

Adran yr Economi a'r Seilwaith
Department for Economy and Infrastructure



Llywodraeth Cymru
Welsh Government

The M4 Motorway (Junction 23 (East of Magor) to West of Junction 29 (Castleton) and Connecting Roads) and The M48 Motorway (Junction 23 (East of Magor) Connecting Road) Scheme 201-

The M4 Motorway (Junction 23 (East of Magor) to West of Junction 29 (Castleton) and Connecting Roads) and The M48 Motorway (Junction 23 (East of Magor) Connecting Road) (Amendment) Scheme 201-

The London to Fishguard Trunk Road (East of Magor to Castleton) Order 201-

The M4 Motorway (West of Magor to East of Castleton) and the A48(M) Motorway (West of Castleton to St Mellons)(Variation of Various Schemes) Scheme 201-

The M4 Motorway (Junction 23 (East of Magor) to West of Junction 29 (Castleton) and Connecting Roads) and the M48 Motorway (Junction 23 (East of Magor) Connecting Road) and The London to Fishguard Trunk Road (east of Magor to Castleton) (Side Roads) Order 201-

The Welsh Ministers (The M4 Motorway (Junction 23 (East of Magor) to West of Junction 29 (Castleton) and Connecting Roads) and the M48 Motorway (Junction 23 (East of Magor) Connecting Road) and the London to Fishguard Trunk Road (East of Magor to Castleton)) Compulsory Purchase Order 201-

The M4 Motorway (Junction 23 (East Of Magor) to West of Junction 29 (Castleton) and Connecting Roads) and The M48 Motorway (Junction 23 (East Of Magor) Connecting Road) (Supplementary) Scheme 201-

The Welsh Ministers (The M4 Motorway (Junction 23 (East Of Magor) to West of Junction 29 (Castleton) and Connecting Roads) and The M48 Motorway (Junction 23 (East Of Magor) Connecting Road) and The London to Fishguard Trunk Road (East of Magor to Castleton)) Supplementary Compulsory Purchase Order 201-

Proof of Evidence

Stephen Bussell BSc (Hons) MIED

Welsh Government, Economics

Document Reference: WG 1.3.1

Contents

1. Author	3
2. Scope of Proof of Evidence	4
3. Principles of Economic Appraisal and Impact Assessment	6
4. Economic Appraisal.....	15
5. Wider Economic Impact Assessment	36
6. Responses to general objections to the draft statutory Orders	60
7. Conclusion	71
1. Appendices.....	75

1. Author

- 1.1 My name is Stephen Bussell. I am an Associate at Ove Arup and Partners Ltd, a multi-disciplinary consultancy. I have 13 years continuous experience as an economist specialising in the economics of public policy and in particular transport infrastructure. I hold a Bachelor of Science degree (with honours) in Economics and Politics from the University of Warwick. I am a member of the Institute of Economic Development.
- 1.2 I specialise in transport economics, cost-benefit analysis and the role of transport in the economy. I have undertaken economic assessments of a number of major road projects in the past including Sections 2 (Gilwern to Brynmawr) and 3 (Brynmawr to Tredegar) of the A465 Heads of the Valleys Road. Both Sections of the A465 were subject to a Public Local Inquiry and I gave evidence on the economic justification of each.
- 1.3 I am currently leading the economic assessment of the A303 Amesbury to Berwick Down for Highways England – a proposal to construct a 2.9km tunnel as the road passes Stonehenge.
- 1.4 I have previously undertaken economic analysis of a range of other transport investments including the electrification of the rail network in South Wales.

Personal Role on the Scheme

- 1.5 The Construction Joint Venture of Costain, Vinci Grands Projet and Taylor Woodrow (the Construction JV) together with the Design Team (a joint venture of Atkins and Arup) commenced work on the current stage of the M4 Corridor around Newport (M4CaN), hereafter referred to as the 'the Scheme', in March 2015. I have been responsible for preparing the Revised Economic Appraisal Report (Document 2.4.12) and the Revised Wider Economic Impact Assessment Report (Document 2.4.11) for the Scheme.

- 1.6 The evidence which I have prepared and provide in this Proof of Evidence is true and I confirm that the opinions expressed are my true and professional opinions.

2. Scope of Proof of Evidence

- 2.1 My evidence concerns the economic justification for the Scheme. The economic justification for the Scheme comprises the following two main elements:
- a) The economic appraisal of the Scheme
 - b) The wider economic impact of the Scheme
- 2.2 The economic appraisal of the Scheme is a quantified assessment of value for money which takes into account a range of costs and benefits for which a monetary value can be estimated. The wider economic impact assessment considers how the Scheme could affect the economy and economic performance.
- 2.3 My evidence is presented in three main parts. In the first part of my evidence, I will describe in more detail the purpose of the economic appraisal and wider economic impact assessment and the distinction between the two analyses. The second part of my evidence will outline the results of the economic appraisal. The third part of my evidence will consider the likely economic impacts of the Scheme.
- 2.4 My evidence is presented in the following structure:
- 1. Author
 - 2. Scope of Proof of Evidence
 - 3. Economic Justification
 - 4. Economic Appraisal
 - 5. Wider Economic Impact Assessment
 - 6. Responses to Objections – Economic Appraisal

7. Responses to Objections – Economic Impact Assessment
8. Summary and Conclusions
9. Appendices

Links with Other Proof of Evidences

- 2.5 The impact of the Scheme on traffic conditions is central to both the economic appraisal and economic impact assessment and both assessments take inputs directly from the traffic model. Therefore the economic appraisal of the Scheme is closely related to the Traffic Proof of Evidence (WG 1.2.1) and I cross refer to this evidence in my Proof of Evidence.
- 2.6 My evidence is also informed by other specialists engaged on the project, particularly in respect of scheme cost information (WG 1.1.1), and impacts on Newport Docks (WG 1.4.1).

Terminology and Guidance

- 2.7 Throughout my evidence, I will refer to guidance on transport appraisal provided by both the Welsh Government and the UK Department for Transport. The primary reference document for economic appraisal in the UK is the Web-based Transport Analysis Guidance (WebTAG). The Welsh Government's equivalent guidance is the Welsh Transport Appraisal Guidance (WelTAG).
- 2.8 WelTAG forms the overarching guidance document for the planning and appraisal of transport proposals in Wales. In relation to technical matters of methodology, WelTAG refers appraisers to WebTAG guidance and data sources.

3. Principles of Economic Appraisal and Impact Assessment

- 3.1 The economic justification of the Scheme has two components: the economic appraisal of the Scheme and the wider economic impact assessment. Each of these two components is intended to capture different economic aspects of the Scheme, and each is of interest to decision makers. This section describes the purpose of each component in turn.

Economic appraisal

Purpose of the Economic Appraisal

- 3.2 The purpose of the economic appraisal is to provide a measure of the value for money of a transport proposal. The economic appraisal uses 'cost-benefit analysis' to establish whether the value of the benefits of a scheme justify its cost.
- 3.3 Cost benefit analysis is a quantitative assessment of scheme impacts and value for money. The cost benefit analysis only considers costs and benefits that can be quantified in monetary terms. Comparing the costs and benefits of a scheme allows decision makers to consider whether a scheme is likely to deliver value for money for the taxpayer.
- 3.4 The value of some impacts or resources can be quantified based on the market price paid for goods and services. For example, changes in fuel costs can be measured directly on the basis of the prices (or forecast prices) faced by users (drivers) per litre of fuel. However, cost benefit analysis also attempts to place a value on impacts which are not associated with a financial transaction and for which markets do not provide prices. In such cases, values are derived from research. The value of journey time savings is the most important example of this. The value of journey time savings is captured irrespective of whether the saving is associated with a financial transaction or financial cost saving, the value of travel time savings experienced by those on leisure trips being a key example of this principle. As such, the economic appraisal is

primarily concerned with the change in societal welfare (or ‘well-being’) as a result of a scheme¹.

- 3.5 Because the economic appraisal is a quantitative assessment the analysis is focussed on, but not limited to, impacts on the economic efficiency of the transport sector. There may be other costs and benefits that cannot be quantified in monetary terms. Therefore, the economic appraisal is only one aspect of the overall case for investment and needs to be balanced against other environmental and social costs and benefits.

Comparing costs and benefits

- 3.6 The cost benefit analysis compares cost and benefits of a situation with the Scheme (the ‘Do Something’ case) against a situation without the Scheme (the ‘Do Minimum’ case). The use of this terminology and the assumptions employed under each scenario is consistent with the traffic assessment (WG 1.2.1).
- 3.7 The analysis compares costs and benefits that occur over time during both the construction and operational phase of the Scheme. An appraisal period is defined for this purpose. The appraisal period is intended to cover the useful life of the asset. In practice, a road construction scheme – so long as maintenance and renewal activity is continued – has an indefinite life. To ensure consistency between projects, a standard appraisal period is defined in WebTAG (Unit A1.1) which extends from the current year (in this case 2016) to a point in time 60 years after the opening of the Scheme.
- 3.8 In order to compare streams of costs and benefits that occur at different points in time, values are converted or ‘discounted’ to a ‘present value’. Discounting costs and benefits that occur in the future reflects the fact that, generally, society prefers to receive goods and services sooner

¹ “Welfare” or “social welfare” is the total well-being of society. It reflects the “utility” of people within society. Although the level of welfare is impossible to measure, it is possible to assess changes resulting of a project or policy.

rather than later. In other words, people and societies place a greater weight on impacts that occur now rather than in the future. It should be noted that discounting is a separate concept to inflation (changes in the prices of goods and services over time).

3.9 The discount rate which is used to convert all costs and benefit to a consistent base year is the HM Treasury Green Book discount rate (also known as the social time preference rate)². This rate is applied in the appraisal of projects across all areas of public policy in the UK. In accordance with WebTAG, all values are converted to 2010 values. The choice of the year 2010 is largely arbitrary but ensures consistency with other transport investments in the UK.

3.10 Given that the cost benefit analysis compares costs and benefits that accrue at different points in time, it is also necessary to account for the effects of inflation. The effect of inflation is to increase the price of goods and services over time. To account for changes in price levels, all values are expressed in real terms by converting to a consistent price base. In accordance with WebTAG, all monetary values are expressed in 2010 prices. The purpose of using a defined price base is to ensure consistency across the assessment of different transport schemes but the choice of the base year has a neutral impact on the relativity between costs and benefits.

3.11 A further adjustment to the monetary values is applied to ensure that all costs and benefits are compared on a consistent basis. This adjustment ensures that all values are expressed in the same 'unit of account'. This adjustment is required because indirect taxation (taxes and subsidies levied on goods and services rather than on incomes or profits) creates two possible units of account: market prices (values including or gross of indirect tax) and factor cost (values excluding or net of indirect tax). Whether costs and benefits are expressed in market prices or in factor cost has no material impact on the economic appraisal, but it is necessary to use a consistent unit of account for all costs and benefits.

² WG 6.1.18

As set out in WebTAG (Unit A1-1) it is customary in transport appraisal to express all values in the market prices unit of account. To achieve this, values which are measured net of tax (i.e. in factor cost) are converted to market prices by applying the 'indirect tax correction factor' which is given in WebTAG. This factor is the average rate of indirect taxation in the economy; currently 1.19 (TAG Databook Version 1.6).

Primary Outputs of the Economic appraisal

- 3.12 As noted, the purpose of the economic appraisal is to quantify a range of impacts of the Scheme such that the costs and benefits of the investment can be compared. The present value of benefits (PVB) of the Scheme is the total of all discounted benefits over the appraisal period. The present value of costs (PVC) of the Scheme is the total of all discounted costs of the Scheme over the appraisal period.
- 3.13 Two key measures are used to summarise the results of the cost-benefit analysis. Firstly, the Net Present Value (NPV) is the difference between the PVB and the PVC. In essence, the NPV is the sum of all costs and benefits. If the NPV is a positive number, this indicates that the benefits of the Scheme outweigh its costs.
- 3.14 The second key measure is the Benefit-Cost Ratio (BCR). This is defined as the ratio of the PVB to the PVC (or the value of scheme benefits divided by the scheme costs). The BCR is typically used as the primary measure of value for money because it summarises the relative scale of costs and benefits – in effect it measures the efficiency of the investment or the value of benefits generated per pound of public funds invested.
- 3.15 A BCR (benefits divided by costs) in excess of 1 indicates that the benefits of a scheme outweigh its costs. The higher the BCR, the more efficient the transport investment and the greater the value for money.
- 3.16 There are no precise rules for assessing the extent to which the value of the BCR indicates that the Scheme offers good value for money for the

taxpayer, although there is a clear distinction between schemes for which the BCR is substantially less than 1 and schemes for which the BCR is substantially in excess of 1.

- 3.17 As noted, not all costs and benefits of the Scheme can be quantified and monetised. Therefore the BCR should be interpreted on the basis of the impacts that are captured within it.

Wider Economic Impact Assessment

- 3.18 The purpose of the wider economic impact assessment is to consider the impact of the M4CaN proposals on the local and regional economy. This assessment is set out in the Revised Wider Economic Impact Assessment Report (Document 2.4.11). The term 'wider economic impacts' reflects the fact that the assessment considers the knock on effects of the Scheme on the economy beyond the initial or direct economic effects on transport users. Undertaking this assessment reflects the strategic economic importance of the M4 to the economy of Wales, as well as the objectives of the Scheme.

- 3.19 The economic appraisal of the Scheme and the wider economic impact assessment are related and overlapping assessments, although they are distinct in their purpose and emphasis. The remainder of this section outlines the key differences between the economic appraisal of the Scheme and the economic impact of the Scheme.

Welfare Effects and GDP Impacts

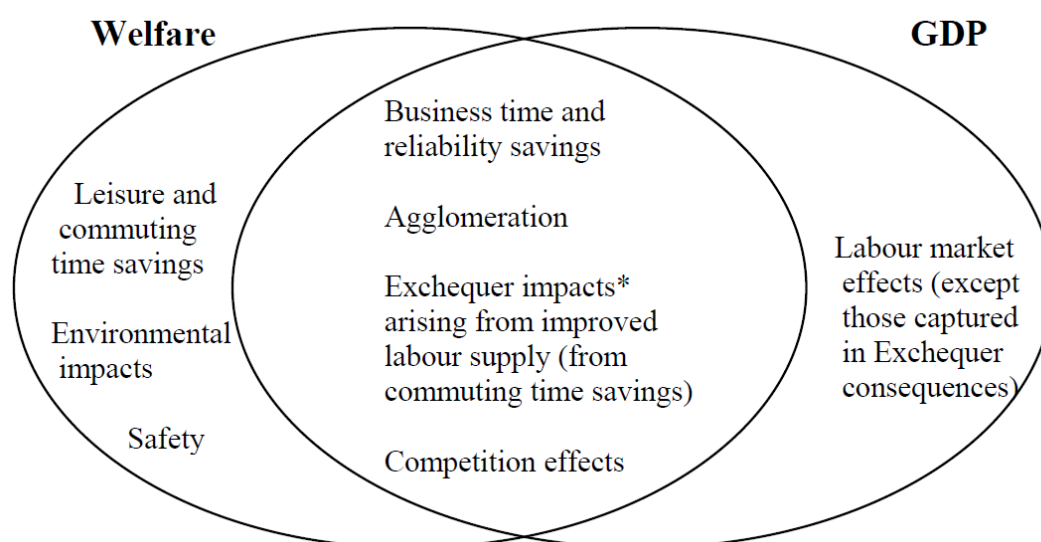
- 3.20 As noted, the economic appraisal is concerned with impacts on welfare. As noted, it seeks to capture the effect on welfare of a range of impacts even for which the market does not provide a measure of value or for which no financial transaction is involved.
- 3.21 Conversely, the wider economic impact assessment considers impacts on the real economy. The purpose of the wider economic impact assessment is to consider how changes in transport conditions will

influence the decisions of economic actors (namely firms and individuals) and how this will ultimately affect the location and scale of economic activity. Therefore, whereas the economic appraisal measures welfare, wider economic impacts are typically expressed in units of Gross Domestic Product (GDP)³ or numbers of jobs created in a given year (rather than necessarily discounted over an appraisal period).

3.22 In this respect there are some overlaps between the two assessments.

This is illustrated in the venn diagram below⁴:

Figure 1: Transport Investments, Welfare and GDP



3.23 The overlapping area in the diagram represents impacts that are both welfare effects and GDP impacts. Benefits (or cost savings) experienced by business users are a prime example of an impact on both welfare and GDP.

3.24 The economic appraisal also assesses a range of welfare impacts that do not directly represent a GDP impact, such as journey time savings for leisure and commuter users. Finally, there are also effects of transport

³ Gross Domestic Product is a monetary measure of the value of all goods and services produced by an economy. GDP is widely used as a measure of economic performance. For regional economies and individual industry sectors, Gross Value Added (GVA) is often used as a measure of economic performance. GVA is closely related to GDP. GVA is the value the output of an industry or region, less the value of intermediate inputs.

⁴ Recreated from Transport, Wider Economic Benefits, and Impacts on GDP. Department for Transport Discussion Paper (July 2005)

investments that increase GDP but do not necessarily result in an equivalent increase in welfare (and are therefore not captured in the economic appraisal).

3.25 Traditionally, economic appraisal of transport schemes has focussed only on the direct impacts of transport schemes on users of the transport system in respect of travel time savings and changes in vehicle operating costs. However, research has shown that transport improvements can lead to a range of indirect economic benefits that occur as a consequence of the ways in which transport affects economic activity. These are referred to as wider economic benefits. A key example of this is agglomeration effects (shown in Figure 1) which describes the economic benefits that transport schemes can deliver by improving connections between firms and within labour markets. As such, considering direct impacts only can lead to underestimation of the overall benefits of transport improvements to society.

3.26 The presence and importance of wider economic benefits was identified by the Standing Advisory Committee on Trunk Road Appraisal (SACTRA) in 1998. The committee recommended that wider economic impacts be given formal consideration in transport economic appraisal. In 2005, drawing on academic research, the Department for Transport introduced guidance which set out procedures to capture a range of the wider economic benefits of transport schemes which have a net effect on welfare at a national (UK) level.

3.27 Since 2009, the assessment of wider economic benefits has been included in WebTAG guidance and incorporated into the cost benefit analysis framework⁵. Current WebTAG guidance refers to these quantifiable wider economic benefits as ‘Wider Impacts’. These impacts are described further in Section 4 of this evidence.

⁵ First introduced as TAG Unit 2.8C (Draft for Consultation) and TAG Unit 3.5.14C (Draft for Consultation). These units were formally adopted in August 2012.

3.28 The inclusion of Wider Impacts in the economic appraisal of the Scheme provides a more accurate assessment of value for money. However, as described in Section 5 of this evidence, in my opinion, the Wider Impacts framework only partially captures the ‘total’ economic benefits of the Scheme.

Geographic Scope and Spatial Effects

3.29 The economic appraisal is focussed only on the net effect of transport improvements on GPD and welfare at a national level. How such costs and benefits are distributed spatially is not considered. In practice, the economic benefits of a transport scheme will be concentrated in particular areas – typically areas in closer proximity to the Scheme – whilst the impacts across a wider area will be more diffuse. It is also the case that a transport improvement may lead to an increase in economic activity in one area at the cost of a reduction in economic activity in other areas. The wider economic impact assessment is concerned with the effects on the economy of a defined geographical area. As described in Section 5 of my evidence, a study area comprising much of South Wales and part of the South West of England was defined for the purposes of the assessment of the economic impact of the M4CaN.

Quantified and Qualitative Evidence

3.30 The relationship between transport and the economy is highly complex. The economic impacts considered in this report are the product of an array of decisions made by individuals and individual businesses about where to work, where to shop, and where to invest. Because of this complexity, it is difficult to be precise about the magnitude of wider economic effects that result from changes in transport conditions.

3.31 Partly as a result of this complexity, when measuring the effect of past infrastructure improvements, it is difficult to isolate the effects of transport from wider economic and social trends. As would be expected, it is also the case that the impact of transport improvements is context

specific. As a result, the analysis of economic impacts cannot be based wholly on empirical relationships between changes in transport and effects on the economy. To reflect this, the wider economic impact assessment is based on a combination of qualitative judgement (drawing on the transport economic literature) and quantitative evidence. This is in contrast to the economic appraisal which is based purely on those impacts that can be quantified and monetised.

4. Economic Appraisal

Guidance

- 4.1 As noted, the economic appraisal of the Scheme is based on a cost benefit analysis. The cost benefit analysis has been undertaken in accordance with WelTAG guidance (specifically, Section 6.2: Transport Economic Efficiency). As noted, in relation to technical matters, WelTAG refers the appraiser to WebTAG guidance and data. Therefore, in practice, WebTAG is the primary reference document for the cost benefit analysis.
- 4.2 The WebTAG units relating to the cost-benefit analysis are TAG Unit A1-1 (Cost Benefit Analysis), TAG Unit A1-2 (Scheme Costs) and TAG Unit A1-3 (User and Provider Impacts)⁶. WebTAG also incorporates economic data and parameters which are applied in the cost benefit analysis (referred to as the TAG Databook).

Approach

- 4.3 The economic appraisal considers the costs and benefits of the Scheme in monetary terms that are accrued over the period from 2016 to a point in time 60 years after the Scheme opening year (in this case 2081).
- 4.4 Benefits relating to the 'economic efficiency' of the transport system are presented in the form of a Transport Economic Efficiency (TEE) table (included as Figure 3 in Appendix A). The term 'benefits' is applied to a specific set of impacts and is applied consistently whether such impacts are positive or negative (i.e. dis-benefits). These benefits are made up of the following:
- a) User benefits
 - b) Journey time savings
 - c) Vehicle operating cost savings

⁶ Specifically, Unit A1-3 User and Provider Impacts, forthcoming change, November 2016.

- d) User charges, such as tolls
 - e) Additional costs to travellers due to disruption during construction and maintenance works
- 4.5 Costs faced by Government (either local or central) to implement the Scheme are presented in the 'public accounts' table (Figure 4 in Appendix A). They include the following:
- a) Operating costs
 - b) Investment costs (or maintenance costs)
 - c) Revenue (in this case toll revenues)
 - d) Developer and other contributions (also not applicable)
 - e) Grant/subsidy payments (not applicable)
- 4.6 The overall cost benefit analysis is presented in the Analysis of Monetised Costs and Benefits table (Figure 5 in Appendix A). The Analysis of Monetised Costs and Benefits also includes benefits or impacts due to changes in greenhouse gas emissions, and changes in the rate of accidents. These benefits would be negative if the situation were to worsen.
- 4.7 Impacts on wider public finances are also included in the Analysis of Monetised Costs and Benefits and are included as a benefit of the Scheme. This relates to changes in tax revenues as a result of the Scheme. Changes in tax revenues are directly linked to changes in fuel expenditure, which is a function of speed and distance of travel.
- 4.8 As noted in Section 3, the economic appraisal includes consideration of some of the wider economic benefits of the Scheme, termed 'Wider Impacts' in WebTAG guidance (TAG Unit A2-1). Such impacts occur as an 'indirect' result of the Scheme and are additional to the 'direct' transport user benefits captured in the Transport Economic Efficiency analysis.

Calculation of Scheme Benefits

4.9 This section of my evidence explains the calculation of Scheme benefits.

M4CaN Transport Model Inputs

4.10 The calculation of benefits relating to the efficiency of the transport network is based on outputs from the M4CaN transport model. The assessment of user benefits takes inputs from the M4CaN transport model (TEMPRO 7.1 Interim for Wales) which is based on up to date traffic growth assumptions. Details of the model are provided in the Revised Traffic Forecasting Report (Document 2.4.13) and described in detail in the traffic Proof of Evidence (WG 1.2.1).

4.11 The M4CaN transport model has been used to produce forecasts for a 'Do Minimum' scenario, which represents the future situation without the Scheme, and a 'Do Something' scenario which represents the future situation with the Scheme. It is the comparison of these two future situations which provides the basis for the economic appraisal.

4.12 The main economic appraisal is undertaken based on the 'Central' traffic growth scenario, although sensitivity testing is undertaken for the 'Low' and 'High' growth scenarios which are also detailed in the Revised Traffic Forecasting Report (Document 2.4.13).

4.13 The M4CaN transport model has also been updated to reflect the UK Government's announcement, contained within the Budget 2016, on the future of the Severn Crossing tolls following the end of the current concession arrangement.

4.14 In the March 2016 Budget, the Government announced its intention to retain tolls on the Severn Crossings at half their current levels. On this basis, the revised economic appraisal assumes, under the 'Core

Scenario' a 'half toll' scenario^{7 8}. In view of the uncertainty over the long term future of the Severn Crossing Tolls, a sensitivity test is included under which it is assumed that the tolls are removed.

User Benefits During Operation

- 4.15 User benefits are comprised of journey time savings, vehicle operating costs and (where relevant) user charges.
- 4.16 The calculation of user benefits has been undertaken using TUBA (Transport User Benefit Appraisal) software. TUBA software has been produced by the Department for Transport to carry out transport scheme economic appraisal. TUBA uses data taken from the traffic model forecasts on the number of trips, average journey times and average distances to calculate journey time savings and vehicle operating cost savings.
- 4.17 The most recent version of TUBA software (version 1.9.8 Interim) has been used to undertake the economic appraisal of the Scheme. This version of the TUBA software is based on economic data and parameters included in the most recent version of the TAG Databook (version 1.6) introduced in July 2016. Inputs to the TUBA model were prepared in accordance with the TUBA Manual⁹ ().
- 4.18 Demand, journey time and trip distances are extracted from the M4CaN Transport Model for each of the five user classes which are represented in the assignment model¹⁰, namely:
- a) Car – employer's business trips

⁷ As described in the Traffic Forecasting Report (December 2016) it is also assumed that VAT would be removed from the toll prices when the bridges return to public ownership and that, in line with previous announcements, that the toll charge Category 2 vehicles (Light Goods Vehicles) is reduced to the level of Category 1 vehicles (cars and minibuses of up to 9 seats).

⁸ Subsequent to the production of the Revised Economic Assessment Report, on 13th January 2017 the UK Government commenced a consultation on the future of the tolls. The consultation document reaffirms the Government's intention to halve the tolls on the Crossings. Specifically, toll levels of £3 per vehicle for cars and light goods vehicles and £10 for heavy goods vehicles have been proposed to come into force from late 2017/early 2018.

⁹ TUBA: General Guidance and Advice. Version 1.9.5 (WG 6.1.21)

¹⁰ The assignment model is the component of the M4CaN Transport Model which provides a representation of the highway network and the resulting traffic flows and conditions.

- b) Car – commuter trips
- c) Car – other trips
- d) Light goods vehicle (LGV)
- e) Heavy goods vehicle (HGV)¹¹

4.19 As identified in the Traffic Proof of Evidence (WG 1.2.1), the transport model is based on three modelled periods: AM peak hour (08:00 to 09:00), PM peak hour (17:00 to 18:00) and Interpeak hour (an average hour representing the period 10:00 to 16:00). It is necessary to apply factors to convert the traffic model outputs from the modelled time periods to represent daily and annual values. Such factors are termed annualisation factors and are derived from traffic count data for the existing M4. Traffic model outputs from the single hour AM and PM peak models have been expanded to represent the full three hour AM and PM peak periods (07.00 to 10.00 and 16.00 to 19.00 respectively) based on the ratio of traffic volumes in the full peak period to traffic volumes in the modelled hour. A similar process has been applied to convert Interpeak model outputs to represent off-peak and weekend periods.

4.20 Traffic forecasts have been prepared for the years 2022, 2037 and 2051. TUBA calculates the benefits for each of the modelled forecast years and then interpolates to calculate the benefits for the intervening years. The year 2051 is the last year for which traffic growth factors are published (within TEMPRO) by the Department for Transport. From 2051 onwards, it is assumed that there is no change in traffic patterns and so the impact of the Scheme on travel times and distances are fixed. Assuming fixed demand and benefits after 2051 is a simplifying assumption which may result in the long term benefits of the Scheme being slightly underestimated.

¹¹ In TUBA software, the HGV user class is further sub-divided into Other Goods Vehicles 1 (OGV 1) and Other Goods Vehicles 2 (OGV 2). OGV 1 includes all rigid vehicles over 3.5 tonnes gross vehicle weight with two or three axles. OGV 2 includes all rigid vehicles with four or more axles and all articulated vehicles.

4.21 Travel costs for road users comprise both the financial costs in relation to fuel costs and other vehicle operating costs, and the opportunity cost of lost time spent in transit¹².

4.22 Vehicle operating costs are made up of two elements:

- a) Fuel operating costs
- b) Non-fuel operating costs

4.23 Fuel consumption rates are a function of both distance travelled and average speeds. Fuel consumption rates are defined for cars (petrol, diesel or electric), LGVs (petrol, diesel or electric), OGV1 and OGV2 and provided in the WebTAG databook. The proportion of cars and LGVs assumed to be using petrol fuel, diesel fuel or electric propulsion are also defined within WebTAG and these proportions are forecast to change over time. Adjustments are made to fuel consumption rates in each year of the appraisal up to 2035 to account for forecast vehicle fuel efficiency improvements. From 2035 onwards, no further data is provided in the WebTAG databook, therefore fuel consumption rates are held constant. Fuel and electricity prices are also defined within TUBA and are based on the WebTAG databook.

4.24 Non-fuel vehicle operating costs comprise vehicle wear and tear including oil, tyres, maintenance and depreciation. Non-fuel operating costs are calculated for each user class based on both distance travelled and time spent travelling using a formula contained within the TUBA software. Non-fuel vehicle operating cost parameters are similarly based on the WebTAG databook.

4.25 Time related journey costs are calculated by applying standard values of travel time saving (referred to as values of time) which are published in the TAG Databook. WebTAG values of time are provided for work

¹² Opportunity cost refers to a benefit that a person could have received, but gave up, to take another course of action. In this context, the opportunity cost of the time spent travelling is the benefit that an individual or business would have enjoyed had that time been spent doing something else.

(employers business and freight) and non-work journey purposes (commute and other).

- 4.26 An update to the values of travel time was introduced in July 2016. The new values of time have been adopted in the appraisal presented here. As a result of these changes, the average value of time assumed for business travel (the car – business user class) is lower than previously estimated by around 35% for drivers and 14% for passengers. However, values of time for business users are assumed to vary by distance, such that shorter distance trips are associated with a lower value of time and longer distance trips are assumed to have a higher value of time. Values of time for commuters are higher by around 46%, whilst values of time for the car – other user class are lower by around 23%. Changes in vehicle occupancy rates have also been incorporated into the updated guidance.
- 4.27 Values of time in WebTAG are per person values. TUBA includes assumptions on vehicle occupancy rates which are used to convert the vehicle hours measured in the assignment model to person hours.
- 4.28 TUBA calculates user benefits on the basis of the theory of consumer surplus and the concept of ‘willingness to pay’. The consumer surplus is defined as the benefit that the consumer (in this case the transport user) enjoys, in excess of the costs which he or she perceives (in relation to financial and time costs). At a given level of travel cost, there is a difference between what users would be willing to pay (in practical terms, the costs that users would be willing to incur) and what they actually pay.
- 4.29 In overall terms, the effect of the Scheme is to reduce the costs of travel, primarily as a result of lower travel times. For existing users, the change in consumer surplus is equal to the change in the costs of travel between a particular origin and destination. For new users, the change in consumer surplus will be the difference between the costs they would be willing to pay and the costs that they actually incur following the

improvement. This will be some proportion of the change in travel costs, but not the full amount of the change as for existing users.

- 4.30 TUBA employs the 'rule of half' formula to approximate the change in consumer surplus resulting from the changes in travel costs and hence the level of user benefits. The rule of half approach assumes that, for new trips, the change in consumer surplus (or the benefit derived from the Scheme) will be half of the change in travel costs.
- 4.31 User benefits are calculated in this way, separately, for changes in travel time, fuel and non-fuel operating costs. The exception to this is non-fuel vehicle operating costs for consumer trips which are assumed not be perceived by users on non-work trips¹³. Instead, the change in total expenditure on non-fuel vehicle operating costs is included in the appraisal.
- 4.32 The M4CaN transport model represents typical operational conditions on the highway network in terms of average flows and speeds on a normal day of operation. The model does not reflect those occasions when a major incident may have occurred which results in severe reduction in network performance. In such instances, the improved network resilience and capacity offered by the M4CaN scheme would minimise the disruption caused by the incident and reduce the additional costs imposed on the travelling public, resulting in a net economic benefit. Such benefits are not included in the quantified economic appraisal of the Scheme.

Impacts During Construction and Maintenance

- 4.33 Traffic management works during construction and maintenance works tend to result in changes in journey times and vehicle operating costs. These impacts need to be taken into account in the economic appraisal for a scheme.

¹³ In this context, 'not perceived' means that, whilst such costs are incurred by users as a result of trip making, they are considered not to influence travel decisions.

- 4.34 During the construction phase of the project, roadworks will be required for the period of the construction of the tie-ins between the new and existing M4 motorway corridor to the west of Junction 28 and to the east of Junction 23. The traffic management associated with the construction of these tie-ins would result in dis-benefits to traffic travelling on this section of the highway network. Details of the approach to traffic management during construction are set out in Environment Statement Appendix SR 3.1 (Document 2.3.2). In practice, traffic management measures are complex, involving many different phases of activity. For the purposes of the economic appraisal, a simplified traffic management schedule has been developed to provide a representation of the likely impacts on traffic during the construction period. This is set out in detail in the Revised Economic Appraisal Report (Document 2.4.12).
- 4.35 Each phase of traffic management has been simulated using the traffic model. Impacts on users have been calculated using TUBA software to translate traffic model outputs for a Do Minimum and Do Something scenario using a similar process to that outlined above for the operational phase. Impacts on users during construction are negative which reflects the disruption caused to users during construction.
- 4.36 In addition to the construction phase, it is necessary for the economic appraisal to take account of disruption during maintenance of both the new road and the existing M4 during the 60-year appraisal period. A maintenance schedule has been devised for the new motorway which includes a recurring cycle of resurfacing, overlay and reconstruction of different sections of the motorway. The effect of traffic management measures employed during these periods of maintenance have been modelled and the resultant impacts on users estimated using TUBA.
- 4.37 When maintenance is taking place on the existing route, the effect of the Scheme would be to reduce the disruption caused to users by providing an alternative route for some traffic and by reducing traffic flows on the existing route in general. Traffic management scenarios have been defined for major maintenance of three structures on the existing route

(the River Usk Bridge, the Malpas Viaduct and the Brynglas Tunnels) and impacts on users have been calculated by comparing the Do Minimum and Do Something scenarios during these periods of maintenance. For conservatism, routine maintenance and resurfacing of the existing route has not been modelled.

- 4.38 The maintenance schedules and traffic management measures are outlined in detail in the Revised Economic Appraisal Report (Document 2.4.12).

Accidents

- 4.39 The safety impacts of the Scheme have been assessed quantitatively and monetised to be incorporated into the overall economic appraisal for the Scheme. Accident saving benefits have been calculated separately using Cost and Benefit to Accidents – Light Touch (COBA-LT¹⁴), a spreadsheet application developed by the Department for Transport to undertake the analysis of the impacts on accidents as part of the economic appraisal of road schemes.
- 4.40 COBA-LT compares accidents by severity and associated costs across the network in the Do Minimum Scenario with those in the Do Something scenario, using details of link and junction characteristics and forecast traffic volumes. The assessment covers both the construction and operational phases of the Scheme. Monetised impacts are calculated based on the average costs of accidents by severity and road class. With the exception of the existing M4 between Junction 23 and Junction 29, the accident rates (accidents per million vehicle kilometres) used in COBA-LT are consistent with those defined in the WebTAG databook .
- 4.41 For the existing M4 around Newport, accident rates are based on observed accident rates derived from data collected over the most recently available five year period. In the Do Something scenario, accident rates are assumed to remain constant on the existing M4

¹⁴ COBALT (COst and Benefit to Accidents – Light Touch), Department for Transport, December 2013

although, in practice, there may be some reduction in accident rates as a result of safety improvements resulting from the reclassification of the existing M4.

4.42 For the proposed new section of motorway, accident rates are based on average rates for a 3 lane motorway. In reality, it is expected that a new motorway, designed to modern standards, would deliver better safety performance compared with the motorway network on average. However, in the absence of accident rates specifically relating to modern motorways it is not possible to reflect this in the analysis.

4.43 In December 2016, an updated version of COBA-LT was released by the Department for Transport. The accident analysis has been updated such that it is based on the updated version. For this reason, the monetised accident impacts set out in this Proof of Evidence differ from those in the Revised Economic Appraisal Report. In the context of the overall appraisal, the effect of this change is very minor and the Initial BCR for the Scheme is unchanged when reported at two decimal places.

Indirect Taxation

4.44 The appraisal captures indirect tax revenues to Central Government through, for example, changes in fuel duty that result from the Scheme. In accordance with standard practice, impacts on indirect tax revenue are included as part of the overall Scheme benefits.

Greenhouse Gases

4.45 The social cost of changes in greenhouse gas emissions are included in the economic appraisal. TUBA calculates changes in greenhouse emissions based on total fuel consumption (petrol and diesel), the calculation of which is referred to in paragraph 4.23 of my evidence.

4.46 In accordance with standard approaches to transport appraisal, the monetised assessment of changes in greenhouse gas emissions is based on outputs from the M4CaN traffic model only. In this regard, the

assessment differs from the analysis of carbon emissions set out in the Carbon Proof of Evidence (WG 1.13.1) which is based on more detailed VISSIM traffic model. Whilst TUBA calculates changes in greenhouse gas emissions based on changes in total vehicle kilometres and changes in average speeds, the more detailed VISSIM traffic model takes account of the stop-start traffic conditions on the M4. It should be noted that both assessments suggest an overall reduction in vehicle emissions as a result of the Scheme.

Wider Impacts

- 4.47 As noted, Wider Impacts is the term given to some of the economic impacts of the transport improvements that are additional to the transport user benefits referred to above. The inclusion of Wider Impacts in the economic appraisal recognises that transport improvements have knock-on effects on the wider economy, the benefits of which would otherwise not be captured. Some of these knock on effects are described in further detail in Section 5 of my evidence.
- 4.48 A framework for the calculation of Wider Impacts has been established by the Department for Transport and is formalised in WebTAG (TAG Unit A2-1)
- 4.49 Three types of Wider Impact are assessed and each is described below:
- a) Agglomeration effects (Wider Impact 1): The term agglomeration refers to the density of economic activity in an area. Firms derive productivity benefits from being located close to other firms and having access to a large labour force. Transport improvements can increase the 'effective density' of an economy by reducing transport costs, thereby improving accessibility between firms in an area, and between firms and the workforce. Therefore, transport schemes that improve accessibility can deliver productivity benefits over and above the direct user benefits.
 - b) Output change in imperfectly competitive markets (Wider Impact 2): Transport improvements can result in lower transport costs for firms. Firms tend to respond to lower costs by reducing prices and increasing output of goods and services. This results a welfare

benefit to consumers that is not captured in the assessment of user benefits. This is because, under conditions of imperfect competition (which is the prevailing state of the economy), consumer's willingness to pay for the additional output will exceed the cost of producing it.

- c) Labour market impacts (Wider Impact 3): Transport costs can act as a barrier to entry into the labour market, given that individuals will weight up the costs of travelling to work against the wages they will earn. Lowering transport costs can improve access to employment opportunities and increase the overall level of employment in an economy. While some of these benefits are captured in the main economic appraisal (in the form of user benefits for commuters) the changes in tax revenues resulting from increased employment are not. Wider Impact 3 is calculated by estimating the impact of changes in the labour market on tax revenues.

4.50 A Wider Impacts model has been constructed for the assessment of agglomeration effects and labour market effects. The Wider Impacts model is described in more detail in the Revised Economic Appraisal Report (Document 2.4.12). Output change in imperfectly competitive markets is calculated as an uplift to the user benefits accruing to business related user classes.

4.51 The assessment of Wider Impacts assumes that patterns of employment are unchanged from the current situation and therefore takes no account of changes in business location that could result from the Scheme which, as well as having a positive impact on the local and regional economy, could stimulate further Wider Impacts, particularly in relation to agglomeration effects.

4.52 As described in Section 3, the presence and importance of such wider economic benefits in transport appraisal is widely acknowledged. However, whilst the inclusion of Wider Impacts provides for a more complete assessment of Scheme benefits, it is acknowledged that Wider Impacts can be quantified with less certainty than direct transport user benefits. As such, the overall appraisal results are presented both with and without Wider Impacts.

4.53 Where Wider Impacts are excluded from the analysis the BCR for the Scheme is referred to as the 'Initial BCR'. Where Wider Impacts are included in the analysis the BCR is referred to as the 'Adjusted BCR'. The assessment of the value for money of the Scheme should take into account both the Initial and Adjusted BCRs for the Scheme.

Calculation of Scheme Costs

4.54 The following section of my evidence explains the calculation of Scheme costs. The cost estimates set out below do not allow for two potential developments in the Scheme. Firstly, as described by Mr Ben Sibert (WG 1.5.1), additional bridge protection works at Newport Docks have been proposed. Secondly, as described by Mr Matthew Jones (WG1.1.1), the Welsh Government is considering the provision of an additional eastbound offslip from the new section of motorway in the vicinity of the motorway service area at Magor. Once a full assessment of these elements has been completed, the economic appraisal for the Scheme will be revised.

Investment Costs

4.55 Scheme costs used in the economic appraisal are set out in Table 1. For the purposes of the economic appraisal, costs are included to account for the reclassification of the existing route and for the reconfiguration of Junction 25 which form part of the M4CaN proposal and are included in the traffic modelling.

4.56 Scheme costs are adjusted for risk of cost overrun based on the Quantified Cost Risk Assessment (QCRA). The purpose of the QCRA is to adjust the cost estimate for the identifiable factors that could result in an overspend relative to the base cost estimate. The QCRA is an extension of the Risk Register for the Scheme. For each identified risk, an assessment has been made of the impact of the risk on the Scheme costs and the likelihood of the risk occurring. The product of these assessments is the expected value of risk for the Scheme.

- 4.57 A further adjustment to the Scheme costs is made to allow for Optimism Bias. Optimism Bias is required to be applied to public sector project scheme estimates to adjust for a systematic historical tendency to underestimate project costs. Optimism Bias can be interpreted as an allowance for risks that cannot be reasonably predicted and are therefore not necessarily captured by the QCRA. The Optimism Bias uplift is applied to the risk adjusted scheme cost estimate.
- 4.58 WebTAG (Unit A1.2) provides default Optimism Bias uplift factors based on empirical evidence on the difference between estimated scheme costs and outturn costs for past highways schemes in the UK. The uplift applied to a scheme is based on empirical evidence and the specific characteristics of the Scheme in question. Such characteristics include the type of project and the degree of complexity, the stage of development of the Scheme, the quality of the risk assessment and the degree to which the likelihood of Optimism Bias has been mitigated. The process for determining the appropriate uplift factor for a scheme is set out in Supplementary Green Book Guidance: Optimism Bias¹⁵.
- 4.59 An assessment of the appropriate level of optimism bias for the Scheme has been undertaken in accordance with WebTAG (Unit A1-2) and the HMT Green Book Supplementary Guidance on Optimism Bias. The resultant Optimism Bias level for the new motorway is an uplift of 5% which equates to approximately £52m. The factor applied reflects three main aspects of the Scheme. Firstly, the maturity of the Scheme and the degree of detail applied in the Scheme design and environmental assessment. Secondly, the quality and coverage of the QCRA which provides quantified estimates for many of the factors that have been the source of Optimism Bias on past schemes. Thirdly, the project is being delivered through an Early Contractor Involvement (ECI) contract under which the financial risks of cost overrun is shared between the contractor and the Welsh Government. This model reduces the likelihood of costs being understated and incentivises the contractor to minimise scheme

¹⁵ WG 6.1.19

costs. Empirical evidence on Optimism Bias pre-dates the widespread adoption of this model.

4.60 An Optimism Bias uplift of 44% has been applied to the reclassification of the existing route and for the reconfiguration of Junction 25, the cost estimates for which are less well developed in comparison with the main scheme.

4.61 In 2015 prices, the total scheme cost applied in the cost benefit analysis is £1.1bn. Costs associated with VAT are excluded because the proposal is a public sector scheme, so that the VAT which is payable is regarded as an internal Government transfer and has a neutral impact in respect of economic efficiency.

4.62 Costs are assumed to be incurred during the period 2016 to 2026, based on the predicted expenditure profile for the Scheme. Most of the expenditure (around 92%) is incurred in the years 2018 to 2022. Expenditure in the period 2023 to 2026 reflects the period of aftercare.

Table 1: Scheme Budget (Q4 2015 prices)

Component	Estimate
Preliminaries including Traffic Management	£212
Roadworks	£268
Structures	£297
Landscaping and environmental works	£45
Works by other authorities	£38
Land and Compensation costs	£92
Risk and Optimism Bias	£141
Project Estimate excluding VAT and Inflation	£1,093
Key Stage 4 Costs	£22
Reclassification and reconfiguration of Caerleon Junction ¹⁶ (including Optimism Bias)	£16
Total Costs	£1,131

¹⁶ These costs are not being delivered as part of the contract to construct the proposed new motorway.

Maintenance Costs

4.63 In addition to the investment costs, it is necessary for the economic appraisal to take account of the cost of maintaining both the new section of motorway and the existing M4 during the 60-year appraisal period. The maintenance schedule used to estimate maintenance costs is equivalent to the maintenance schedule referenced elsewhere in my Proof of Evidence in respect of the calculation of user benefits during periods of maintenance.

4.64 The maintenance costs included in the economic appraisal, which have been estimated by the Welsh Government, are shown in Table 2. Maintenance costs for the existing M4 are slightly reduced under the Do Something scenario. This is due to the fact that the presence of the new motorway would offer the opportunity to undertake maintenance works in a different way. Specifically, with the Scheme in place, future refurbishment of the Brynglas Tunnels would likely be undertaken over a shorter time period involving daytime closure of the carriageway, rather than over an extended period of night time closures.

Table 2: Estimated 60-Year Maintenance Costs (2014 Prices)

	Maintenance Costs (£)		
	Existing M4	Proposed Scheme	Total
Do Minimum	310	NA	310
Do Something	280	250	530

Economic Appraisal Results: Core Scenario

4.65 The economic appraisal results for the Scheme are given in Tables 3 and 4 for the Core Scenario. The completed WebTAG appraisal tables are included as Appendix A to this Proof of Evidence. As noted, the Core Scenario is based on the central (or most likely) traffic growth scenario and assumes half toll levels on the Severn Crossings.

4.66 The results presented in Table 3 are based only on direct transport benefits and exclude Wider Impacts. As noted, the BCR calculated on this basis is referred to as the 'Initial BCR' for the Scheme.

4.67 The total discounted costs (PVC) of the Scheme is £0.95bn (2010 prices and values). The total discounted benefits (PVB) of the Scheme is £1.54bn (2010 prices and values). The difference between benefits and costs (the NPV for the Scheme) is £0.59bn resulting in an Initial BCR for the Scheme of 1.62. This indicates that, before wider economic benefits are considered, the Scheme represents value for money as the costs of investment will be more than offset by the improvements in transport economic efficiency, safety and carbon emissions.

Table 3: Summary of Economic Appraisal: Core Scenario (Excluding Wider Impacts)

		Results (£m) (2010 prices, discounted to 2010)
User Benefits	Consumers	851
	Business	697
Construction Phase Impacts	Consumers	-21
	Business	-14
Maintenance Impacts	Consumers	28
	Business	10
Accident Benefits		4 ¹⁷
Greenhouse Gas Benefits		6
Indirect Tax Revenues		-19
Initial Present Value of Benefits, PVB		1,541
Present Value of Costs, PVC		952
Initial Net Present Value, NPV		589
Initial Benefit-to-Cost Ratio, BCR		1.62

4.68 Table 4 sets out the results of the appraisal if Wider Impacts are included in the analysis to give an 'Adjusted BCR' for the Scheme. As noted above, the assessment of Wider Impacts is associated with a higher degree of uncertainty than the assessment of direct impacts on

¹⁷ As described in Section 4.43, accident impacts have been revised such that they are based on the most up to date version of COBA-LT. Accident impacts reported in the Revised Economic Appraisal Report were £4.2m (PV 2010). This has been revised to £3.7m (PV 2010).

users. However, by excluding Wider Impacts, the Initial BCR fails to capture a range of important economic benefits of the Scheme.

Therefore, the Adjusted BCR provides a better measure of the overall balance of costs and benefits and therefore the value for money of the Scheme.

When Wider Impacts are included, the NPV of the Scheme increases to £1.17bn (2010 prices and values) and the BCR increases to 2.22¹⁸. This result demonstrates that the benefits of the Scheme outweigh costs by a ratio in excess of two to one.

Table 4: Summary of Economic Appraisal: Core Scenario (Including Wider Impacts)

	Results (£m) (2010 prices, discounted to 2010)
Initial Present Value Benefits, PVB	1,541
Wider Impact 1: Agglomeration Impacts	504
Wider Impact 2: Increased Output in Imperfectly Competitive Markets	69
Wider Impact 3: Labour Market Impacts	5
Total Wider Impacts, PVB	577
Adjusted Present Value of Benefits, PVB	2,118
Present Value of Costs, PVC	952
Adjusted Net Present Value, NPV	1,166
Adjusted Benefit-to-Cost Ratio, BCR	2.22

Sensitivity Analysis – Low and High Growth

4.69 In addition to the central traffic growth forecasts, sensitivity tests were carried out for low and high growth scenarios. The derivation of these forecasts is detailed in the Revised Traffic Forecasting Report (Document 2.4.13). The results of the economic appraisal for these forecasts are summarised in Table 5.

4.70 Under a low traffic growth scenario, the benefits of the Scheme are reduced such that the initial BCR for the Scheme falls slightly below one

¹⁸ The Adjusted BCR set out in the Revised Economic Appraisal Report was 2.23. This change is accounted for by the adoption of the updated version of COBA-LT referenced above.

to 0.94. However, if Wider Impacts are included, the low growth BCR remains above one at 1.38. The high growth BCR is 2.81 if Wider Impacts are excluded, or 3.64 including Wider Impacts. As the Adjusted BCR provides the more realistic assessment of quantifiable costs and benefits it can be seen that the Scheme provides benefits in excess of costs even under the low growth traffic scenario.

Table 5: Economic Appraisal, Low and High Growth Forecasts

		Results (£m) 2010 Prices, Discounted to 2010	
		Low Growth	High Growth
Direct Transport Economic Benefits	Present Value of Benefits, PVB (£000)	897	2,671
	Present Value of Costs, PVC (£000)	951	952
	Net Present Value, NPV (£000)	-53	1,719
	Benefit-to-Cost Ratio, BCR	0.94	2.81
Direct and Wider Transport Economic Benefits	Present Value of Benefits, PVB (£000)	1,310	3,464
	Present Value of Costs, PVC (£000)	951	952
	Net Present Value, NPV (£000)	359	2,511
	Benefit-to-Cost Ratio, BCR	1.38	3.64

Sensitivity Analysis – Severn Crossing Tolls

4.71 The future of the Severn Crossing tolls is a factor which will influence future traffic flows on the M4 corridor around Newport. As noted, the Core Scenario for the M4CaN scheme is based on a half toll scenario in line with the UK Government's stated intention regarding the future of the toll following the end of the current concession arrangement.

4.72 However, in view of the uncertainty over the long term future of the Severn Crossing Tolls, a sensitivity test has been undertaken which assumes that the tolls are removed. If tolls are removed, the Initial BCR

for the Scheme increases to 1.83. If Wider Impacts are then included, the Adjusted BCR for the Scheme would be 2.46.

Table 6: Economic Appraisal, No Severn Crossing Tolls

		Results (£m) 2010 Prices, Discounted to 2010
		No Severn Crossing Tolls
Direct Transport Economic Benefits	Present Value of Benefits, PVB (£000)	1,778
	Present Value of Costs, PVC (£000)	971
	Net Present Value, NPV (£000)	807
	Benefit-to-Cost Ratio, BCR	1.83
Direct and Wider Transport Economic Benefits	Present Value of Benefits, PVB (£000)	2,393
	Present Value of Costs, PVC (£000)	971
	Net Present Value, NPV (£000)	1,422
	Benefit-to-Cost Ratio, BCR	2.46

5. Wider Economic Impact Assessment

Introduction

- 5.1 This Section considers the potential impact of the M4CaN proposals on the local and regional economy. Undertaking an assessment of economic impacts recognises the strategic importance of the M4 to the economy of South Wales as well as the Welsh Government's objectives for the Scheme.
- 5.2 The primary focus of the assessment is on the long term impact of M4CaN once the Scheme is in operation, although an assessment has been undertaken of the impacts of the Scheme on the economy during the construction phase.

Transport and the Economy

- 5.3 Transport plays a critical role in supporting the economy. Improvements in transport infrastructure can impact on economic performance in a number of ways. A recent review of the relationship between transport and economic performance commissioned by the Department for Transport ('Transport Investment and Economic Performance: Implications for Project Appraisal' [Document 6.1.23] referred to here as the TIEP report) grouped the impact of transport improvements into the following three categories:
- a) User benefits
 - b) Productivity effects
 - c) Investment and employment effects
- 5.4 User benefits include direct savings in terms of time and vehicle operating costs. These effects are captured in the economic appraisal although, as noted in the TIEP review, it is widely acknowledged that such benefits fail to capture the full impact of major projects.

- 5.5 Productivity effects refers to improvements in economic performance resulting from improved accessibility. Productivity effects arise primarily from increased economic density and scale that transport improvements afford. There are three main ways in which increased economic density and scale leads to higher productivity. Firstly, transport improves interaction and competition between firms, allowing firms to reach wider markets, enabling them to expand and gain economies of scale. Secondly, transport improvements can support the clustering of activity, enabling cities to specialise in particular industrial sectors. Thirdly, transport improves the functioning of the labour market. Improving accessibility has the effect of expanding labour market catchment areas. This improves people's access to employment opportunities. In doing so firms benefit from being able to choose from a wider pool of labour and therefore knowledge and skills. Productivity effects are partially captured in the economic appraisal through the inclusion of Wider Impacts, specifically through the assessment of agglomeration impacts.
- 5.6 The third category of impact covers impacts on employment and investment. This refers to the ways in which transport influences patterns of investment and economic activity, by increasing the attractiveness of particular areas and thereby shaping the location decisions of firms. Impacts on employment and investment can be highly significant for local and regional economies. However, increased investment in one part of the country may be accounted for by a reduction in activity elsewhere and therefore such impacts tend not be wholly additional at a national (UK) level. For this reason, such impacts are not captured in the economic appraisal but they are relevant to the economic impact assessment.

Economic Context

- 5.7 The impacts of transport improvements on economic performance are highly specific to the particular characteristics of both the Scheme and the economic context. The economy of South Wales is highly reliant on the M4 as the primary east-west road link. The M4 is the main route in

and out of the country for over 70% of the country's population and economy¹⁹.

- 5.8 The M4 in South Wales is the most heavily used road in Wales. It connects the major urban centres in South Wales. It plays a key strategic role in connecting South Wales with the rest of UK and Europe, providing links to Ireland via the ports of South West Wales as well as providing the gateway link between South Wales, England and mainland Europe.
- 5.9 The Scheme itself runs from the southern part of Monmouthshire, through Newport to the border of Newport and Cardiff. Two new junctions would be created on the new route: Docks Way Junction and Glan Llyn Junction.

Study Area

- 5.10 Given the strategic importance of the M4, the area of influence of the Scheme is considered to extend beyond the immediate surrounding area of Monmouthshire, Newport and Cardiff. For the purposes of the economic impact assessment, a study area has been defined which comprises 12 local authority areas in Wales, covering the urban conurbation of South Wales as far West as Swansea, and four counties and unitary authorities in the South West of England which covers the area often referred to as 'Greater Bristol'. This area is shown in Appendix B.
- 5.11 This area has been defined based on analysis of M4CaN traffic model outputs which confirms that the majority of the trips benefiting from the Scheme (and the majority of the monetised user benefits calculated for the purposes of the economic appraisal) have an origin or destination in this study area. There would be further economic benefits of the Scheme beyond this boundary. However, economic effects are expected to be most significant within the study area given its proximity to the Scheme.

¹⁹ Based on the population and economies (as measured by Gross Value Added) of Local Authorities in South West and South East Wales.

Population Growth

5.12 The study area as a whole has a population of approximately 2.9 million²⁰. The South Wales study area has a population of approximately 1.9 million, and accounts for over 60% of the total resident population of Wales. In overall terms, the population of this area has been growing. A comparison of the 2001 and 2011 census shows that population has grown faster in the major urban centres such as Cardiff and Newport than the outlying areas of the South Wales valleys. Newport's population has grown broadly in line with the study area average at 0.6% per annum. Population projections published by the Office of National Statistics and the Welsh Government suggests that the population of the study area will increase by 12.5% over the period 2014 to 2039²¹.

Employment and Commuting

5.13 There are approximately 1.3 million people employed in the study area²². In South Wales, there were approximately 750,000 employee jobs in 2014. Employment is more heavily concentrated in the urban areas located along the route of the M4. In this respect it is notable that the local authority areas of Newport, Cardiff, Bridgend and Swansea accounted for over half of all jobs in South Wales.

5.14 Patterns of commuting in the study area are complex. Based on 2011 Census data, 12,900 people commute from the Welsh study area to their place of work in the English study area and 5,500 commute to South Wales from the English study area. In South Wales, the predominant movements of commuters are into or between the largest urban centres of Cardiff, Newport and Swansea. Both north-south and east-west movements are strongly represented in commuting patterns. Newport itself draws more than 40% of its workforce from other local authorities

²⁰ 2011 Census

²¹ 2014-based Local Authority Population Projections for Wales and the 2014-based Subnational Population Projections for Local Authorities in England.

²² Business Register and Employment Survey (BRES)

with the largest inflows from Caerphilly, Cardiff, Torfaen and Monmouthshire.

- 5.15 Car travel is the dominant mode for commuting journeys in the study area. A comparison of mode shares drawn from the 1991 and 2011 Census suggests that, for South Wales, dependence on car use for commuting has increased. The average distance that people are willing to travel to work has also slightly increased in recent decades.

Overall Economic Performance and Productivity

- 5.16 The Gross Value Added (GVA) of an economy provides a useful measure of overall economic performance. It is a measure of the total value of goods and services produced by an economy. GVA is closely related to Gross Domestic Product (GDP) commonly used to measure economic performance at a national level. GVA per capita can be used to compare the economic performance of areas of different sizes, although it should be noted that, at a local level, GVA per capita will be influenced by factors such as the level of inward or outward commuting.
- 5.17 Levels of GVA per capita demonstrate that there are significant differences in economic performance across the study area. For the South Wales study area, GVA per capita in 2014 was 72% of the UK average²³. In comparison, GVA per capita for the portion of the study area located in the South West of England was above the UK average. Notably, levels of GVA per capita were higher in Greater Bristol than for any of the local authority areas in South Wales, including Cardiff and the Vale of Glamorgan. Differences in levels of GVA between the South West of England and South Wales are reflective of a more general trend of reducing GVA per capita as you move west along the M4 corridor from Central London.
- 5.18 Within South Wales, no parts of the study area have a GVA per capita equivalent to the UK average. The highest rates of GVA per capita are in

²³ ONS Regional Accounts

Newport and Monmouthshire (91% of the UK average) and Cardiff (92% of the UK average) although it should be noted that both Newport and Cardiff have a net inflow of commuters which contributes to higher GVA per capita.

5.19 Productivity (GVA per worker) is widely recognised as a key factor which explains lower levels of GDP per capita. GVA per worker measures the value of goods and services produced by each worker and provides a measure of labour productivity. Productivity levels in Wales (as measured by GVA per worker) are approximately 82% of productivity levels across the UK²⁴. GVA per worker in the South West lags the UK average by a smaller margin.

5.20 Levels of productivity in an economy are influenced by a wide range of factors such as the industrial composition of an economy and the skills of the workforce. A series of academic studies, commissioned by the Welsh Government, have sought to explain the longstanding gap in productivity between Wales and the UK average²⁵. These studies have used statistical data (for Wales and the UK as a whole) to examine the relationship between levels of productivity and a range of possible explanatory factors.

5.21 This research has consistently found that spatial factors or accessibility – as influenced by the quality of transport provision – are significant factors in determining economic performance in Wales, once other factors (such as industrial composition and skills levels) have been taken into account. These relationships are an example of the productivity impacts of transport improvements identified in the TIEP report (Document 6.1.23).

5.22 Crucially, the research carried out in Wales suggests that transport can play a role in narrowing the productivity gap between Wales and the UK in two respects: firstly by improving accessibility at a local and regional

²⁴ ONS Regional Accounts

²⁵ Four main studies have been published on the topic of productivity variations between Wales and the rest of the UK. The first of these - Understanding the productivity variations between Wales and the UK (2006). University of the West of England and the University of Bath – was published in 2006.

scale (and therefore stimulating agglomeration effects described in Section 4), and secondly, by improving connectivity between Wales and other regions of the UK, in particular London.

5.23 The most recently published study commissioned by the Welsh Government (Document 6.1.24) concludes that *‘inaccessibility clearly has major impacts on levels of productivity in Wales, including possible remoteness from major markets, specialist suppliers and services, larger pools of skilled labour or contact with other business and information sources’*.²⁶

5.24 This research builds on a similar study previously commissioned by Welsh Government which considered the influence of travel times to London specifically (Document 6.1.25)²⁷. At an industry level, travel time to London was a significant factor in explaining productivity differentials between firms across all sectors other than catering and transport. In overall terms, the research found that a 10% increase in travel time (by road) to London is associated with a 0.45% reduction in productivity. Put another way, reducing travel times to London by 10% would, all things being equal, result in an improvement in productivity of 0.45%.

Land Use and Planning Context

5.25 The quality of the transport network, and crucially, the perceived quality of the transport network is an important determinant of business investment decisions²⁸. Given that the M4CaN proposals will improve transport conditions and create two new motorway junctions, it is relevant to consider the land use and planning context, particularly in the south of Newport.

²⁶ D.J. Webber, A. Plumridge and M. Horswell (2016) “Understanding productivity variations between Wales and England”. Report to the Welsh Government. (WG 6.1.24)

²⁷ Extending the research on understanding the productivity variations between Wales and the UK (2009). Professor John Hudson, Department of Economics & International Development, University of Bath (WG 6.1.25)

²⁸ The 2015 CBI Infrastructure Survey found that 94% of businesses report that the quality of infrastructure as a decisive factor when planning future investment, whilst 89% of businesses see investment in the UK’s motorway network as crucial or beneficial for their operations.

5.26 Analysis of the Local Development Plans for Newport and Monmouthshire and Cardiff (Documents 5.3.1, 5.3.2 and 5.3.4 respectively) highlights that there are a range of existing and allocated employment sites in Newport, Monmouthshire and Cardiff that are in close proximity to the proposed new motorway. These sites are indicated on the map shown in Appendix C. Each of the LDPs recognises the importance of transport and access to the motorway network in attracting new investment and employment to these sites.

Impacts on Traffic and Transport Conditions

5.27 In economic terms, the M4 around Newport plays multiple roles. The M4 facilitates the movements of goods and people between Wales and the rest of the UK and Europe, enabling firms in South Wales to access domestic and international markets. The M4 is the most heavily used transport link between the main urban centres in the Severn Estuary of Swansea, Bridgend, Cardiff, Newport and Bristol. The M4 around Newport also plays a key role in facilitating the movement of commuters through South Wales. For many users, there is no feasible alternative to the M4.

5.28 The Traffic Proof of Evidence (WG 1.2.1) details the existing traffic conditions on the M4 around Newport. In summary, this highlights that this section of the M4 suffers issues of congestion, particularly during the peak periods. Congestion results in slow moving traffic on the M4 around Newport which in turn results in longer journey times for users. Levels of congestion also contribute to high levels of journey time variability and therefore poor journey time reliability. Delays on this part of the M4 and issues of poor journey time reliability are worsened by the frequency of traffic incidents on the motorway and the limitations of alternative routes during periods of perturbation.

5.29 The business community in Wales has expressed concern over traffic issues on the M4 and has highlighted the potential of such issues to negatively influence people's perceptions of Wales as a business

location. For example, an open letter from members of the business community in relation to the M4CaN proposals states: *‘The constant disruption and delay along the main motorway route across South and West Wales caused by the Brynglas tunnel bottleneck around Newport significantly damages the Welsh economy and negatively impacts upon Wales’ standing as a globally competitive business location.*²⁹

5.30 This echoes previous statements by the CBI in Wales who have described the M4 as ‘not fit for purpose’ and have suggested that a new motorway around Newport is the ‘number one priority for a large number of CBI members’³⁰.

5.31 Furthermore, as the primary route in and out of South and South West Wales, the current state of the M4 has negative impacts on the perceptions of Wales as a place visit and do business. The Brynglas Tunnels, for example, have been described by the former Prime Minister as a *‘foot on the windpipe of the Welsh economy’*³¹.

5.32 In the absence of intervention, growing traffic demand will increase the severity of traffic problems on the M4 around Newport leading to longer journey times and more frequent delays.

5.33 In summary, the M4CaN is expected to:

- a) Reduce journey times for east-west movements by alleviating congestion and providing a faster and more direct route through South Wales. In 2037, it is expected that average AM peak time journey times for travel between Junction 30 and the M4 toll plaza will be lower by around 8 minutes in the eastbound direction and by around 7 minutes in the westbound direction
- b) Improve conditions and reduce journey times for users of the existing route travelling to and from Newport and the southern part of Monmouthshire

²⁹ Open letter from CBI Wales and leading Welsh businesses to Welsh politicians: ‘Delivery of M4 Black Route is vital for the Welsh economy’ (February 2013)

³⁰ CBI Wales Chair (June 2014). Restated in: <http://www.walesonline.co.uk/business/business-news/m4-relief-road-around-newport-7227326>

³¹ Former Prime Minister David Cameron (The Senedd, 1st November 2013)

- c) Improve the reliability of journeys in South Wales by increasing capacity and reducing the day to day variability of journey times
- d) Increase the resilience of the trunk road network to traffic incidents by providing relief to the Junctions at Tredegar Park on the west side of Newport and the Coldra on the east side of the City, whilst also providing a sufficient strategic alternative route for east-west journeys through South Wales
- e) Improve perceptions of the speed and reliability of road travel in South Wales

Impacts During Construction

5.34 The construction of a scheme of the scale and nature of the M4CaN will have economic impacts in its own right. The construction of the Scheme would have direct impact on the economy through the employment of a construction workforce. There would be further, indirect, economic impacts associated with the purchasing of goods and services required to deliver the Scheme. When assessing the economic impact of the construction phase, consideration also needs to be made of the impact of any disruption to traffic during this period.

5.35 In respect of direct employment effects, based on current estimates over the course of the construction period, including designers and sub-contractors – a total of around 5,000 worker years would be required to deliver the project. This equates to an average of nearly 1,400 people employed directly on the Scheme (either by the contractor directly or through sub-contractors) every month over the duration of the construction period.

5.36 Highway construction requires a range of occupations and skillsets. This Scheme, by its nature, will demand resources in various specific disciplines (engineering and design, heavy civil works, specialist earthworks, piling, structural steel, cable stays and so on).

5.37 The extent to which these construction jobs could be filled by local workers depends on the availability of suitably skilled local people and

the contractor's approach to recruitment. This, in turn, is influenced by the contractual requirements placed upon the contractor in respect of recruitment and training policies.

- 5.38 Targeted Recruitment and Training (TR&T) requirements have been identified within the works information for the project team, set by the Welsh Government as the Client organisation. As a minimum, the contractor is required to ensure that 12% of the total labour costs relate to the employment of new entrant trainees who have an apprenticeship, trainee or employment contract with the contractor or a subcontractor, and are engaged in a training programme that is accepted by the Welsh Government as being appropriate. The Construction Joint Venture has committed to achieving 20% of labour costs from new entrant trainees which will serve to maximise the economic benefits of the construction period both in the short and long term.
- 5.39 In respect of the indirect impacts of the construction phase, the construction of the Scheme would further require the procurement of around £523m goods and services, of which around £356m would be materials and associated works, and around £167m would be equipment costs. This expenditure would lead to further downstream impacts on the economy.
- 5.40 The project team has expressed a commitment to local purchasing (procurement) policies when possible and appropriate. For example, for standard procurement, the contractor would favour local purchasing. The local definition depends on the type of purchase but for small and standard goods and services, local would likely correspond to the South Wales and Bristol markets, whereas for more specialised items the notion of local is likely to expand to the UK market. The opportunity to procure locally would be on a case by case basis, based on the availability of appropriate local suppliers.
- 5.41 It should be noted that limits to the capacity of the construction sector in the local area will also limit the potential impact of the Scheme on

construction sector output and employment locally. In response to an increase in demand for construction goods (resulting from the Scheme), there will be some scope for the construction sector to increase capacity by recruiting and training new workers (an effect reinforced by the proposed approach to delivery), by using capital stock (machinery and equipment) more intensively, or by investing in new capital stock.

5.42 Where capacity is limited, the construction of the Scheme may divert resources from other construction projects which may then need to be serviced by construction firms from outside the local area.

Notwithstanding this, the construction of the Scheme would have a substantial positive, albeit temporary, impact on the level of output and employment in the construction sector in the study area.

5.43 During the construction phase and as a result of physical works, there will be some disruption to the local transport network, which could have a slight and temporary negative impact on economic activity in some locations. However, given that the Scheme is largely an offline construction project (works to construct new infrastructure rather than works to modify existing infrastructure), disruption and potential associated negative impacts would be limited and largely restricted to the works connecting the proposed new section of motorway route into the existing transport network at its interchanges and intermediate junctions.

5.44 As set out in Section 4, negative impacts on business users during the construction phase are estimated to be £14m (2010 prices and values). Whilst the impact of the traffic management measures is negative, this needs to be viewed in the context of the benefits to business users of the Scheme itself during the operational phase which amount to £697m (2010 prices and values).

5.45 Another potential source of disruption during the construction phase would be through the use of the existing transport network by construction traffic. This would be partially mitigated through careful

planning of construction traffic routes and associated traffic management aimed at minimising the extent to which works and construction traffic may impede users on the network.

Impacts During Operation

Transmission Mechanisms

5.46 A range of 'transmission mechanisms' have been identified through which the Scheme will impact on the economy of the study area. The transmission mechanisms have been identified on the basis of the impact of the Scheme on transport conditions and the economic geography of the study area. The transmission mechanisms are as follows:

- a) Reducing transport costs for businesses in the study area by providing faster and more reliable transport for business travellers and for the movement of goods
- b) Improving the functioning of the labour market in South Wales by increasing access to employment opportunities for workers and improving access to a suitable workforce for firms
- c) Improving productivity by fostering agglomeration effects within South Wales and the South West of England and reducing travel times to London and other UK regions
- d) Stimulating land use change and new investment by improving access to key employment sites in the south of Newport
- e) Improving perceptions of South and South West Wales as a place to visit and do business

5.47 Each of the above transmission mechanisms is described in more detail in the following sections of my evidence and an assessment of the significance of each impact has been made.

Business Costs and Efficiency

5.48 Congestion and delays on the existing M4 around Newport imposes costs on businesses both as a result of longer journey times for business

travellers and for the movement of goods, but also because of the disruption caused by traffic incidents. As traffic levels increase, the costs imposed on businesses in the study area will increase.

5.49 The combined effect of reduced congestion, faster journey times and improved network resilience resulting from the M4CaN proposals will therefore result in lower transport costs for businesses in the study area.

5.50 The direct benefits of the Scheme for business users are calculated based on outputs from the traffic model. Cost savings for businesses comprise time and cost savings accruing to business travellers and heavy goods vehicles. Because the traffic model is based on average journey times, cost savings and efficiency benefits related to improved reliability and resilience are excluded.

5.51 Such cost savings are included in the economic appraisal of the Scheme as benefits accruing to businesses and they represent a positive impact on GDP. The purpose of this analysis is to consider the spatial distribution of such benefits and the effects on businesses in the study area.

5.52 In practice, it is difficult to precisely trace the spatial distribution of transport cost savings. When production costs are reduced, the ultimate beneficiary of the improvement may not necessarily be the original user (or in this case business). In practice, the benefits may ultimately be shared between a 'customer' and 'supplier'. Under competitive conditions, the initial beneficiary of lower transport costs may pass on the cost saving to other businesses or consumers in lower prices. In a similar way, a reduction in fuel prices paid by hauliers would be reflected to some degree in the haulage costs faced by manufacturers or retailers.

5.53 Furthermore, changes in transport costs and accessibility will also affect competition between firms which is not reflected in the analysis. The improvements brought about by the M4CaN will effectively reduce production costs, enabling firms in the study area to compete more

effectively in markets over a wider area. By extension, the M4CaN could also have the effect of reducing costs for firms outside the study area competing in local markets. The effect of changes in patterns of competition will differ across different sectors of the economy. Widening market access is also a key mechanism through which the expected productivity benefits of the Scheme will occur. This is discussed in more detail in elsewhere in my evidence.

5.54 I have estimated that the cost savings for businesses in the study area are estimated to be in the region of £30m per annum by 2037 (expressed in 2016 prices). Businesses in South Wales will be the main beneficiaries, receiving £24m per annum.

5.55 Over the 60 year appraisal period, the cumulative GVA impacts of the Scheme would be approximately £0.5bn (2010 prices and values), of which £0.4bn are estimated to accrue to the South Wales economy.

5.56 It should be noted that these are considered to be conservative estimates of the impact of the Scheme on business costs and efficiency. User benefits calculated in the traffic model are based on savings in average journey times (in addition to changes in vehicle operating costs). However, no quantification of the benefits to businesses of a more reliable and resilient transport network has been undertaken.

5.57 As an illustration of the scope and scale of these benefits, an exercise has been undertaken to simulate the effects on traffic flows of a period of closure. Specifically, the scenario considered was an eastbound closure of the M4 between Junctions 28 and 24 at present day (2014) traffic levels. This scenario and the impact on traffic flows is described in the evidence of Mr Bryan Whittaker (WG 1.2.1). The costs to the economy of the delays on the M4 and the wider network resulting from such an event have been estimated by applying the values of time referenced in Section 4³². This analysis suggests that the costs of closure is

³² Calculated based on the additional travel times incurred by goods vehicles and business travellers. Costs incurred by commuters are assumed to be equally shared between businesses and individuals. Excludes impacts on other journey purposes not related to work.

approximately £110,000 per hour during peak times, reducing to £15,000 for the interpeak period³³.

5.58 In my opinion, the above estimates are likely to understate the true economic costs of periods of disruption. This is because the values of time applied represent average values for predictable changes in journey time. In practice, unanticipated delays causes disruption to business processes which imposes further economic costs.

Labour Market Impacts

5.59 The M4 around plays an important role in facilitating commuting movements into Newport from the local authorities from the North and East (in particular Caerphilly, Torfaen and Monmouthshire). The M4 also facilitates east-west commuting flows, particularly between Cardiff and Newport, but also cross-border commuting flows between South Wales and the South West of England.

5.60 By 2022, data from the M4CaN Transport Model suggests that the existing section of the M4 around Newport (under the Do Minimum scenario) will cater for in the region of 28,000 commuters each weekday. To place this into context, approximately 22,000 people in South Wales travel to work by train³⁴.

5.61 Reducing journey times and improving journey time reliability has the effect of increasing the area over which people are able or willing to look for work. Effectively, this widens the effective area over which firms can recruit, making it easier for firms to fill vacant positions, or to find workers with the right skills for the job. Access to a skilled workforce is also an important determinant of firm location. Therefore, over time, changes in

³³ Whilst this assessment is based on a single modelled hour, the transport model will allow some journeys to be delayed by in excess of one hour.

³⁴ Based on the results of the 2011 Census for residents of South Wales. The number of commuter trips extracted from the M4CaN Transport Model are not directly comparable to the results of the Census. The M4CaN model estimates numbers of trips whilst the Census data relates to numbers of commuters. On any given day, not all of those who report that they travel by train will do so. Similarly, commuters who typically use other modes may, on occasion, use the rail network.

the labour market can influence business decisions about where to locate, as well as individuals' decisions about where to live.

5.62 Accessibility modelling has been employed to demonstrate the effect of the M4CaN on access to employment opportunities for residents of the study area, and access to the labour force for firms within the study area. The accessibility model is based on the AM peak period traffic model. The outputs of the accessibility model are presented in Appendix D.

5.63 This indicates that the effect of the Scheme is to improve access to employment for large parts of the study area. The most significant improvement in access to employment are likely to occur for residents of Cardiff, Newport and Monmouthshire. On average, it is estimated that residents of Newport would experience a 6% increase in the number of accessible job opportunities, whilst Cardiff and Monmouthshire residents would experience an increase of 8% and 14% respectively. It is also notable that the benefits of improved access to jobs extend westward beyond Cardiff, and eastward into the South West of England.

5.64 Similarly, employers would benefit from improved access to labour. As for access to employment, the accessibility modelling shows that firms in Cardiff, Newport and Monmouthshire experience the greatest increase in workforce access. On average firms located in Newport experience an increase in the size of the accessible workforce by road of 8%, firms in Cardiff would experience an increase of 9% and firms in Monmouthshire an increase of 10%. Improved access to labour is particularly significant for workplaces located in the southern part of Newport.

5.65 As for the assessment of business cost savings, the accessibility modelling is based on changes in average journey times. In practice, poor journey time reliability will act as a deterrent to commuters and therefore the impact of the Scheme on reliability and resilience is also relevant to the impact of the Scheme on labour markets.

Agglomeration Effects and Productivity

5.66 As noted, the productivity gap between South Wales and the rest of the UK is, in part, explained by spatial factors. By improving journey times and journey time reliability, the M4CaN will serve to reduce the productivity gap between South Wales and the rest of the UK.

5.67 In addition to the direct effects of reduced transport costs, the Scheme will increase productivity in two ways. Firstly, by improving accessibility within the study area, increasing the effective density of the economy and allowing firms to take advantage of agglomeration economies. Secondly, and in addition, the Scheme will help to reduce the relative peripherality of South Wales by reducing journey times between Wales and major urban centres in the UK, most notably London. The effect of this will be to widen firms' access to markets, enabling them to grow and take advantage of economies of scale, and allowing cities to specialise in sectors of activity for which they have a comparative advantage.

5.68 The former effect (agglomeration economies) can be quantified based on parameters provided by WebTAG which are in turn drawn from academic literature on the relationship between economic density and productivity. These benefits were described in Section 4 and are included in the Wider Impacts element of the economic appraisal.

5.69 Employing WebTAG parameters, the agglomeration effects of M4CaN are expected to result in an increase in the GVA of South Wales of approximately £17m per annum (2016 prices) in 2037 or £26m per annum for the study area as a whole. In present value terms over the whole appraisal period, the total impact would be £0.3bn (2010 prices and values) in South Wales and £0.5bn in the study area as a whole.

5.70 I consider these estimates to be conservative for two main reasons. Firstly, the calculation is based on average journey times and costs under no influence of periods of disruption and poor journey time reliability. Secondly, the calculation of agglomeration effects assumes

fixed land use. In practice, the Scheme will also stimulate changing land use patterns which is likely to act to further increase economic density.

5.71 The second productivity effect – reduced peripherality – is much more difficult to predict or measure with accuracy. A high level assessment based on an increase in productivity of 0.45% for every 10% increase in travel times to or from London (based on the research described above) would suggest a productivity benefit of the Scheme in the region of £25m per annum (2016 prices) or £0.6bn (2010 prices and values) of GVA over a 60 year appraisal period. These benefits do not form part of the economic appraisal set out in Section 4.

5.72 The combined impact of transport cost savings and other productivity benefits (linked to increased agglomeration and reduced peripherality) is expected to contribute in the region of £66m per annum (2016 prices) to the GVA of South Wales, each year, by the design year of 2037. Across the Study Area as a whole, the impact on GVA is estimated to be £81m per annum.

5.73 Over the 60 year appraisal period, the GVA impacts of the Scheme would total £1.3bn (2010 prices and values) in South Wales and £1.6bn for the study area as a whole. These impacts represent a permanent improvement in the underlying productivity of the economy.

Land Use and Investment

5.74 The M4CaN is expected to influence land use and investment in two interrelated ways. Firstly, the Scheme will improve access to current and potential employment sites adjacent to the proposed route of the new motorway. The improvement in accessibility afforded by the new route and the creation of two new motorway junctions to the south of Newport is expected to increase the attractiveness of these sites for investment. Secondly, the new motorway would be expected to improve perceptions of South Wales more generally as a business location, affecting land use patterns across a wider area.

- 5.75 Although such effects may be experienced over a wide area, it is reasonable to expect that the area immediately adjacent to the Scheme and the new motorway junctions would benefit most directly. There is a large amount of vacant allocated employment land to the South of Newport which would be more attractive to firms and investors if the Scheme is delivered.
- 5.76 There is approximately 181 hectares of allocated employment land within a 1km radius of the Scheme. This area is indicated by the dotted line in the Figure shown in Appendix C. Based on benchmarked plot ratios, should these sites be fully developed, they could cater for in the region of 15,000 jobs. This excludes Newport Docks which is also allocated for employment uses.
- 5.77 It should be noted that this represents the capacity of these sites. Whether this capacity is realised in practice will depend on whether there is sufficient demand for employment land.
- 5.78 The M4 will afford improved access to the sites. For example, the traffic model suggests that a journey from Glan Llyn (the former Llanwern Steelworks site) to Cardiff would be around 13 minutes quicker in 2037 as a result of the Scheme, whilst a journey from Glan Llyn to Bristol would be around 4 minutes quicker as a result of the Scheme. Combined with the effect of the Scheme on the resilience and reliability of the road network, such improvements would have a material impact on the attractiveness of these sites.
- 5.79 Transport and accessibility will be just one factor considered by potential investors alongside costs and land or rents, site area, development costs, access to markets and access to a suitably skilled workforce. However, in my opinion, the effect of the Scheme would be to increase demand for employment land in this area and accelerate the development of these sites. The Scheme will positively contribute to the rate and scale of employment creation at these sites.

5.80 It would also be expected that these sites will attract higher value activity (in respect to GVA per worker) than would otherwise be the case without the Scheme. Sites with good access to the motorway network are more likely to attract firms trading across the UK or internationally, rather than those simply serving local markets. Such firms will tend to be associated with higher value employment and therefore higher wages. In this respect it is instructive that recent research commissioned by the Welsh Government (described above in Section 5.23) has identified that firms with multiple plants tend to be more productive than smaller, single plant firms, whilst multi-national firms tend to be more productive than firms which trade only in the UK.

5.81 Some of the new investment attracted to south of Newport and Monmouthshire is likely to represent a relocation of activity from other parts of the study area, rather than wholly additional employment. However, given the strategic importance of the M4 corridor as the primary route in and out of South Wales, the Scheme will have a positive impact on perceptions of South Wales as a business location, making employment sites in South Wales relatively more attractive than other UK regions.

5.82 It is therefore reasonable to conclude that the Scheme will deliver a net overall increase in investment in the study area, rather than simply a redistribution of employment from one part of the study area to another. This would have a net positive impact on employment and GDP in South Wales.

Business and Visitor Perceptions

5.83 Current traffic conditions on the M4 around Newport have a negative impact on the both the actual and perceived quality of the transport network amongst the public and the business community.

5.84 Although perceptions are difficult to measure, economic impacts are ultimately the culmination of a vast array of decisions made by

individuals (consumers) and businesses about where to live, work and spend leisure time. In respect of transport, such decisions will be influenced by the way people perceive the ease of access, rather than necessarily a calculation of average journey times.

- 5.85 The fact that the M4 around Newport is perceived negatively by the business community and others is likely to be related both to day to day congestion and delay, but also because of the delays caused by traffic incidents which cause the greatest disruption. The improved resilience of the M4CaN proposals will therefore contribute to improving perceptions of the M4 and ease of access to South Wales more generally.
- 5.86 Whilst it is difficult to isolate precisely where and when the improvements would be pivotal to a decision to invest in South Wales or South West Wales, transport will be an important factor in determining location for a range of business sectors. Therefore it is reasonable to conclude that the Scheme will contribute to the overall quality of the business environment. Importantly, whilst the analysis provided in Sections 5.74 to 5.82 above focussed on a specific range of sites adjacent to the new route, in reality the quality of the M4 is likely to influence investment decisions over a much wider area of South Wales and South West Wales.
- 5.87 It is also important to consider how traffic issues on the M4 affect the decisions of individual consumers. In 2014, there were nearly 10 million domestic overnight visitors to Wales³⁵. These visits were associated with expenditure in the Welsh economy of £1.7bn. A proportion of these visits will be those visiting family and friends, or travelling on business. Such visitors may be relatively insensitive to traffic conditions. However, holiday tourism specifically accounted for 6.4 million overnight visits and £1.3bn of expenditure.
- 5.88 Because the M4 provides a point of access for visitors to the whole of South Wales, any implications of M4CaN on the visitor economy are

³⁵ The GB Tourist Statistics 2014 (TNS, Visit Wales, Visit England, Visit Scotland)

likely to be widespread. Given the role of the M4, it would be reasonable to estimate that the majority of tourists to South Wales and South West Wales experience conditions on the M4 around Newport during their visit.

- 5.89 Should visitors experience significant delays due to disruption on the M4, it would be logical to expect – particularly those on shorter overnight or weekend visits – that this will influence their overall experience of their visit to Wales and therefore their likelihood of making return visits.

Other Impacts – Impacts on Newport Docks

- 5.90 The proposals include a new bridge crossing of the River Usk, which has several commercially operated wharves. The bridge and approach viaducts also cross the Newport Docks, owned and operated by Associated British Ports (ABP), between North and South Dock. ABP is a Statutory Undertaker and has objected to the Scheme to the Secretary of State under section 16 of the Acquisition of Land Act 1981, alleging that the Scheme would have serious detriment to the carrying on of the undertaking.

- 5.91 Impacts on ABP Newport and other companies located at Newport Docks potentially impacted by the Scheme are considered in the evidence of Mr Andrew Meaney (WG 1.4.1). In overall terms, Mr Meaney concludes that the net effect of the Scheme on revenues at ABP is likely to amount to between £16.5m and £24.8m in present value terms, of which £8.5m relates to impacts on shipping revenues. The overall detriment to ABP (taking into account savings in costs) would amount to between £4.2m and £16.9m (present value). This translates to between 3.1% and 5.8% of Newport Dock's present value. The estimated impacts are calculated based on forecast cash flows over the period to 2018 to 2035 including the terminal value of cash flows (the value of future cash flows beyond the forecast period).

5.92 As identified by Mr Meaney, in respect of shipping impacts, it should be noted that the analysis takes no account of the potential for any shipping displaced from the North Dock to be accommodated within the South Dock, and therefore the analysis is likely to overestimate the true impacts on the volumes of shipping using Newport Docks and the impacts on ABP Newport's revenues.

5.93 Newport Docks plays both a direct and indirect role in the economy. In respect to impacts on the economy beyond the perimeter of the port, Mr Meaney notes that the scale of activities at ABP Newport does not in itself provide an indication of its overall implications for the economy as it does not take into account the additionality of these activities. In this respect there is an important distinction between impacts on ABP Newport and its tenants and the productivity benefits of the Scheme described elsewhere in this Proof of Evidence which are wholly additional.

5.94 When considering the implications on the economy more broadly, it is important to recognise that shipping displaced from Newport Docks may be accommodated at other ports, including those in South Wales. Similarly, firms who previously received goods unloaded at Newport Docks are likely to adjust to the new situation by sourcing inputs from other ports or suppliers.

5.95 Based on the analysis provided by Mr Meaney, I conclude that the long term implications for the economy of impacts on Newport Docks of relatively minor significance when placed in the context of the positive economic impact of the Scheme more broadly.

6. Responses to general objections to the draft statutory Orders

- 6.1 Individuals and organisations have submitted objections to the draft Orders in accordance with the statutory process.
- 6.2 Whilst the Welsh Government and its project team has considered and taken into account all of the responses, I address the general objections that are relevant to economic issues and the value for money of the Scheme.

General objections

- 6.3 General objections relate to concerns about the cost, value for money and/or alleged economic benefits of the Scheme³⁶. Each of these matters have been dealt with in my evidence. I cross reference specific matters raised evidence below.

Objections based on concerns about the treatment of costs in the economic appraisal

- 6.4 Friends of the Earth Cymru has objected to the economic appraisal of the Scheme on the basis of the treatment of costs in the economic appraisal³⁷. Specifically, the objection relates to the treatment of inflation, the exclusion of VAT from the Scheme cost estimate, and the treatment of maintenance costs.

Treatment of Inflation

- 6.5 The cost of a project can only be understood in the context of the prices of goods and services in the economy more generally. Because of inflation, the price of the project will increase over time. However, if the

³⁶ OBJ0017, OBJ0045, OBJ0092, OBJ0135, OBJ0162, OBJ0163, OBJ0164, OBJ0168, OBJ0181, OBJ0188, OBJ0192, OBJ0203, OBJ0206, OBJ0243, OBJ0258, OBJ0259, OBJ0262, OBJ0314, OBJ0335, OBJ0092, OBJ0265, OBJ0292, OBJ0018, OBJ0024, OBJ0125, OBJ0154, OBJ0307, OBJ0310, OBJ0314, OBJ0338, OBJ0026, OBJ0139, OBJ0150, OBJ0167, OBJ0177, OBJ0185, OBJ0247, OBJ0108, OBJ0283, OBJ0263, OBJ0264, OBJ0285, OBJ0286, OBJ0300, OBJ0081, OBJ0149, OBJ0251, OBJ0290, OBJ0031

³⁷ OBJ0125

general level of prices in the economy increase at the same rate, in 'real terms', the cost of the project will be unchanged.

- 6.6 Government budgets will also increase with inflation. For this reason it is normal practice for the public sector to express the cost of a project in a particular price base and this convention is followed by the Welsh Government on all of its highway schemes.
- 6.7 As described in Section 3 of my evidence, the economic appraisal is conducted in a consistent price base such that they can be directly compared. Failing to adjust for the effect of inflation would mean that the cost benefit assessment would place too much weight on costs and benefits which occur in the future where values would be higher simply because of inflation.
- 6.8 It would only be necessary to adjust a scheme budget inflation where there is an expectation that the cost of a scheme will increase in real terms (i.e. at a faster rate than general inflation). In the short run, fluctuations in the costs of labour or materials can result in construction inflation being higher or lower than general inflation. However, in the long run, construction prices (and infrastructure construction costs specifically) have risen at a similar rate to prices in the economy more generally.
- 6.9 In my opinion, there is no clear evidence to suggest that construction inflation will increase at a faster rate than general inflation and therefore I consider the treatment of costs in the economic appraisal to be appropriate.

Treatment of VAT

- 6.10 The cost estimate for the Scheme excludes VAT. However, VAT represents an internal Government transfer. Any expenditure subject to VAT will result in an increase in overall Government tax receipts. Therefore, any expenditure relating to VAT does not represent an

economic cost and there is no loss of welfare associated with it. It is therefore appropriate to exclude VAT from the economic appraisal.

Scheme Maintenance Costs

6.11 The approach to the estimation of maintenance costs is set out in Section 4 of my evidence. This approach is similar to that used for the purposes of the economic appraisal of the Scheme undertaken during Key Stage 2 as set out in the July 2014 Economic Assessment Report. Over the 60 year appraisal period, the costs of maintaining the new section of motorway are estimated to be £250m (2014 prices). This is similar to the cost estimate applied in the Key Stage 2 of £261m (2013 prices).

Objections based on concerns about the calculation of scheme benefits

6.12 Friends of the Earth Cymru has questioned the approach to annualising the outputs of the traffic model for the purposes of the economic appraisal³⁸. Specifically, Friends of the Earth Cymru has questioned why the annualisation factors applied are less than the total number of hours in the year.

6.13 The approach to annualising traffic model outputs is set out in Section 4 of this Proof of Evidence. Annualisation factors are derived from traffic count data and are based on the ratio of traffic flows in the modelled periods, to the traffic flows experienced over the period being assessed. For example, the annualisation factor used to convert the outputs of the AM peak hour model to the full AM peak period (07.00 to 10.00) is based on the ratio of traffic flows experienced between 08.00 and 09.00 and traffic flows experienced between 07.00 and 10.00. Because traffic flows vary for different times of the day and between weekdays and weekends, the annualisation factors are not equal to the total number of hours in a year.

³⁸ OBJ0125

Objections relating to Newport Docks

6.14 Impacts on ABP Newport and other companies located at Newport Docks potentially impacted by the Scheme are considered in Section 5 of my evidence and assessed in detail in the evidence of Mr Andrew Meaney (WG 1.4.1).

Objections relating to Magor Service Station

6.15 Roadchef Limited “Roadchef” is the leasehold owner and operator of the Motorway Service Area (MSA) at Junction 23a of the M4 at Magor. Roadchef are objecting to the Scheme on the grounds that the proposed access arrangements would discourage drivers from stopping at the service area.

6.16 Roadchef contend that the reduction in users taking a break would adversely affect the financial viability of the service area leading, ultimately, to closure and thus undermining the job security of 190 employees. They contend that this would then have a knock-on effect for the local economy, particularly for those local firms and people whose businesses/employment are indirectly linked to the MSA.

6.17 Rontec is the freehold owner of Magor MSA and owns and operates the petrol filling station. Rontec has similarly objected to the Scheme on the basis that, in their view, the proposed access arrangements are fundamentally flawed and will adversely affect the long term future of the services.

6.18 In assessing these objections, I consider three issues in turn:

- a) The impact of the Scheme on customer volumes and revenues.
- b) The financial viability of a rest area at Magor.
- c) Impacts on the local and regional economy.

Impacts on Service Station Revenues

- 6.19 The proposed access arrangements for the MSA at Magor are set out in evidence of Mr Ben Sibert (WG 1.5.1). As described by My Sibert, traffic travelling eastbound on the proposed new motorway would experience a more indirect arrival to the rest area than present. Traffic travelling westbound on the proposed motorway would experience a more indirect exit from the rest area than at present. All other access routes (arrivals and departures) to the rest area would be similar to existing conditions.
- 6.20 Future users of the reclassified M4 and the M48 will be unaffected by the Scheme. Similarly, those accessing the services via the B4245/A4810 from the South would also have similar access arrangements to today. I recognise, however, that users of these routes are likely to account for a minority of MSA customers.
- 6.21 For strategic journeys on the M4 (those travelling between Junction 30 and Junction 23), access to the service area will be less direct than at present due to the Scheme.
- 6.22 The implications of the proposed access arrangements for the journey times of potential MSA customers is described in the evidence of Mr Bryan Whittaker (WG 1.2.1). Mr Whittaker identifies the additional travel time added to a journey as a result of a decision to stop at the services both with and without the Scheme. In my opinion, this approach to measuring access/egress travel times most closely aligns with the way travel times will be perceived by potential customers.
- 6.23 As set out in the evidence of Mr Whittaker, in the Do Minimum scenario (in 2037), not including the time spent at the services themselves, the additional travel time incurred to visit the service area is between 0.5 and 0.8 minutes in an eastbound direction and 1.2 to 1.4 minutes in a westbound direction.
- 6.24 In the Do Something scenario, travel times will depend on whether a driver chooses to access or egress the service area via the reclassified

M4, via the proposed new motorway using Glan Llyn Junction, or via the proposed new motorway using Junction 23.

- 6.25 In summary, depending on the route taken and the time of day, the additional travel time incurred by users of the proposed M4 choosing to stop at the service area would increase by between 3 and 6 minutes in an eastbound direction and between 3 and 5 minutes in a westbound direction.
- 6.26 The changes in access arrangements will have a detrimental impact on the service area as it will impose an additional time penalty on those wishing to stop at the services. This may deter a proportion of travellers who would have otherwise chosen to stop at the services resulting in some loss of trade.
- 6.27 In practice, there may also be a psychological effect of the changes in access arrangements that would need to be considered alongside the analysis of journey times. The requirement for users to travel through additional junctions or to travel for a short distance in the opposite direction to their intended direction (for example, due to the requirement for eastbound users to perform a u-turn at Junction 23 in order to access the services) may act to reinforce the impact of longer journey times.
- 6.28 A further psychological effect relates to the relative importance of access and egress arrangements in influencing traveller behaviour. It is likely that customers will place more weight on access rather than egress travel time as this may be more foremost in the mind of potential customers when considering whether to visit the services or not. As a result, the changes in access arrangements are likely to have a more negative impact on eastbound rather than westbound travellers.
- 6.29 Whilst the change in access arrangements is expected to result in some loss of trade, this needs to be qualified in a number of respects.
- a) Firstly, competing service stations at Junction 30 (Cardiff Gate) to the west and Junction 17 (Leigh Delamere) to the east are relatively

poor substitutes for Magor MSA because of the distances and travel times between the service stations. An eastbound traveller considering whether to stop at Magor would need to delay their stop by 52.9km or approximately 36 minutes if they were to choose to stop at Leigh Delamere instead. A westbound traveller would need to delay their stop by 25.7km or approximately 22 minutes.

Alternatively, travellers would have the option to use the Severn View service area located on the M48 at Aust. However, the majority of strategic traffic passing Junction 23 will use the M4 Second Severn Crossing. For these travellers, the requirement to divert from the M4 Second Severn Crossing to the M4 Severn Bridge is such that Severn View services is unlikely to be a good substitute for Magor MSA. Such travel times and distances will deter some travellers from choosing an alternative service station.

- b) The changed access arrangements will affect different types of customer in different ways. In general, it would be reasonable to expect that MSA customers who plan to spend a longer amount of time at the services will be less sensitive to an increase in access/egress travel times. For example, the hotel business at Magor MSA is unlikely to be significantly affected by the change in access arrangements. In relation to this issue, it should be noted that visits to the services of a longer duration are likely to be of higher financial value to Roadchef than shorter visits.
- c) Whilst the effect of the Scheme will be to increase travel times for potential customers, when considering both the reclassified M4 and the proposed M4 motorway in combination, it will also result in a higher overall volume of traffic passing Magor MSA. In the opening year of 2022, the total volume of traffic using either the new or reclassified M4 at Magor is forecast to increase by 5% as a result of the Scheme. In the design year of 2037, the total volume of traffic using the new or reclassified M4 at Magor is forecast to increase by 12% as a result of the Scheme. This will have the effect of increasing the size of the market for the service area by a similar proportion.

6.30 In overview, whilst the changes in access arrangements are likely to result in some loss of customers and trade at the MSA, the predicted increase in traffic flows will offset, at least in part, the detrimental impacts of the Scheme.

6.31 As noted, the Welsh Government is considering the addition of an eastbound off-slip which would, if progressed, significantly mitigate the detrimental impacts of the Scheme on the MSA.

The Financial Viability of a Service Area at Magor

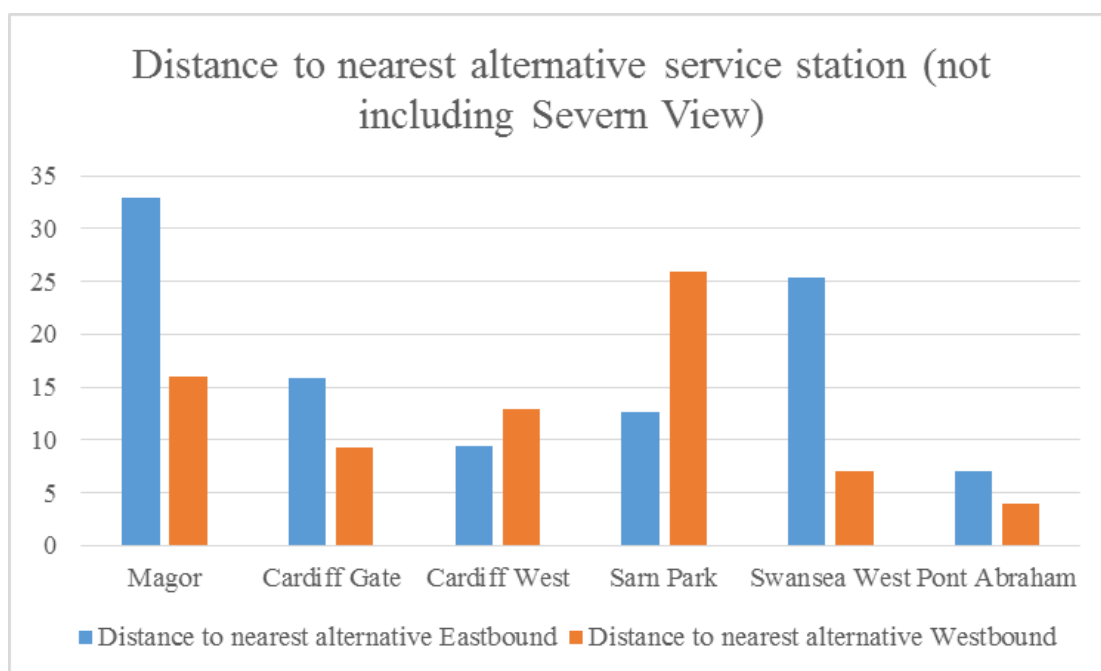
6.32 Notwithstanding that there may be an overall negative impact on the volume of customers using the service area at Magor, from an economic perspective a key question is whether the service area is likely to remain financially viable with the Scheme in place. The Welsh Government has requested financial information in relation to the services in order to better inform an assessment as to the viability of the MSA. Roadchef has declined to provide that information. Access to financial information would assist in assessing the impact of the Scheme on the viability of the services. Notwithstanding the lack of relevant financial information there are three main factors which lead me to conclude that a service area at this location would continue to be viable. These are as follows:

- a) Firstly, as stated by Roadchef in correspondence, Magor MSA is the busiest service station in Wales. The service area benefits from a relatively high volume of traffic passing the services. Of the six service stations located on the M4 corridor in South Wales, only Cardiff West services (Junction 33) benefits from higher passing traffic volumes. Although outside Wales, Severn View service area at Aust continues to operate despite traffic flows on this section of the M48 being around a quarter of that passing Magor MSA. The fact that Roadchef currently has high visitor volumes suggests that there is significant scope for the services to remain profitable even if the Scheme has a negative impact on trade.
- b) Relative to other services on the M4 in South Wales, Magor MSA faces a lesser degree of competition. Figure 2 shows the distance, in miles between each of the service stations on the M4 in South Wales and the nearest competing service station in either direction. The combined distance between Magor MSA and its nearest eastbound and westbound competitors is higher than for any other service station on the M4 in Wales.
- c) Irrespective of the impact of the Scheme, traffic volumes passing Magor services are forecast to increase (both as a result of

background growth in traffic and the planned changes to the Severn Crossing Tolls. Based on the M4 CaN traffic model, Average Annual Daily Traffic (AADT) travelling past Junction 23a was 70,600 in 2014. By 2022, with the Scheme in place, AADT is expected to increase by 31% to 92,200. By 2037, traffic volumes are forecast to be 66% higher than in 2014. Rising traffic levels should serve to strengthen the financial viability of the service area.

- d) Detrimental impacts on revenues at Magor MSA could be mitigated by a reduction in operating costs or an appropriate re-configuration of the customer offer at the service area.

Figure 2: Service Areas on the M4 in South Wales



Impacts on the Local and Regional Economy

6.33 As set out above, whilst the Scheme could have an overall negative impact on the services, it is unlikely that this will result in the services ceasing to operate. Nonetheless, a reduction in customer volumes will result in lower turnover which in turn would lead to lower employment at the MSA.

6.34 However, any reduction in expenditure at Magor MSA is likely to be accounted for by an increase in expenditure elsewhere, either at another service area or in the economy more generally. Logically, it would be

expected that Cardiff Gate services would be the primary beneficiary and therefore a proportion of the reduction in expenditure would be retained in the Welsh economy. Therefore, the total loss of income to the Welsh economy would be substantially less than the loss of revenue to Magor MSA.

6.35 Notwithstanding these offsetting effects, a reduction in trade volumes at Magor MSA would have a localised negative impacts on the economy. However, in my opinion, any impacts would be short term in nature. Over time, the economy would adjust to the new situation and the level of employment would recover. In the event that redundancies were required, whilst this may have a dislocating impact on individuals concerned, it would be reasonable to expect that, over time, those affected would find alternative employment elsewhere.

6.36 Furthermore, whilst any reduction in revenue may have a consequential impact on other local businesses indirectly linked to the MSA, there is no evidence to suggest that local supply chain linkages in relation to the services are particularly strong or that the local economy of Magor has a high degree of dependence on the services.

6.37 In my opinion, whilst the Scheme may have an overall detrimental impact on Magor MSA, the economic impacts of the changes in access arrangements will limited in scale and scope when viewed in the context of the overall economic benefits of the Scheme.

Objections relating to impact of the Scheme on the operations of individual businesses

6.38 A number of objections have been raised by individual businesses who have identified that the Scheme and the associated land requirement would have a temporary or permanent impact on their operations.

6.39 The evidence of Mr Ben Sibert (WG 1.5.1) address matters of land required for the Scheme in relation to objections received from private

individuals or businesses with interests in the land, such as Freehold, Leasehold or tenants in the draft CPO.

6.40 As stated in the evidence of Mr Matthew Jones (WG 1.1.1), in respect of the CPO, the Welsh Government has engaged with businesses with a view to understanding and, where necessary and appropriate, mitigating potential impacts of the Scheme on their operation, including through the relocation of businesses to alternative premises.

6.41 Where impacts on businesses cannot be fully mitigated, either through scheme design or relocation, this would, at least in the short term, have a negative consequence for the local economy. Such impacts would need to be considered in the context of the substantially positive economic impacts expected to result from the Scheme more generally.

7. Conclusion

Economic Appraisal

- 7.1 The economic appraisal compares the costs of constructing and maintaining the Scheme with the benefits of the proposed Scheme in relation to user benefits (travel time savings, vehicle operating costs and user charges), indirect taxation, accident benefits, greenhouse gas emissions and wider economic benefits (termed Wider Impacts).
- 7.2 The economic appraisal considers only those costs and benefits that can be quantified and monetised. In this respect, the analysis is focussed on, but not limited to, impacts on the economic efficiency of the transport sectors. There may be other costs and benefits that cannot be quantified in monetary terms. Therefore, the economic appraisal is only one aspect of the overall case for investment and needs to be balanced against other environmental and social costs and benefits. Equally, it should be recognised that the economic appraisal excludes a range of transport related benefits related to improved network resilience and reliability.
- 7.3 The results of the economic appraisal are summarised in the benefit-cost ratio (BCR) for the Scheme. A BCR (benefits divided by costs) in excess of 1 indicates that the benefits of the Scheme outweigh the costs. The higher the BCR, the more efficient the transport investment and the greater the value for money.
- 7.4 The BCR for the Scheme is presented both including and excluding Wider Impacts. Where Wider Impacts are excluded from the analysis, the BCR for the Scheme is referred to as the 'Initial BCR'. Where Wider Impacts are included in the analysis, the BCR is referred to as the 'Adjusted BCR'.
- 7.5 The core scenario for the Scheme is based on the central (or most likely) traffic growth forecasts and assumes that the tolls on the Severn Crossings are half their current level. Under this scenario, the Scheme has an initial benefit to cost ratio (Initial BCR) of 1.62. When Wider

Impacts are included in the assessment, the Adjusted BCR for the Scheme is 2.22. In other words, the benefits of the Scheme outweigh its costs by a ratio of over 2 to 1.

- 7.6 The quantification of Wider Impacts is subject to a greater degree of uncertainty than the assessment of direct economic benefits relating to travel time savings and vehicle operating costs. However, by excluding Wider Impacts, the Initial BCR fails to capture a range of important economic benefits of the Scheme. Therefore, the Adjusted BCR provides the more realistic measure of overall value for money.
- 7.7 Sensitivity tests have also been undertaken which consider the effect on the economic appraisal of lower or higher than anticipated traffic growth. Between the low and high traffic growth forecasts, the Adjusted BCR for the Scheme (including Wider Impacts) ranges from 1.38 to 3.64.
- 7.8 In my opinion, the economic appraisal demonstrates that the benefits of the Scheme will substantially outweigh its costs and therefore confirms that the Scheme represents value for money.

Wider Economic Impact Assessment

- 7.9 The M4 is the main route in and out of the country for over 70% of Wales' population and economy. The M4 facilitates the movements of goods and people between Wales and the rest of the UK, enabling firms in South Wales to access domestic and international markets. The M4 is the most heavily used transport link between the main urban centres in the Severn Estuary of Swansea, Bridgend, Cardiff, Newport and Bristol. The M4 Corridor around Newport also plays a key role in facilitating the movement of commuters through South Wales. For many users, there is no feasible alternative to the M4.
- 7.10 Traffic congestion on the M4 Corridor around Newport results in longer journey times for users. Traffic incidents can exacerbate delays and cause disruption to businesses and other users, resulting in poor journey time reliability. Given the reliance on the M4, any disruption to the

smooth operation of the motorway in South Wales imposes costs on individuals and businesses and has a negative impact on the economy. Furthermore, as the primary route in and out of South and South West Wales, the current state of the M4 has negative impacts on the perceptions of Wales as a place to visit and do business.

- 7.11 The M4CaN proposals will improve the functioning of the road network by providing a faster and more reliable route for strategic journeys, whilst also strengthening the resilience of the road network in South Wales.
- 7.12 In my opinion, the Scheme will deliver a substantial positive economic impact both during the construction phase and the operational phase.
- 7.13 During the construction phase, the Scheme is expected to employ an average of 1,400 people per month over the 42 month construction period and will require the procurement of approximately £523m value of goods and services. The approach to construction is geared towards the delivery of local economic benefits through employment and training.
- 7.14 Once operational, the Scheme will have a strongly positive economic impact in the following ways:
- a) Reducing transport costs for businesses in the study area by providing faster and more reliable transport for business travellers and for the movement of goods
 - b) Improving the functioning of the labour market in South Wales by increasing access to employment opportunities for workers and improving access to a suitable workforce for firms
 - c) Improving productivity by fostering agglomeration effects within South Wales and the South West of England and reducing travel times to London and other UK regions
 - d) Stimulating land use change and new investment by improving access to key employment sites in the south of Newport
 - e) Improving perceptions of South and South West Wales as a place to visit and do business

- 7.15 Only some of these economic impacts can be measured through quantitative analysis. Based on outputs from the traffic model, it is estimated that the Scheme would have a positive impact on the GVA of South Wales in the region of £66m (2016 prices) per annum by the design year of 2037. Over the 60 year appraisal period, the GVA impacts of the Scheme would total £1.3bn (PV 2010) in South Wales.
- 7.16 In my opinion there is a range of further economic benefits linked to the perception of South Wales as a place to visit and invest that are less easily quantified but nonetheless significant.

1. Appendices

Appendix A: Appraisal Tables

Appendix B: Economic Impact Assessment Study Area

Appendix C: M4 Corridor Existing and Allocated Employment Sites

Appendix D: Labour Market Accessibility Modelling

APPENDIX A – APPRAISAL TABLES (CORE SCENARIO)

Figure 3 - Transport Economic Efficiency Table

Non-business: Commuting		ALL MODES	ROAD	BUS and COACH		RAIL	OTHER
<u>User benefits</u>	TOTAL		Private Cars and LGVs	Passengers	Passengers		
Travel time	249,955		249,955				
Vehicle operating costs	-5,376		-5,376				
User charges	-261		-261				
During Construction & Maintenance	5,210		5,210				
NET NON-BUSINESS BENEFITS: COMMUTING	249,528	(1a)	249,528				

Non-business: Other		ALL MODES	ROAD	BUS and COACH	RAIL	OTHER
<u>User benefits</u>	TOTAL		Private Cars and LGVs	Passengers	Passengers	
Travel time	604,967		604,967			
Vehicle operating costs	3,060		3,060			
User charges	-1,672		-1,672			
During Construction & Maintenance	1,543		1,543			
NET NON-BUSINESS BENEFITS: OTHER	607,898	(1b)	607,898			

Business			Goods Vehicles	Business Cars & LGVs	Passengers	Freight	Passengers
<u>User benefits</u>							
Travel time	572,731		88,652	484,079			
Vehicle operating costs	127,047		98,468	28,579			
User charges	-3,077		-2,144	-933			
During Construction & Maintenance	-4,295		-1,029	-3,266			
Subtotal	692,406	(2)	183,947	508,459			
Private sector provider impacts					Freight	Passengers	
Revenue	0						
Operating costs	0						
Investment costs	0						
Grant/subsidy	0						
Subtotal	0	(3)					
Other business impacts							
Developer contributions	0	(4)					
NET BUSINESS IMPACT	692,406	(5) = (2) + (3) + (4)					

TOTAL		
Present Value of Transport Economic Efficiency Benefits (TEE)	1,549,832	(6) = (1a) + (1b) + (5)

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

Figure 4 – Public Accounts Table

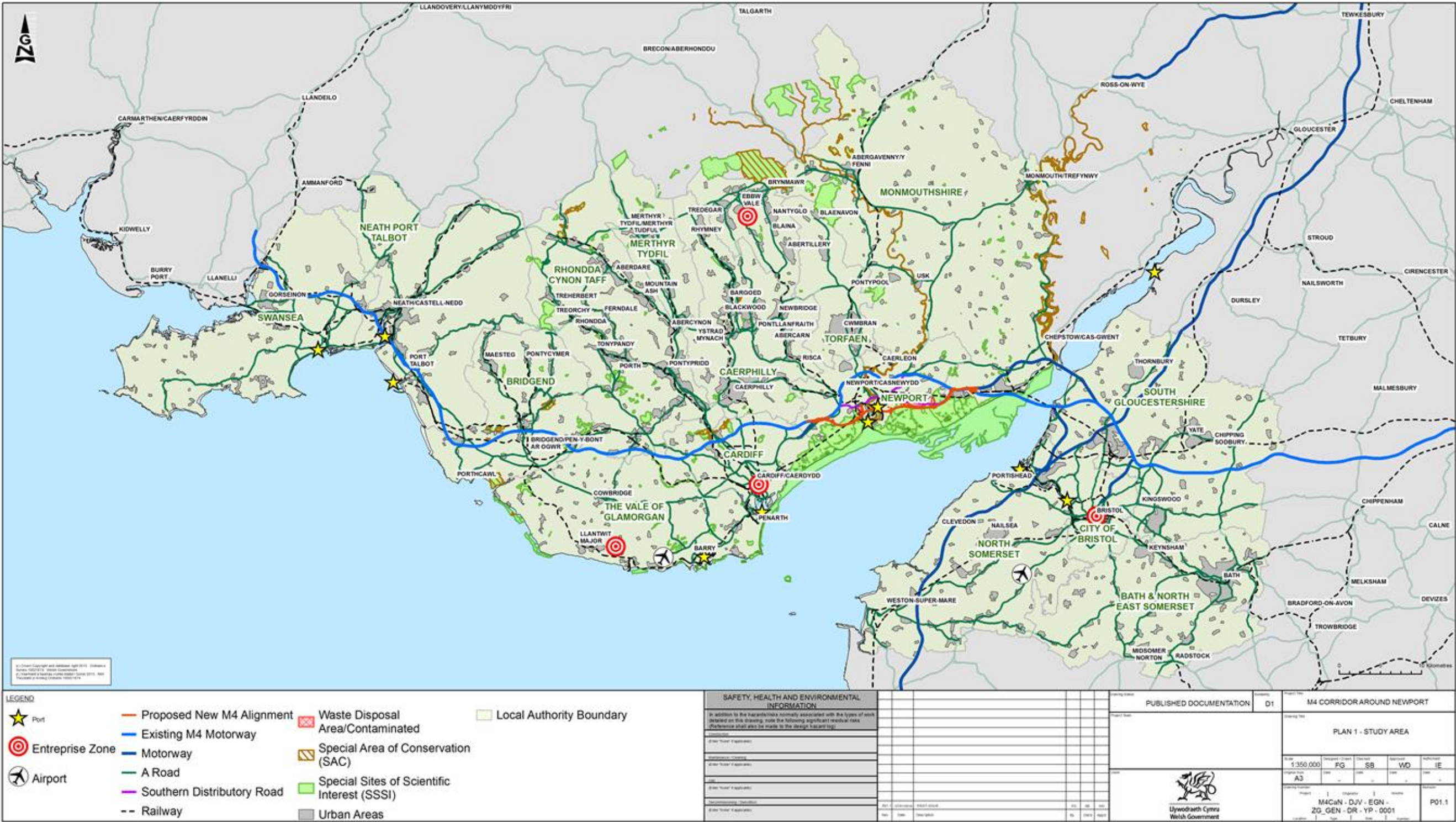
	ALL MODES	ROAD	BUS and COACH	RAIL	OTHER
<u>Local Government Funding</u>	TOTAL	INFRASTRUCTURE			
Revenue	0	0			
Operating Costs	0	0			
Investment Costs	0	0			
Developer and Other Contributions	0	0			
Grant/Subsidy Payments	0	0			
NET IMPACT	0 (7)	0			
<u>Central Government Funding: Transport</u>					
Revenue	-19,248	-19,248			
Operating costs	66,363	66,363			
Investment Costs	904,920	904,920			
Developer and Other Contributions	0	0			
Grant/Subsidy Payments	0	0			
NET IMPACT	952,035 (8)	952,035			
<u>Central Government Funding: Non-Transport</u>					
Indirect Tax Revenues	18,667 (9)	18,667			
TOTALS					
Broad Transport Budget	952,035 (10) = (7) + (8)				
Wider Public Finances	18,667 (11) = (9)				
<p>Notes: Costs appear as positive numbers, while revenues and 'Developer and Other Contributions' appear as negative numbers.</p> <p>All entries are discounted present values in 2010 prices and values.</p>					

Figure 5 - Analysis of Monetary Costs and Benefits**Analysis of Monetised Costs and Benefits: M4 CaN Core Scenario**

Noise	0	(12)
Local Air Quality	0	(13)
Greenhouse Gases	5,716	(14)
Journey Quality	0	(15)
Physical Activity	0	(16)
Accidents	3,778	(17)
Economic Efficiency: Consumer Users (Commuting)	249,528	(1a)
Economic Efficiency: Consumer Users (Other)	607,898	(1b)
Economic Efficiency: Business Users and Providers	692,406	(5)
Wider Public Finances (Indirect Taxation Revenues)	-18,667	(11) - sign changed from PA table, as PA table represents costs, not benefits
Present Value of Benefits (see notes) (PVB)	1,540,660	(PVB) = (12) + (13) + (14) + (15) + (16) + (17) + (1a) + (1b) + (5) - (11)
Broad Transport Budget	952,035	(10)
Present Value of Costs (see notes) (PVC)	952,035	(PVC) = (10)
OVERALL IMPACTS		
Net Present Value (NPV)	588,625	NPV=PVB-PVC
Benefit to Cost Ratio (BCR)	1.62	BCR=PVB/PVC

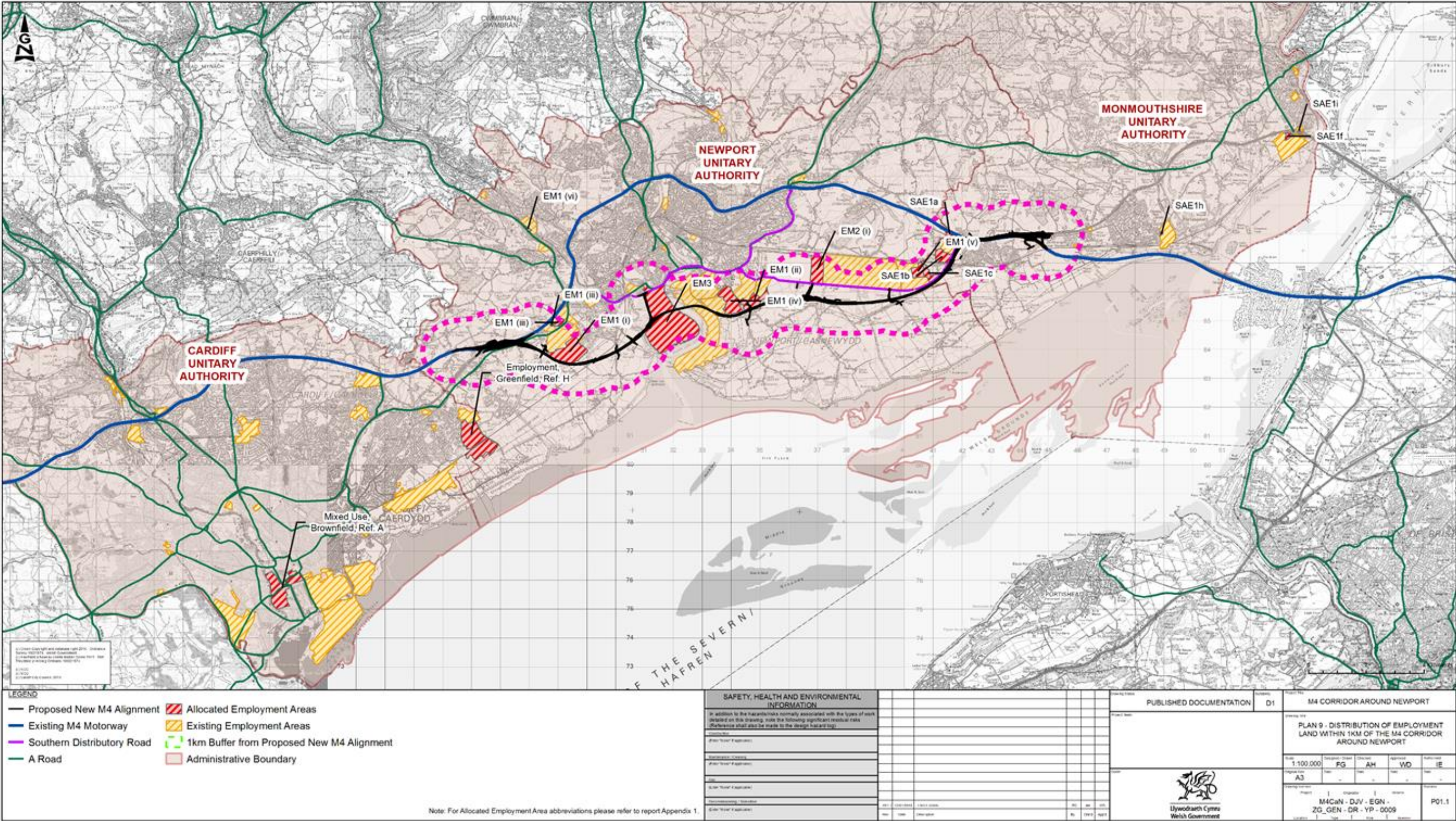
APPENDIX B – Wider Economic Impact Assessment Study Area

Figure 6 – Wider Economic Impact Assessment Study Area



APPENDIX C – Land Use and Planning Context

Figure 7 – Land Use and Planning Context



APPENDIX C – Access to Employment Opportunities / Access to a Labour Force

Figure 8 – Change in Access to Employment

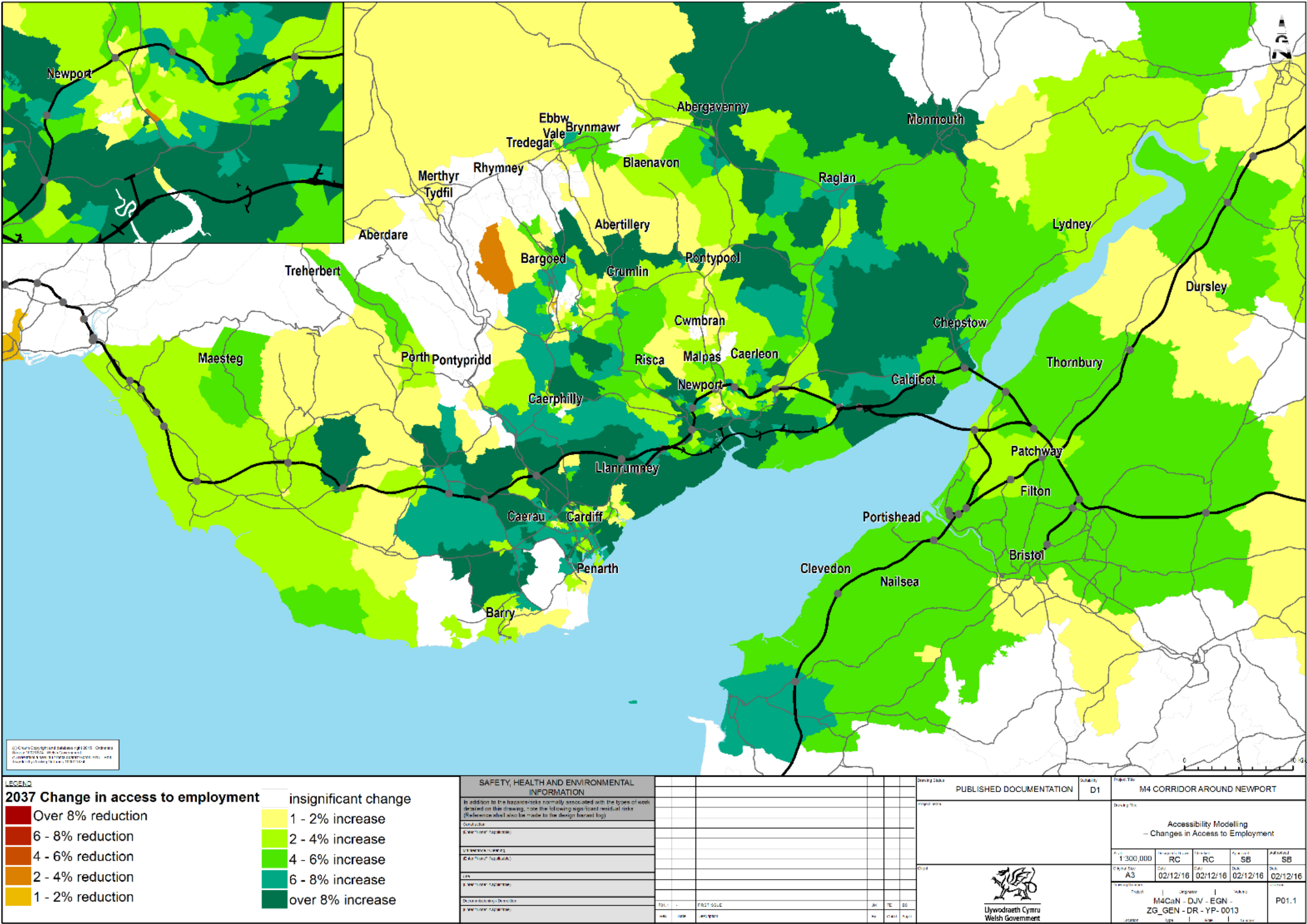


Figure 9 – Change in Access to the Labour Force

