



MetroWest

Phase 2 Preliminary Business Case
Appendix E - Wider Impacts Report

July 2015

travelwest 

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

MetroWest Phase 2 Preliminary (Strategic Outline) Business Case

Wider Economic Impacts

Prepared for
West of England Authorities

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MetroWest Phase 2

Preliminary (Strategic Outline) Business Case
Wider Economic Impacts

South Gloucestershire Council

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1. Introduction

1.1 Background

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

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

MetroWest is being delivered in phases; MetroWest Phase 2 offers an hourly service for the re-opened Henbury line with stations at Henbury and North Filton and along the Filton Bank with up to two new stations coupled with a half-hourly service for the Yate to Bristol line.

1.2 Preliminary Business Case of MetroWest Phase 2

Four scheme options have been considered through the Preliminary Business Case assessment. Common features of all options are four new stations, at Henbury and North Filton on the Henbury line, and Ashley Down and Constable Road on Filton Bank; plus an improved service frequency at Yate. Train service operating specifications for each option are described briefly as follows:

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

In addition, a 5th option was developed and appraised in the light of the results for the above options.

The current MetroWest Phase 2 programme is targeting a project opening year of 2021.

1.3 This report

This report sets out the assessments of some of the wider economic effects of MetroWest Phase 2 that are additional to transport user benefits:

- Chapter 2 outlines key steps and assumptions in estimating wider impacts of MetroWest Phase 2, based on methodology guidance in WebTAG Unit A2.1. Impacts considered include agglomeration, imperfect competition and tax revenues from labour supply effects.
- Chapter 3 sets out the calculations and results of the analysis.
- Chapter 4 outlines the calculation of wider economic impacts of an additional option for MetroWest Phase 2.
- Chapter 5 provides a brief summary of the results

2. Basic Assessment Specification

2.1 Introduction

This chapter outlines key steps and assumptions in estimating wider impacts of MetroWest Phase 2 that are additional to transport user benefits. The methodology adopted is in line with guidance in WebTAG Unit A2.1 and follows a similar process used by CH2M to assess Phase 1 of MetroWest. The remainder of this chapter covers the basic assessment specification used, moving on to discuss agglomeration, imperfect competition and tax revenues from labour supply effects.

2.2 Type of Impacts Assessed

The Wider Impacts Assessment for MetroWest Phase 2 is mainly focused on the following three areas:

- Agglomeration – By reducing journey times across the West of England (WoE), the relative agglomeration¹ 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.

2.3 Appraisal Period

This assessment captures the aforementioned wider impacts accrued over a 60-year appraisal period from the scheme opening year 2021² to 2081. The four Do-Something scenarios described in Chapter 1 were assessed against the same Do-Minimum; more detailed descriptions documented in the Preliminary Business Case (PBC) report.

2.4 Geographical Detail

The main input for Wider Impacts Assessment includes DfT's standard economic dataset and outputs from GBATS3³ models supplemented by other information such as 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:

- Extent of coverage – consideration was given to the extent of the rail network covers as well as the area for which that GBATS3 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

¹ Agglomeration is a term used to infer the ability of an economy to act through the density of (the locations or links between) companies to interact with one another.

² The first forecasting year in GBATS3 is 2016, which is prior to the anticipated scheme opening year of 2021. Rather than creating a new forecasting year of 2021 in GBATS3, 2016 results have been taken as a proxy for 2021, with post-assignment adjustment of forecasting results if any discrepancies are noted.

³ GBATS3 is a multi-modal transport model covering West of England. Detail of the model specification, functionality and its validation are available in the PBC and supplementary documents.

included in the area of investigation, namely Bath and North East Somerset, Bristol City, North Somerset and South Gloucestershire;

- 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 GABTS3 and also follow Ward boundaries (or its aggregation) so modelling output and existing demographic information can be taken on board with ease; and
- Fitness for purpose – formulation of sectors also considered significant elements of MetroWest Phase 2, 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.

Following the principles set out above, the sectoring system is illustrated in Figure 2.1. The four LADs in WoE are split into 13 different sectors, with the rest of the UK represented by sector no.14.

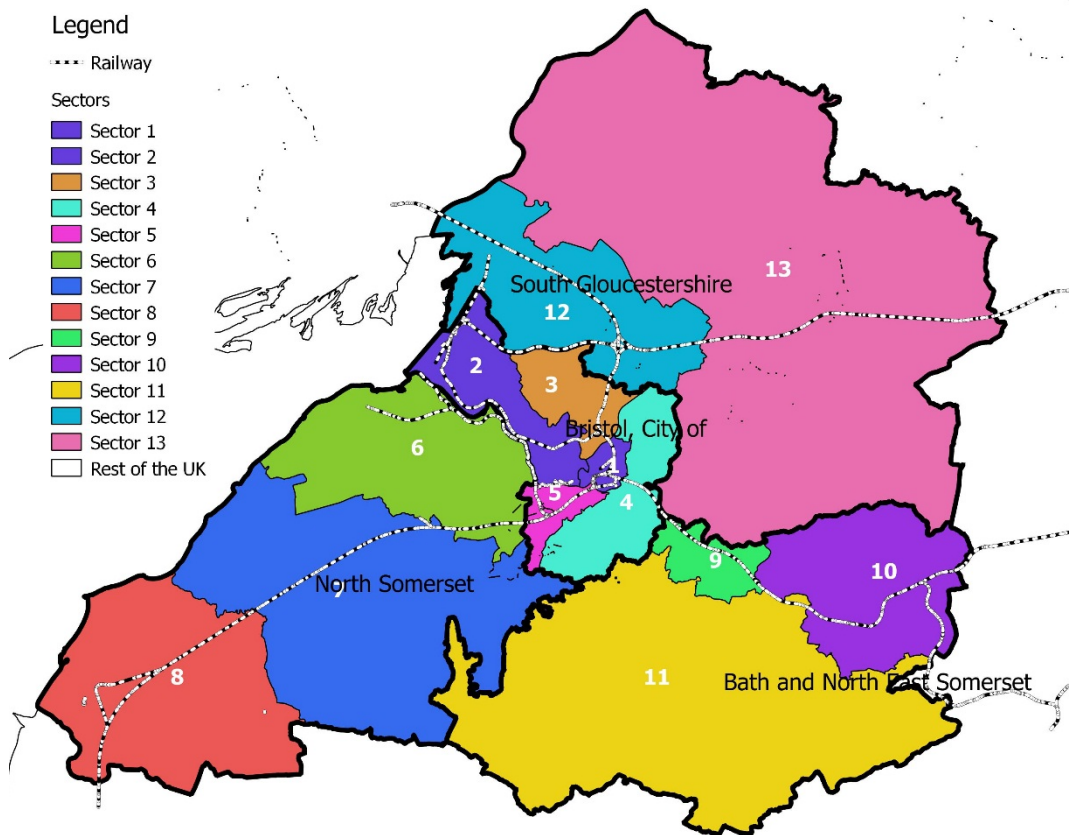


Figure 2-1: Illustration of the Adopted Sector System

3. Analysis and Results

3.1 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 3.1 summarises data used for estimating the agglomeration impact including their sources and key assumptions adopted. Further information is set out in subsequent tables.

Table 3.1: 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 GBATS3 model and presented in Table 3.2 and Table 3.3.
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.
Public Transport generalised cost matrices weighted across user groups	Journey time skims for the Do Minimum were taken from GBATS3 output and used to derive generalised costs based on standard Value of Time (VOT) from DfT's latest TAG Data Book. Journey time saving as a result of MetroWest Phase 2 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'.
Highway generalised cost matrices weighted across user groups	Journey time, distance and road charge skim matrices were taken from GBATS3 output and converted the generalised travel cost following standard approach and parameters for VOT and VOC calculation in the latest TAG Data Book. In order to remove 'modelling noise' in the current GBATS3 model suite, the highway travel cost for Do Something scenario was assumed to be the same as its counterpart in Do Minimum due to the fact that modal shift from road users to rail is minor. This is a conservative approach as the minor modal shift would generate decongestion benefits and hence reduce travel cost in reality despite the absolute change is small.
Public Transport trip matrices	Travel demand matrices, including all sub-modes (bus, BRT and rail) were taken from GBATS3 output. Business and commuting journeys were extracted separately.
Hwy trip matrices by journey purpose and time period	Travel demand matrices were taken from GBATS3 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.

Information in Table 3.2 is the number of employment in each LAD by employment sector, which is in line with assumptions in TAG Data Book for year 2031. Table 3.3 illustrates how information in Table 3.2 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 3.2: 2031 Employment by LAD

Local Authorities	Manufacturing	Construction	Consumer Services	Producer Services	Total
South Gloucestershire	14189	11288	47903	46104	119484
Bristol City	11776	9012	48154	97666	166608
Bath & North East Somerset	5123	3943	24098	19794	52958
North Somerset	6578	3885	28408	21479	60350

Table 3.3: 2031 Employment by Sector

Local Authorities	Sector	Ratio	Manufacturing	Construction	Consumer Services	Producer Services	Total
South Gloucestershire	12	54%	7665	6098	25879	24907	64549
South Gloucestershire	13	46%	6524	5190	22024	21197	54935
Bristol City	1	13%	1584	1212	6477	13137	22410
Bristol City	2	38%	4468	3420	18272	37060	63220
Bristol City	3	17%	2019	1545	8255	16742	28560
Bristol City	4	25%	2895	2215	11837	24008	40956
Bristol City	5	7%	810	620	3313	6719	11461
Bath & North East Somerset	9	22%	1124	865	5287	4342	11618
Bath & North East Somerset	10	52%	2659	2046	12506	10272	27482
Bath & North East Somerset	11	26%	1341	1032	6306	5180	13858
North Somerset	6	45%	2941	1737	12699	9602	26978
North Somerset	7	29%	1911	1129	8253	6240	17534
North Somerset	8	26%	1726	1020	7455	5637	15838

Agglomeration impacts were estimated for year 2021 and 2031 and then profiled across the appraisal period between 2021 and 2081, and discounted to 2010 prices and values.⁴ Results are presented in Table 3.4. Figure 3.1 broadly illustrates how the estimated agglomeration impacts distribute across different geographic sectors in both options assessed using different shades of green. Darker colours represent higher percentage of agglomeration impact.⁵

Table 3.4: Agglomeration Impacts

Agglomeration Impacts (£000s)	Option 1a	Option 1b	Option 2a	Option 2b
2021	£1,137	£1,229	£1,154	£1,245
2031	£1,240	£1,344	£1,258	£1,363
2021 to 2081 (discounted)	£29,624	£32,095	£30,061	£32,535

It can be seen that the agglomeration benefits would be highest in Sector 12, the Bristol North Fringe, which is where biggest impacts from rail improvement are expected. The sectors with higher agglomeration impacts are generally aligned with origins from which travel time benefits are expected from one or more rail services where improvements are proposed as part of MetroWest Phase 2.

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

⁵ Note that the pattern is the same for all options, in as much as differences can actually be displayed in map form.

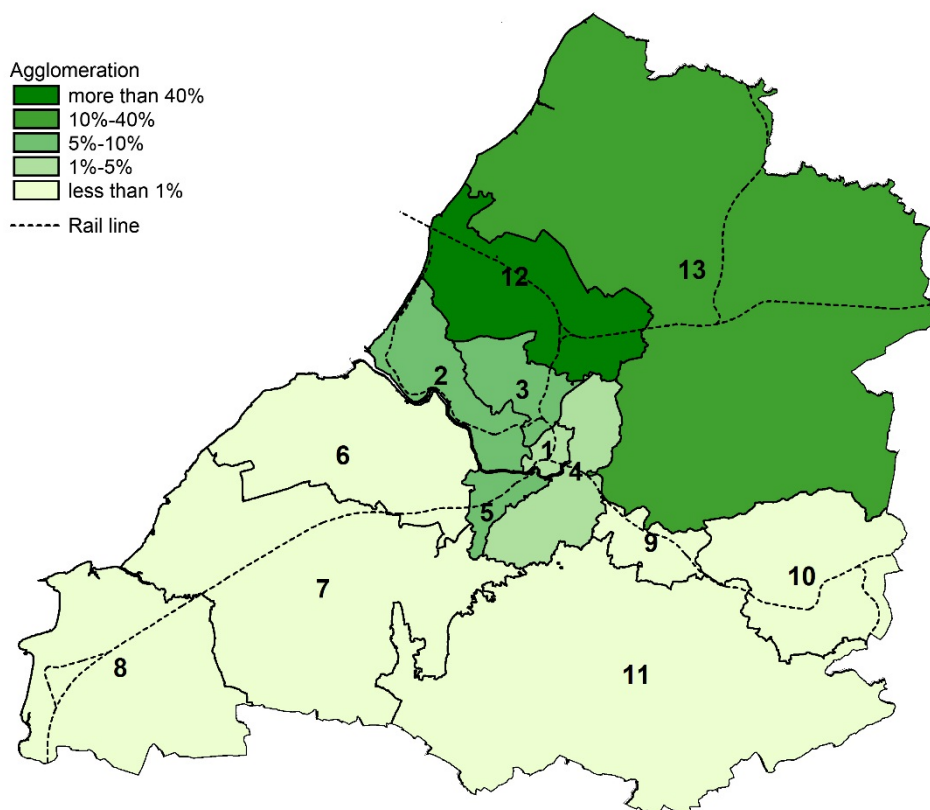


Figure 3-1: Distribution of Agglomeration Impacts across the Study Area

3.2 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 3.5 presents the estimated imperfect competition impact, which is 10% of the business user benefits in rail and highway. Overall the total value of benefits is around £2m.

Table 3.5: Imperfect Competition Impacts

(£000s)	Option 1a	Option 1b	Option 2a	Option 2b
Imperfect Competition Impacts	£1,735	£2,180	£2,005	£2,138

3.3 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 3.6.

Table 3.6: 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>i</i> and working in zone <i>j</i> 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 GBATS3 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.

Table 3.6: Labour Supply Impacts Data

Data required	Source / Challenges & Solutions
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 listed in Table 3.1.
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 3.7. Information was disaggregated to individual geographic sectors using the number of home-based work trips from GBATS3 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 3.8.

Table 3.7: Numbers of Workers in each LAD by Residence

Numbers of Worker	2011	2019	2031
South Gloucestershire	131,089	139,431	145,507
Bristol	197,915	214,391	232,160
Bath and North East Somerset	79,491	83,778	86,477
North Somerset	94,139	97,432	103,080

* 2011 values were taken from 2011 Census data ('KS601EW to KS603EW - Economic activity by sex')

* 2019 and 2031 values were derived based on growth factor for workers derived from TEMPRO dataset 6.2

Table 3.8: Increase in Tax Revenues from Labour Supply Effects

Labour supply impacts (£000s)	Option 1a	Option 1b	Option 2a	Option 2b
2021	£27	£29	£27	£29
2031	£69	£74	£69	£75
2021 to 2078 (discounted)	£1,513	£1,633	£1,534	£1,654

3.4 Overall

Table 3.9 shows summary and total values of wider impacts for the Wider Impact Assessment for the Preliminary Business Case of MetroWest Phase 2.

Table 3.9: Summary total Wider Impacts (2021-80)

(£000s)	Option 1a	Option 1b	Option 2a	Option 2b
Agglomeration impacts	£29,624	£32,095	£30,061	£32,535
Imperfect competition impacts	£1,735	£2,180	£2,005	£2,138
Labour supply impacts	£1,513	£1,633	£1,534	£1,654
TOTAL Wider Impacts	£32,873	£35,908	£33,600	£36,327

4. Additional Option

4.1 Introduction

Analysis of the costs and benefits of the four scheme options considered through the Preliminary Business Case (PBC) indicated a need to consider alternatives, principally to understand whether the benefits of MetroWest Phase 2 could be achieved with an option that would cost less to deliver.

To this end, an additional option has been devised, based on option 1a. This option is very similar to option 1a, but with only one station on the Filton Bank between Stapleton Road and Filton Abbey Wood, instead of two. Constable Road is by far the most expensive station and it generates the fewest trips, therefore it was removed, so this new option (Option '1a_x') can be briefly described as follows:

Option 1a_x – additional option

- Re-opened Henbury line with hourly service operating as a spur from Bristol Temple Meads;
- New stations at Henbury, North Filton and Ashley Down; and
- Extension of existing service terminating at Bristol Parkway to Yate (providing a service of 2 trains per hour at Yate).

This additional option has also been assessed for its wider impacts

4.2 Basic Assessment Specification

The same methodology has been applied to the assessment of this option as the other four options, focusing again on the three areas of:

- Agglomeration
- Output change in imperfectly competitive markets; and
- Labour supply impacts.

Likewise the same appraisal period has been employed and geographical details remain the same in terms of the extent of coverage and sectoring used.

4.3 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. Base information used and the detailed approach followed is set out earlier in this chapter. GBATS3 was again used to provide inputs to the calculations.

Agglomeration impacts were estimated for year 2021 and 2031 and then profiled across the appraisal period between 2021 and 2081, and discounted to 2010 prices and values.⁶ Results are presented in Table 4.1, with option 1a results repeated for comparison. Option 1a_x generates slightly fewer benefits than option 1a. Geographical distribution is the same as other options.

Table 4.1: Agglomeration Impacts – additional option

Agglomeration Impacts (£000s)	Option 1a	Option 1a_x
2021	£1,137	£1,038
2031	£1,240	£1,132
2021 to 2081 (discounted)	£29,624	£27,061

⁶ Agglomeration impacts were assumed to change over time at the same rate as user VOT.

4.4 Imperfect Competition

Imperfect competition impact can be calculated as 10% of business user benefits in rail and highway which will have already been interpolated, extrapolated and discounted over the appraisal period. Table 4.2 shows estimated imperfect competition impact, with option 1a repeated for comparison. Overall the total value of benefits is around £2m, this time slightly larger than option 1a.

Table 4.2: Imperfect Competition Impacts – additional option

(£000s)	Option 1a	Option 1a_x
Imperfect Competition Impacts	£1,735	£2,021

4.5 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. 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 4.3. Comparison with option 1a indicates a slightly lower calculation of benefit.

Table 4.3: Increase in Tax Revenues from Labour Supply Effects – additional option

Labour supply impacts (£000s)	Option 1a	Option 1a_x
2021	£27	£24
2031	£69	£63
2021 to 2078 (discounted)	£1,513	£1,389

4.6 Overall

Table 4.4 shows summary and total values of wider impacts for the option 1a_x, in comparison with option 1a, for Wider Impact Assessment for the Preliminary Business Case of MetroWest Phase 2. It can be noted that, as with other options, there is not a significant difference between the options, though option 1a_x generates slightly lower benefits overall than option 1a.

Table 4.4: Summary total Wider Impacts – additional option

(£000s)	Option 1a	Option 1a_x
Agglomeration impacts	£29,624	£27,061
Imperfect competition impacts	£1,735	£2,021
Labour supply impacts	£1,513	£1,389
TOTAL Wider Impacts	£32,873	£30,470

5. Summary

Over the 60-year appraisal period between 2021 and 2080, assessment results indicate that the agglomeration impact is around £30m with relatively minor differences between options considered. Distribution of this impacts across the study area was cross-checked against components of rail improvements in MetroWest Phase 2 and where their impacts are anticipated.

The impact due to output change in imperfectly competitive markets is usually 10% of the business user benefits and is estimated to be approximately £2m across all options. Increase in tax revenues from labour supply effects as a result of MetroWest Phase 2 is under £2m.

Table 5.1 shows summary and total values of wider impacts for the Wider Impact Assessment for the Preliminary Business Case of MetroWest Phase 2.

Table 5.1: Summary total Wider Impacts (2021-80)

(£000s)	Option 1a	Option 1b	Option 2a	Option 2b
Agglomeration impacts	£29,624	£32,095	£30,061	£32,535
Imperfect competition impacts	£1,735	£2,180	£2,005	£2,138
Labour supply impacts	£1,513	£1,633	£1,534	£1,654
TOTAL Wider Impacts	£32,873	£35,908	£33,600	£36,327

Additional option

Table 5.2 shows summary and total values of wider impacts for option 1a_x, in comparison with option 1a; option 1a_x generates slightly lower benefits overall than option 1a.

Table 5.2: Summary total Wider Impacts – additional option

(£000s)	Option 1a	Option 1a_x
Agglomeration impacts	£29,624	£27,061
Imperfect competition impacts	£1,735	£2,021
Labour supply impacts	£1,513	£1,389
TOTAL Wider Impacts	£32,873	£30,470