Welsh Government

M4 Corridor Around Newport - Motorway to the South of Newport

Economic Assessment Report

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1 Introduction

1.1 Scheme Background

The M4 in South Wales forms part of the Trans-European Transport Network (TEN-T), which provides connections throughout Europe by road, rail, sea and air. The M4 plays a key strategic role in connecting South Wales with the rest of Europe, providing links to Ireland via the ports in South West Wales and England, and mainland Europe to the east. It is a key east-west route being the main gateway into South Wales and also one of the most heavily used roads in Wales.

The M4 is critical to the Welsh economy as it facilitates the transport of goods, links people to jobs and employment sites, and serves the Welsh tourism industry. Cardiff, Newport and Swansea have ambitious regeneration strategies and Monmouthshire County Council is developing areas around Junction 23A of the M4. Rhondda Cynon Taff has important gateways onto the motorway at Junctions 32 and 34. Bridgend is served by M4 Junctions 35 and 36. Neath Port Talbot straddles the motorway and gets important access from Junctions 38 to 43. Congestion on the M4 causing unreliable journey times and reduced service levels will therefore hinder economic development in South Wales.

The M4 between Junctions 28 and 24 was originally designed as the 'Newport Bypass' with further design amendments in the 1960s to include the first motorway tunnels to be built in the UK.

The M4 Motorway between Magor and Castleton does not meet modern motorway design standards. This section of the M4 has many lane drops and lane gains, resulting in some two-lane sections, an intermittent hard shoulder and frequent junctions.

It is often congested especially during weekday peak periods, resulting in slow and unreliable journey times and stop-start conditions with incidents frequently causing delays. Congestion and unreliable journey times have been a fact of life on the M4 around Newport for many years. The motorway and surrounding highway network does not cope with sudden changes in demand or operation, for example as a result of accidents or extreme weather events. These issues are worse at times of peak travel and the problems have grown as the number of users on the network has increased.

Since 1991, much assessment and consultation has been undertaken to develop a preferred solution to the problems on the motorway around Newport. A detailed history is documented in the M4 Corridor around Newport WelTAG[1] Stage 1 (Strategy Level) Appraisal Report[2]. During 2013-14 a draft Plan for the M4 Corridor around Newport was developed. The provision of a new section of 3-lane motorway to the south of Newport (the Scheme) forms the main part of the draft Plan. The proposed new section of motorway has been developed following extensive consultation, investigation and analysis. The aim was to minimise the

[1] Welsh Transport Planning and Appraisal Guidance, available at http://wales.gov.uk/topics/transport/publications/weltag/?lang=en
[2] Welsh Government, M4 Corridor around Newport, WelTAG Appraisal Report Stage 1 (Strategy Level), Arup, June 2013, available at www.m4newport.com

impact on the environment, whilst fully meeting motorway design and safety standards.

1.2 Objective of this Report

The purpose of this Economic Assessment Report is to provide a detailed summary of the economic appraisal undertaken for the scheme. The report outlines the methodology and assumptions adopted in undertaking the economic assessment, and presents the results of the assessment.

1.3 Report Structure

Following this introduction, the report is structured as follows:

- Chapter 2 provides information on the scheme and the traffic forecasts used as the basis for the economic assessment;
- Chapter 3 outlines the approach used for the economic assessment;
- Chapter 4 details the cost estimates for the scheme used in the assessment;
- Chapter 5 provides an overview of the different categories of benefits assessed for the scheme;
- Chapter 6 presents the results of the economic assessment for the core scheme and the sensitivity tests;
- Chapter 7 describes the assessment of wider economic benefits; and
- Chapter 8 contains concluding comments.

2 Motorway to the South of Newport: The Scheme

2.1 Scheme Description

The scheme provides a new section of dual 3-lane motorway between Junction 23 (Magor) and Junction 29 (Castleton). The scheme is some 22.5km in length, and is shown in Figure 2.1.

The scheme includes a number of new junctions:

- A full-movement junction (the Docks Junction) to the west of the River Usk in the Docks area, with a dual carriageway link to a new at-grade roundabout on the A48 Southern Distributor Road, to improve access to central Newport and the Docks area;
- A full-movement junction at Glan Llyn to provide access to the East Newport Development Area, which is allocated for employment and residential uses within the Newport Unitary Development Plan and the emerging Local Development Plan. This would link to a new at-grade roundabout on the A4810 Steelworks Access Road via a dual carriageway link;
- The replacement of the existing free-flow arrangement at Junction 23 east of Magor, with a full-movement junction with the B4245 and a dual carriageway link connecting to a new at-grade roundabout on the M48. This roundabout provides a connection between the M48 and a new link feeding into the existing motorway from Coldra via Junction 23a.

2.2 Transport Model

The basis for forecasting is the M4 Corridor around Newport traffic model which has been validated for a 2012 base year. The development and the validation of the base year traffic model has been detailed in the Local Model Validation Report (LMVR)[3]. The model uses the SATURN modelling suite (Simulation and Assignment of Traffic in Urban Road Networks).

The M4 model incorporates separate models for the AM and PM peak hour and a representative interpeak hour, each including capacity restraint mechanisms through junction simulation and speed-flow relationships.

Five user classes are modelled:

- Car – employer's business trips;
- Car – commuter trips;
- Car – other trips;
- Light goods vehicle (LGV); and
- Heavy goods vehicle (HGV).

[3] M4 Corridor Around Newport – Motorway to the South of Newport, Local Model Validation Report, Arup, June 2014

Figure 2.1: Motorway to the South of Newport

The core area of the traffic model covers the M4 between Junction 30 in the west and Junction 21 in the east, including junctions 29 and 23 that are the western and eastern ends respectively of the proposed new section of motorway. Within this core area are key roads/corridors of interest including:

- the existing M4 and proposed new section of motorway to the South of Newport;
- the M48 motorway;
- access routes to the existing M4 and M48 motorways from Cardiff, Newport, Chepstow and the hinterland north of Newport;
- the corridors on the east and west banks of the River Usk that could connect Central Newport to the M4 motorway to the south of Newport via intermediate junction(s); and
- east / west routes through Newport via Newport Bridge, George Street Bridge and the Southern Distributor Road (SDR).

The core area is modelled at a high level of detail (SATURN simulation network). Outside this core area is a large area-of-influence where changes in traffic flow may be experienced following opening of the M4 motorway to the south of Newport. This extends to Skewen (M4 J43) in the west, the A465 Heads of the Valleys Road and M50 in the north, and the M5 J8 to 18a in the east. The area-of-influence is modelled at a lower level of detail (SATURN buffer network).

The study area is shown in Figure 2.2.

2.3 Demand Model

The demand model is an incremental multinominal logit model. The demand model applies variable demand by using the base year costs and the Reference Case trip patterns, derived from the base year trip matrix assuming no changes in travel costs. The demand model then pivots off the base year assignment to create the Do Minimum matrix accounting for:

- Transport interventions between the base year and the forecast year;
- Increases in the value of time resulting from real increases in income;
- Increases in levels of congestion arising from increased car usage; and
- Increases in fuel efficiency that make car travel cheaper.

The Do Something scenario is then generated by pivoting off the converged Do Minimum Scenario.

Realism testing on the base year traffic model was undertaken to ensure that the M4 traffic model responds to changes in travel costs in a realistic way. Further details of the base year realism testing are given in the LMVR.

A systematic approach has been adopted in building up the Variable Demand Model (VDM) forecasts. The Core Scenario Reference Case matrices were developed first and changes in travel patterns compared with the 2012 base year. The Core Scenario Do Minimum forecasts were then produced and changes in travel patterns compared with the respective Reference Case for each of the two modelled years 2022 and 2037. Finally, the Core Scenario Do Something

forecasts were produced and changes in travel patterns compared with the Do Minimum.

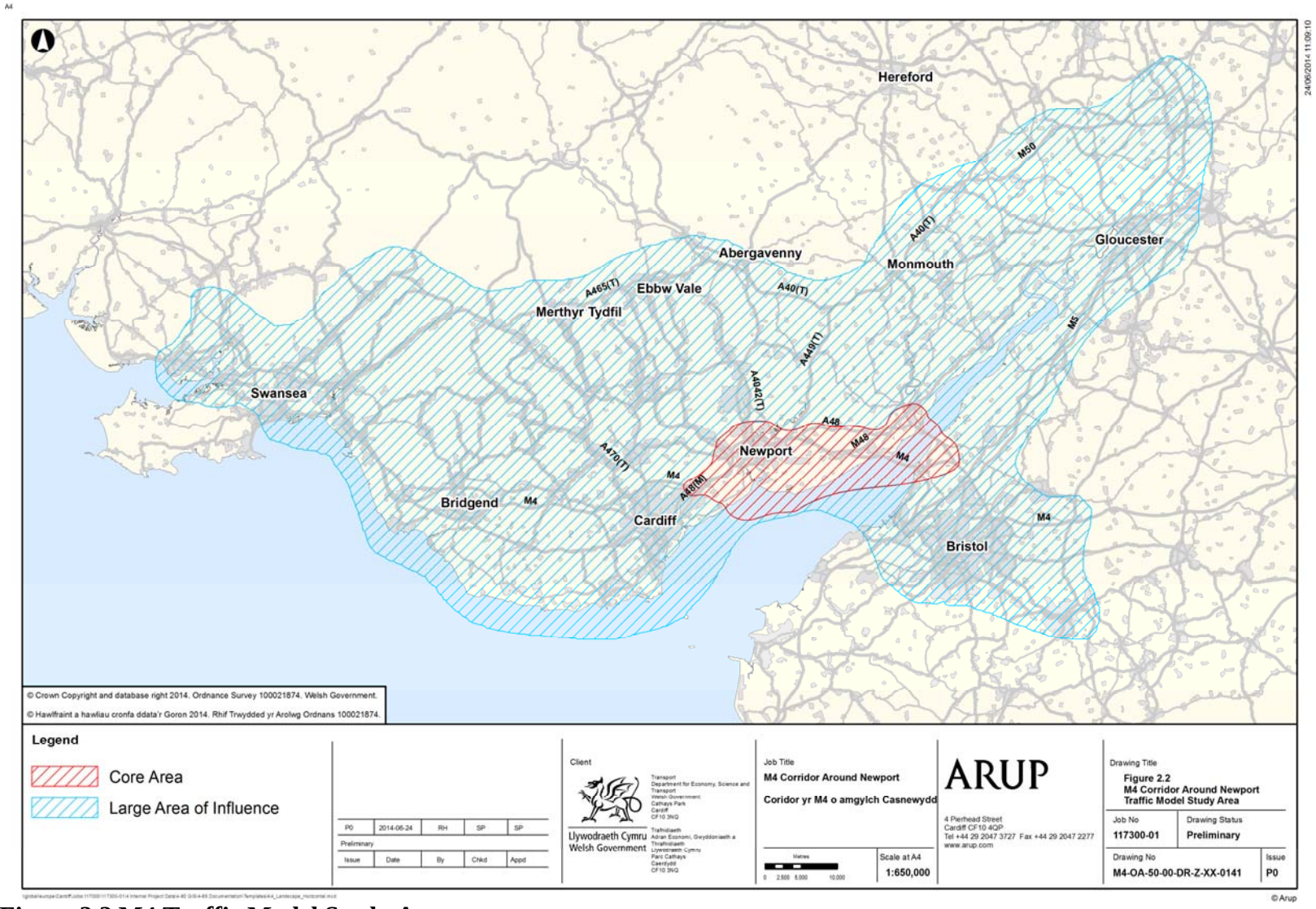

Figure 2.2 M4 Traffic Model Study Area

Variable Demand Modelling is carried out for car trips but not for freight trips, as it is assumed that while freight traffic is susceptible to re-routeing the total demand for freight traffic is fixed. For car trips, the variable demand parameters can vary significantly between different trip purposes, reflecting the likelihood that the demand for more essential travel, such as employer's business trips, may be less affected by congestion than discretionary travel demand, such as leisure trips.

2.4 Traffic Forecasts and Sensitivity Tests

The validated 2012 base model has been used to develop forecast reference demand matrices for two future years: 2022 (the scheme opening year) and 2037 (the design year). The development of the forecast reference matrices is described in the Traffic Forecasting Report[4].

In addition to the central growth reference demand, the Traffic Forecasting Report also details the development of low and high growth reference demand for the forecast years, following the advice given in WebTAG, and presents the forecasts for the scheme under central growth, low growth and high growth assumptions.

The Do Minimum Scenario represents the future year situation without the motorway to the south of Newport. Highway schemes that are likely to take place independently of the motorway to the south of Newport are included in the Do Minimum network. These are:

- **Tredegar Park Roundabout (Junction 28).** As part of the M4 Corridor Enhancement Measures (CEM) Programme, a scheme to improve the operation of the Junction 28 roundabout at Tredegar Park is being promoted by the Welsh Government. The provisional design for this scheme comprises an enlarged at-grade signalised gyratory, incorporating a through link from the M4 (west) to the A48 Southern Distributor Road.
- **A467 Bassaleg Roundabout.** This improvement is also proposed as part of the M4 CEM programme, and the provisional design would convert the existing A467 Bassaleg roundabout into a signalised 'throughabout', with a new two-way link connecting the A467 northern and southern arms.
- **A48 Pont Ebbw Roundabout.** This is an additional proposal that is being promoted as part of the M4 CEM programme. The provisional scheme design would convert the existing signalised roundabout into a signalised 'throughabout', with a new link connecting the eastern and western arms of the A48 Southern Distributor Road.
- **A465 Heads of the Valleys Dualling.** The A465 trunk road forms an alternative east-west strategic route to the M4, particularly for traffic travelling between the Midlands and West Wales. Four sections of this improvement scheme are in the planning stage:
    - Section 3 (Brynmawr to Tredegar) is under construction and is expected to be completed by 2015;

[4] M4 Corridor around Newport – Motorway to the South of Newport, Traffic Forecasting Report, Arup, June 2014

  - Section 2 (Gilwern to Brynmawr) is scheduled to start construction in 2014;
  - Section 5 (Dowlais Top to the A470) is not yet programmed, but will be commenced in time for completion by 2020; and
  - Section 6 (A470 to Hirwaun) is not yet programmed, but will also be commenced in time for completion by 2020.

- **Newport Eastern Expansion Area.** Additional infrastructure is proposed to serve the major residential developments planned on the former steelworks site and the area north of the railway around the village of Llanwern. The proposals comprise:
  - A new north-south link over the mainline railway, connecting Llanwern village to the improved Steelworks Access Road; and
  - Upgrading of the A48 SDR / Cot Hill junction, from the existing left-in/left-out priority arrangement to an all-movement signal-controlled junction.

  However, the phasing of the development proposals for Newport Eastern Expansion Area has been extended, and it is now assumed that the above infrastructure proposals will be in place prior to the 2037 design year. By the 2022 opening year, it is assumed that the only additional infrastructure will be the construction of a new junction on Cot Hill west of Llanwern village, to facilitate access for the initial development phases on the land north of the mainline railway.

In addition to the core scenario tests using central, low and high growth reference demand, two further scenarios have been examined. These are:

- No traffic growth from 2012 in all forecast years; and
- Central growth with the removal of the existing Severn Crossing tolls.

3 Approach to Economic Assessment

3.1 Principles of Assessment

Guidance on undertaking economic assessments for transport schemes is given in WebTAG[5,6]. The economic assessment appraises the costs and benefits of a transport scheme that are accrued over a 60 year period in monetary terms. In order to ensure consistency, all monetary values are discounted to a common price base to give 'present values'. The current price base year for economic assessments stipulated by the Guidance is 2010.

The benefits are broadly made up of the following:

- journey time savings;
- vehicle operating cost savings;
- user charges, such as tolls;
- accident savings;
- carbon emission savings; and
- additional costs to travellers due to disruption during construction and maintenance works.

With the exception of accidents and carbon emissions, these benefits relate to the 'Economic Efficiency' of the transport system and are presented in the form of a Transport Economic Efficiency (TEE) table. The TEE table also includes private sector impacts.

The 'public accounts' relate to the costs faced by Government (either local or central) to implement the scheme. They include the following:

- revenue (for example through the introduction of tolls);
- operating costs;
- investment costs;
- developer and other contributions (not applicable);
- grant/subsidy payments (not applicable); and
- indirect tax revenues to government through, for example, fuel duty that result from the scheme.

The overall Analysis of Monetised Costs and Benefits also includes benefits due to savings in accidents and carbon emissions. These would be negative if they were to increase. The total benefits are compared with the total costs from the public accounts identified above, in order to determine the value for money of the scheme.

[5] Transport Analysis Guidance, Cost-Benefit Analysis, TAG Unit A1.1, Department for Transport, January 2014
[6] Transport Analysis Guidance, User and Provider Impacts, TAG Unit A1.3, Department for Transport, January 2014

3.2 Software

TUBA (**T**ransport **U**ser **B**enefit **A**ppraisal) software (version 1.9.4) has been used to undertake the economic assessment for the motorway to the south of Newport. This software has been produced by the Department for Transport to carry out transport scheme economic appraisal using a 'willingness to pay' approach with fixed or variable demand. The economic impacts of a scheme are derived by comparing the future year situation with the scheme (Do Something scenario) to the situation without the scheme (Do Minimum).

TUBA uses data taken from the traffic model forecasts on the number of trips, average journey times and average distances to calculate the TEE and carbon benefits in accordance with the WebTAG methodology. It also requires the scheme investment and operating costs to be input.

4 Costs

4.1 Investment Costs

There are three main elements of the scheme cost estimate:

- the base cost – the basic costs of constructing the scheme before allowing for risks;
- adjustment for risk – which covers all the identified risks as assessed and quantified through a Quantified Risk Assessment resulting in the risk-adjusted cost estimate; and
- adjustment for optimism bias – to reflect the systematic bias for estimated scheme costs and delivery times to be too low and too short respectively. This results in an increase to the cost estimate.

The investment costs (ie capital costs) are distinguished from operating costs. The main components of the investment costs for the scheme are:

- **Construction costs,** including main works, ancillary works, statutory undertakings, site supervision and testing;
- **Land and property costs,** including compensation; and
- **Preparation and Supervision costs**, including project management, design, public consultation, Public Inquiry, gaining statutory powers, surveys, compensation, supervision and testing.

In the context of the appraisal, there is likely to be some difference between what is expected and what actually happens. This may be due to bias, which may be unwittingly inherent in the appraisal, as well as risks and uncertainties that might materialise during the course of the project. It is thus important to identify and mitigate risks and make allowances for “optimism bias”.

In order to adjust the base cost for the risks associated with the cost of the scheme, a Quantified Risk Assessment has been undertaken.

The scheme cost estimates are shown in Table 4.1, based on 2013 Quarter 4 prices. The allowance for VAT is excluded from the cost estimates input to the economic assessment, as this is dealt with internally by the assessment software.

Table 4.1: Scheme Cost Estimate (2013 Q4 Prices)

Item		Cost (£)	Optimism Bias (£)	Total (£)
Construction	Preliminaries	125,686,167	3,887,201	129,573,368
	Main Works	503,085,466	23,418,650	526,504,116
	Risk	121,097,822	-	121,097,822
	Third Party Costs	21,906,787	3,645,315	25,552,102
	Employer Costs	9,350,000	1,650,000	11,000,000
Land		69,912,500	12,337,500	82,250,000
Preparation		90,281,567	6,821,069	97,102,636
Supervision		4,182,494	738,087	4,920,581
TOTAL		**945,502,803**	**52,497,822**	**998,000,626**

4.2 Maintenance Costs

In addition to the investment costs, it is necessary for the economic assessment to take account of the cost of maintaining both the new section of motorway and the existing M4 during the 60-year assessment period.

Following discussions with the Welsh Government, a draft maintenance schedule has been devised for two scenarios:

- Do Minimum: the cost of maintaining the existing M4 between Junction 23 and Junction 29; and
- Do Something: the cost of maintaining both the existing M4 and the proposed scheme.

The maintenance schedules include a recurring cycle of resurfacing / overlay / reconstruction of different sections of the motorway, together with major maintenance of structures and annual routine maintenance.

The estimated maintenance costs included in the economic assessment are shown in Table 4.2.

Table 4.2: Estimated 60-Year Maintenance Costs (2013 Q4 Prices)

	Maintenance Costs (£)		
	Existing M4	Proposed Scheme	Total
Do Minimum	352,092,490	-	352,092,490
Do Something	352,092,490	261,245,310	613,337,800

5 Estimation of Benefits

5.1 Economic Parameters

WebTAG Guidance[7] provides details of the default economic data that should be adopted for the economic assessment of transport schemes. TUBA has a standard economics file that contains the default data from WebTAG which includes the following:

- Present value discount rates;
- Values of time and estimated rates of change;
- Tax rates and estimated rates of change;
- Carbon dioxide emission rates;
- Monetary values of carbon dioxide emissions;
- Proportion of petrol and diesel within vehicle fleet and estimated rates of change;
- Parameters for fuel consumption (related to travel distances and times);
- Fuel costs and estimated rates of change;
- Rates of change in fuel efficiency;
- Non fuel vehicle operating cost parameters (related to travel distance and times) and estimated changes;
- Trip purpose proportions; and
- Vehicle occupancies.

The economic parameters file also includes default journey purpose splits for each vehicle type. However, as the output from the traffic model was given by journey purpose, this was used in preference to the default values.

5.2 Time and Vehicle Operating Cost Benefits

5.2.1 Assessment Period and Modelled Years

The proposed opening year for the scheme is 2022. It is assumed that construction of the scheme would commence in 2018. The assessment covers a 60 year period, starting with the scheme opening year, 2022, up to 2081.

The TUBA assessment has taken data from the traffic model forecasts, which have been prepared for 2022 and 2037. TUBA calculates the benefits for each of the modelled forecast years and then interpolates to calculate the benefits for the intervening years. After the last modelled year, the default TUBA assumption is that there is no change in traffic patterns and so the benefits do not change, but they are discounted back over a longer period of time to the economic base year of 2010.

[7] Transport Analysis Guidance, User and Provider Impacts, Unit A1.3, Department for Transport, May 2014

5.2.2 Annualisation Factors

Annualisation factors have been calculated to convert the traffic model output from the modelled time periods up to annual values. The annualisation factors were calculated from Automatic Traffic Count (ATC) data on the M4 motorway, and are shown in Table 5.1.

Table 5.1: Annualisation Factors

Description	Annualisation Factor	Modelled Time Period
AM peak hour to total annual hours during AM peak	710	AM Peak Hour
Interpeak hour to total annual hours during interpeak	1538	Interpeak Hour
PM peak hour to total annual hours during PM peak	711	PM Peak Hour
Interpeak hour to total annual hours during weekends	1461	Interpeak Hour
Interpeak hour to total annual off-peak hours	908	Interpeak Hour

5.2.3 Traffic Data

TUBA requires matrices to be input containing data from the Do Minimum and Do Something traffic models, to enable the software to calculate benefits to transport users. The following matrices are required as input:

- trip matrices, which give the number of trips travelling between each origin and destination zone in the traffic model;
- time matrices, which represent the average time for travel between each of the origin and destination zones; and
- distance matrices, which represent the average distance of trips travelled between each of the origin and destination zones.

These matrices were extracted from the traffic model for 2022 and 2037 and used as input to TUBA.

5.2.4 User Classes

As noted in Section 2.2, the traffic model has five user classes:

- Car – employer's business;
- Car – other;
- Car – commute;
- Light Goods Vehicles; and
- Heavy Goods Vehicles.

Given the high number of user classes involved in the TUBA assessments, a separate TUBA run was undertaken for each of the user classes listed above. This provided a breakdown of the benefits for each of the user classes, which were then combined to give the overall scheme benefits.

5.3 Benefits During Construction and Maintenance

5.3.1 Scheme Construction

Traffic management works during construction tend to result in changes in journey times and vehicle operating costs. Construction work also has an impact on accidents. These impacts need to be taken into account in the economic assessment for a scheme. Generally, the presence of roadworks results in increased travel costs and hence the benefits due to construction works are normally negative. The net benefits associated with maintenance works can be positive where the maintenance schedule for an unimproved route is more frequent and more costly than that for an improved route.

For the proposed scheme, roadworks will be required during 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.

TUBA has been used to assess the cost of the disruption to road users during the construction of the tie-ins. Traffic forecasts have been prepared by coding the traffic management works into the 2022 Do Minimum network and assigning the 2022 trip matrix. Table 5.2 outlines the assumed traffic management arrangements that were coded into the model network.

Table 5.2: Traffic Management Schedule during Construction

Year	Months	Castleton Interchange			Magor Interchange		
		Length	Lanes (each direction)	Speed Limit (mph)	Length	Lanes (each direction)	Speed Limit (mph)
2018	12	1 km either side of tie-in	2	50	1km either side of chainage 23+500	2	50
2019-21	33	1 km either side of tie-in	2	50	-	-	-
2021	3	1 km either side of tie-in	2	50	1km either side of chainage 21+500	2	50

Traffic forecasts have been prepared for each scenario for 2018 and 2022, with the 2018 trip matrices being interpolated between the 2012 base year matrices and the 2022 forecast matrices. The model results were input to TUBA, and the resulting disbenefits were factored down from the four-year assessment period to the duration assumed for each scenario as shown in Table 5.2. The output from this TUBA assessment of the impact of the construction works was then incorporated into the overall results for the economic assessment.

5.3.2 Maintenance

In addition to the cost of construction, it is necessary for the economic assessment to take account of the cost of maintaining both the new road and the existing M4 during the 60-year assessment period.

As noted in Section 4.2, a draft maintenance schedule was devised for two scenarios following discussions with the Welsh Government:

- Do Minimum: the cost of maintaining the existing M4 between Junction 23 and Junction 29; and
- Do Something: the cost of maintaining both the existing M4 and the proposed scheme.

The maintenance schedules include a recurring cycle of resurfacing / overlay / reconstruction of different sections of the motorway, together with major maintenance of structures and annual routine maintenance. For the purpose of this assessment, it was assumed that all resurfacing works would be carried out only at night, involving minimal disruption to road users, and these items were accordingly omitted from the calculation of benefits. Overlay and reconstruction works, however, were assumed to involve 24-hour working throughout.

Table 5.3 summarises the assumed maintenance schedule used to calculate overall benefits in the Do Minimum Scenario, and Table 5.4 shows the equivalent for the Do Something scenario.

Future year traffic forecasts have been used to estimate the impact of each maintenance schedule. The Do Minimum maintenance model results were input to TUBA for comparison with the standard Do Minimum model results, and the resulting disbenefits were factored down to the duration assumed for each scheme as shown in Table 5.3.

Similarly, the Do Something maintenance model results were compared with the standard Do Something model in TUBA, and the Do Something maintenance disbenefits factored to the duration assumed for each scheme as shown in Table 5.4.

The Do Something maintenance disbenefits were then subtracted from the Do Minimum maintenance disbenefits to give the net impact on maintenance arising from the scheme. The output from this TUBA assessment of the impact of the maintenance works was then incorporated into the overall results for the economic assessment.

Table 5.3: Maintenance Schedules, Do Minimum Scenario

Sections	Do Minimum			
	Road Type	Traffic Management	Years	Duration (Months)
M48 J2-J23	D2M	Contraflow, 1 lane each direction, 50mph speed limit	2040 2056 2072	4 4 4
SSC-J23	D3M	2 lanes each direction, 50 mph speed limit	2039 2055 2071	3 3 3
J23-J23a	D3M	2 lanes each direction, 50 mph speed limit	2020 2039 2055 2071	3 3 3 3
J23a-J24	D3M	2 lanes each direction, 50 mph speed limit	2038 2054 2070	4 4 4
J24-J25	D3M	2 lanes each direction, 50 mph speed limit	2038-39 2054-55 2070-71	3 3 3
J25-J26	D2M	Contraflow, 1 lane each direction, 50mph speed limit	2037 2045-46 2053 2069 2077-78	4 12 4 4 12
J26-J28	D3M	2 lanes each direction, 50 mph speed limit	2037-2038 2053-2054 2069-2070	4 4 4
J28-J29	D3M	2 lanes each direction, 50 mph speed limit	2017 2037 2053 2069	3 3 3 3

Table 5.4: Maintenance Schedules, Do Something Scenario

Sections	Do Something			
	Road Type	Traffic Management	Years	Duration (Months)
M48 J2-J23	D2M	Contraflow, 1 lane each direction, 50mph speed limit	2040 2056 2072	4 4 4
SSC-J23	D3M	2 lanes each direction, 50 mph speed limit	2039 2055 2071	3 3 3
J23-J23a	D2M	Contraflow, 1 lane each direction, 50mph speed limit	2040 2056 2072	3 3 3
J23a-J24	D3M	2 lanes each direction, 50 mph speed limit	2038 2054 2070	4 4 4
J24-J25	D3M	2 lanes each direction, 50 mph speed limit	2038-39 2054-55 2070-71	3 3 3
J25-J26	D2M	Contraflow, 1 lane each direction, 50mph speed limit	2037 2045-46 2053 2069 2077-78	4 12 4 4 12
J26-J28	D3M	2 lanes each direction, 50 mph speed limit	2037-2038 2053-2054 2069-2070	4 4 4
J28-J29	D3M	2 lanes each direction, 50 mph speed limit	2037 2053 2069	3 3 3
New Scheme, J23 – Glan Llyn	D3M	2 lanes each direction, 50 mph speed limit	2041 2057 2073	12 12 12
New Scheme, Glan Llyn - Docks	D3M	2 lanes each direction, 50 mph speed limit	2042 2058 2074	12 12 12
New Scheme, Docks – J29	D3M	2 lanes each direction, 50 mph speed limit	2043 2059 2075	12 12 12

5.4 Safety Benefits

The safety impacts of the scheme have been assessed quantitatively and monetised to be incorporated into the overall economic assessment for the scheme. Accident saving benefits have been calculated separately using Cost and Benefit to Accidents – Light Touch (COBA-LT), a spreadsheet application developed by the Department for Transport (DfT) to undertake the analysis of the impacts on accidents as part of the economic appraisal of road schemes.

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. Accident rates and costs used in COBA-LT are consistent with those defined in the Design Manual for Roads and Bridges[8].

The resulting safety benefits calculated by COBA-LT were then added to the main TUBA assessment for the scheme.

[8] Design Manual for Roads and Bridges, Volume 13, Section 1, Part 2, The Valuation of Costs and Benefits, Department for Transport, June 2006

6 Economic Assessment Results

6.1 Core Scheme

The 'Transport Economic Efficiency' (TEE) benefits are made up of the monetary journey time benefits, vehicle operating cost savings and benefits during construction and maintenance. When added to the carbon and accident benefits, these give the Present Value of Benefits (PVB) in 2010 prices.

The 'Public Accounts' are made up of the costs incurred by Government as a result of the scheme, including investment and operating costs. Revenues to Government are also included (as negative costs) which are made up of 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. The Present Value of Costs (PVC) is the net total from the public accounts table.

The Analysis of Monetised Costs and Benefits compares the PVB and the PVC to give the Net Present Value (NPV) and Benefit to Cost Ratio (BCR) for the scheme. The NPV is calculated by subtracting the present value of costs (PVC) from the total present value of benefits (PVB). The BCR is calculated by dividing the PVB by the PVC.

A positive NPV and a BCR greater than unity indicate that the benefits due to the scheme outweigh its costs and so it is positive in economic terms. The higher the NPV and BCR, the better the value for money of the scheme.

A summary of the economic assessment results for the scheme is shown in Table 6.1, while the full results are given in Appendix A.

Table 6.1: Summary of Economic Assessment (Central Growth)

	Results (2010 prices, discounted to 2010)
Present Value of Benefits, PVB (£000)	2,005,829
Present Value of Costs, PVC (£000)	877,231
Net Present Value, NPV (£000)	1,128,598
Benefit-to-Cost Ratio, BCR	2.29

The BCR takes into account transport user benefits and accident benefits over a 60 year period. It also takes into account disruption caused as a result of construction work and the net maintenance benefits during the assessment period.

The results indicate that, assuming central growth predictions, the scheme has a positive NPV of £1.1bn and a BCR of 2.29. This indicates that the scheme is positive in economic terms as the scheme costs will be more than offset by the improvements in transport economic efficiency, safety and carbon emissions, and the BCR indicates that the scheme would represent high value for money.

6.2 Sensitivity Tests

6.2.1 Lambda Parameter

WebTAG Guidance[9] recommends that sensitivity tests be undertaken to ensure the robustness of the results of the economic assessment. In particular, it is recommended that the lambda parameter (λ) used in the variable demand model, which governs the individual demand mechanisms, be tested using increased values. If the scheme remains economically viable with the higher values of lambda, then it can be concluded that the economic assessment will be robust against the effects of induced traffic.

WebTAG suggests that a test with the value of lambda increased by 50% should be carried out. Table 6.2 lists the values of the lambda parameters used, and compares the BCR values obtained from this test with the main economic results.

Table 6.2: Lambda Sensitivity Test Results

		Original Test	Sensitivity Test
Lambda Parameter	Employer's Business	-0.074	-0.111
	Other	-0.083	-0.1245
	Commuting	-0.065	-0.0975
Present Value of Benefits (£000)		2,005,829	2,255,593
Present Value of Costs (£000)		877,231	877,231
Benefit to Cost Ratios		2.29	2.57

The results indicate that increasing lambda by 50% would result in an increase in scheme benefits of about 12%, with the BCR increasing to 2.57. This indicates that the scheme remains high value for money.

6.2.2 Low and High Growth

In addition to the central growth forecasts, sensitivity tests were carried out for low and high growth assumptions. The method of producing the traffic forecasts for low and high growth are detailed in the Traffic Forecasting Report[10]. The results of the economic assessment for these forecasts are shown in Appendix B and summarised in Table 6.3.

The results show that even under Low Growth forecast assumptions, the scheme would provide value for money, with a BCR of 1.75. Under High Growth, the NPV is estimated to increase to almost £2bn with a BCR of 3.27.

[9] Transport Analysis Guidance, Variable Demand Modelling, TAG Unit M2, Department for Transport, January 2014
[10] M4 Corridor around Newport – Motorway to the South of Newport, Traffic Forecasting Report, Arup, June 2014

Table 6.3: Economic Assessment, Low and High Growth Forecasts

	2010 Prices, Discounted to 2010	
	Low Growth	High Growth
Present Value of Benefits, PVB (£000)	1,536,384	2,870,412
Present Value of Costs, PVC (£000)	877,231	877,231
Net Present Value, NPV (£000)	659,153	1,993,181
Benefit-to-Cost Ratio, BCR	1.75	3.27

6.2.3 No Growth Assumption

As a further test of the economic robustness of the scheme, in addition to the standard Low Growth scenario, a test was carried out using the validated base year (2012) demand, so assuming no growth in traffic at all over the 60-year assessment period. For this purpose, variable demand modelling was not applied, so that the 2012 base year demand remained unchanged for the future year assessments.

The results of this test are given in Appendix C, and summarised in Table 6.4.

Table 6.4: Economic Assessment, No Traffic Growth Assumption

	Results (2010 prices, discounted to 2010)
Present Value of Benefits, PVB (£000)	939,162
Present Value of Costs, PVC (£000)	877,231
Net Present Value, NPV (£000)	61,931
Benefit-to-Cost Ratio, BCR	1.07

The results indicate that, even in the unlikely event of traffic remaining at the levels observed in 2012, the scheme would achieve a positive NPV of around £62m with a BCR of more than 1, indicating that the scheme benefits would be likely to outweigh the costs over the appraisal period.

6.2.4 Removal of Severn Crossing Tolls

Unless new legislation is agreed between the Department for Transport and the Welsh Government, the end of the concession agreement for the Severn Crossing Tolls will be 2022 at the latest. Removal of the tolls and elimination of delays associated with toll collection will result in increased traffic demand.

With the predicted increase in demand applied to the central growth reference demand, the resulting forecasts were subject to TUBA assessment. The results of this test are given in Appendix D, and summarised in Table 6.5.

Table 6.5: Economic Assessment, Removal of Severn Crossing Tolls

	Results (2010 prices, discounted to 2010)
Present Value of Benefits, PVB (£000)	2,317,754
Present Value of Costs, PVC (£000)	877,231
Net Present Value, NPV (£000)	1,440,523
Benefit-to-Cost Ratio, BCR	2.64

The results show that, compared with the central growth assessment results shown in Table 6.1, the scheme benefits would increase by more than 15%, strengthening the economic case for the scheme by increasing the BCR from 2.29 to 2.64.

7 Wider Impacts

7.1 Overview

The journey time savings achieved by the scheme will increase the accessibility between areas of economic activity in the study area and improve access to jobs. This will generate wider economic benefits that are additional to the transport user benefits captured in the traditional economic appraisal. The wider impacts described here relate to quantifiable indirect benefits which are additional to direct economic effects and enable the calculation of an adjusted Net Present Value and Benefit Cost Ratio for the scheme accounting for indirect economic effects.

A framework for the calculation of impacts has been established by the Department for Transport and is formalised in WebTAG[11]. Under the guidance, wider impacts relate to three effects:

- **Agglomeration effects** - The term agglomeration refers to the concentration of economic activity over an area. Transport can act to increase the accessibility of an area to a greater number of firms and workers, thereby impacting on the level of agglomeration. Increased agglomeration is empirically associated with higher productivity. Therefore, improved access can result in higher productivity and GDP;
- **Output change in imperfectly competitive markets** – under conditions of imperfect markets, lower production costs (due to reduced transport costs) can result in an increase in output which will be of value to consumers. The welfare gain to consumers will be higher than the initial value of the reduction in transport costs; and
- **Labour market impacts** – where transport improvements reduce the costs of commuting, they effectively act to reduce barriers to employment and improve access to employment opportunities. Wider impacts can result where a transport scheme results in a transfer of employment from low to high productive jobs, or by increasing the overall level of employment in an economy.

In most circumstances, agglomeration effects and output changes account for the majority of wider impacts of transport improvements. Therefore, whilst the scheme is expected to play an important role in improving access to employment and labour, this report focuses on agglomeration effects and output changes.

The wider impacts model is based on a study area comprising 27 zones covering South Wales and the West of England. In the outer study area these zones correspond to local authority areas; closer to Newport the local authority areas have been split in two to provide additional detail.

[11] Transport Analysis Guidance, Wider Impact, Unit A2.1, Department for Transport, January 2014

7.2 Agglomeration Impacts

Agglomeration impacts capture the enhanced productivity that firms derive from being close to one another and from being located in large labour markets, which increases as travel times are reduced. The calculation is based on the change in an area's effective density, a measure of the mass of economic activity which depends on the number of jobs available in surrounding areas and the generalised cost to reach them. Zones such as Monmouthshire South, which require use of the M4 via Newport to access the high concentration of jobs in Cardiff, have the highest change in effective density as a result of this scheme. The calculation also depends on baseline GDP per worker and employment levels, so it is not surprising that overall agglomeration impacts are highest in zones such as Cardiff East and Newport West.

Figure 7.1 shows the agglomeration impacts predicted by the model in 2037. The total agglomeration benefits are predicted to be £9.6m in 2022 and £28.7m in 2037 (2010 prices), of which 31% will be realised in Cardiff and 21% in Newport. Agglomeration benefits are highest in the producer services sector, which accounts for 75% of the total benefit in 2037.

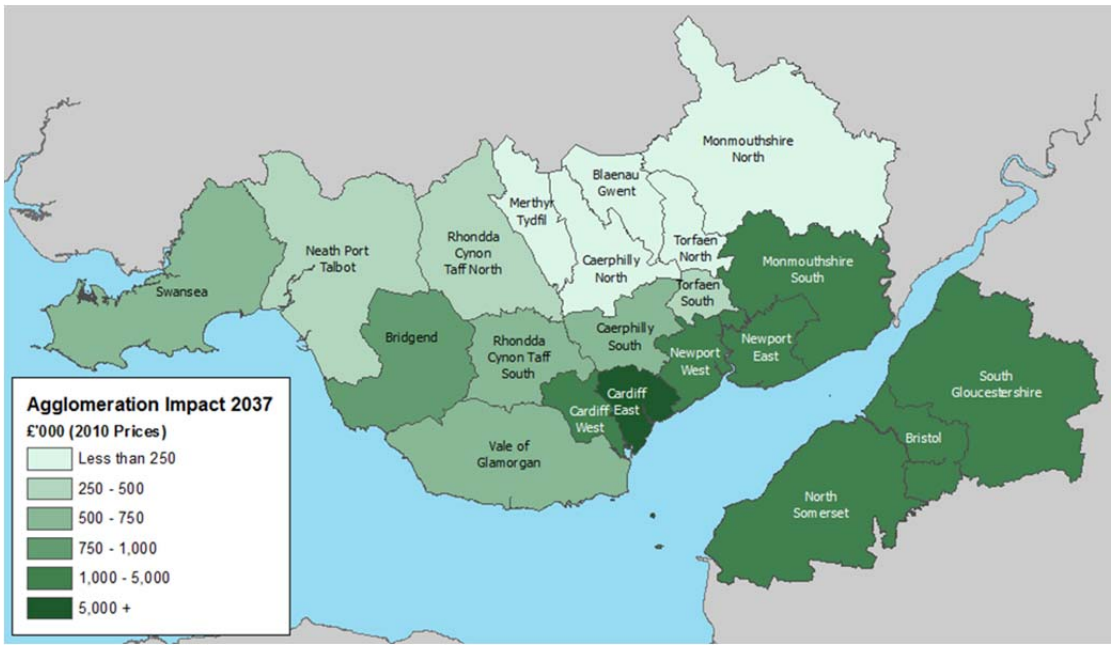

Figure 7.1: Forecast Agglomeration Impacts of the M4 Scheme, 2037

7.3 Output Change in Imperfectly Competitive Markets

This is the benefit due to increases in the output of goods and services that are valued more highly by consumers than the cost of producing them. As set out in the guidance, this is calculated as a 10% uplift to business user benefits, resulting in an additional benefit of £6.8m in 2037 (2010 prices).

7.4 Labour Market Impacts

Journey time savings reduce the costs associated with working, increasing effective wages and therefore bringing more people into the labour force. The additional labour supply produces additional economic output. Although the welfare benefits from labour market impacts are partially captured in the commuter user benefits calculated in the economic appraisal, the tax implications are not. Therefore the additional economic output is multiplied by the relevant rate of taxation to calculate the wider impact.

The estimated labour market impacts are illustrated in Figure 7.2. Tax revenues arising from these impacts are expected to total £1.1m in 2037 (2010 prices). Monmouthshire South accounts for 19% of this total, as workers in this zone are particularly affected by the M4 scheme in being able to reach major employment centres in Cardiff.

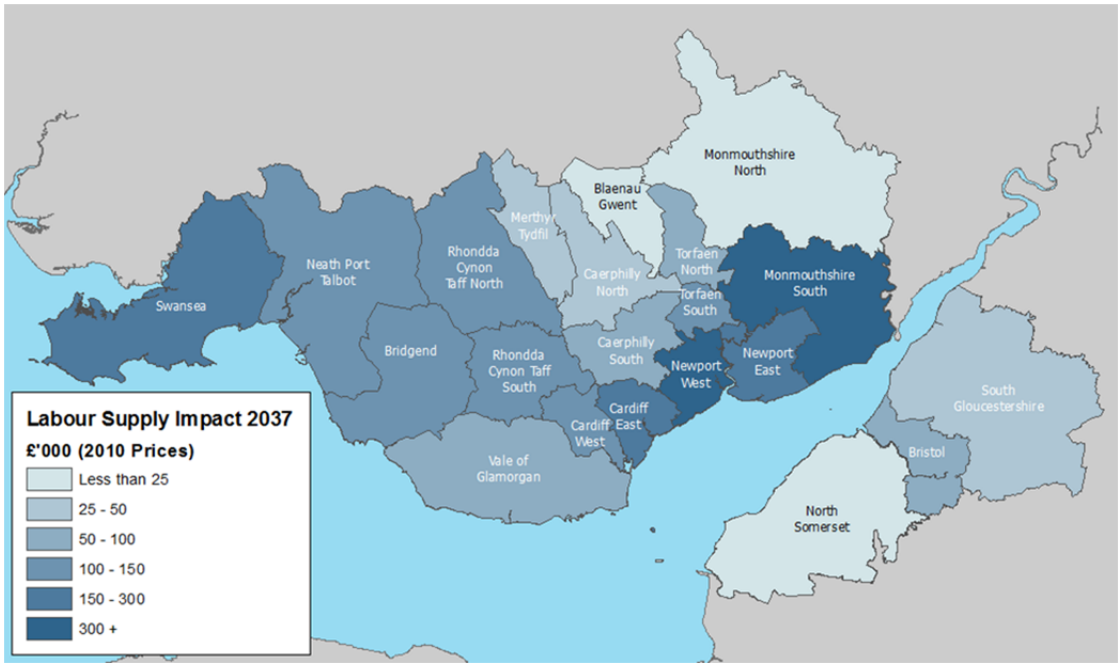

Figure 7.2: Labour Supply Impact on GDP, 2037

7.5 Summary of Results

The summary of the wider impacts is shown in Table 7.1. The scheme is expected to generate £36.7m of wider impacts in 2037 (in 2010 prices), producing a total of £3.1bn over the full 60-year appraisal period.

Table 7.1: Summary of Wider Impacts

Price Base: 2010 **Appraisal Period: 2022-81** **Units: £000**					
Wider Impact	**2022**	**2037**	**2081**	**Full Appraisal Period (undiscounted)**	**Net Present Value (discounted)**
Agglomeration (no employment relocation)	9,578	28,698	67,258	2,436,513	562,744
Output in imperfectly competitive markets	2,794	6,837	16,407	558,474	130,006
Labour supply impact (no residential relocation)	367	1,129	2,901	101,522	23,056
TOTAL	12,740	36,664	86,566	3,096,509	715,806

The wider impacts have a Net Present Value of £715.8m, representing an uplift of 37% on the user benefits contained in the appraisal. Table 7.2 summarises the total direct and wider benefits from the scheme.

This shows that the scheme would produce direct benefits of about £2,006m at 2010 prices (discounted to 2010), with an additional £716m arising from wider benefits. The overall BCR of the scheme, taking the wider benefits into account, is 3.1, indicating that the scheme offers high value for money.

Table 7.2 – M4 Scheme: Direct and Wider Economic Assessment Results

Benefits / Costs	£000s (2010 prices, discounted to 2010)
DIRECT ECONOMIC ASSESSMENT	
Consumer User Benefits	653,530
Business User Benefits	1,240,515
Private Sector Provider Impacts	32,229
Accident Benefits	60,835
Greenhouse Gases	-15,782
Present Value of Benefits (PVB)	**2,005,829**
Present Value of Costs (PVC)	**877,231**
NPV (Direct Economic Assessment)	**1,128,598**
BCR (Direct Economic Assessment)	**2.29**
WIDER IMPACTS ASSESSMENT	
Agglomeration Effects	562,744
Increased Output	130,006
Labour Supply Impact	23,056
Total Wider Impacts	**715,806**
Total PVB	**2,721,634**
Total NPV	**1,844,403**
Adjusted BCR	**3.10**

8 Summary and Conclusions

This report has described the work undertaken to assess the economic impact of the motorway to the south of Newport. The assessment has encompassed both the direct economic impact on transport users, together with the wider effects on the local economy, over a 60-year period.

The economic assessment has been undertaken using the TUBA software in order to take account of the effects of the variable demand modelling. As TUBA does not calculate accident benefits, these have been estimated separately using COBA-LT. The assessments have been carried out over a 60-year period, in accordance with the Department for Transport Guidance (WebTAG).

In addition to a central growth forecast scenario, which has formed the basis for the main assessment, a number of other assumed scenarios have been tested. These relate to future traffic growth assumptions and the removal of Severn Crossing tolls.

The results have indicated that the scheme would provide high value for money, producing an overall benefit to cost ratio (BCR) of 2.29 for central growth. When the predicted wider impacts are taken into account, the adjusted BCR would increase to 3.09 for central growth.

If low growth were to occur, the assessment suggests a BCR of 1.75, whilst, if high growth were to occur, a BCR of 3.3 has been predicted.

The removal of tolls from the Severn Crossing is predicted to increase the BCR to 2.64 for central growth.

This assessment has shown that, for a range of assumed future conditions, the provision of a new section of motorway to the south of Newport is likely to represent high value for money in respect of the investment needed to deliver the scheme.

Appendix A

Economic Assessment Tables - Central Growth

A1 Central Growth

Economic Efficiency of the Transport System (TEE)

Consumers

User Benefits (£000)	**All Modes**		**Road**		**Bus**
Personal Travel	**Total**		Personal		Passengers
Travel Time	622,381		622,381		0
Vehicle Operating Costs	-20,583		-20,583		0
User Charges	0		0		0
During Construction & Maintenance	51,732		51,732		
NET CONSUMER BENEFITS	**653,530**	*(1)*	653,530		0

Business

User Benefits			Personal	Freight	Passengers
Travel Time	1,052,890		669,571	383,319	0
Vehicle Operating Costs	100,505		35,598	64,907	0
User Charges	0		0	0	0
During Construction & Maintenance	87,120		56,645	30,475	
Subtotal	**1,240,515**	*(2)*	761,814	478,701	0

Private Sector Provider Impacts					
Revenue	32,229		31596	633	0
Operating Costs	0		0	0	0
Investment Costs	0		0	0	0
Grant/Subsidy	0		0	0	0
Subtotal	**32,229**	*(3)*	31596	633	0

Other Business Impacts			
Developer contributions	0	*(4)*	0
NET BUSINESS IMPACT	**1,272,744**	*(5) = (2) + (3) + (4)*	

TOTAL (£000)		
Present Value of Transport Economic Efficiency Benefits	**1,926,275**	*(6) = (1) + (5)*

Notes:

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

2) All entries are discounted present values, in 2010 prices and values.

Public Accounts

	All Modes			
Local Government Funding	**Total**		**Road**	**Bus**
Revenue	0		0	0
Operating Costs	0		0	0
Investment Costs	0		0	0
Developer & Other Contributions	0		0	0
Grant/Subsidy Payments	0		0	0
NET IMPACT	**0**	*(7)*	0	0
Central Government Funding				
Revenue	0		0	0
Operating Costs	96,765		96,765	0
Investment Costs	780,466		780,466	0
Developer & Other Contributions	0		0	0
Grant/Subsidy Payments	0		0	0
NET IMPACT	**877,231**	*(8)*	877,231	0
Central Government Funding: Non-Transport				
Indirect Tax Revenues	-34,501		-34,501	
TOTALS				
Broad Transport Budget	**877,231**	*(9) = (7) + (8)*		
Wider Public Finances	**-34,501**			

Notes:

1) Costs appear as positive numbers, while revenues and 'Developer and Other Contributions' appear as negative numbers.

2) All entries are discounted present values in 2010 prices and values.

Analysis of Monetised Costs & Benefits

Greenhouse Gases	-15,782	
Consumer User Benefits	653,530	
Business User Benefits	1,240,515	
Private Sector Provider Impacts	32,229	
Other Business Impacts	0	
Accident Benefits	60,835	
Wider Public Finances(Indirect Taxation Revenues)	34,501	
Present Value of Benefits (PVB)	**2,005,829**	
Local Government Funding	0	
Central Government Funding	877,231	
Present Value of Costs (PVC)	**877,231**	
OVERALL IMPACTS		
Net Present Value (£000)	**1,128,598**	NPV=PVB-PVC
Benefit to Cost Ratio	**2.29**	BCR=PVB/PVC

Notes:

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

Appendix B

Economic Assessment Tables - Low and High Growth

B1 Low Growth

Economic Efficiency of the Transport System (TEE)

Consumers

User Benefits (£000)	**All Modes**		**Road**		**Bus**
Personal Travel	**Total**		Personal		Passengers
Travel Time	471,203		471,203		0
Vehicle Operating Costs	-7,932		-7,932		0
User Charges	0		0		0
During Construction & Maintenance	31,258		31,258		
NET CONSUMER BENEFITS	**494,529**	*(1)*	494,529		0

Business

User Benefits			Personal	Freight	Passengers
Travel Time	796,954		506,387	290,567	0
Vehicle Operating Costs	90,507		30,463	60,044	0
User Charges	0		0	0	0
During Construction & Maintenance	54,164		36,461	17,704	
Subtotal	**941,625**	*(2)*	573,311	368,315	0

Private Sector Provider Impacts					
Revenue	24,727		24314	413	0
Operating Costs	0		0	0	0
Investment Costs	0		0	0	0
Grant/Subsidy	0		0	0	0
Subtotal	**24,727**	*(3)*	24314	413	0

Other Business Impacts			
Developer contributions	0	*(4)*	0
NET BUSINESS IMPACT	**966,352**	*(5) = (2) + (3) + (4)*	

TOTAL (£000)		
Present Value of Transport Economic Efficiency Benefits	**1,460,881**	*(6) = (1) + (5)*

Notes:

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

2) All entries are discounted present values, in 2010 prices and values.

Public Accounts

	All Modes			
Local Government Funding	**Total**		**Road**	**Bus**
Revenue	0		0	0
Operating Costs	0		0	0
Investment Costs	0		0	0
Developer & Other Contributions	0		0	0
Grant/Subsidy Payments	0		0	0
NET IMPACT	**0**	*(7)*	0	0
Central Government Funding				
Revenue	0		0	0
Operating Costs	96,765		96,765	0
Investment Costs	780,466		780,466	0
Developer & Other Contributions	0		0	0
Grant/Subsidy Payments	0		0	0
NET IMPACT	**877,231**	*(8)*	877,231	0
Central Government Funding: Non-Transport				
Indirect Tax Revenues	-19,823		-19,823	
TOTALS				
Broad Transport Budget	**877,231**	*(9) = (7) + (8)*		
Wider Public Finances	**-19,823**			

Notes:

1) Costs appear as positive numbers, while revenues and 'Developer and Other Contributions' appear as negative numbers.

2) All entries are discounted present values in 2010 prices and values.

Analysis of Monetised Costs & Benefits

Greenhouse Gases	-9,125	
Consumer User Benefits	494,529	
Business User Benefits	941,625	
Private Sector Provider Impacts	24,727	
Other Business Impacts	0	
Accident Benefits	64,805	
Wider Public Finances(Indirect Taxation Revenues)	19,823	
Present Value of Benefits (PVB)	**1,536,384**	
Local Government Funding	0	
Central Government Funding	877,231	
Present Value of Costs (PVC)	**877,231**	
OVERALL IMPACTS		
Net Present Value (£000)	**659,153**	NPV=PVB-PVC
Benefit to Cost Ratio	**1.75**	BCR=PVB/PVC

Notes:

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

B2 High Growth

M4 CAN Project, Central Growth, Final TEE

Economic Efficiency of the Transport System (TEE)

Consumers

User Benefits (£000)	All Modes		Road		Bus
Personal Travel	**Total**		Personal		Passengers
Travel Time	921,031		921,031		0
Vehicle Operating Costs	-34,594		-34,594		0
User Charges	0		0		0
During Construction & Maintenance	76,434		76,434		
NET CONSUMER BENEFITS	**962,871**	*(1)*	962,871		0

Business

User Benefits			Personal	Freight	Passengers
Travel Time	1,535,254		982,620	552,634	0
Vehicle Operating Costs	120,675		44,359	76,316	0
User Charges	0		0	0	0
During Construction & Maintenance	126,388		80,557	45,831	
Subtotal	**1,782,317**	*(2)*	1,107,536	674,781	0

Private Sector Provider Impacts					
Revenue	38,246		38048	198	0
Operating Costs	0		0	0	0
Investment Costs	0		0	0	0
Grant/Subsidy	0		0	0	0
Subtotal	**38,246**	*(3)*	38048	198	0

Other Business Impacts			
Developer contributions	0	*(4)*	0
NET BUSINESS IMPACT	**1,820,563**	*(5) = (2) + (3) + (4)*	

TOTAL (£000)		
Present Value of Transport Economic Efficiency Benefits	**2,783,434**	*(6) = (1) + (5)*

Notes:

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

Public Accounts

	All Modes			
Local Government Funding	**Total**		**Road**	**Bus**
Revenue	0		0	0
Operating Costs	0		0	0
Investment Costs	0		0	0
Developer & Other Contributions	0		0	0
Grant/Subsidy Payments	0		0	0
NET IMPACT	**0**	*(7)*	0	0
Central Government Funding				
Revenue	0		0	0
Operating Costs	96,765		96,765	0
Investment Costs	780,466		780,466	0
Developer & Other Contributions	0		0	0
Grant/Subsidy Payments	0		0	0
NET IMPACT	**877,231**	*(8)*	877,231	0
Central Government Funding: Non-Transport				
Indirect Tax Revenues	-49,484		-49,484	
TOTALS				
Broad Transport Budget	**877,231**	*(9) = (7) + (8)*		
Wider Public Finances	**-49,484**			

Notes:

1) Costs appear as positive numbers, while revenues and 'Developer and Other Contributions' appear as negative numbers.

2) All entries are discounted present values in 2010 prices and values.

Analysis of Monetised Costs & Benefits

Greenhouse Gases	-22,400	
Consumer User Benefits	962,871	
Business User Benefits	1,782,317	
Private Sector Provider Impacts	38,246	
Other Business Impacts	0	
Accident Benefits	59,893	
Wider Public Finances(Indirect Taxation Revenues)	49,484	
Present Value of Benefits (PVB)	**2,870,412**	
Local Government Funding	0	
Central Government Funding	877,231	
Present Value of Costs (PVC)	**877,231**	
OVERALL IMPACTS		
Net Present Value (£000)	**1,993,181**	NPV=PVB-PVC
Benefit to Cost Ratio	**3.27**	BCR=PVB/PVC

Notes:

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

Appendix C

Economic Assessment Tables - No Growth Test

C1 No Growth Test

Economic Efficiency of the Transport System (TEE)

Consumers

User Benefits (£000)	**All Modes**		**Road**		**Bus**
Personal Travel	**Total**		Personal		Passengers
Travel Time	280,454		280,454		0
Vehicle Operating Costs	3,672		3,672		0
User Charges	0		0		0
During Construction & Maintenance	19,455		19,455		
NET CONSUMER BENEFITS	**303,581**	*(1)*	303,581		0

Business

User Benefits			Personal	Freight	Passengers
Travel Time	462,071		315,666	146,405	0
Vehicle Operating Costs	81,061		26,824	54,237	0
User Charges	0		0	0	0
During Construction & Maintenance	32,762		21,302	11,460	
Subtotal	**575,894**	*(2)*	363,792	212,102	0

Private Sector Provider Impacts					
Revenue	17,196		16731	465	0
Operating Costs	0		0	0	0
Investment Costs	0		0	0	0
Grant/Subsidy	0		0	0	0
Subtotal	**17,196**	*(3)*	16731	465	0

Other Business Impacts			
Developer contributions	0	*(4)*	0
NET BUSINESS IMPACT	**593,090**	*(5) = (2) + (3) + (4)*	

TOTAL (£000)		
Present Value of Transport Economic Efficiency Benefits	**896,671**	*(6) = (1) + (5)*

Notes:

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

2) All entries are discounted present values, in 2010 prices and values.

Public Accounts

	All Modes			
Local Government Funding	**Total**		**Road**	**Bus**
Revenue	0		0	0
Operating Costs	0		0	0
Investment Costs	0		0	0
Developer & Other Contributions	0		0	0
Grant/Subsidy Payments	0		0	0
NET IMPACT	**0**	*(7)*	0	0
Central Government Funding				
Revenue	0		0	0
Operating Costs	96,765		96,765	0
Investment Costs	780,466		780,466	0
Developer & Other Contributions	0		0	0
Grant/Subsidy Payments	0		0	0
NET IMPACT	**877,231**	*(8)*	877,231	0
Central Government Funding: Non-Transport				
Indirect Tax Revenues	-5,091		-5,091	
TOTALS				
Broad Transport Budget	**877,231**	*(9) = (7) + (8)*		
Wider Public Finances	**-5,091**			

Notes:

1) Costs appear as positive numbers, while revenues and 'Developer and Other Contributions' appear as negative numbers.

2) All entries are discounted present values in 2010 prices and values.

Analysis of Monetised Costs & Benefits

Greenhouse Gases	-2,214	
Consumer User Benefits	303,581	
Business User Benefits	575,894	
Private Sector Provider Impacts	17,196	
Other Business Impacts	0	
Accident Benefits	39,614	
Wider Public Finances(Indirect Taxation Revenues)	5,091	
Present Value of Benefits (PVB)	**939,162**	
Local Government Funding	0	
Central Government Funding	877,231	
Present Value of Costs (PVC)	**877,231**	
OVERALL IMPACTS		
Net Present Value (£000)	**61,931**	NPV=PVB-PVC
Benefit to Cost Ratio	**1.07**	BCR=PVB/PVC

Notes:

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

Appendix D

Economic Assessment Tables - Severn Crossing Tolls Removed

D1 Severn Crossing Tolls Removed

Economic Efficiency of the Transport System (TEE)

Consumers

User Benefits (£000)	**All Modes**		**Road**		**Bus**
Personal Travel	**Total**		Personal		Passengers
Travel Time	749,228		749,228		0
Vehicle Operating Costs	-30,902		-30,902		0
User Charges	0		0		0
During Construction & Maintenance	59,777		59,777		
NET CONSUMER BENEFITS	**778,103**	*(1)*	778,103		0

Business

User Benefits			Personal	Freight	Passengers
Travel Time	1,240,913		782,238	458,675	0
Vehicle Operating Costs	100,438		35,279	65,159	0
User Charges	0		0	0	0
During Construction & Maintenance	100,668		65,454	35,214	
Subtotal	**1,442,019**	*(2)*	882,971	559,048	0
Private Sector Provider Impacts					
Revenue	0		0	0	0
Operating Costs	0		0	0	0
Investment Costs	0		0	0	0
Grant/Subsidy	0		0	0	0
Subtotal	**0**	*(3)*	0	0	0

Other Business Impacts			
Developer contributions	0	*(4)*	0
NET BUSINESS IMPACT	**1,442,019**	*(5) = (2) + (3) + (4)*	

TOTAL (£000)		
Present Value of Transport Economic Efficiency Benefits	**2,220,122**	*(6) = (1) + (5)*

Notes:

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

2) All entries are discounted present values, in 2010 prices and values.

Public Accounts

	All Modes			
Local Government Funding	**Total**		**Road**	**Bus**
Revenue	0		0	0
Operating Costs	0		0	0
Investment Costs	0		0	0
Developer & Other Contributions	0		0	0
Grant/Subsidy Payments	0		0	0
NET IMPACT	**0**	*(7)*	0	0
Central Government Funding				
Revenue	0		0	0
Operating Costs	96,765		96,765	0
Investment Costs	780,466		780,466	0
Developer & Other Contributions	0		0	0
Grant/Subsidy Payments	0		0	0
NET IMPACT	**877,231**	*(8)*	877,231	0
Central Government Funding: Non-Transport				
Indirect Tax Revenues	-47,462		-47,462	
TOTALS				
Broad Transport Budget	**877,231**	*(9) = (7) + (8)*		
Wider Public Finances	**-47,462**			

Notes:

1) Costs appear as positive numbers, while revenues and 'Developer and Other Contributions' appear as negative numbers.

2) All entries are discounted present values in 2010 prices and values.

Analysis of Monetised Costs & Benefits

Greenhouse Gases	-20,126	
Consumer User Benefits	778,103	
Business User Benefits	1,442,019	
Private Sector Provider Impacts	0	
Other Business Impacts	0	
Accident Benefits	70,296	
Wider Public Finances(Indirect Taxation Revenues)	47,462	
Present Value of Benefits (PVB)	**2,317,754**	
Local Government Funding	0	
Central Government Funding	877,231	
Present Value of Costs (PVC)	**877,231**	
OVERALL IMPACTS		
Net Present Value (£000)	**1,440,523**	NPV=PVB-PVC
Benefit to Cost Ratio	**2.64**	BCR=PVB/PVC

Notes:

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