum above RPI) up to 2013 and from 2021. No increases applied after demand cap year (see above). Revenue growth also takes account of forecast increases in RPI relative to GDP deflator (until demand cap year), since appraisal uses GDP deflator to deflate prices to price base year.	1.0%	DfT advice	
Average fare increases (% per annum above RPI) between 2014 and 2020 inclusive	0%	DfT advice	
Reduction in car kms for 100% increase in rail passenger kms (diversion rate), for external costs of car use	26%	WebTAG (Unit A5.4, Table 1)	Same rate applied across GB
Other assumptions			
TOC revenue and TOC operating cost transfer: During current franchise the following proportion of revenue and operating costs is assumed to be transferred to government After current franchise expires the following proportion of revenue and operating costs is assumed to be transferred to government	 50% 100%	 Network Rail assumption Network Rail assumption	If the TOC is publicly-owned all revenue is transferred to government during the current franchise. Overall revenue and operating cost transfer assumptions are shown in the TEE tables.
Network Rail operating costs			All NR operating costs are treated as central government costs
Disruption during construction: Schedule 4 costs as a proportion of investment cost User disbenefits as a proportion of revenue disbenefits (i.e. Schedule 4) Non user disbenefits as a proportion of revenue disbenefits	 10% 100% 25%	 Project Team Economic Analysis Team assumption Economic Analysis Team assumption	 User & non-user benefits are increased to allow for factor to market price adjustment.
Indirect tax costs	Various including current fuel duty rates, resource costs of fuel and average fuel efficiency, and forecast changes in these parameters over the appraisal period	WebTAG (Unit A5.3, 4.7 and July 2017 databook)	As a simplifying assumption, the share of petrol and diesel in total car miles is assumed to be 50%/50% throughout the appraisal period. No electric car mileage is assumed.

Appendix B
Wider Economic Impacts Assessment

MetroWest Phase 1 OBC Wider Economic Impacts

PREPARED FOR:	WoE Councils
PREPARED BY:	GW
DATE:	20th December 2017
PROJECT NUMBER:	674946.CM.64.01
REVISION NO.:	1
APPROVED BY:	GWa/HS

1.0 Introduction

The methodology adopted in assessing wider economic impacts is in line with guidance in WebTAG Unit A2.1 and follows a similar process used by CH2M in the Preliminary Business Cases (PBC) of both MetroWest Phases 1 and 2.

2.0 Impacts Assessed

The Wider Impacts Assessment is focused on the following three areas:

- Agglomeration – By reducing journey times across the West of England (WoE), the relative agglomeration[1] of business in this area will increase. This will have a direct impact on the productivity and GDP of the UK and is a central element to the estimation of Wider Impacts;
- Output change in imperfectly competitive markets – A reduction in the costs of transport allows businesses to operate more efficiently, improves their output and intensity of business practices, and hence allows for benefits; and
- Labour supply impacts – This captures tax revenues arising from the welfare effects to the UK economy of having a wider human resource pool. As travel costs are reduced, more workers will be attracted to the workplace from either new areas accessible by the scheme or areas that are already connected receiving an improved service.

This assessment captures the wider impacts accrued over a 60-year appraisal period from the scheme opening year 2021 to 2081. Separate analysis has been carried out for the high and low demand sensitivity tests, in addition to the central OBC scheme case.

3.0 Geographical Detail

The main inputs for Wider Impacts Assessment include the DfT's standard economic dataset and outputs from GBATS4[2] models supplemented by local planning data and demographic information for the study area under investigation. As these data comes with varying geographical detail, a sector system was adopted to reconcile such discrepancy and also provide sufficient detail to enable decision-makers to understand the geographical distribution of wider impacts in WoE and areas further afield. The sector system was defined taking on board the following three aspects:

[1] Agglomeration is a term used to infer the ability of an economy to act through the density of companies to interact with one another.

[2] GBATS4 is a multi-modal transport model covering West of England. More detail of the model specification, functionality and its validation are available in the MetroWest Phase 1 OBC Forecasting Report and supplementary documents.

- Extent of coverage – consideration was given to the extent of the rail network covers as well as the area for which that GBATS4 modelling suite is capable of producing reasonably detailed output. The extent of coverage was also selected based on individual Local Authority District (LAD) boundary in order to be consistent with the format of the DfT's economic dataset. Four LADs were included in the area of investigation, namely Bath & North-East Somerset, Bristol City, North Somerset and South Gloucestershire Councils;
- Sectoring – each selected LAD was split into sectors for examination of benefit distribution across different parts of the region. Compatibility with different tiers of geographical area definition was the key for defining the sector system in order to facilitate access to other data that is readily available. The formulated sectors are therefore aggregation of traffic zones in GABTS4 and also follow Ward boundaries (or its aggregation) so modelling output and existing demographic information can be taken on board with ease. The four LADs in WoE are split into 13 different sectors, with the rest of the UK represented by sector 14; the sectoring system is illustrated in Figure 1; and
- Fitness for purpose – formulation of sectors also considered significant elements of MetroWest Phase 1, e.g. new stations, so the methodology framework is capable for providing insight on how different elements of interventions are likely to contribute to the overall wider impacts, should relevant input data can be made available.

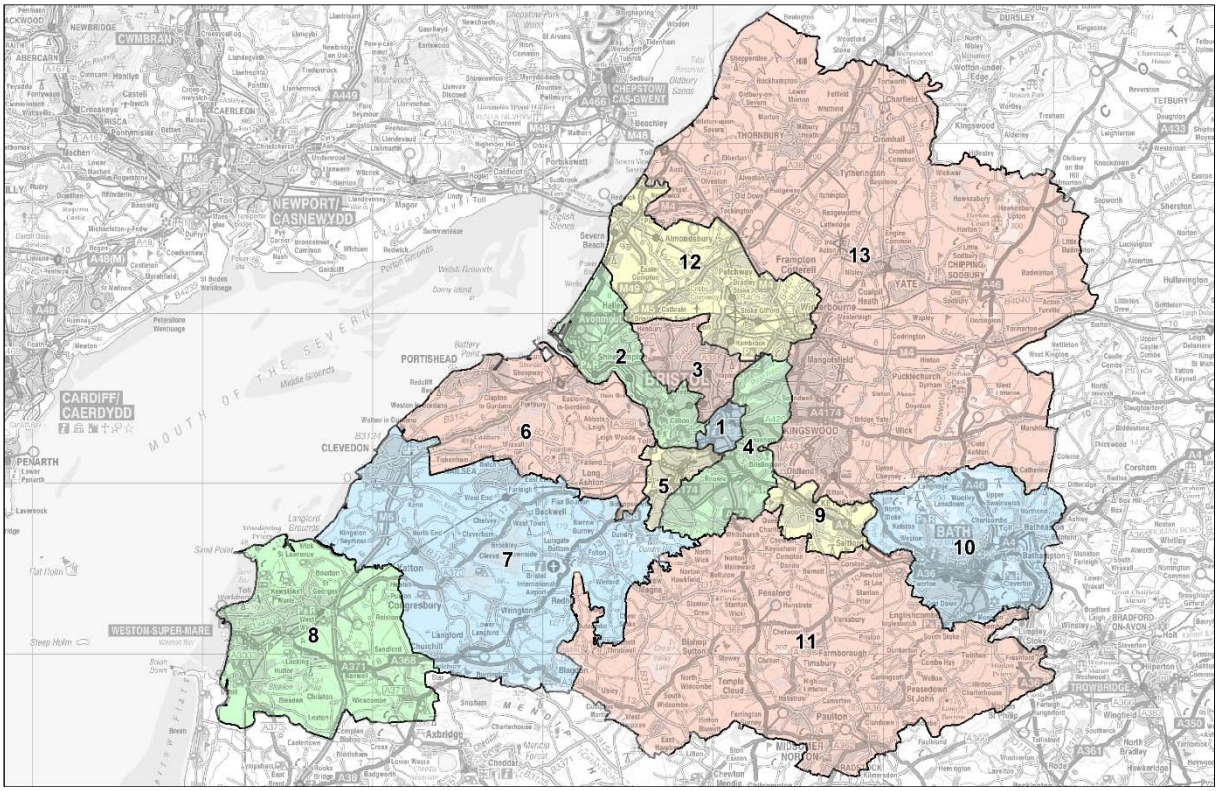

Figure 1: Wider impacts (and TUBA) sector system

4.0 Agglomeration

The calculation of agglomeration impacts follows the method set out in Appendix D of WebTAG Unit A2.1, based on demographic data as well as generalised travel demand and costs for business and commuting trips. Table 1 summarises data used for estimating the agglomeration impact including their sources and key assumptions adopted. Further information is set out in subsequent tables.

Table 2 has the number of employment in each LAD by employment sector, which is in line with assumptions in TAG Data Book for year 2036. Table 3 illustrates how information in Table 2 was apportioned to individual geographical sectors based on ratios derived from the number of arriving commuting trips in each sector during the AM peak. The volume of arriving commuting trips in the AM was regarded as a proxy (in relative terms) for number of jobs in this process.

Table 1: Data used for agglomeration impact calculation

Data required	Source & Assumptions
Local GDP per Worker	DfT Sectoral GDP forecasts for individual LADs were used. No variation in GDP per worker within individual LADs was considered.
Sectoral and total employment forecasts	DfT Sectoral and total employment forecasts for individual LADs were used. Total employment figures were apportioned to each geographical sector of individual LADs based on information derived from GBATS4 model and
Agglomeration elasticities by industrial sector	Recommended values from Table 1 at Page 9 of TAG Unit A2.1 were adopted.
Parameter for distance decaying	Recommended values from Table 1 at Page 9 of TAG Unit A2.1 were adopted.
Generalised cost matrices weighted across user groups [3]	Journey time, distance and road charge skim matrices were taken from GBATS4 output and converted the generalised travel cost following standard approach and parameters for VOT and VOC calculation in the latest TAG Data Book. Journey time saving as a result of MetroWest Phase 1 was derived based on sector-to-sector movements and deducted from the Do Minimum values to derive Do Something travel time. This again was converted generalised travel cost based on TAG compliant VOT. This approach ensures that all benefits derived are directly attributed to the proposed scheme and removes the risk of introducing spurious benefits as a result of potential 'modelling noise'.
Trip matrices by journey purpose and time period [3]	Travel demand matrices were taken from GBATS4 output. Business and commuting journeys were extracted separately. Highway car trips were converted to person trips using appropriate occupancy values from the latest TAG Data Book.

Agglomeration impacts were estimated for year 2021 and 2036 and then profiled[4] across the appraisal period between 2021 and 2081, and discounted to 2010 prices and values.

Results are presented in Table 4, for the OBC scheme and in addition for the high and low demand sensitivity tests carried out. Sectors with higher impacts are generally aligned with origins from which travel time benefits are expected from rail service improvements proposed as part of MetroWest Phase 1. As such, agglomeration benefits are highest in North Somerset, accounting for almost 50% of the total, with most of the remainder split between Bristol City and Bath & North-East Somerset.

Table 2: 2036 Employment by LAD

Source: tag-workbook-wider-impacts-dataset.xls

Local Authorities	Manufacturing	Construction	Consumer Services	Producer Services	Total
Bath & N.E.Somerset	4,658	3,577	24,306	21,191	53,732
Bristol City	10,802	8,249	48,877	106,470	174,398
North Somerset	6,088	3,588	28,646	22,865	61,187
South Gloucestershire	12,872	10,218	47,685	48,550	119,325

[3] The assessment methodology principally operates on the relationship between average generalised costs for 2-way trips before and after the scheme is implemented. This is not significantly different if public transport generalised costs are included or not. In addition, as a result of the hybrid rail demand and benefits methodology (as discussed previously), generalised costs are not readily available in the same formats, further complicating the calculations. Hence, it is considered appropriate to use just the highway generalised cost changes as a proxy to determine overall scheme wider impacts, with rail trips pivoting off related generalised cost changes

[4] Agglomeration impacts were assumed to change over time at the same rate as user VOT.

Table 3: 2036 Employment by Sector
Source: tag-workbook-wider-impacts-dataset.xls

Local Authorities	Sector	Ratio	Manufacturing	Construction	Consumer Services	Producer Services	Total
Bath & N.E.Somerset	9	9%	402	308	2,096	1,827	4,633
Bath & N.E.Somerset	10	67%	3,106	2,385	16,206	14,129	35,826
Bath & N.E.Somerset	11	25%	1,151	884	6,004	5,234	13,273
Bristol City	1	15%	1,653	1,262	7,480	16,294	26,689
Bristol City	2	41%	4,410	3,367	19,953	43,464	71,193
Bristol City	3	15%	1,663	1,270	7,525	16,391	26,849
Bristol City	4	20%	2,169	1,656	9,813	21,375	35,013
Bristol City	5	8%	908	693	4,107	8,946	14,654
North Somerset	6	22%	1,322	779	6,219	4,964	13,284
North Somerset	7	35%	2,151	1,268	10,122	8,079	21,621
North Somerset	8	43%	2,615	1,541	12,305	9,821	26,282
South Gloucestershire	12	48%	6,237	4,952	23,107	23,526	57,822
South Gloucestershire	13	52%	6,634	5,267	24,578	25,024	61,503

Table 4: Agglomeration impacts
Source: CH2M calculations

Agglomeration Impacts (£000s)	OBC Scheme	HIGH demand sensitivity	LOW demand sensitivity
2021	£2,104,483	£2,196,099	£2,212,273
2036	£3,249,492	£3,390,955	£2,627,147
Appraisal period (discounted)	£68.44m	£71.42m	£57.73m

5.0 Imperfect Competition

TAG Unit A2.1 suggests that the imperfect competition impact can be calculated as 10% of business user benefits which will have already been interpolated, extrapolated and discounted over the appraisal period. No further profiling or discounting is required. Table 5 presents the estimated imperfect competition impact, which is 10% of the business user benefits in rail and highway, for the OBC scheme and in addition for the high and low demand sensitivity tests carried out. Overall the total value of benefits for the OBC scheme is £4.56m.

Table 5: Imperfect competition impacts
Source: CH2M calculations

(£000s)	OBC Scheme	HIGH demand sensitivity	LOW demand sensitivity
Imperfect Competition Impacts	£4,563,557	£4,988,311	£4,529,033

6.0 Tax Revenues from Labour Supply Effects

The calculation of labour supply impact also follows the method set out in Appendix D of TAG Unit A2.1, based on inputs similar to what was used for estimating agglomeration impact, as listed in Table 6.

Table 6: Labour supply impacts data

Data required	Source / Challenges & Solutions
Elasticity of labour supply with respect to net return from working	DfT economic dataset; Recommended value is 0.1, Table 2 at Page 9 of TAG Unit A2.1
Number of workers living in zone *i* and working in zone *j* varying by forecast year	2011 Census data ('KS601EW to KS603EW - Economic activity by sex') was used to derive the total number of workers by LAD (economically active population in employment). The distribution of number of workers (by residence) to the sectors where their workplaces are is based on information derived from the GBATS4 AM commuting trip matrices. The total number of HBW trips in the AM was used as the weighting to apportion total number of workers from one sector to sub-groups by their respective destination sectors.
Mean gross workplace-based earnings by zone	DfT economic dataset
Median wage of marginal worker entering the labour market by zone	Derived from DfT economic dataset
Average tax rate	DfT economic dataset; Recommended value is 0.3, Table 2 at Page 9 of TAG Unit A2.1
Pay of marginal worker compared to average worker	DfT economic dataset; Recommended value is 0.69, Table 2 at Page 9 of TAG Unit A2.1
Round-trip commuting generalised cost	Derived from relevant generalised cost data.
Tax take on increased labour supply parameter	This is equal to 40% in accordance with guidance in WebTAG

Detailed information on the number of workers (by residence) was required for estimating increased tax revenues from Labour Supply Effects. This was derived using a combination of 2011 Census data and information from TEMPRO and is presented in Table 7. Information was disaggregated to individual geographic sectors using the number of home-based work trips from GBATS4 for the AM peak hour.

Values of the estimated increase in tax revenues from Labour Supply Effects for the modelled forecasting years and the entire appraisal period are presented in Table 8.

Table 7: Numbers of Workers in each LAD by Residence
Source: tag-workbook-wider-impacts-dataset.xls

Numbers of Worker	2011	2021	2036
Bath and North East Somerset	86,850	96,044	106,555
Bristol	216,840	232,958	270,805
North Somerset	82,807	98,815	110,355
South Gloucestershire	162,707	181,697	192,721

Table 8: Increase in Tax Revenues from Labour Supply Effects
Source: CH2M calculations

Labour supply impacts (£000s)	OBC Scheme	HIGH demand sensitivity	LOW demand sensitivity
2021	£38,387	£40,675	£41,767
2036	£46,906	£49,701	£30,664
Appraisal period (discounted)	£1.03m	£1.09m	£0.75m

7.0 Wider Impacts summary

Table 9 shows summary and total values of wider impacts for the Wider Impact Assessment for the Preliminary Business Case of MetroWest Phase 1.

Table 9: Summary total Wider Impacts (2021-80)
Source: CH2M calculations

(£000s)	OBC Scheme	HIGH demand sensitivity	LOW demand sensitivity
Agglomeration impacts	£68.44m	£71.42m	£57.73m
Imperfect competition impacts	£4.56m	£5.00m	£4.53m
Labour supply impacts	£1.03m	£1.09m	£0.75m
TOTAL Wider Impacts	£74.03m	£77.49m	£63.01m

Appendix C
Regeneration and GVA

MetroWest Phase 1 OBC
Economic Development/Regeneration Assessment

PREPARED FOR:	WoE Councils
PREPARED BY:	GW
DATE:	20th December 2017
PROJECT NUMBER:	674946.CM.64.01
REVISION NO.:	1
APPROVED BY:	GWa/HS

1.0 Introduction

Transport infrastructure can play a key role in regeneration and making an area's economy more productive and boosting economic output. Improved infrastructure can lead to improved access to markets and customers, higher mobility and flexibility of the labour market and more reliable supply of goods and services. There is a clear role for transport infrastructure, including public transport services, in driving regeneration and enhancing the economic output of an area.

Standard economic appraisal using WebTAG and DfT's Value for Money Guidance has historically focused on monetary valuations of time savings, accidents and financial aspects relating to the delivery of the transport system in isolation (e.g. fare revenue and operating costs). Recently, appraisal techniques have evolved with a view to incorporating the value of wider economic impacts such as labour market's access to more productive jobs or access for unemployed members of the workforce to employment opportunities. Further, local authorities and sub-regional economic development agencies such as local enterprise partnerships retain an interest in establishing the economic development impacts of transport schemes, measured in terms of metrics such as job creation and GVA uplift.

This technical note, building on the guidance prepared by the Department for Transport (DfT), West of England (WoE) Local Enterprise Partnership (LEP) and others, outlines the regeneration benefits of MetroWest Phase 1.

2.0 Scheme Context

MetroWest Phase 1 (the 'Scheme') aims to improve heavy rail commuter transport provision throughout North Somerset, Bristol and the wider West of England, by providing additional routes, enhanced service coverage and frequency. This will facilitate increased accessibility across the West of England area, by linking outlying settlements that do not currently benefit from rail provision (such as Portishead) with key employment and service destinations such as Central Bristol. The Scheme will also support linkages between North Somerset and the wider West of England region, via Central Bristol.

CH2M have been asked to assess the economic development impacts of the Scheme, to supplement the conventional economic appraisal of transport efficiency changes and wider impacts. This is underpinned by a range of economic development guidance published by national (e.g. Homes and Communities Agency [HCA], DfT) and sub-regional bodies (LEP, Local Authority).

Note that for the purpose of this analysis, the 'Scheme' refers to the preferred option for MetroWest Phase 1. The preferred option entails enhanced service frequency on the Severn Beach line

(upgraded to thirty minute intervals) as well as establishment of a new service between Portishead and Bristol Temple Meads (based on an hourly service frequency).

3.0 Methodology

3.1 Overview

Within this context, this assessment adopts a bespoke methodology to estimate the economic development and wider regeneration impacts of the Scheme. The methodology attempts to reconcile the West of England LEP's economic impact guidance with DfT's emerging Wider Economic Impact guidance and labour market modelling that is consistent with previous analysis undertaken for previous stages of the MetroWest project.

In particular, the West of England LEP's economic impact guidance was utilised to inform construction stage job creation and GVA uplift, as well as providing the overall framework for analysis encompassing treatment of wider 'operational stage' impacts and treatment of additionality.The DfT's emerging Wider Economic Impact guidance was consulted to establish the narrative linking transport investment to economic externalities. Existing labour market modelling, in the form of spatial labour market balance sheets that were used extensively on the MetroWest project, was retained as the primary model driving analysis of wider economic development impacts.

3.2 Labour Market Balance Sheets

The labour market balance sheet model consists of a number of key tasks, including:

- **Defining the geographic areas for analysis**: This includes defining the catchment area for rail demand, analogous to the primary labour supply zone. It also includes establishing the employment destinations of key labour demand zones. The determination of the key labour demand zones is based on employment density data for the WoE sub-region. The primary labour supply zone is defined as the four local authorities comprising the WoE (namely Bath and North East Somerset, Bristol, North Somerset and South Gloucestershire).
- **Determine existing and projected travel patterns**: This includes summary results of high level multi-modal transport modelling exercise undertaken using the GBATS4 model. In particular, the summary results for am peak journeys (used as a proxy for travel to work) originating from the primary labour supply zone by modes and destinations are used as key input assumptions for preparation of high level current and future labour market balance sheets.
- **Preparation of a current labour market balance sheet for the WoE**: This is based on the latest employment [1], labour supply data [2], unemployment [3] and vacancy data [4] sourced from NOMIS and Neighbourhood Statistics at small area level for the WoE.
- **Preparation of a future labour market balance sheet for the WoE:** This involves application of relevant growth factors based on the Tempro Planning Data and the West of England's Growth scenarios. This exercise results in development of future labour market balance sheets for the WoE post implementation of the Scheme. This is undertaken for each option and a do minimum scenario, and provides an indication of how the various scenarios may facilitate accessibility to jobs and subsequent growth in economic output across the WoE in future years.
- **Establishing the current and future economic output for the WoE:** This involves combining the outputs of the developed labour market balance sheets with the WoE LEPs per annum per capita GVA parameters. The result is estimation of current economic value in the WoE and future value under the Do Minimum and Preferred Option scenarios.

1 Source: Business Register and Employment Survey, 2015, NOMIS

2 Source: Economic Growth Forecasts, 2015, West of England LEP

3 Source: Claimant Count data, 2015, NOMIS

4 Source: Notified Job Vacancy data, 2012, NOMIS

- **Establishing the impact of the Scheme:** The approach reconciles labour supply and labour demand changes resulting from increased accessibility in response to transport interventions. It identifies changes in trip movements and the destination of trips from demand forecasting analysis to determine whether labour supply and labour demand are better matched. Where trip numbers between supply and demand zones increase, this is interpreted as a change in the number of job opportunities filled by the available labour force. This can be translated into an estimate for GVA change, as highlighted above. A proportion of the change in annual economic output in the WoE can be viewed as the impact of the Scheme.

In light of these methodological overviews, the labour market balance sheet approach was considered appropriate for a number of reasons:

- Continued use of the labour market balance sheet approach provides consistency with previous stages of assessment as well as direct comparison to earlier results;
- The labour market balance sheet approach adheres to many of the principles outlined in the emerging DfT Wider Economic Impacts guidance, including consideration of demand and supply side factors (through reconciliation of labour demand and labour supply)
- Notwithstanding the above similarities, the DfT Wider Economic Impacts guidance is yet to be formally adopted, so complete re-work of the labour market balance sheet model is unnecessary;
- The existing 'Regeneration Assessment' prescribed through DfT's current guidance is more suited to application in highway investment contexts, rather than rail investment;
- The outputs from the analysis can be readily substituted into the framework for reporting impacts identified in the West of England LEP's economic impact guidance.

As a result, it is felt that the labour market balance sheet offers the most suitable approach to the assessment of wider impacts in the context of MetroWest Phase 1.

3.3 Scheme Profile and Discounting

In addition to the methodological considerations outlined above, the estimation and monetisation of economic impacts is underpinned by various factors relating to the expenditure profile for the Scheme, opening year of operation and approach to discounting. For the current analysis, the following expenditure profile was adopted:

Year	2017	2018	2019	2020	2021
Expenditure Profile for Preferred Option	5%	5%	5%	35%	50%

The opening year of operation for the Scheme is assumed to commence in the year following final expenditure. Based on the expenditure profile, the Scheme will be operational in 2022. Further, a discount rate of 3.5% was adopted for the analysis, in line with HM Treasury's Green Book.

4.0 Results

4.1 Construction Stage Impacts

Construction stage impacts in the form of employment creation and associated GVA uplift are driven by expected construction turnover, reflected in scheme costs. Direct employment impacts are derived through application of construction cost per job benchmark to overall turnover. A benchmark of £90,000 (2014) prices is recommended by West of England LEP. Application of this benchmarks to the direct construction costs (i.e. on-site works) for the Scheme results in a direct construction stage job creation estimate of 720 jobs, based on 2017 prices and values, as follows:

Option	Construction Costs (£m)	Construction Cost per Job Benchmark	Direct Jobs (FTEs)
Preferred Scheme	67.5	£93,718	720

The West of England LEP also advise that indirect job creation, resulting from supply chain and induced income (expenditure) effects within the local economy, is generated in line with an employment multiplier of between 1.7 and 2.0. Based on the assumption that construction works will support a labour force with a high local content, sourced from within the West of England, the high-end multiplier of 2.0 was applied to the direct job creation to forecast indirect job creation. This effectively doubles the direct construction stage job estimate outlined above to generate the total construction stage job estimate outlined below. The estimates show that more than 1,400 construction stage jobs (direct and indirect) could be supported by the Scheme, as follows:.

Option	Direct Jobs (FTEs)	Employment Multiplier Effect	Indirect Jobs (FTEs)	Total Job Creation
Preferred Scheme	720	2.0	720	1,441

The forecast for GVA uplift in the construction stage is informed by the West of England LEP's assumption that the GVA to turnover ratio amounts to 0.4 for all direct construction expenditure (i.e. on site works) and 0.5 for all non-construction scheme costs (i.e. design work etc). Applying these benchmarks to the specific construction and non-construction elements for the Scheme results in estimates of nearly £33m for direct GVA uplift as a result of the Scheme, as follows:

Option	Construction Costs (£m)	GVA/ Turnover Benchmark	Direct Construction GVA	Non-Construction Costs (£m)	GVA/ Turnover Benchmark	Direct Non-Construction GVA	Total Direct GVA Uplift*
Preferred Scheme	67.5	0.4	£27.01	11.7	0.5	£5.86	£32.86

Note: GVA figures are undiscounted at this stage

The West of England LEP also advise that indirect GVA uplift, again resulting from supply chain and induced income (expenditure) effects within the local economy, is generated in line with an output multiplier of between 1.8 and 1.9. Based on the assumption that construction works result in largely local supply chain and employment effects within the West of England, the high-end multiplier of 1.9 was applied to the direct GVA uplift to forecast indirect GVA uplift. This nearly doubles the direct GVA uplift estimate outlined above to generate the total construction stage GVA uplift outlined below. The estimates show that more than £62m of construction stage GVA uplift (direct and indirect, undiscounted) could be generated by the Scheme, as follows:

Option	Direct GVA Uplift	Output Multiplier Effect	Indirect GVA Uplift	Total GVA Uplift
Preferred Scheme	£32.86	1.9	£29.58	£62.44

5.0 Operational Stage Impacts

Operational stage impacts take two forms:

- Wider economic development impacts;
- Rail operations impacts.

The wider economic development impacts, assessed via the Labour Market Balance Sheet approach, are presented first.

5.1 Wider Economic Development Impacts

As identified above, the primary labour supply zone is defined as the four local authorities that constitute the WoE; namely Bath & North-East Somerset Council, Bristol City Council, North Somerset Council and South Gloucestershire Council. It should also be noted that the demand

forecasting analysis draws on a wider catchment area than the WoE. This is reflected in the changes in travel demand following Scheme implementation and is therefore captured by the labour market balance sheet model.

Initial analysis of data sourced from the public domain suggests that there are almost 559,000 working age residents economically active in the study area. Of these some 550,000 are in employment and some 9,000 are currently unemployed. The analysis also suggests a balanced labour market, with similar proportions of residents employed in high value adding producer services (e.g. business, professional, technical, etc) at 26%, relative to consumer services (e.g. wholesale, retail, hotels, etc) at 28% and public services sectors at 26%. Data summarised in Table 1 is adopted as key input data to establish the current labour market balance sheet.

Table 1. Working Age Residents
Source: Oxford Economic 'West of England Forecasts' 2015

Employment Sector	Working Age Residents
Manufacturing	40,887
Consumer Services	155,247
Producer Services	141,319
Public Services	141,622
Other Activities	70,788
Total Employed	**549,863**
Unemployed	**8,872**
Total	**558,735**

The identification of labour demand zones was informed by analysis undertaken in 2012 which involved mapping employment densities[5] at small area level, and is summarised in Figure 1. This definition is supplemented by a number of key employment growth locations that have been designated as enterprise areas, further to the nationally-recognised Temple Quarter Enterprise Zone. Such enterprise areas and enterprise zones have been included as labour demand zones. This highlights ten areas as key employment destinations, which are set out (showing total jobs and vacancies included) in Table 2. These are defined as the key labour demand zones and are presented in Figure 1.

Table 2. Key employment destinations
Source: Neighbourhood Statistics

Key employment destination	Jobs	Vacancies
Avonmouth/Severnside Enterprise Area	19,615	1,740
Bath City Riverside Enterprise Area	39,950	894
Bristol City Centre	95,455	2,566
Filton Enterprise Area	11,850	830
North Fringe	50,615	633
Portishead	11,900	529
Science Park Enterprise Area	3,520	49
Temple Quarter Enterprise Zone	60,085	244
Weston-super-Mare and Gateway Enterprise Area	32,215	946
Yate and Thornbury	15,730	410

5 Employment density for the purpose of this assessment is defined as jobs per square kilometre. The LSOA level workplace jobs data used to define the employment densities has been sourced from Business Register and Employment Survey (NOMIS, 2015). The data on areas for relevant output areas has been sourced from Neighbourhood Statistics.

The small area employment data also suggests that there are some 211,000 jobs distributed elsewhere within the WoE. The labour demand data summarised above is also adopted as key input data to establish the current labour market balance sheet.

5.1.1 Existing and projected travel patterns

The next step was to establish the current movement patterns of residents and employees within the WoE as well as projections following the implementation of the Scheme. This data was derived based on outputs from the GBATS4 multimodal model and has been summarised for the 'Do Minimum' (i.e. without Scheme) and 'Do Something' (i.e. with Scheme) scenarios in Table 3. The movement data outlined in the tables also acts as key input data for establishing the current and future labour market balance sheets for the options. It should be noted at this point that change in trip numbers between the 'Do Minimum' and 'Do Something' options in 2036 is relatively small.

Table 3. Work Journeys Originating from the WoE by Destinations – all Options
Source: GBATS Multimodal Model, CH2M Calculations

Destinations	Total Movements		Proportional Movements	
	2036 Do Min	2036 Do Some	2036 Do Min	2036 Do Some
Avonmouth EA	8,033	8,072	6.7%	6.7%
Bath EA	2,386	2,490	2.0%	2.1%
Bristol City Centre	15,073	15,313	12.5%	12.7%
Filton EA	7,339	7,283	6.1%	6.0%
North Fringe	12,428	12,368	10.3%	10.2%
Portishead	3,603	3,646	3.0%	3.0%
Science Park EA	2,169	2,117	1.8%	1.8%
Temple Quarter EZ	3,663	3,663	3.0%	3.0%
Weston Super Mare EA	3,522	3,517	2.9%	2.9%
Yate and Thornbury	2,919	2,905	2.4%	2.4%
Other Destinations	59,418	59,513	49.3%	49.2%
Total Movements	120,554	120,886	100.0%	100.0%
Increase in Trips over 2036 Do Min		0.28%		

The current labour market balance sheet for the WoE, which is based on the labour demand, labour supply and labour movement data presented in earlier sections, is presented in Table 4 and Table 5. The balance sheet suggests that some 6% of the employment opportunities available in the WoE are taken up by workers who reside outside the area. This implies there is competition for employment opportunities from workers outside the WoE, particularly in producer and public services. The balance sheet also highlights a marginal shortfall in jobs, derived as the difference between current unemployment and current vacancies. There is also a shortfall of 5,200 employees when comparing in-commuters (c. 33,000) with out-commuters (c. 28,00). These shortfalls could reflect lost or missing economic value generating opportunities for employers and residents within the sub-region.

In addition to the data presented in earlier sections, the development of the current labour market balance sheet uses the following key assumptions:

- Number of workers from the WoE accessing jobs outside the area equals the number of jobs available outside the area; and

Labour supply from outside the WoE accessing jobs within the area is derived as a balance between total jobs and employed workforce in the area.

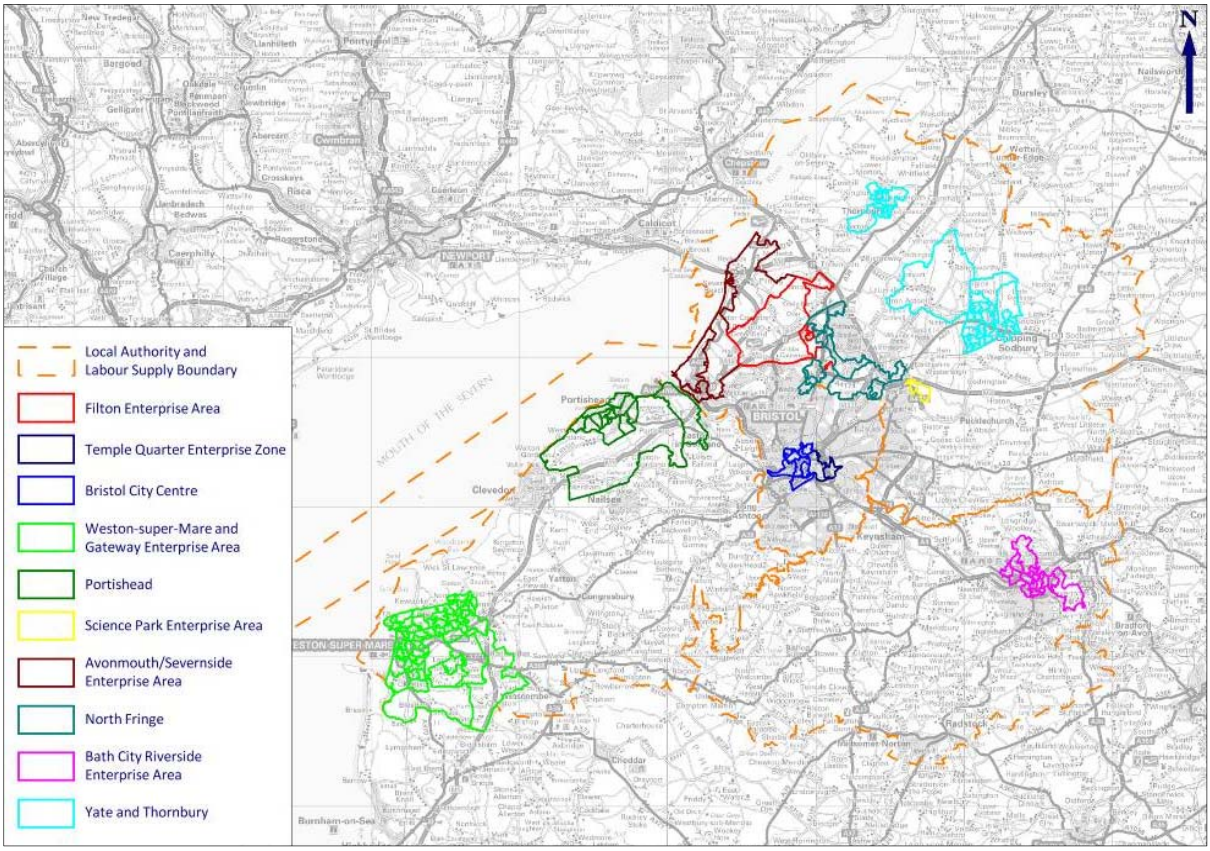

Figure 1. Labour Demand Zones

Source: Business Register and Employment Survey, ONS, NOMIS

Table 4. Current Labour Market Balance Sheet – Labour Supply

Source: CH2M Calculations

Labour supply	Manufacturing	Consumer Services	Producer Services	Public Services	Other Activities	Total
Avonmouth EA	1,934	7,343	6,684	6,699	3,348	26,008
Bath EA	717	2,722	2,478	2,483	1,241	9,642
Bristol City Centre	5,329	20,235	18,420	18,459	9,227	71,669
Filton EA	1,641	6,231	5,672	5,684	2,841	22,070
North Fringe	4,696	17,830	16,231	16,266	8,130	63,153
Portishead	1,311	4,977	4,531	4,540	2,269	17,628
Science Park EA	434	1,647	1,499	1,503	751	5,834
Temple Quarter EZ	1,417	5,379	4,896	4,907	2,453	19,052
Weston Super Mare EA	970	3,682	3,351	3,358	1,679	13,039
Yate and Thornbury	1,086	4,122	3,753	3,761	1,880	14,601
Other Destinations	21,353	81,078	73,803	73,962	36,969	287,165
TOTAL Phase 1 Labour Supply (employed and unemployed)	41,547	157,752	143,599	143,907	71,930	558,735
Labour Supply from outside study area	-	-	22,351	10,628	-	32,980
Unemployed Labour Supply	660	2,505	2,280	2,285	1,142	8,872

Table 5. Current Labour Market Balance Sheet - Availability of Jobs
Source: CH2M Calculations

Labour supply	Manufacturing	Consumer Services	Producer Services	Public Services	Other Activities	Total
Avonmouth EA	2,050	12,855	2,255	715	1,740	19,615
Bath EA	495	11,785	10,225	14,715	2,730	39,950
Bristol City Centre	950	15,575	48,995	25,705	4,230	95,455
Filton EA	250	7,700	1,650	1,725	525	11,850
North Fringe	5,685	5,350	17,015	18,070	4,495	50,615
Portishead	750	4,735	2,610	2,940	865	11,900
Science Park EA	100	1,750	1,025	520	125	3,520
Temple Quarter EZ	1,050	15,115	29,365	8,930	5,625	60,085
Weston Super Mare EA	1,230	10,225	7,035	10,465	3,260	32,215
Yate and Thornbury	1,355	5,025	3,400	3,770	2,180	15,730
Other Destinations	21,220	58,290	40,095	64,695	27,185	211,485
Total Jobs	35,229	150,400	169,120	152,989	53,523	561,262
Total Vacancies	94	1,995	5,450	739	563	8,842
Employment Surplus or Shortfall	-566	-510	3,170	-1,546	-579	-30

The future labour market balance sheets are shown in Tables 6, 7 and 8; Table 6 has future availability of jobs (common to do minimum and all options); Table 7 shows do minimum labour supply; and Table 8 includes do something labour supply. Note that in addition to the data presented in earlier sections, the development of the future labour market balance sheets uses the following key assumptions:

- Labour supply will increase in line with the Tempro 'workers' growth factors:

Tempro 'workers' Growth Factors, 2014-31	
Bath & NE Somerset	105.8%
City of Bristol	112.7%
North Somerset	107.7%
South Gloucestershire	107.6%
Average	108.5%

- Labour demand will increase in line with the Tempro 'jobs' growth factors:

Tempro 'jobs' Growth Factors, 2014-31	
Avonmouth EA	113.5%
Bath EA	112.7%
Bristol City Centre	119.2%
Filton EA	108.8%
North Fringe	111.0%
Portishead	113.7%
Science Park EA	109.2%
Temple Quarter EZ	119.2%
Weston Super Mare EA	114.1%
Yate and Thornbury	109.2%

- Unemployment will fall by 50% between the present and 2036.
- Labour supply from outside the WoE accessing jobs within the area is derived as a balance between total jobs and employed workforce in the area.

Table 6. Future Labour Market Balance Sheet – Availability of Jobs – All Scenarios
Source: CH2M Calculations

Employment Sector	Manufacturing	Consumer Services	Producer Services	Public Services	Other Activities	Total
Avonmouth EA	2,326	14,587	2,559	715	1,974	22,162
Bath EA	558	13,276	11,518	14,715	3,075	43,142
Bristol City Centre	1,132	18,565	58,402	25,705	5,042	108,847
Filton EA	272	8,375	1,795	1,725	571	12,738
North Fringe	6,309	5,938	18,884	18,070	4,989	54,190
Portishead	853	5,386	2,969	2,940	984	13,131
Science Park EA	109	1,910	1,119	520	136	3,795
Temple Quarter EZ	1,252	18,017	35,003	8,930	6,705	69,907
Weston Super Mare EA	1,404	11,669	8,029	10,465	3,720	35,287
Yate and Thornbury	1,480	5,489	3,714	3,770	2,381	16,835
Other Destinations	23,990	65,899	45,329	64,695	30,734	230,647
Total Jobs in WoE	39,685	169,112	189,320	152,250	60,313	610,680
Total Additional Jobs 2014-2036	4,457	18,712	20,200	-739	6,789	49,419

Table 7. Future Labour Market Balance Sheet – Labour Supply Do Minimum
Source: CH2M Calculations

Employment Sector	Manufacturing	Consumer Services	Producer Services	Public Services	Other Activities	Total
Avonmouth EA	3,093	11,746	10,692	10,715	5,356	41,602
Bath EA	862	3,275	2,981	2,987	1,493	11,599
Bristol City Centre	5,804	22,039	20,062	20,105	10,049	78,059
Filton EA	2,698	10,246	9,326	9,346	4,672	36,288
North Fringe	4,570	17,351	15,794	15,828	7,911	61,453
Portishead	1,326	5,034	4,583	4,593	2,296	17,831
Science Park EA	797	3,028	2,756	2,762	1,381	10,724
Temple Quarter EZ	1,411	5,356	4,876	4,886	2,442	18,971
Weston Super Mare EA	1,296	4,921	4,480	4,489	2,244	17,431
Yate and Thornbury	1,073	4,075	3,710	3,718	1,858	14,435
Other Destinations	22,018	83,602	76,101	76,265	38,120	296,106
Unemployed Labour Supply	330	1,252	1,140	1,143	571	4,436
TOTAL Phase 1 Labour Supply (employed and unemployed)	45,279	171,926	156,501	156,836	78,393	608,935
Labour Supply from outside study area	-	-	33,960	-	-	33,960

Table 8. Future Labour Market Balance Sheet – Labour Supply Do Something
Source: CH2M Calculations

Employment Sector	Manufacturing	Consumer Services	Producer Services	Public Services	Other Activities	Total
Avonmouth EA	3,108	11,802	10,743	10,766	5,381	41,799
Bath EA	900	3,417	3,111	3,117	1,558	12,104
Bristol City Centre	5,896	22,389	20,380	20,424	10,209	79,297
Filton EA	2,678	10,168	9,255	9,275	4,636	36,012
North Fringe	4,547	17,267	15,718	15,751	7,873	61,156
Portishead	1,342	5,095	4,638	4,647	2,323	18,044
Science Park EA	778	2,955	2,690	2,696	1,348	10,468
Temple Quarter EZ	1,411	5,356	4,876	4,886	2,442	18,971
Weston Super Mare EA	1,295	4,915	4,474	4,484	2,241	17,409
Yate and Thornbury	1,068	4,055	3,692	3,700	1,849	14,364
Other Destinations	22,053	83,736	76,223	76,386	38,181	296,579
Unemployed Labour Supply	330	1,252	1,140	1,143	571	4,436
TOTAL Phase 1 Labour Supply (employed and unemployed)	45,406	172,407	156,939	157,275	78,613	610,640
Labour Supply from outside study area	-	-	33,521	-	-	33,521

It should also be noted that labour demand is fixed across the future year scenarios. The same Tempro 'jobs' growth factor is used for each scenario. This is because while the Scheme is assumed to facilitate accessibility to jobs and link labour supply with employment destinations (i.e. labour demand) more effectively, it will not directly create new permanent jobs at these locations. In addition, new development at the various labour demand zones is assumed to be promoted or accelerated rather than contingent on delivery of the Scheme. That is to say, future employment land development could occur even in the absence of the Scheme.

Within this context, the future labour market balance sheets show that labour demand will grow by almost 49,000 jobs by 2036 under each of the future scenarios. Increased labour demand and an increasing workforce residing within the study area, coupled with the Scheme (and associated additional rail passenger demand), contributes to increasing the economic output post Scheme implementation.

However, the key driver of the wider economic development and regeneration resulting from the Scheme is the increased accessibility between labour supply and labour demand zones, and particularly between skilled labour and key employment destinations. Changes in accessibility attributable to the Scheme are measured by the change in rail passenger demand between labour supply and labour demand zones after implementation of the Scheme. As noted previously, the increase in trips facilitated between the zones is modest. This is highlighted by an increase in between-zone trips of 0.28% from the Do Minimum to Do Something scenarios, as outlined by the demand forecast associated with the Scheme.

Estimating the regeneration and future economic outputs attributable to the Scheme requires the use of outputs from the labour market balance sheets and application of the South West Growth Scenarios[6] per annum per capita GVA parameters outlined in Table 9. The result is an estimation of current economic value generated and the future value of the area pre-and post-implementation.

6 Oxford Economics 'West of England Forecasts' (2015)

Table 9. GVA Indicators (per annum per FTE, 2011 prices)
Source: Oxford Economics 'West of England Forecasts' (2015)

Local Authorities	Manufacturing	Consumer Services	Producer Services	Public Services	Other Activities
Bath & NE Somerset	£68,729	£41,454	£86,616	£41,510	£56,796
City of Bristol	£68,411	£42,784	£69,085	£37,059	£54,016
North Somerset	£66,287	£42,112	£83,420	£42,637	£54,614
South Gloucestershire	£64,308	£42,785	£57,630	£46,896	£49,648
Average	£66,239	£42,471	£70,238	£41,048	£53,388

Applying these parameters to the labour market balance sheet outputs for the Do Minimum and Do Something scenarios suggests that:

- Some £31.457 billion of annual economic activity will be generated in the Do Minimum scenario, without implementation of the Scheme;
- Up to £31.550 billion of annual economic activity will be generated in the Do Something scenario, with implementation of the Scheme.

The annual GVA analysis for the Do Minimum and Do Something scenarios in 2036 is presented in Table 10 for the Do Minimum, and Table 11 for the Do Something.

Table 10: Economic Value – GVA per annum – 2036 Do Minimum (2011 prices)
Source: CH2M Calculations

Labour demand zone	Manufacturing	Consumer Services	Producer Services	Public Services	Other Activities	Total
Avonmouth EA	£211,624,782	£502,523,328	£738,651,410	£397,077,804	£289,291,971	£2,139,169,295
Bath EA	£59,277,115	£135,755,790	£258,205,025	£124,006,380	£84,808,769	£662,053,080
Bristol City Centre	£397,082,450	£942,910,335	£1,385,969,585	£745,057,481	£542,813,386	£4,013,833,237
Filton EA	£173,525,620	£438,362,621	£537,478,053	£438,311,743	£231,940,426	£1,819,618,464
North Fringe	£293,860,624	£742,354,430	£910,203,551	£742,268,271	£392,784,409	£3,081,471,285
Portishead	£87,890,799	£212,012,831	£382,295,536	£195,815,430	£125,370,878	£1,003,385,473
Science Park EA	£51,278,954	£129,541,543	£158,831,371	£129,526,508	£68,541,247	£537,719,622
Temple Quarter EZ	£96,505,513	£229,161,591	£336,841,142	£181,076,133	£131,923,444	£975,507,824
Weston Super Mare EA	£85,915,105	£207,247,002	£373,701,928	£191,413,702	£122,552,670	£980,830,407
Yate & Thornbury	£69,024,529	£174,370,639	£213,796,495	£174,350,402	£92,260,605	£723,802,670
Other Destinations	£1,458,445,549	£3,550,635,557	£5,345,192,469	£3,130,540,141	£2,035,140,344	£15,519,954,060
Total economic value generated	£2,984,431,040	£7,264,875,667	£10,641,166,566	£6,449,443,994	£4,117,428,150	£31,457,345,416

Table 11: Economic Value – GVA per annum – Do Something (2011 prices)
Source: CH2M Calculations

Labour demand zone	Manufacturing	Consumer Services	Producer Services	Public Services	Other Activities	Total
Avonmouth EA	£212,631,146	£504,913,036	£742,164,005	£398,966,074	£290,667,675	£2,149,341,937
Bath EA	£61,857,010	£141,664,236	£269,442,781	£129,403,461	£88,499,868	£690,867,355
Bristol City Centre	£403,380,631	£957,865,970	£1,407,952,646	£756,874,944	£551,423,026	£4,077,497,217
Filton EA	£172,203,868	£435,023,593	£533,384,059	£434,973,103	£230,173,726	£1,805,758,349
North Fringe	£292,440,526	£738,766,962	£905,804,943	£738,681,219	£390,886,258	£3,066,579,909
Portishead	£88,940,150	£214,544,109	£386,859,864	£198,153,322	£126,867,714	£1,015,365,160
Science Park EA	£50,055,058	£126,449,721	£155,040,477	£126,435,045	£66,905,345	£524,885,646
Temple Quarter EZ	£96,504,919	£229,160,179	£336,839,068	£181,075,018	£131,922,632	£975,501,816
Weston Super Mare EA	£85,809,476	£206,992,203	£373,242,481	£191,178,368	£122,401,998	£979,624,527
Yate & Thornbury	£68,686,163	£173,515,856	£212,748,442	£173,495,718	£91,808,334	£720,254,513
Other Destinations	£1,460,776,170	£3,556,309,533	£5,353,734,177	£3,135,542,797	£2,038,392,533	£15,544,755,210
Total economic value generated	£2,993,285,118	£7,285,205,398	£10,677,212,944	£6,464,779,070	£4,129,949,107	£31,550,431,638

The analysis presented in previous sections suggests that the Scheme will generate more than £93m of additional economic output per annum post implementation. This is related to accessibility changes which allow the West of England's labour supply to access job opportunities more readily. The number of trips estimated by the demand forecasting analysis is anticipated to increase by 0.28%. Therefore, the number of accessible jobs and employment is expected to increase by similar factors. On this basis, the gross regeneration and economic development impacts of implementing the Scheme can be summarised as:

- 1,705 additional FTE jobs facilitated;
- £93m in additional GVA for the local economy (per annum).

These impacts reflect an assumption that all additional trips generated by the Scheme are employment related trips. This is considered a sound assumption, given that the analysis primarily focusses on movements to and from labour demand zones which are characterised as places of employment. However, this assumption may be considered to be optimistic on the basis that not all trips generated by the Scheme will be employment trips. For context, the GBATS4 multimodal model, which provides disaggregation of trips by journey purpose, suggests that only 27.4% of all trips in the AM peak are employment related. This rises to 60.9% if rail trips are considered alone.

These factors have therefore been applied to the employment and GVA outputs outlined above to generate a robust spread of regeneration and economic development impacts attributable to implementation of the Scheme. These impacts are summarised in Table 12, which outlines more conservative impacts based on employment trips factors of 27.4% and 60.9%.

Table 12. Regeneration and Economic Development Impacts by Attribution Assumption (2011 prices)
Source: CH2M Calculations

Employment Trips Factor	Jobs	GVA per annum
All Employment Trips - 100%	1,705	£93,086,222
Rail-based Employment trips - 60.9%	1,038	£56,667,695
All Modes Employment Trips – 27.4%	467	£25,518,646

5.2 Rail Operations Impacts

In addition, the operation of the additional train services and stations will generate some additional employment. Previous iterations of MetroWest Phase 1 analysis suggested that seventy staff would be required if a full scheme was implemented (based on 30 minute service intervals across all lines), including train drivers, train guards, ticket office staff, general maintenance and cleaning etc. As the preferred Scheme represents a slight variation on the option described above (i.e. an hourly rather than 30 minute service interval along the Portishead line in particular), a proportional approach is adopted to estimating the scale of employment generated as part of the preferred option's operation.

The preferred option results in implementation two stages out of the three required for full implementation, meaning two-thirds of the full complement of staff are required for the Scheme (i.e. 47 employees). Combining the employment opportunities generated directly through operation of rail services and stations with the wider employment opportunities outlined above (pivoting from the conservative estimate of 467 jobs), the total quantum of employment opportunities generated in the operational stage amounts to more than 500 permanent full time equivalent jobs, as follows:

Option	Direct GVA Uplift
Wider Employment Opportunities	467
Direct Rail Operations Employment Opportunities	47
Total	514

This level of employment facilitated by the Scheme can be translated to GVA uplift through the application of best practice GVA per benchmark figures. Appropriate benchmarks for GVA associated with wider employment opportunities were sourced from the West of England's Growth Forecasts as described above. In contrast, the benchmark for direct rail operations is sourced from the Annual Business Survey (2015). Applying the relevant benchmarks to the employment estimates outlined above results in GVA uplift forecasts of between £32m per annum (2017 prices and values).

Impact Type	GVA Uplift per Annum
Wider GVA Uplift	£27,947,436
Direct Rail Operations GVA Uplift	£3,915,478
Total	£31,862,915

6.0 Summary and Conclusions

The economic development and regeneration analysis outlined above demonstrates that the Scheme has the potential to facilitate significant positive economic impacts across the West of England, in both the construction and operational phases. The analysis is consolidated and summarised in the table below, which suggests that the Scheme could generate more than 1,400 jobs and £57m in GVA during the construction stage as well as more than 500 permanent jobs and £32m in GVA per annum during the operational stage.

Economic Indicator	Value
GVA £M temporary impact during construction	£57,122,715
No of additional temporary new jobs during construction	1,441
GVA £M permanent impact per annum	£31,862,915
No of additional permanent new jobs	514
GVA £M Temporary (during construction) and permanent impact during first 10 years post scheme opening (discounted)	£264,781,565

Note that all monetised figures in the table above reflect 2017 prices and values. Also note that the results in the table above reflect the following calculations:

- 'GVA £m temporary impact during construction' – discounted values based on direct and indirect GVA;
- 'No of additional temporary new jobs during construction' – direct and indirect employment;
- 'GVA £m permanent impact per annum' – gross direct GVA per annum in 2036, from operational and wider job creation;
- 'GVA £m Temporary (during construction) and permanent impact during first 10 years post scheme opening (discounted)' – assumes construction GVA plus ten years of annual permanent GVA from operational and wider sources.

Appendix D
TEE, PA and AMCB tables

TEE, PA & AMCB – OBC scheme

Economy: Economic Efficiency of the Transport System (TEE)

Consumer - Commuting user benefits	**All Modes**	**Road**		**Rail**	
Travel Time	143,130	18,809		124,321	
Vehicle operating costs	1,420	1,420		0	
User charges	0	0		0	
During Construction & Maintenance	-106	0		-106	
NET CONSUMER - COMMUTING BENEFITS	**144,444**	**20,229**		**124,215**	
Consumer - Other user benefits	**All Modes**	**Road**		**Rail**	
Travel Time	53,969	7,092		46,877	
Vehicle operating costs	536	536		0	
User charges	0	0		0	
During Construction & Maintenance	-106	0		-106	
NET CONSUMER - OTHER BENEFITS	**54,398**	**7,628**		**46,771**	
Business	All Modes	Personal	Freight	Personal	Freight
Travel Time	43,662	3,678	15,626	24,358	0
Vehicle operating costs	2,996	706	2,290	0	0
User charges	0	0	0	0	0
During Construction & Maintenance	-212	0	0	-212	0
Subtotal	**46,447**	**4,385**	**17,916**	**24,146**	**0**
Private Sector Provider Impacts					
Revenue	0	0		0	
Operating costs	0	0		0	
Investment costs	0	0		0	
Grant/subsidy	0	0		0	
Subtotal	**0**	**0**		**0**	
Other business Impacts					
Developer contributions	0	0		0	
NET BUSINESS IMPACT	**46,447**				
TOTAL					
Present Value of Transport Economic **Efficiency Benefits (TEE)**	**245,290**				

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**	**Rail**
Revenue	0	0	0
Operating Costs	-177	-177	0
Investment Costs	0	0	0
Developer Contributions	0	0	0
Grant/Subsidy Payments	94,369	0	94,369
NET IMPACT	**94,192**	**-177**	**94,369**
Central Government Funding: Transport	**ALL MODES**	**Road**	**Rail**
Revenue	-126,770	0	-126,770
Operating costs	126,221	0	126,221
Investment costs	0	0	0
Developer Contributions	0	0	0
Grant/Subsidy Payments	0	0	0
NET IMPACT	**-549**	**0**	**-549**
Central Government Funding: Non-Transport			
Indirect Tax Revenues	12,678	12,678	0
TOTALS			
Broad Transport Budget	93,643	-177	93,820
Wider Public Finances	12,678	12,678	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

Accidents, noise, air quality & greenhouse gases	6,286
Economic Efficiency: Consumer Users (Commuting)	144,444
Economic Efficiency: Consumer Users (Other)	54,398
Economic Efficiency: Business Users and Providers	46,447
Wider Public Finances (Indirect Taxation Revenues)	-12,678
Present Value of Benefits (PVB)	**238,897**

Broad Transport Budget	93,643
Present Value of Costs (PVC)	**93,643**

OVERALL IMPACTS	
Net Present Value (NPV)	**145,254**
Benefit to Cost Ratio (BCR)	**2.55**

Accidents, noise, air quality & greenhouse gases	6,286
Reliability	1,823
Wider Impacts	74,025
Option values	25,481
including Wider Impacts & Option Values	
PVB	338,403
PVC	93,643
NPV	244,760
BCR	**3.61**

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.

TEE, PA & AMCB – sensitivity 1; High demand growth

Economy: Economic Efficiency of the Transport System (TEE)

Consumer - Commuting user benefits	**All Modes**	**Road**		**Rail**	
Travel Time	151,250	18,205		133,045	
Vehicle operating costs	1,091	1,091		0	
User charges	0	0		0	
During Construction & Maintenance	-106	0		-106	
NET CONSUMER - COMMUTING BENEFITS	**152,235**	**19,296**		**132,939**	
Consumer - Other user benefits	**All Modes**	**Road**		**Rail**	
Travel Time	57,029	6,864		50,165	
Vehicle operating costs	411	411		0	
User charges	0	0		0	
During Construction & Maintenance	-106	0		-106	
NET CONSUMER - OTHER BENEFITS	**57,334**	**7,276**		**50,059**	
Business	All Modes	Personal	Freight	Personal	Freight
Travel Time	49,580	5,167	18,346	26,067	0
Vehicle operating costs	2,975	876	2,099	0	0
User charges	0	0	0	0	0
During Construction & Maintenance	-212	0	0	-212	0
Subtotal	**52,343**	**6,043**	**20,445**	**25,855**	**0**
Private Sector Provider Impacts					
Revenue	0	0		0	
Operating costs	0	0		0	
Investment costs	0	0		0	
Grant/subsidy	0	0		0	
Subtotal	**0**	**0**		**0**	
Other business Impacts					
Developer contributions	0	0		0	
NET BUSINESS IMPACT	**52,343**				
TOTAL					
Present Value of Transport Economic **Efficiency Benefits (TEE)**	**261,912**				

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**	**Rail**
Revenue	0	0	0
Operating Costs	-177	-177	0
Investment Costs	0	0	0
Developer Contributions	0	0	0
Grant/Subsidy Payments	94,369	0	94,369
NET IMPACT	**94,192**	**-177**	**94,369**
Central Government Funding: Transport	**ALL MODES**	**Road**	**Rail**
Revenue	-135,436	0	-135,436
Operating costs	126,221	0	126,221
Investment costs	0	0	0
Developer Contributions	0	0	0
Grant/Subsidy Payments	0	0	0
NET IMPACT	**-9,215**	**0**	**-9,215**
Central Government Funding: Non-Transport			
Indirect Tax Revenues	12,031	12,031	0
TOTALS			
Broad Transport Budget	84,977	-177	85,154
Wider Public Finances	12,031	12,031	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

Accidents, noise, air quality & greenhouse gases	6,652
Economic Efficiency: Consumer Users (Commuting)	152,235
Economic Efficiency: Consumer Users (Other)	57,334
Economic Efficiency: Business Users and Providers	52,343
Wider Public Finances (Indirect Taxation Revenues)	-12,031
Present Value of Benefits (PVB)	**256,533**

Broad Transport Budget	84,977
Present Value of Costs (PVC)	**84,977**

OVERALL IMPACTS	
Net Present Value (NPV)	**171,556**
Benefit to Cost Ratio (BCR)	**3.02**

Accidents, noise, air quality & greenhouse gases	6,652
Reliability	1,929
Wider Impacts	77,490
Option values	25,481
including Wider Impacts & Option Values	
PVB	359,503
PVC	84,977
NPV	274,527
BCR	**4.23**

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.

TEE, PA & AMCB – sensitivity 2; Low demand growth

Economy: Economic Efficiency of the Transport System (TEE)

Consumer - Commuting user benefits	**All Modes**	**Road**		**Rail**	
Travel Time	131,800	17,966		113,834	
Vehicle operating costs	1,537	1,537		0	
User charges	0	0		0	
During Construction & Maintenance	-106	0		-106	
NET CONSUMER - COMMUTING BENEFITS	**133,231**	**19,503**		**113,728**	
Consumer - Other user benefits	**All Modes**	**Road**		**Rail**	
Travel Time	49,698	6,774		42,924	
Vehicle operating costs	580	580		0	
User charges	0	0		0	
During Construction & Maintenance	-106	0		-106	
NET CONSUMER - OTHER BENEFITS	**50,172**	**7,354**		**42,818**	
Business	All Modes	Personal	Freight	Personal	Freight
Travel Time	41,265	3,712	15,249	22,303	0
Vehicle operating costs	2,751	578	2,173	0	0
User charges	0	0	0	0	0
During Construction & Maintenance	-212	0	0	-212	0
Subtotal	**43,804**	**4,290**	**17,422**	**22,091**	**0**
Private Sector Provider Impacts					
Revenue	0	0		0	
Operating costs	0	0		0	
Investment costs	0	0		0	
Grant/subsidy	0	0		0	
Subtotal	**0**	**0**		**0**	
Other business Impacts					
Developer contributions	0	0		0	
NET BUSINESS IMPACT	**43,804**				
TOTAL					
Present Value of Transport Economic **Efficiency Benefits (TEE)**	**227,207**				

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**	**Rail**
Revenue	0	0	0
Operating Costs	-177	-177	0
Investment Costs	0	0	0
Developer Contributions	0	0	0
Grant/Subsidy Payments	94,369	0	94,369
NET IMPACT	**94,192**	**-177**	**94,369**
Central Government Funding: Transport	**ALL MODES**	**Road**	**Rail**
Revenue	-116,307	0	-116,307
Operating costs	126,221	0	126,221
Investment costs	0	0	0
Developer Contributions	0	0	0
Grant/Subsidy Payments	0	0	0
NET IMPACT	**9,914**	**0**	**9,914**
Central Government Funding: Non-Transport			
Indirect Tax Revenues	11,567	11,567	0
TOTALS			
Broad Transport Budget	104,105	-177	104,282
Wider Public Finances	11,567	11,567	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

Accidents, noise, air quality & greenhouse gases	6,418
Economic Efficiency: Consumer Users (Commuting)	133,231
Economic Efficiency: Consumer Users (Other)	50,172
Economic Efficiency: Business Users and Providers	43,804
Wider Public Finances (Indirect Taxation Revenues)	-11,567
Present Value of Benefits (PVB)	**222,058**

Broad Transport Budget	104,105
Present Value of Costs (PVC)	**104,105**

OVERALL IMPACTS	
Net Present Value (NPV)	**117,953**
Benefit to Cost Ratio (BCR)	**2.13**

Accidents, noise, air quality & greenhouse gases	6,418
Reliability	1,766
Wider Impacts	63,009
Option values	25,481
including Wider Impacts & Option Values	
PVB	310,548
PVC	104,105
NPV	206,443
BCR	**2.98**

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.

TEE, PA & AMCB – sensitivity 3; Fare/growth cap at 10 years

Economy: Economic Efficiency of the Transport System (TEE)

Consumer - Commuting user benefits	**All Modes**	**Road**		**Rail**	
Travel Time	125,934	17,965		107,969	
Vehicle operating costs	1,537	1,537		0	
User charges	0	0		0	
During Construction & Maintenance	-106	0		-106	
NET CONSUMER - COMMUTING BENEFITS	**127,365**	**19,502**		**107,863**	
Consumer - Other user benefits	**All Modes**	**Road**		**Rail**	
Travel Time	47,497	6,776		40,721	
Vehicle operating costs	580	580		0	
User charges	0	0		0	
During Construction & Maintenance	-106	0		-106	
NET CONSUMER - OTHER BENEFITS	**47,971**	**7,355**		**40,615**	
Business	All Modes	Personal	Freight	Personal	Freight
Travel Time	40,115	3,712	15,249	21,153	0
Vehicle operating costs	2,751	578	2,173	0	0
User charges	0	0	0	0	0
During Construction & Maintenance	-212	0	0	-212	0
Subtotal	**42,654**	**4,290**	**17,422**	**20,941**	**0**
Private Sector Provider Impacts					
Revenue	0	0		0	
Operating costs	0	0		0	
Investment costs	0	0		0	
Grant/subsidy	0	0		0	
Subtotal	**0**	**0**		**0**	
Other business Impacts					
Developer contributions	0	0		0	
NET BUSINESS IMPACT	**42,654**				
TOTAL					
Present Value of Transport Economic **Efficiency Benefits (TEE)**	**217,989**				

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**	**Rail**
Revenue	0	0	0
Operating Costs	-177	-177	0
Investment Costs	0	0	0
Developer Contributions	0	0	0
Grant/Subsidy Payments	94,369	0	94,369
NET IMPACT	**94,192**	**-177**	**94,369**
Central Government Funding: Transport	**ALL MODES**	**Road**	**Rail**
Revenue	-111,302	0	-111,302
Operating costs	126,221	0	126,221
Investment costs	0	0	0
Developer Contributions	0	0	0
Grant/Subsidy Payments	0	0	0
NET IMPACT	**14,919**	**0**	**14,919**
Central Government Funding: Non-Transport			
Indirect Tax Revenues	11,567	11,567	0
TOTALS			
Broad Transport Budget	109,111	-177	109,288
Wider Public Finances	11,567	11,567	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

Accidents, noise, air quality & greenhouse gases	6,409
Economic Efficiency: Consumer Users (Commuting)	127,365
Economic Efficiency: Consumer Users (Other)	47,971
Economic Efficiency: Business Users and Providers	42,654
Wider Public Finances (Indirect Taxation Revenues)	-11,567
Present Value of Benefits (PVB)	**212,831**

Broad Transport Budget	109,111
Present Value of Costs (PVC)	**109,111**

OVERALL IMPACTS	
Net Present Value (NPV)	**103,720**
Benefit to Cost Ratio (BCR)	**1.95**

Accidents, noise, air quality & greenhouse gases	6,409
Reliability	1,766
Wider Impacts	63,009
Option values	25,481
including Wider Impacts & Option Values	
PVB	301,321
PVC	109,111
NPV	192,210
BCR	**2.76**

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.

TEE, PA & AMCB – sensitivity 4; Fare/growth cap at 30 years

Economy: Economic Efficiency of the Transport System (TEE)

Consumer - Commuting user benefits	**All Modes**	**Road**		**Rail**	
Travel Time	157,074	18,208		138,867	
Vehicle operating costs	1,091	1,091		0	
User charges	0	0		0	
During Construction & Maintenance	-106	0		-106	
NET CONSUMER - COMMUTING BENEFITS	**158,060**	**19,299**		**138,761**	
Consumer - Other user benefits	**All Modes**	**Road**		**Rail**	
Travel Time	59,192	6,861		52,331	
Vehicle operating costs	411	411		0	
User charges	0	0		0	
During Construction & Maintenance	-106	0		-106	
NET CONSUMER - OTHER BENEFITS	**59,497**	**7,273**		**52,225**	
Business	All Modes	Personal	Freight	Personal	Freight
Travel Time	50,723	5,167	18,346	27,209	0
Vehicle operating costs	2,975	876	2,099	0	0
User charges	0	0	0	0	0
During Construction & Maintenance	-212	0	0	-212	0
Subtotal	**53,486**	**6,043**	**20,445**	**26,997**	**0**
Private Sector Provider Impacts					
Revenue	0	0		0	
Operating costs	0	0		0	
Investment costs	0	0		0	
Grant/subsidy	0	0		0	
Subtotal	**0**	**0**		**0**	
Other business Impacts					
Developer contributions	0	0		0	
NET BUSINESS IMPACT	**53,486**				
TOTAL					
Present Value of Transport Economic **Efficiency Benefits (TEE)**	**271,043**				

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**	**Rail**
Revenue	0	0	0
Operating Costs	-177	-177	0
Investment Costs	0	0	0
Developer Contributions	0	0	0
Grant/Subsidy Payments	94,369	0	94,369
NET IMPACT	**94,192**	**-177**	**94,369**
Central Government Funding: Transport	**ALL MODES**	**Road**	**Rail**
Revenue	-139,062	0	-139,062
Operating costs	126,221	0	126,221
Investment costs	0	0	0
Developer Contributions	0	0	0
Grant/Subsidy Payments	0	0	0
NET IMPACT	**-12,841**	**0**	**-12,841**
Central Government Funding: Non-Transport			
Indirect Tax Revenues	12,031	12,031	0
TOTALS			
Broad Transport Budget	81,351	-177	81,528
Wider Public Finances	12,031	12,031	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

Accidents, noise, air quality & greenhouse gases	6,661
Economic Efficiency: Consumer Users (Commuting)	158,060
Economic Efficiency: Consumer Users (Other)	59,497
Economic Efficiency: Business Users and Providers	53,486
Wider Public Finances (Indirect Taxation Revenues)	-12,031
Present Value of Benefits (PVB)	**265,672**

Broad Transport Budget	81,351
Present Value of Costs (PVC)	**81,351**

OVERALL IMPACTS	
Net Present Value (NPV)	**184,321**
Benefit to Cost Ratio (BCR)	**3.27**

Accidents, noise, air quality & greenhouse gases	6,661
Reliability	1,929
Wider Impacts	77,490
Option values	25,481
including Wider Impacts & Option Values	
PVB	368,643
PVC	81,351
NPV	287,292
BCR	**4.53**

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.

TEE, PA & AMCB – sensitivity 5; Operating cost risk elements included

Economy: Economic Efficiency of the Transport System (TEE)

Consumer - Commuting user benefits	**All Modes**	**Road**		**Rail**	
Travel Time	143,130	18,809		124,321	
Vehicle operating costs	1,420	1,420		0	
User charges	0	0		0	
During Construction & Maintenance	-106	0		-106	
NET CONSUMER - COMMUTING BENEFITS	**144,444**	**20,229**		**124,215**	
Consumer - Other user benefits	**All Modes**	**Road**		**Rail**	
Travel Time	53,969	7,092		46,877	
Vehicle operating costs	536	536		0	
User charges	0	0		0	
During Construction & Maintenance	-106	0		-106	
NET CONSUMER - OTHER BENEFITS	**54,398**	**7,628**		**46,771**	
Business	All Modes	Personal	Freight	Personal	Freight
Travel Time	43,662	3,678	15,626	24,358	0
Vehicle operating costs	2,996	706	2,290	0	0
User charges	0	0	0	0	0
During Construction & Maintenance	-212	0	0	-212	0
Subtotal	**46,447**	**4,385**	**17,916**	**24,146**	**0**
Private Sector Provider Impacts					
Revenue	0	0		0	
Operating costs	0	0		0	
Investment costs	0	0		0	
Grant/subsidy	0	0		0	
Subtotal	**0**	**0**		**0**	
Other business Impacts					
Developer contributions	0	0		0	
NET BUSINESS IMPACT	**46,447**				
TOTAL					
Present Value of Transport Economic **Efficiency Benefits (TEE)**	**245,290**				

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**	**Rail**
Revenue	0	0	0
Operating Costs	-177	-177	0
Investment Costs	0	0	0
Developer Contributions	0	0	0
Grant/Subsidy Payments	94,369	0	94,369
NET IMPACT	**94,192**	**-177**	**94,369**
Central Government Funding: Transport	**ALL MODES**	**Road**	**Rail**
Revenue	-126,770	0	-126,770
Operating costs	152,779	0	152,779
Investment costs	0	0	0
Developer Contributions	0	0	0
Grant/Subsidy Payments	0	0	0
NET IMPACT	**26,009**	**0**	**26,009**
Central Government Funding: Non-Transport			
Indirect Tax Revenues	12,678	12,678	0
TOTALS			
Broad Transport Budget	120,200	-177	120,377
Wider Public Finances	12,678	12,678	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

Accidents, noise, air quality & greenhouse gases	6,286
Economic Efficiency: Consumer Users (Commuting)	144,444
Economic Efficiency: Consumer Users (Other)	54,398
Economic Efficiency: Business Users and Providers	46,447
Wider Public Finances (Indirect Taxation Revenues)	-12,678
Present Value of Benefits (PVB)	**238,897**

Broad Transport Budget	120,200
Present Value of Costs (PVC)	**120,200**

OVERALL IMPACTS	
Net Present Value (NPV)	**118,697**
Benefit to Cost Ratio (BCR)	**1.99**

Accidents, noise, air quality & greenhouse gases	6,286
Reliability	1,823
Wider Impacts	74,025
Option values	25,481
including Wider Impacts & Option Values	
PVB	338,403
PVC	120,200
NPV	218,203
BCR	**2.82**

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.

TEE, PA & AMCB – sensitivity 6; Ashton Vale Road junction benefits included

Economy: Economic Efficiency of the Transport System (TEE)

Consumer - Commuting user benefits	**All Modes**	**Road**		**Rail**	
Travel Time	148,343	24,022		124,321	
Vehicle operating costs	1,421	1,421		0	
User charges	0	0		0	
During Construction & Maintenance	-106	0		-106	
NET CONSUMER - COMMUTING BENEFITS	**149,658**	**25,443**		**124,215**	
Consumer - Other user benefits	**All Modes**	**Road**		**Rail**	
Travel Time	55,935	9,058		46,877	
Vehicle operating costs	536	536		0	
User charges	0	0		0	
During Construction & Maintenance	-106	0		-106	
NET CONSUMER - OTHER BENEFITS	**56,364**	**9,594**		**46,771**	
Business	All Modes	Personal	Freight	Personal	Freight
Travel Time	45,275	3,986	16,932	24,358	0
Vehicle operating costs	2,997	706	2,290	0	0
User charges	0	0	0	0	0
During Construction & Maintenance	-212	0	0	-212	0
Subtotal	**48,060**	**4,692**	**19,222**	**24,146**	**0**
Private Sector Provider Impacts					
Revenue	0	0		0	
Operating costs	0	0		0	
Investment costs	0	0		0	
Grant/subsidy	0	0		0	
Subtotal	**0**	**0**		**0**	
Other business Impacts					
Developer contributions	0	0		0	
NET BUSINESS IMPACT	**48,060**				
TOTAL					
Present Value of Transport Economic **Efficiency Benefits (TEE)**	**254,083**				

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**	**Rail**
Revenue	0	0	0
Operating Costs	-177	-177	0
Investment Costs	0	0	0
Developer Contributions	0	0	0
Grant/Subsidy Payments	94,369	0	94,369
NET IMPACT	**94,192**	**-177**	**94,369**
Central Government Funding: Transport	**ALL MODES**	**Road**	**Rail**
Revenue	-126,770	0	-126,770
Operating costs	126,221	0	126,221
Investment costs	0	0	0
Developer Contributions	0	0	0
Grant/Subsidy Payments	0	0	0
NET IMPACT	**-549**	**0**	**-549**
Central Government Funding: Non-Transport			
Indirect Tax Revenues	12,678	12,678	0
TOTALS			
Broad Transport Budget	93,643	-177	93,820
Wider Public Finances	12,678	12,678	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

Accidents, noise, air quality & greenhouse gases	6,286
Economic Efficiency: Consumer Users (Commuting)	149,658
Economic Efficiency: Consumer Users (Other)	56,364
Economic Efficiency: Business Users and Providers	48,060
Wider Public Finances (Indirect Taxation Revenues)	-12,678
Present Value of Benefits (PVB)	**247,690**

Broad Transport Budget	93,643
Present Value of Costs (PVC)	**93,643**

OVERALL IMPACTS	
Net Present Value (NPV)	**154,047**
Benefit to Cost Ratio (BCR)	**2.65**

Accidents, noise, air quality & greenhouse gases	6,286
Reliability	1,823
Wider Impacts	74,025
Option values	25,481
including Wider Impacts & Option Values	
PVB	347,196
PVC	93,643
NPV	253,553
BCR	**3.71**

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.

Appendix E
Appraisal Summary Table (AST)

MetroWest Phase 1 OBC – Appraisal Summary Table (AST)

Appraisal Summary Table

Date produced:	20/12/2017

Contact:	
Name	James Willcock
Organisation	North Somerset Council
Role	Project Manager

Name of scheme:	MetroWest Phase 1
Description of scheme:	Infrastructure and passenger train operations to provide a half-hourly service for the Severn Beach Line (to Avonmouth, hourly to Severn Beach); half hourly service for local stations on the Bath Spa Line; and hourly service for a reopened Portishead Line (new stations at Portishead and Pill).

Impacts		Summary of key impacts	Assessment			
			Quantitative	Qualitative	Monetary £(NPV)	Distributional 7-pt scale/ vulnerable grp
Economy	Business users & transport providers	Journey time savings are significant in geographical areas where impacts are anticipated. This covers savings for public transport users as a result of the new stations at Portishead/Pill and frequency improvement, and for highway users as a result of decongestion in the highway network where modal shift to rail occurs. (NOTE - benefit split by journey times for highway only)	Value of journey time changes(£) Net journey time changes (£) 0 to 2min: £18,545,216 / 2 to 5min: £3,736,568 / > 5min: £19,227	Not required	£46,438,407	Large beneficial distributional impact
	Reliability impact on Business users	Some reduction in highway traffic will result in small changes in journey time, and quantifiable reliability benefits for all users. Rail reliability has not been modelled.	NOTE - impact is highway only and total for all users	Not required	£1,823,385	
	Regeneration	The scheme links a number of regeneration and enterprise zones, and has the potential to generate new jobs, both during construction and operational stages.	1400 jobs & £57m GVA - construction stage 500 permanent jobs & £32m GVA per annum - operational	Not required	£264,781,565	
	Wider Impacts	The scheme improves productivity of local economy through improving transport provision, bringing businesses closer to each other and to the labour market.	£68.4m agglomeration benefits, £4.6m imperfect competition and £1.0m labour supply	Not required	£74,025,119	
Environmental	Noise	The increases in noise are due to the operation of the new rail service. These are not significant increases but the change in noise is sufficient to move a band in the noise worksheet. There would be a minor adverse impact at the Trinity Primary School in Portishead. Negligible impacts are expected within the Avon Gorge Woodlands SAC and SSSI and other designated areas along the route. No dwellings are expected to be eligible under the Noise Insulation Regulations. There are predicted to be no impacts are night due to the service only being operational during the day.	Households experiencing increased daytime noise in forecast year: 523 Households experiencing reduced daytime noise in forecast year: 0 Households experiencing increased night time noise in forecast year: 0 Households experiencing reduced night time noise in forecast year: 0	Not required	-£511,257	Minor adverse distributional impact
	Air Quality	The physical works for the Project cross a short section of the Bristol Air Quality Management Area (AQMA) and during operation passenger services from the scheme would extend from Portishead to Bristol passing through the AQMA from Parson Street Junction into Bristol. Air quality monitoring data suggest that AQS objectives are being met within the Project extent in North Somerset. The Project crosses one ecological designated site (Avon Gorge Woodlands SAC and SSSI) where baseline NOx levels are close to the critical level. The Project offers an alternative travel mode that promotes a Modal shift which leads to some beneficial air quality impacts in the surrounding area. These benefits are however offset by the additional diesel locomotives on the Portishead Branch Line which are expected to lead to an increase in NOx and PM10 emissions. These changes are likely to lead to adverse impacts at receptors nearest to the rail line. The Project is not predicted to result in any exceedances of the annual mean AQS objective for traffic pollutants.	**Assessment Score:** PM10: 586.09 NO2: 8,216.57 **Emissions:** PM10: +1 tonnes NOx: +936 tonnes	Not required	**AIR QUALITY VALUATION:** Value of change in PM10 concentrations: NPV: £-0.0m Value of change in NOx emissions: NPV: £-0.5m Total value of change in air quality: £-0.5m **MAIN-SENSITIVITY:** Value of change in PM10 concentrations: NPV: £-0.0m Value of change in NOx emissions: NPV: £-9.6m Total value of	Minor adverse distributional impact
	Greenhouse gases	The Project is expected to result in decrease in vehicle kilometers travelled across the road network which has the potential to result in a decrease in CO2 emissions. However, rail emissions associated with the Project are expected to contribute to an increase in CO2 emissions.	Change in non-traded carbon over 60y (CO2e): N/A Change in traded carbon over 60y (CO2e): N/A	Not required	£250,774	
	Landscape	Area north of Avon Gorge and Avon Gorge itself: **slight adverse effect** due to vegetation clearance creating more open views of construction activities and of the railway when the DCO Scheme is in operation. Area south of Avon Gorge: **neutral/slight adverse effect** due to opening up of views in the landscape, although existing landscape already has dominant transport infrastructure features and urban land cover. Overall **slight adverse effect** due to the reasons set out above. DCO Scheme will affect areas of recognised landscape quality and will impact on certain views across the area.	N/A	Slight adverse	N/A	
	Townscape	**Neutral effect** on the townscape of the Ashton Gate/Ashton Vale area due to the fact that transport infrastructure (including the existing Portbury Freight Line) is already a dominant feature in the landscape, and many views are restricted by commercial/industrial buildings so would not change significantly with the DCO Scheme. Future trends in the area are likely to include increased development and expansion outwards into the urban/rural fringe, and increased traffic volumes, so the DCO Scheme would fit this trend.	N/A	Neutral	N/A	
	Historic Environment	The DCO Scheme is assessed to have a direct **slight adverse/neutral** effect on non-designated cultural heritage assets during the enabling works and construction through the removal of known and hitherto unknown archaeological remains along the railway corridor. The adverse effects arising from these direct impacts on this resource can be adequately mitigated through preservation by record and the significance effect of the residual impact is assessed to be neutral and not significant in regards to the EIA Regulations. The effect of the DCO Scheme on the setting of the designated cultural heritage assets along the route during construction and operation is generally neutral and not significant in regards to the EIA Regulations. This results largely from the lack of inter-visibility between the DCO Scheme and heritage assets.	N/A	Slight adverse/Neutral	N/A	
	Biodiversity	The Portishead to Pill line will have **slight adverse** effects on Field east of M5 Motorway, Lodway Wildlife Site due to loss of habitat, however this impact is considered to be negligible in magnitude due to the minor loss of habitat anticipated. **Slight adverse** effects are also considered possible on protected species such as great crested newts, other amphibian species, badgers, otter and bats through the fragmentation of habitats and disturbance and death/injury from direct collision with trains. The operational maintenance of the railway corridor may also cause **slight adverse** effects on habitats such as woodland, trees and scrub due to direct loss, as well as Japanese knotweed due to the potential of facilitating the spread of this invasive species. The impact on North Somerset and Mendips Bats SAC is **to be assessed** following further bat survey in 2018. The Freight Line section of the DCO is assessed to have a **slight adverse** effect on internationally and nationally important sites/species such as the Avon Gorge and Woodlands SAC/SSSI, Leigh Woods NNR and Ancient Woodland and the notable and the important plant species these sites support, these impacts are likely to arise through the routine maintenance and clearance of the railway corridor, however they will be mitigated through the implementation of a Site Vegetation Management Statement which will be developed in consultation with Natural England. A slight adverse effect is also anticipated on the internationally important site Bath and Bradford on Avon Bats SAC, however this assessment is ongoing due to further assessment on the use and value of the tunnels to bats. A number of Local Wildlife Sites are also predicted to have potentially **slight adverse** effects due to the Freight Line section of the scheme. These include Bower Ashton BWNS, River Avon NSWS and River Avon SNCI, effects on these sites will arise due to habitat loss. A **slight adverse** effect may also occur on protected species such as badger, otters and bats through the fragmentation of habitats, disturbance and death/injury from direct collision with trains. Habitats that may be subject to a slight adverse impact includes ephemeral/short perennials which may be effected due to the routine maintenance and clearance of the railway corridor. In addition a slight adverse effect may occur due to the potential spread of invasive plant species during this routine maintenance and clearance.	N/A	Slight adverse	N/A	
	Water Environment	The water environment is typical of the locality with watercourses mostly comprising small watercourse with primarily a drainage function (some man-made) of low to medium importance discharging directly into the tidal River (Bristol) Avon which is of Very High importance. Groundwater is of Medium to High importance on a local to regional scale. The larger watercourses - Severn Estuary, River (Bristol) Avon and Easton-in-Gordano Stream are of High quality, whereas the smaller watercourses are of medium to low quality. Most are important on a local scale, with on the River (Bristol) Avon being important at a regional scale and the Severn Estuary at a national scale due to its size and ecological designations. There will be little impact upon the water environment as the scheme involves minimal additional impermeable surfaces (mostly relating to the stations and associated car parking areas) and results in little change in water quality, with some improvement in some areas through the removal of contaminated old sleepers and renewal of ballast. As the scheme involves very little change from the existing situation the magnitude of all the impacts is considered to be negligible, except for a slight adverse impact relating to the increased flood risk to the railway line from the River (Bristol) Avon, which will worsen over time. This results in a significance score of "Insignificant" for all of the impacts, apart from two exceptions for which the significance score is "Low Significance". The first exception is the flood risk to the railway from the River (Bristol)	N/A	Neutral	N/A	
Social	Commuting and Other users	Journey time savings are significant in geographical areas where impacts are anticipated. This covers savings for public transport users as a result of the new stations at Portishead/Pill and frequency improvement, and for highway users as a result of decongestion in the highway network where modal shift to rail occurs. (NOTE - benefit split by journey times for highway only)	Value of journey time changes(£) Net journey time changes (£) 0 to 2min: £23,997,886 / 2 to 5min: £3,821,405 / > 5min: £37,577	Not required	£198,842,893	Evenly spread across vulnerability
	Reliability impact on Commuting and Other users	Some reduction in highway traffic will result in small changes in journey time, and quantifiable reliability benefits for all users. Rail reliability has not been modelled.	NOTE - impact is highway only and total for all users	Not required	£1,823,385	
	Physical activity	The proposed scheme accounts for cyclists, pedestrians and equestrians by delivering and planning for measures to minimise the interaction between these modes and motorised traffic (including trains). The measures provided for Non-Motorised Users (NMUs) that will be delivered as part of the scheme ensures that the opportunity to undertake trips through active modes will be enhanced. Based on the work undertaken, the assessment suggests that the scheme will have an overall slight beneficial impact on physical activity.	N/A	Slight beneficial	N/A	
	Journey quality	Improved frequencies on the Severn Beach line and local stations to Bath will help reduce the extent of overcrowding and lower traveller stress by improved ease and convenience. The analysis also suggests that there will be neutral impacts on other factors such as cleanliness, facilities, information and traveller's views. With the introduction of passenger rail services to Pill and Portishead, there will be larger beneficial impacts such as new facilities at the railway stations, smoothness of ride, traveller views and integration into existing national railway information portals. Based on the evidence, it is concluded that there will be a moderate beneficial impact.	N/A	Moderate beneficial	N/A	
	Accidents	A full assessment of the likely impacts of the scheme was undertaken, and this suggests that as MetroWest is a rail scheme, with minimal changes on other parts of the network.	A saving of 130 accidents	Not required	£5,845,450	
	Security	The new rail stations will enhance the security of both locations by providing additional footfall, CCTV, emergency contact points and improved lighting. However, while there will be a general improvement in security of the area, rail stations can also attract crime. The scheme is therefore envisaged to have a neutral impact on security.	N/A	Neutral	N/A	
	Access to services	MetroWest Phase 1 will generally enhance the public transport offer in area served, thus improving links to key services. There is a more substantial enhancement to the public transport offer in Portishead and Pill. Overall, MetroWest Phase 1 is assessed to have a slight beneficial on access to services.	N/A	Slight beneficial	N/A	Evenly spread across vulnerability
	Affordability	The assessment indicates there will be beneficial affordability impacts from reduced fuel costs, shorter journeys and reduced congestion. However, this needs to be set against the additional costs of rail fares and car parking charges (if travelling to the stations by car).Improved frequencies are expected to increase the numbers travelling by rail, but there may be some extraction from existing public transport provision which could impact on affordability. Based on the evidence, it is concluded that MetroWest Phase 1 will result in a neutral impact.	N/A	Neutral	N/A	
	Severance	Negative impacts are expected at the various at-grade crossing points affected by the Scheme. The negative impact is a result of increased journey times opposed to safety. It is expected that the overall safety of pedestrians and cyclists will be improved, particularly at Ashton Vale.Overall the scheme has a slight adverse impact on severance.	N/A	Slight adverse	N/A	
	Option and non-use values	The scheme will add a rail option to a public transport offer that currently only includes bus, and a bus service that is adversely affected by traffic congestion	26,235 population within 2km of new rail station	Not required	£25,480,590	
Public Accounts	Cost to Broad Transport Budget	Public sector costs associated with investments for scheme implementation and ongoing support/maintenance, such as capital investment, operating costs and revenue income.	N/A	Not required	£93,642,672	
	Indirect Tax Revenues	The impact on tax and fuel duty loss as a result of reduction in fuel consumption.	N/A	Not required	-£12,677,961	