Welsh Government

M4 Corridor around Newport - Motorway to the South of Newport

Business Case 2014

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Executive Summary

Following the Welsh Government's adoption of a Plan for the M4 Corridor around Newport, the decision was taken to modify the 2006 Preferred Route (TR 111) for the motorway to take into account comments received during the draft Plan consultation. The Plan is seeking to improve accessibility for people, Welsh goods and services to international markets by addressing capacity and resilience on the main gateway into South Wales, which is the M4 Corridor. In parallel with the Plan, Welsh Government is taking forward a Cardiff Capital Region Metro. The Metro is seeking to improve accessibility to local employment sites, educational facilities and services within the Region and is complementary to the Plan for the M4 Corridor around Newport.

The provision of a new section of 3-lane motorway to the south of Newport (the scheme) forms the main part of the Welsh Government's Plan[1] to provide additional capacity on the M4 corridor around Newport in South Wales. The scheme comprises the following elements:

- Construction of new sections of dual 3-lane motorway routed to the south of Newport with major tie-in arrangements east of Magor and at Junction 29 (Castleton Interchange) on the existing M4 motorway;
- A new crossing of the River Usk and Newport Docks to the south of Newport;
- An all movements junction on the west bank of the River Usk to improve access to central Newport and Newport Docks;
- An all movements junction at Glan Llyn to provide access to the proposed Llanwern railway station and 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;
- A junction east of Magor to improve connectivity between the M4, M48 and B4245, providing access to Seven Tunnel Junction station/park and ride and to the Caldicot areas;
- Environmental design including landscaping associated with the new section of motorway route; and
- Diversions of utilities necessary to construct the new sections of motorway.

This Business Case for the Motorway to the South of Newport has been prepared in accordance with current best practice[2], adopting HM Treasury's recommended five case model approach, in order to assist the Welsh Government in respect of investment decisions. The strategic case for the proposals is described and the case for change is confirmed. Details of the project's overall balance of benefits and costs are presented in the economic case, as are wider economic benefits. A financial appraisal has been undertaken and the commercial and management arrangements necessary to ensure successful delivery of the scheme are set out.

[1] M4 Corridor around Newport Plan, Welsh Government, July 2014 available at www.M4newport.com.
[2] The Transport Business Case, Department for Transport, April 2011

Strategic Case

The Case for Change – Identified Problems

The main road network in South Wales experiences traffic congestion during peak periods, particularly on the existing M4 motorway and on the approaches to Cardiff, Newport and Swansea. This results in longer and less reliable journey times, which impacts on the ability of individuals to access employment opportunities and discourages investment. Transport congestion also has environmental impacts affecting local communities.

The M4 motorway provides the primary east/west strategic road link that underpins the economy of South Wales. 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.

Existing problems encountered on the motorway between Magor and Castleton, in particular, relate to capacity and resilience. The overriding problem on the motorway in South Wales is one of congestion during peak periods of travel. During these times, traffic is slowed and stop-start conditions are a common occurrence with major and minor incidents exacerbating delays and causing journey time unreliability.

The M4 motorway between Junctions 24 and 28 was opened in 1967 as a dual 2-lane Newport bypass. Whilst the existing motorway was designed and constructed to the geometric standards of the day, the traffic flows experienced today are higher than was planned for. Widening to dual 3-lane standard took place in the early 1980s as a short-term measure to relieve congestion. The widening compromised the geometric design standards further. There are some sections of the motorway around Newport that only have two lanes and considerable lengths of the motorway have discontinuous hard shoulders.

Over the years, high levels of traffic on the motorway around Newport have resulted in problems of congestion, particularly in the morning and evening peak periods. Over 100,000 vehicles per average weekday use sections of the motorway around Newport. There are also problems with network resilience as there is limited capacity on alternative routes when traffic needs to be diverted off the M4 around Newport.

Strategic Importance

Measures to deal with resilience, safety and reliability issues on the M4 corridor around Newport are referred to within the National Transport Plan (March 2010), Prioritised National Transport Plan (December 2011) and Wales Infrastructure Investment Plan (2012).

In July 2013, Edwina Hart, Welsh Government Minister for Economy, Science and Transport delivered a Written Statement on Transport. This stated the intention to consult on a draft plan for the M4 Corridor around Newport that, if implemented, would lead to a motorway being built to the south of Newport.

Improving transport links between South Wales and Bristol, Heathrow Airport, London and the South East of England is a vital priority for wealth creation and investment, as is facilitating movement of goods and people between the

industrialised Midlands/North of England and South Wales. The section of the M4 motorway around Newport is a critical common link on both of these strategic routes. Reliability and efficient operating conditions on this section of motorway are thus of high importance to the economy and to the perception of Wales as a place to do business.

The case for intervention to relieve traffic problems along the M4 around Newport is well established. The strategic importance of the motorway to the economy of South Wales reaffirms the case for investment in the provision of additional capacity on the M4 Corridor around Newport This is a strategic economic priority for Wales.

Economic Case

In economic terms, the main benefits of the motorway to the south of Newport would be:

- Reduced journey times;
- Increased reliability and reduced delays for users;
- Improved network resilience by providing an alternative route east/west around Newport; and
- Improved road safety.

A traffic model has been used to simulate traffic conditions on the road network around Newport. This traffic model was originally based on traffic and network data collected in 2005 and 2006 and was subject to a present year validation in 2012, based on traffic surveys that were conducted during Spring 2012. Further model development has been undertaken in 2014 to ensure that the model is compliant with current guidance and best practice. The traffic model has been used to prepare future year traffic forecasts for low, central and high growth scenarios. The scheme year of opening for the motorway to the south of Newport has been assumed to be 2022 and the scheme's design year has been assumed to be 2037 in accordance with WebTAG[3] and DMRB[4] guidance. Variable demand modelling has been deployed using DIADEM[5] in accordance with WebTAG guidance. This has enabled future traffic conditions to be analysed with and without the new section of motorway.

A detailed estimate has been prepared of the likely investment costs of delivering the scheme. This has included allowance for risk and Optimism Bias. Using the transport benefits of the scheme as derived from the traffic modelling and the estimated investment costs as inputs, an economic assessment has been undertaken using TUBA[6] in accordance with WebTAG.

The outcomes of the economic assessment of the Transport Economic Efficiency for the scheme assuming central traffic growth are as follows:

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[3] Transport Analysis Guidance – WebTAG, Department for Transport (web-based)
[4] Design Manual for Roads and Bridges, Volume 12, Department for Transport
[5] DIADEM (Dynamic Integrated Assignment Demand Modelling) – Department for Transport see http://www.dft.gov.uk/topics/appraisal-evaluation/tools/diadem
[6] Department for Transport - TUBA Guidance – Version 1.9.4, Atkins, June 2014

- ***Net Present Value (NPV)[7] of the motorway to the south of Newport is estimated to be +£1.1bn; and***
- ***Benefit to Cost Ratio (BCR)[8] for the investment in the motorway to the south of Newport is forecast to be 2.29.***

The economic assessment has indicated that the project is likely to result in monetised economic benefits of more than double the investment made, such that the net present value of the scheme will be likely to exceed £1billion even before the potential wider economic benefits of the scheme are considered.

As part of the economic assessment, consideration has been given to the wider economic impacts which might result in South Wales and the South West of England. The new section of motorway to the south of Newport will improve connectivity along the east/west corridor, reducing barriers to trade and commuting. The scheme will stimulate "agglomeration effects" that result from improved accessibility. Access to London and the South East will also be improved and will thus strengthen economic opportunities for the region and encourage inward investment.

Department for Transport (DfT) guidance provides a framework for estimating wider impacts based on changes in transport costs. The Wider Impacts framework is based on the following elements:

- Agglomeration economies – the productivity benefits for firms increasing the effective concentration of economic activity;
- Increased output in imperfectly competitive markets – welfare gains to consumers of increased turnover impacts of lower transport costs; and
- Increased labour supply – lower commuting costs encouraging increased labour market participation and changing patterns of employment.

The existing M4 currently performs twin roles in terms of support to the regional/national economy, namely:

- Providing inter-regional linkages and linkages between Wales and the rest of the UK; and
- Facilitating movement within the city-region, particularly focussed on Cardiff and Newport.

With regard to the former of these, the motorway south of Newport will provide more reliable and efficient linkages between South East Wales and England. The motorway south of Newport will improve travel times between Cardiff, Newport and Bristol and therefore will act to strengthen the 'Severnside agglomeration'.

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[7] The Net Present Value (NPV) is calculated as the sum of project benefits minus the sum of project costs. Future benefits and costs are discounted (converted to 'present values') so that they can be directly compared. The discount rate reflects the fact that generally, people prefer to receive goods and services now rather than later.

[8] The Benefit Cost Ratio (BCR) is calculated as the ratio of discounted benefits to discounted costs. A BCR greater than 1 indicates that benefits outweigh costs.

Provision of the motorway south of Newport will also free up capacity on the existing M4 around Newport. This will improve the functioning of the city-region and hence improve employment opportunities within South East Wales. Improved operating conditions on the existing M4 around Newport, in conjunction with the Cardiff Capital Region Metro, will open up potential to improve the local transport networks within the city of Newport, and will generally increase local accessibility.

Initial assessments of the wider impacts of the motorway south of Newport suggest that the consideration of these economic effects might add up to some 37% to the direct benefits of reduced user costs. By improving accessibility and through the provision of new junctions, the motorway south of Newport would also be expected to result in new investment and employment, bringing additional benefits to the South Wales economy. Therefore, when Wider Impacts are included in the appraisal, the total Net Present Value of the scheme rises from £1.1bn to £1.8bn and the BCR for the scheme rises to 3.1.

Overall, the economic appraisal has shown that the provision of a new section of motorway to the south of Newport represents high value for money as defined in the Department for Transport's guidance on economic case as part of the Transport Business Case.[9]

The motorway south of Newport has the potential for significant environmental effects which focus on the Preferred Route corridor for the motorway to the south of Newport and arise from the construction of the road and its subsequent use. The main impacts are summarised in the table below:

Environmental Impacts of the Motorway to the South of Newport

Topic	Likely Impact
Ecology and Nature Conservation	The Preferred Route will cross 8.5km of Sites of Special Scientific Interest (SSSI). The primary interest of the SSSI stems from the flora and fauna of the reen network. Impacts on the SSSI and associated reens habitat will be mitigated through extensive construction environmental mitigation, a strategy of replacement reens and potentially replacement habitat for the loss of designated SSSI. The route also crosses the River Usk SAC (Special Area of Conservation), for which further assessment under the Habitats Regulations (2010) will be required. The scheme will require sensitive design and the inclusion of mitigation measures to avoid effects on designated sites including European Sites.
Geology, Hydrogeology and Soils	No designated geological sites are present along the Preferred Route corridor. The potential for pollution incidents will be managed through the implementation of a Construction Code of Practice. Some areas of contamination along the path of the road have been identified requiring removal or stabilisation on site.
Materials	Cutting will be required at Castleton to accommodate the new interchange, and to a lesser extent at Magor. Re-use of materials within the scheme will seek to minimise the import and export of materials, including off-site transportation of landfill waste. The Preferred Route corridor aims to minimise impacts associated with crossing the Docks Way Landfill site.

[9] See Value for Money Guidance, Economic Case, Transport Business Case, DfT, 27 April 2011

Environmental Impacts of the Motorway to the South of Newport

Topic	Likely Impact
Landscape	Large landscape impacts are expected as a result of the construction of the scheme across sensitive landscape character areas. A large bridge crossing structure is proposed across the River Usk, which would have impacts on central Newport, including the Transporter Bridge. The bridge design and materials, and the design and planting of embankments will be carefully considered. A new bridge could be seen as a positive addition to the Newport townscape and current suite of bridges in the city. Replacement of existing planting around Castleton and Magor will be essential for landscaping. Additional planting around residential areas would help mitigate effects.
Cultural Heritage	The Preferred Route corridor passes through parts of the Gwent Levels registered historic landscape. The Grade II listed Magor Vicarage would be demolished as a result of the scheme. One Scheduled Monument lies close to the preferred route corridor, and several others within 500m of the scheme. There is a potential for encountering as yet undiscovered archaeological deposits, particularly across the Gwent Levels.
Community and Private Assets	Based on the footprint of the Preferred Route corridor the scheme will result in the loss of approximately 500 hectares of Grade 2 and Grade 3 agricultural land, and require the demolition of approximately 40 residential/commercial/community buildings. In addition, a number of businesses in the Docks area, and agricultural businesses are likely to be impacted. This does not take into account individual circumstances, or changes that may arise as the detailed design develops.
Road Drainage and the Water Environment	The Preferred Route corridor will require a number of watercourse crossings and culverts constructed to maintain hydrological connectivity. The existing reen network will be maintained and enhanced through a system of culverting, diversions and replacement reens. Detailed design measures will include Sustainable Urban Drainage (SUDS) features. Water Treatment Areas, including reed-bed filtration will be incorporated into the scheme to manage quality and quantity of surface water discharge.
Air Quality	Reductions in pollution levels will be experienced in areas alongside the existing M4 in Newport. The road will give rise to deterioration in air quality near the preferred route corridor, affecting approximately 187 properties. Improvements in air quality are expected along the existing M4, which benefits over 7900 properties. Critical loads for nitrogen deposition on the SSSI are not expected to be exceeded.
Noise and vibration	The Gwent Levels have relatively low ambient noise levels, and therefore introducing a new source of noise is likely to increase noise levels to parts of the Gwent Levels by 10bB(A) or more at residential receptors close to the preferred route corridor. A greater number of residential properties will benefit from improvements in background noise levels of up to 5dB(A). Most properties at Magor and Castleton are expected to experience a decrease in noise, arising from the construction of the scheme to low noise motorway standards in comparison with the existing M4, upgrading of the existing carriageway and topographical screening.
Effects on all Travellers	Some disruption to pedestrians, cyclists and equestrians is expected during construction but will be minimised in the longer term through the provision of new improved route alternatives. Driver views and stress are likely to be improved, in accordance with the objectives of the scheme.

Commercial Case

Effective competition is essential if value for money is to be delivered from the procurement process. Therefore, it will be important for the Welsh Government to clearly demonstrate its support and commitment to the motorway to the south of Newport in order to generate confidence to secure the interest of contractors.

The commercial case assumes an Early Contractor Involvement (ECI) delivery model. ECI is proven to be an effective approach to delivery of major highway schemes. Early involvement of the contractor adds value for the Welsh Government by providing greater programme and cost certainty, designing in contractor's construction methodology, driving down cost and reducing the level of risk at the commencement of the construction contract.

A key factor will be the level of certainty that the project will proceed through to a successful contractual close. Dialogue between the UK and Welsh Governments has identified preferential borrowing capabilities for major infrastructure projects.

Financial Case

The high level cost estimate for the new section of motorway is around £1bn. This estimate includes allowances for optimism in bias and for risk. Work will continue to seek opportunities to reduce costs through value engineering and competitive tendering. As well as Welsh Government budgets, it is planned to utilise UK borrowing powers afforded by recent initiatives, including discussions between the Welsh Government and HM Treasury/Department for Transport, as well as the work of the Silk Commission[10], which has created future potential funding opportunities for Welsh Government infrastructure projects.

Management Case

Delivery of the motorway to the south of Newport will be managed by Welsh Government and will be subject to OGC gateway processes. There is a defined project structure and governance. Welsh Government will be assisted by legal, financial, technical and contract specialists.

Project management and governance arrangements are outlined as part of the management case, including remits for a project board, core project team and advisors.

The key statutory and regulatory processes and the likely activities involved in obtaining the necessary approvals to implement the project are also set out as part of the management case.

The Welsh Government, as promoter of this project, is fully cognizant with all statutory and regulatory processes and associated risks. The Welsh Government has the necessary resources, experience and expertise to deliver this project.

[10] The 'Silk' Commission on Devolution in Wales, which is reviewing the case for the devolution of fiscal powers and reviewing the powers of the National Assembly for Wales, due to report in Spring 2014.

Business Case Conclusion

The strategic importance of the M4 motorway to the economy of South Wales is well established. However, there are widely perceived operational difficulties on the motorway around Newport, which increase the costs of doing business in Wales and act as a barrier to the movement of people and goods within South Wales and between Wales and other parts of the UK and beyond.

The Plan for the M4 Corridor around Newport is seeking to improve accessibility for people, Welsh goods and services to international markets by addressing capacity and network resilience. The motorway to the south of Newport will provide a more direct route, relieving congestion by separating strategic and local traffic, reducing journey times and improving reliability.

There is a strong economic case for the scheme which will provide high value for money even before wider economic impacts are taken into account. The motorway to the south of Newport has significant environmental effects, which focus on the Preferred Route corridor and arise from the construction of the road and its subsequent use.

A possible funding mechanism comprising a combination of borrowing and capital budget has been outlined for the motorway to the south of Newport. Given political will, there are no insurmountable commercial obstacles and there are clear management processes in place to ensure the successful delivery of this major infrastructure project.

1 Introduction

Following the Welsh Government's adoption of a Plan for the M4 Corridor around Newport, the decision was taken to modify the 2006 Preferred Route (TR 111) for the motorway to take into account comments received during the draft Plan consultation. The Plan is seeking to improve accessibility for people, Welsh goods and services to international markets by addressing capacity and resilience on the main gateway into South Wales, which is the M4 Corridor. In parallel with the Plan, Welsh Government is taking forward a Cardiff Capital Region Metro. The Metro is seeking to improve accessibility to local employment sites, educational facilities and services within the Region and is complementary to the Plan for the M4 Corridor around Newport.

The provision of a new section of 3-lane motorway to the south of Newport (the Scheme) forms the main part of the Welsh Government's Plan to provide additional capacity on the M4 Corridor around Newport. The proposed route of the new section of motorway is illustrated in Figure 1.1.

The scheme that is the subject of this business case comprises the following elements:

Construction of new sections of dual 3-lane motorway routed to the south of Newport with major tie-in arrangements east of Magor and at Junction 29 (Castleton Interchange) on the existing M4 motorway;

- A new crossing of the River Usk and Newport Docks to the south of Newport;
- An all movements junction on the west bank of the River Usk to improve access to central Newport and Newport Docks;
- An all movements junction at Glan Llyn to provide access to the proposed Llanwern railway station and 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;
- A junction east of Magor to improve connectivity between the M4, M48 and B4245, providing access to Seven Tunnel Junction station/park and ride and to the Caldicot development areas;
- Environmental design including landscaping associated with the new section of motorway route; and
- Diversions of utilities necessary to construct the new sections of motorway.

Up until 2009, the New M4 Project had been a long-standing proposal for the construction of a new dual 3-lane motorway between Magor (Junction 23) and Castleton (Junction 29) of the existing M4. Options had been appraised in terms of economic, environmental and social benefits and disbenefits, including consideration of tolling.

In July 2009, a written statement by the then Deputy First Minister Ieuan Wyn Jones, announced that the New M4 was not affordable. The statement, however,

accepted "the need to urgently address safety and capacity issues on the existing route" through the introduction of "a range of measures".

The M4 Corridor Enhancement Measures (CEM) Programme was thus initiated at that time by the Welsh Government and this aimed to create an affordable package of measures to deal with resilience, safety and reliability issues within the M4 corridor between Magor and Castleton. As part of the M4 CEM Programme, a comprehensive engagement process was launched in September 2010 culminating in a public consultation held between March and July 2012. The consultation resulted in general support for the phased provision of an additional high quality road to the south of Newport, complemented by additional measures to address travel related problems within the M4 Corridor. By phasing the delivery of the new road, investment could be allocated to align with available funding. However, this was not seen to be a cost effective, value for money solution as the majority of the benefits would only accrue upon completion of the full extent of the new road.

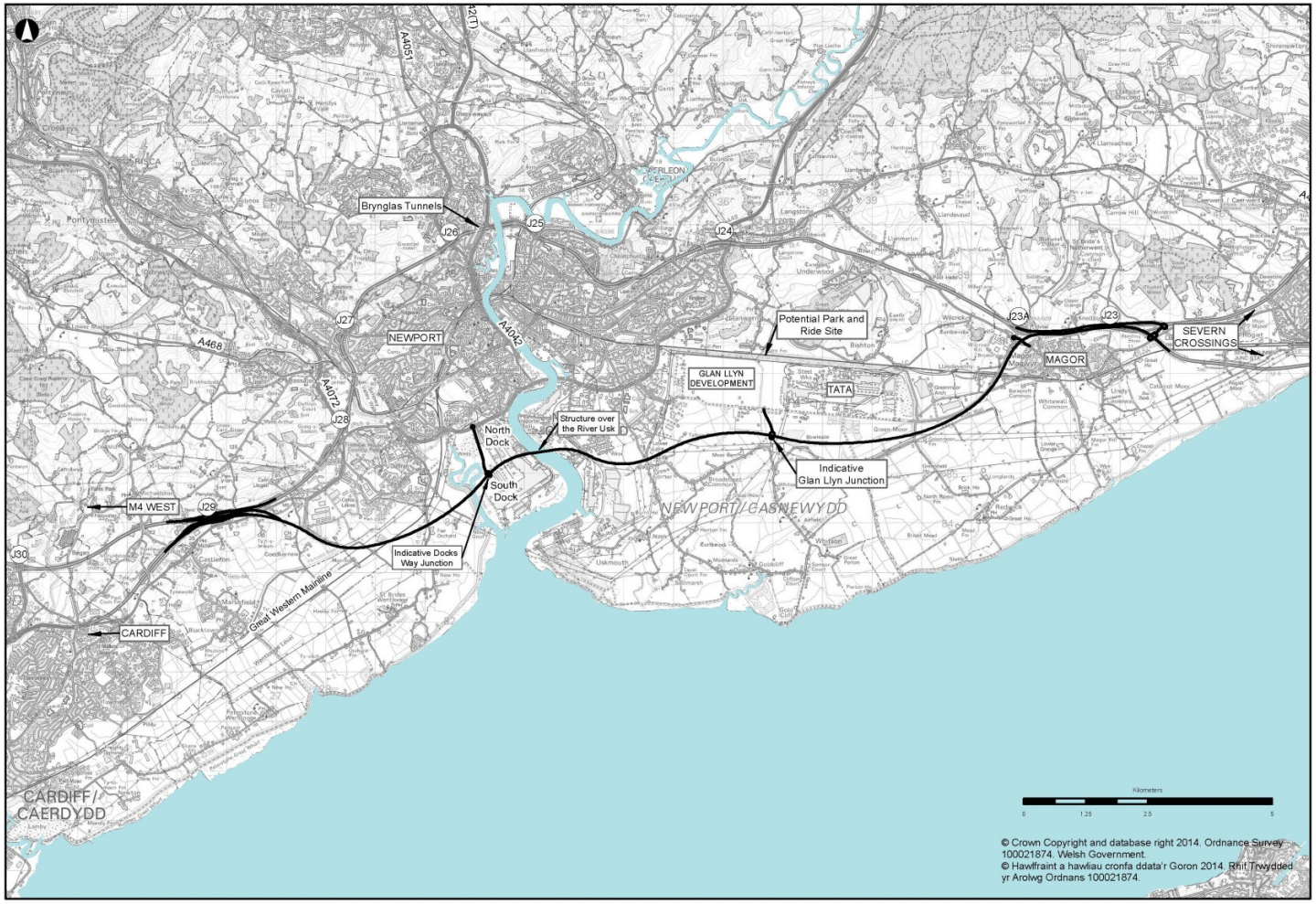
Since 2012, discussions between the Welsh Government and HM Treasury/ Department for Transport have resulted in potential funding opportunities for Welsh Government infrastructure projects. As a consequence, the decision was taken by the Welsh Government to further reconsider solutions to resolve transport related problems on the M4 Corridor around Newport.

A draft Plan for the M4 Corridor around Newport has subsequently been developed. This was subject to public consultation between September and December 2013. The emerging M4 Corridor around Newport Plan is compatible with, and will complement, the Cardiff Capital Region Metro and the electrification of the rail network in South Wales. In recognising the range of the transport planning objectives for the M4 Corridor around Newport, the Welsh Government is expected to adopt the Plan for the M4 Corridor around Newport, which combines both highway infrastructure and complementary measures.

In order to assist decision making with regard to investment in and delivery of the Plan for the M4 Corridor around Newport, this Business Case 2014 has been prepared for the new section of motorway to the south of Newport.

This Business Case 2014 has followed Treasury's advice on evidence-based decision making as set out in the Green Book. The business case has thus been developed following Treasury's best practice five case model approach.

Figure 1.1: Proposed Route of the Motorway to the South of Newport



The business case aims to demonstrate that the project:

- is supported by a robust **case for change** that fits with wider Welsh Government objectives – the 'strategic case';
- demonstrates **value for money** – the 'economic case;
- is **commercially viable** – the 'commercial case';
- is **financially affordable** – the 'financial case'; and
- is **achievable** – the 'management case'.

The investigations and analyses undertaken in order to prepare this business case have followed guidance provided by WebTAG[11], WelTAG[12] and the Design Manual for Roads and Bridges (DMRB)[13]. Such guidance has provided advice on:

- setting objectives and identifying problems;
- developing potential solutions;
- traffic modelling and appraisal of alternative solutions; and
- appraisal to meet with Welsh Government's requirements.

The investigation and analyses undertaken and the development of the business case are described in the remaining sections of this report.

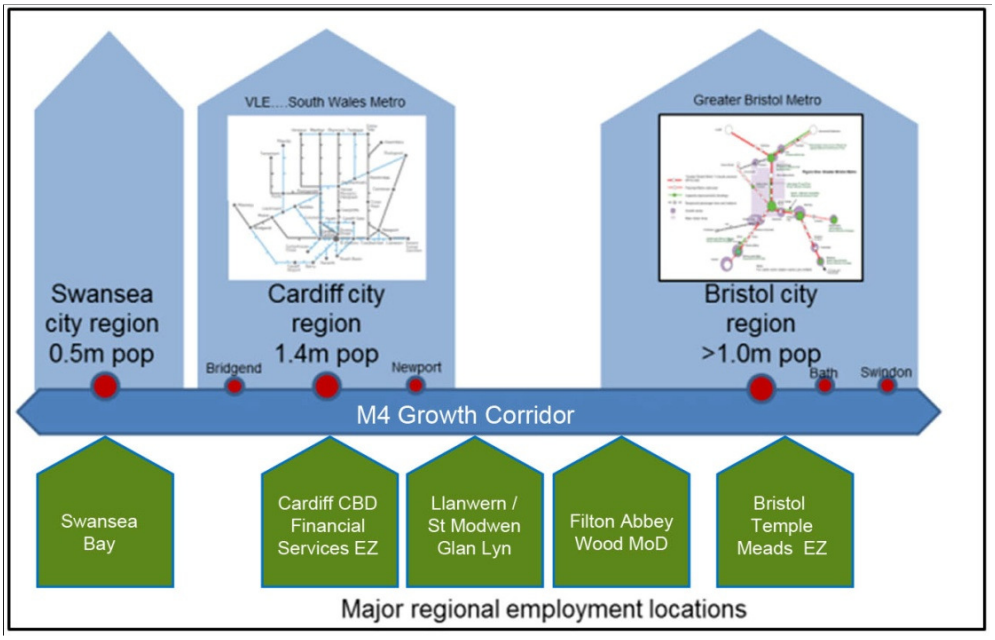
[11] Transport Analysis Guidance – WebTAG, Department for Transport (web-based)
[12] Welsh Transport Planning and Appraisal Guidance, WelTAG, The Welsh Assembly Government, June 2008
[13] Design Manual for Roads and Bridges, Volume 12, Department for Transport

2 The Wider Strategic Contribution of the M4 Transport Corridor in South Wales

2.1 Context

The main road network in South Wales experiences traffic congestion during peak periods, particularly on the M4 motorway and on the approaches to Swansea, Cardiff and Newport. This results in unreliable journey times, which impacts on the ability of individuals to take up job opportunities and discourages investment from high value businesses. Transport congestion also has environmental impacts affecting local communities.

Provision of efficient transport links is crucial for access to jobs in South Wales, the efficient distribution of freight and ensuring that barriers to future development, regeneration and growth are avoided. Given the build up of centres for employment and services along the coastal areas of South Wales served by the M4 corridor, a key driver for the economy is connectivity between these centres and, by extension, access to South West Wales as well as links into Severnside and Greater Bristol. Throughout discussions of the benefits of increased transport capacity along the M4 corridor in South Wales, the need for improved connections to London and the South East of England, including key hubs and international gateways such as Heathrow Airport, has been acknowledged. Facilitating movements of goods and people between the industrialised Midlands/North of England and South Wales and it ports is important to ensure the continuing well-being of the economy of Wales. The need to provide good access westwards to the ports of Milford Haven and Fishguard and hence Ireland is thus also important to the local economy.



Clearly, the M4 motorway plays a vital role in providing the east/west strategic road link that underpins the economy of South Wales and facilitates the mass movement of people and goods to stimulate economic and social activity within the region. Any disruption to the smooth operation of the motorway in South Wales has a negative impact upon economic development. This has been borne out by surveys of businesses in the region, as well as by support for the scheme by the Confederation of British Industry (CBI) and the Institution of Civil Engineers (ICE Wales Cymru).

The M4 motorway also has a role in supporting the functions of the nascent city-region in South East Wales. This centres around Cardiff and Newport and radiates out to the Valleys, creating a catchment population of some 1.4 million. The use of the M4 around Newport and Cardiff is an essential part of day to day activity within the city-region.

Improving transport links between South Wales and Bristol, Heathrow Airport, London and the South East of England is a vital priority for wealth creation and investment, as is facilitating movement of goods and people between the industrialised Midlands/North of England and South Wales. The section of the M4 motorway around Newport is a critical common link on both of these strategic routes. Reliability and efficient operating conditions on this section of motorway are thus of importance to the economy and to the perception of Wales as a place to do business.

2.2 Strategic Policy Drivers

Investing in sustainable transport infrastructure to support economic growth is a priority of both the Welsh Government and the Department for Transport:

Welsh Government ***(Economic Renewal Strategy)***

"Investing in high quality sustainable infrastructure - Wales needs modern, sustainable infrastructure to underpin economic growth and the wellbeing of our people. Our people, businesses and communities need to be well-connected within and beyond Wales and have access to the right facilities and services where they live and work."

Welsh Government ***(Economic Renewal Programme)***

"The absence of a major conurbation (by European standards) is associated with wages and productivity levels that are lower than would otherwise be the case (the "agglomeration effect"); however, there is a key opportunity in the medium term to build on the projected rapid population growth of Cardiff, our capital city."

The Welsh economy has lagged behind other regions of the UK in recent years. The linear dispersal of centres of economic activity along the coast of South Wales is such that the economic and social well-being of South Wales is heavily dependent on efficient transport links between local, regional and national centres.

The Welsh Government's National Transport Plan (NTP) reiterates the strategic importance of the east-west transport corridor in South Wales:

Welsh Government ***(National Transport Plan)***

"East-west travel in south Wales by rail, road and public transport is dominated by movements in and between the key settlements of Cardiff, Swansea and Newport and their surrounding areas."

Swansea, Cardiff and Newport are all important European cities in their own right, sitting on a designated Trans European Network (TEN-T) route. This route provides a strategic link to the important ports of Milford Haven and Fishguard in West Wales, the deep water port facilities at Port Talbot, as well as to the ports of Cardiff, Newport and Avonmouth.

Welsh Government ***(Written Statement – Transport)***

"Transport has a critical role to play in improving Wales' economic competitiveness and provides enhanced access to jobs and services…Transport (seen) as a key enabler of this Government's priorities…a motorway being built to the South of Newport recognised as essential to support the Welsh economy."

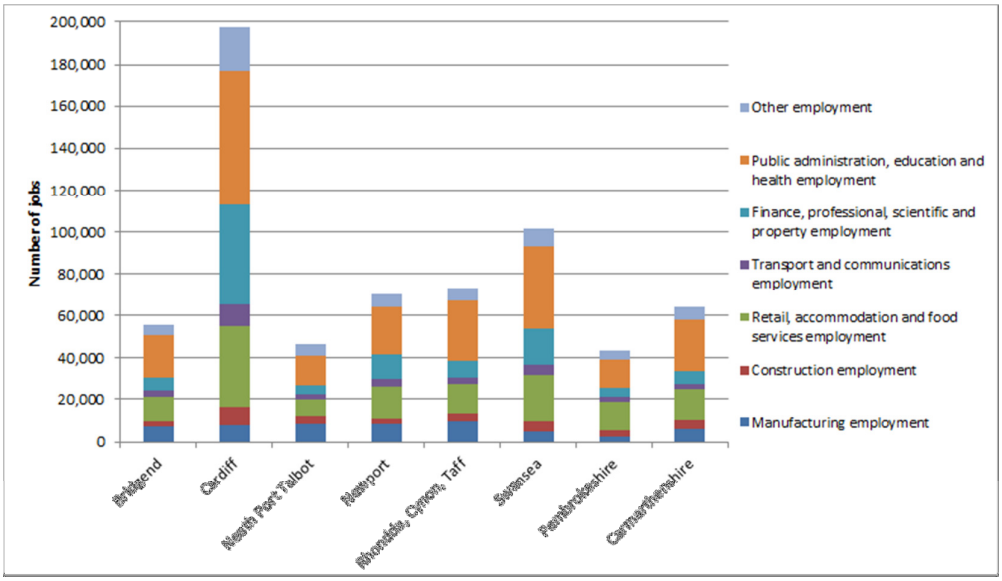
In July 2013, Edwina Hart, Welsh Government Minister for Economy, Science and Transport delivered a Written Statement on Transport. This stated the intention to consult on a draft plan for the M4 Corridor around Newport that, if implemented, would lead to a motorway being built to the south of Newport.

2.3 Supporting Economic Growth in South Wales

Provision of sufficient capacity within the transport network in South Wales is crucial for access to jobs, enabling the efficient distribution of freight and ensuring that barriers to future development, regeneration and growth are avoided. A key driver for the economy of South Wales is connectivity between Swansea, Cardiff and Newport and, by extension, accessibility for South West Wales as well as links into Severnside and Greater Bristol.

The economy of South Wales is dominated by the major economic activity centres of Cardiff, Swansea and Newport with the added significance of the deep water port at Port Talbot and the steelworks at Margam and Llanwern. The economy, and therefore the drivers for demand and provision of transport services, is polycentric. The importance of Cardiff, Swansea, Newport, the Valleys and West Wales as employment centres and the percentage of jobs by sector are shown in the Figure 2.1.

Figure 2.1: Percentage of Jobs by Sector in South Wales in 2012



Source: ONS business register and employment survey analysis

In addition to growth in employment opportunities in South Wales, a number of strategically important sites in England are located along the M4 corridor for which the travel to work area spans the Severn Crossings.

Severn Crossing Tolls

The Severn Bridges Act 1992 established the conditions under which the current concession agreement will end, and both bridges crossing the River Severn will revert to public ownership. The Act notes that the concession agreement ends either at:

- The end of the period of 30 years beginning with the appointed day; or
- Where it appears to the Secretary of State that the revenue requirement has been met on a day, the right of the concessionaire to exercise the power to levy tolls shall end at such time after that day as the Secretary of State may determine.

On 6 March 1992 the Secretary of State signed the Order setting the start date of the concession as 26 April 1992.

It is therefore the case that, 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.

Arup analysis[14] suggests that removing the tolls and eliminating any toll associated collection delay could result in an estimated increase in traffic demand across the crossings of some 12%. This is equivalent to around 11,000 vehicles per day. This equates to an estimated increase in traffic demand of up to 9% on some sections of the M4 around Newport.

[14] Arup, The Impact of the Severn Tolls on the Welsh Economy Report (2012).

2.4 Economic Activity across the Severn Estuary

Recent developments, both commercial and governmental, are reinforcing the economic links between centres of activity in the wider South Wales/Severnside region, which may be considered to extend from Swansea to Swindon. These developments are contributing to a need for greater connectivity as people increasingly seek access to employment across a wider geographical area. Currently, more than 80,000 vehicles, including some 10,000 heavy goods vehicles, cross the Severn Estuary on a daily basis. This gives an indication of the level of economic interdependence between England and Wales at this regional level. Pivotal to this connectivity is the transport infrastructure provided along the M4 Corridor between Bristol and Swansea.

2.5 Freight

As the main gateway into South Wales and part of the strategic Trans-European Transport Network (TEN-T), the motorway around Newport plays a critical role in freight operations. In the Ministerial Statement on Freight on 18 July 2013, the Minister for Economy, Science and Transport recognised that sustainable freight networks are a major factor in all successful, modern economies, and that it is important for them to be integrated fully in developing the future transport planning framework for Wales to help businesses create jobs and sustainable economic growth. Following this statement, the Wales Freight Task and Finish Group was convened to advise the Minister on key freight issues, with its focus being on the key drivers of demand, any capacity issues and the appropriate interventions needed to support the development of Enterprise Zones, City Regions and commercial and business centres in Wales more widely. One of the twenty four recommendations made by the Group was that "***The Welsh Government continues to proceed as quickly as possible and in accordance with due process in order to provide a motorway to the South of Newport to address transport related problems on the M4".***

3 Strategic Case – the Case for Change

3.1 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 to England and mainland Europe to the east. It is a key east-west route being the main gateway into South Wales and the section of the motorway around Newport is one of the most heavily used roads in Wales.

The M4 provides a facility for transporting goods, for linking people to jobs and employment sites as well as serving the Wales tourism industry. The M4 is critical to the local South Wales economy. Cardiff and Newport have ambitious regeneration strategies and Monmouthshire is developing areas around Junction 23a of the M4. Traffic congestion on the M4 could hamper these plans and impact negatively on regional economic development.

For many years, concerns have been raised regarding the potential for delays on the motorway and trunk road network in South Wales. In March 1989, the Secretary of State for Wales commissioned the South Wales Area Traffic Survey (SWATS) to review traffic patterns over part of the trunk road network in South Wales in order to identify problem areas and propose possible solutions. The SWATS Report (1990) identified the need for substantial improvement to the M4 to address a growing capacity issue on the motorway, in particular the section between Magor and Castleton. As a consequence, a proposal for a new dual 3-lane motorway (to be known as the M4 Relief Road) was included in the Welsh Trunk Road Forward Programme in 1991.

This proposal was the subject of public consultation during 1993 and 1994, following which the Preferred Route for the M4 Relief Road was announced in 1995. The Preferred Route was subsequently modified in 1997 to allow for development of the LG site at Duffryn.

As well as pursuing the new road proposal as a possible solution to predicted traffic problems on the M4, a more broadly-based study of solutions was undertaken, known as the Common Appraisal Framework Study (CAF). This study was undertaken between 1997 and 1999, and sought to assess the advantages and disadvantages of alternative solutions to the congestion problem against acceptable environmental, financial, economic and safety criteria.

The fundamental requirements used for the evaluation were whether:

- The solution could provide relief to the M4 around Newport; and
- The costs were commensurate with the likely benefits of the scheme.

The CAF study concluded that there were two main ways in which relief could be provided from the effects of increasing traffic on the M4 around Newport whilst minimising any disbenefits:

- The construction of the M4 Relief Road; and

- A hybrid strategy which combined some car restraint (ie tolling the existing M4) with significantly improved public transport.

The National Assembly for Wales Local Government and Environment (LGE) Committee considered the findings of the CAF study in February 2000. Given the LGE committee did not support the introduction of tolls, a second Hybrid scenario was developed (Hybrid 2). Hybrid 2 provided additional capacity at the Brynglas Tunnels (and associated widening of the motorway to the west of the Tunnels) replacing the tolling measure in the previous Hybrid scenario (Hybrid 1). The assessment of this Hybrid 2 scenario showed that it would provide a lesser degree of congestion relief compared to the M4 Relief Road.

In considering the overall conclusions of the CAF Study, the then Transport Directorate found that none of the alternatives investigated would relieve the M4 around Newport to the same degree as the M4 Relief Road. The conclusion was to:

- Discard Hybrid 2;
- Discard widening of the existing M4 around Newport as a means of increasing capacity; and
- Accept that the M4 Relief Road would be the appropriate scheme to implement if increased capacity is needed.

In 2002, the proposal for an M4 Relief Road was put "On Hold" in the Trunk Road Forward Programme, pending the conclusion of the Wales Spatial Plan.

In November 2004, "People, Places, Futures – The Wales Spatial Plan" was published. It included the intention to:

"*…increase the transport capacity of the corridors and gateways to Europe and beyond. This will include capacity enhancements on the M4 and A465 corridors through the Trunk Road Forward Programme as well as development of routes from Cardiff International Airport*".

In December 2004, the Minister for Economic Development and Transport reported on the outcome of his review of transport programmes, which he had undertaken to ensure a good strategic fit with 'Wales: A Better Country' and the Wales Spatial Plan. One of the conclusions of the review was that additional capacity was required on the M4 motorway in South East Wales, in order to reduce congestion, improve resilience and remove an obstacle to greater prosperity along the whole corridor through to Swansea and West Wales.

In addition to widening the motorway north of Cardiff, the Minister announced proposals to develop a New M4 south of Newport between Magor and Castleton. At the same time, it was announced that the existing route could include priority measures for public transport and multiple occupancy vehicles. This meant that the M4 Relief Road scheme was re-named as the New M4 Project and advanced from the 'On Hold' category into Phase 2 of the Trunk Road Forward Programme.

Following the Ministerial Review in November 2004, the New M4 Project was the subject of a thorough re-examination in order to ensure fit with current policies and to take account of physical and legislative changes. Three key activities were undertaken:

- A re-examination of route corridors considering, in particular, the implications and consequences of legislative changes and physical developments within the original project study area;
- An holistic review of the previously published Preferred Route (published 1997); and
- A review of the junction strategy.

The conclusion of these studies confirmed the route to the south of Newport as the optimal solution. Following the Preferred Route and Junction Strategy Review, a TR 111[15] (April 2006) was published to protect a revised route corridor.

When the National Transport Plan was published in 2010, the New M4 was considered to be unaffordable and the M4 Corridor Enhancement Measures (M4 CEM) Programme had been put in place to urgently address safety and capacity issues on the existing route through the introduction of a range of measures.

As part of the M4 CEM Programme, a comprehensive engagement process was launched in September 2010 culminating in a Consultation, open to all, held between March and July 2012. During the engagement process, the Welsh Government and its project team conducted dialogue and deliberative sessions both with internal and external specialists and expert stakeholders, encompassing a diverse range of views and interests relating to transport in South East Wales, as well as with people likely to be interested in and affected by any transport measures potentially adopted and implemented by Welsh Government.

The consultation resulted in public support for the provision of an additional high quality road to the south of Newport[16], supported by additional measures to address travel related problems within the M4 Corridor. These were referred to as Common Measures and comprised a mix of network improvements, network management, demand management, alternative modes and smarter sustainable choices. The M4 CEM WelTAG Stage 1 (Strategy Level) Appraisal Report[17] concluded that the following measures were worthy of further consideration:

- A new dual carriageway route to the south of Newport;
- Public transport enhancement; and
- Common measures.

[15] Once the preferred route is announced, Welsh Government serves a *statutory notice* (TR 111) on the local planning authorities requiring the line (land within 67m from the centre line of the proposed road) to be protected from development. The statutory blight rules come into play. In 2006, this was enacted under Article 15 of the Town & Country Planning General Development Order 1995. Currently, this would be enacted under Article 19 of the Town & Country Planning (Development Management Procedure) (Wales) Order 2012.
[16] Welsh Government, M4 Corridor Enhancement Measures (M4 CEM), Participation Report, Arup, August 2013
[17] Welsh Government, M4 Corridor Enhancement Measures (M4 CEM), WelTAG Appraisal Report Stage 1 (Strategy Level), Arup, March 2013

3.2 M4 Corridor around Newport draft Plan

Initiatives, including discussions between the Welsh Government and HM Treasury/Department for Transport, as well as the work of the Silk Commission[18], have created potential funding opportunities for Welsh Government infrastructure projects. As a consequence, the decision was taken by the Welsh Government to further reconsider solutions to resolve transport related problems on the M4 around Newport. An M4 Corridor around Newport WelTAG Stage 1 (Strategy Level) Appraisal[19] was undertaken. This concluded that a new section of 3-lane motorway to the south of Newport following a protected (TR111) route, in addition to complementary measures, would best achieve the goals and address the problems of the M4 Corridor around Newport. Following this appraisal, a draft Plan has been developed for the M4 Corridor around Newport. This draft Plan was subject to public consultation between September and December 2013.

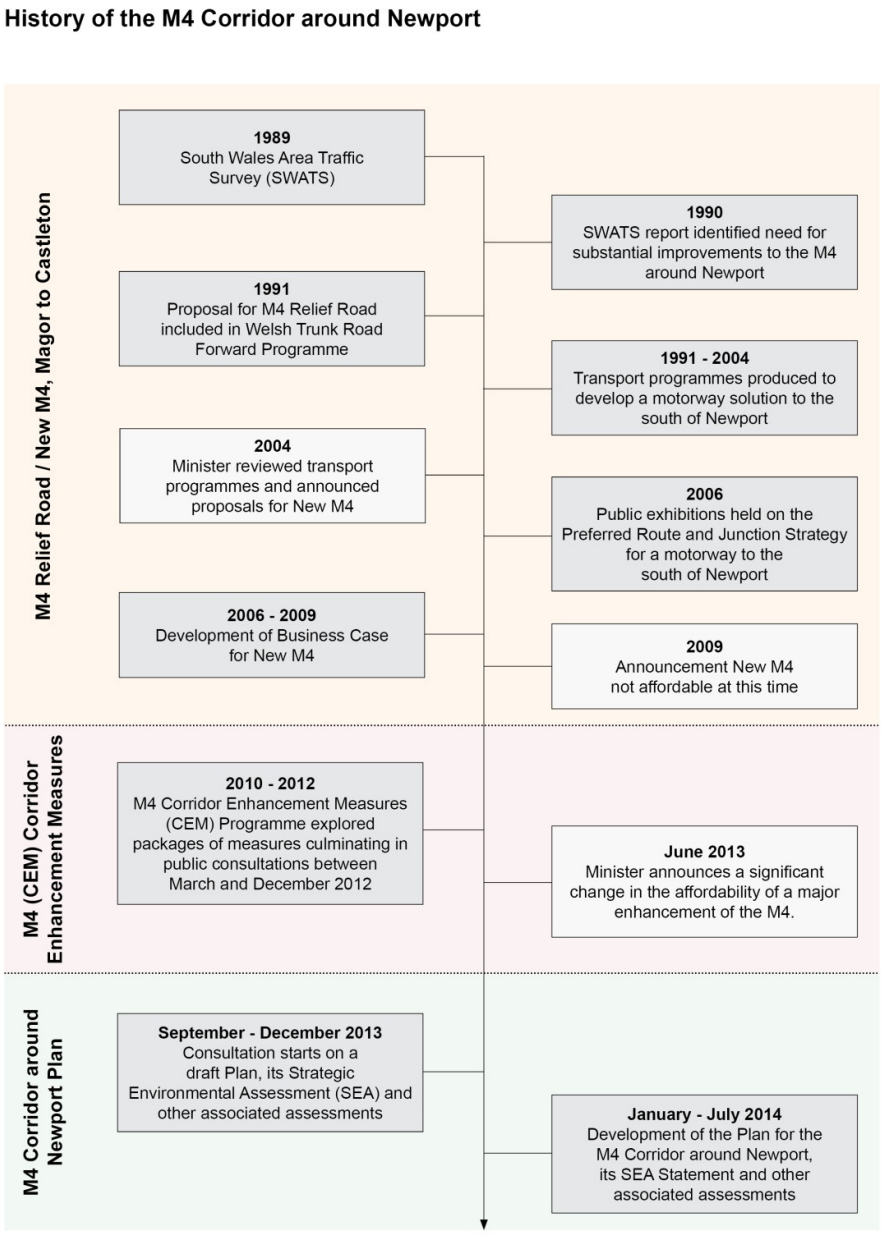
An important element of the Welsh Government's Plan for the M4 Corridor around Newport comprises the construction of a new section of 3-lane motorway to the south of Newport. In order to assist in the delivery of the Plan and to aid decision making in relation to major new infrastructure investment, this Business Case 2014 has been prepared for the new section of motorway to the south of Newport.

The milestones and key activities described in previous sections are illustrated in Figure 3.1.

[18] The 'Silk' Commission on Devolution in Wales, which is reviewing the case for the devolution of fiscal powers and reviewing the powers of the National Assembly for Wales, Part 2 Report, March 2014

[19] Welsh Government, M4 Corridor around Newport, WelTAG Appraisal Report Stage 1 (Strategy Level), Arup, June 2013

Figure 3.1: History of the M4 Corridor around Newport



3.3 Problems on the M4 around Newport

Existing problems encountered on the motorway between Magor and Castleton relate particularly to capacity and resilience. The existing physical constraints along the route of the motorway around Newport have been identified. These are highlighted in Figure 3.2 and the associated photographs that follow.

The over-riding problem on the M4 in South East Wales is one of congestion during peak periods of travel. During these times, traffic is slowed and stop-start conditions are a common occurrence with major and minor incidents exacerbating delays and causing journey time unreliability. These conditions also lead to adverse impacts on air pollution in the built up areas of Newport alongside the motorway.

A comparison of volumes on the M4 in 2013 with the theoretical capacity for urban motorways[20] has shown that sections of the existing M4 around Newport are operating at approaching or above capacity during weekday peak periods of travel (see Table 3.3). As flows approach the theoretical capacity, the following characteristics are likely to become increasingly evident:

- The speeds of individual vehicles will not be constant;
- Lane changing still occurs although opportunities are very limited;
- Off-side speeds will be similar to the near-side and may over short periods be slightly lower; and
- Any minor incident is likely to result in unrecoverable flow breakdown and queuing traffic and will lead to a reduction in throughput.

The Welsh Government has looked in detail at what travel related problems exist on the M4 Corridor between Magor and Castleton, and has consulted widely, including with those involved in managing transport in and around Newport.

The problems identified are as follows:

Capacity

1. A greater volume of traffic uses the M4 around Newport than it was designed to accommodate, resulting in regular congestion at peak times over extended periods;
2. The M4 around Newport is used as a convenient cross town connection for local traffic with insufficient local road capacity. Even with improved public transport (Cardiff Capital Region Metro), the problem of insufficient road capacity will continue to exist;
3. Heavy Goods Vehicles (HGVs) do not operate efficiently on the motorway around Newport;
4. There is insufficient capacity through some of the Junctions (e.g. 3-lane capacity drops to 2-lane capacity);
5. The 2-lane Brynglas Tunnels are a major capacity constraint; and
6. The M4 cannot cope with increased traffic from new developments.

[20] Design Manual for Roads and Bridges, Volume 5, Section 1, Part 3, TA 79/99 "Traffic Capacity of Urban Roads"

Resilience

7. There are difficulties in maintaining adequate traffic flows on the M4 and alternative highway routes at times of temporary disruption. Alternative routes are not able to cope with M4 traffic;
8. The road and rail transport system in and around the M4 Corridor is at increasing risk of disruption due to extreme weather events;
9. When there are problems on the M4, there is severe disruption and congestion on the local and regional highway network;
10. The M4 requires essential major maintenance within the next 5-10 years; this will involve prolonged lane closures and speed restrictions, thus increasing congestion problems; and
11. There is insufficient advance information to inform travel decisions when there is a problem on the M4.

Safety

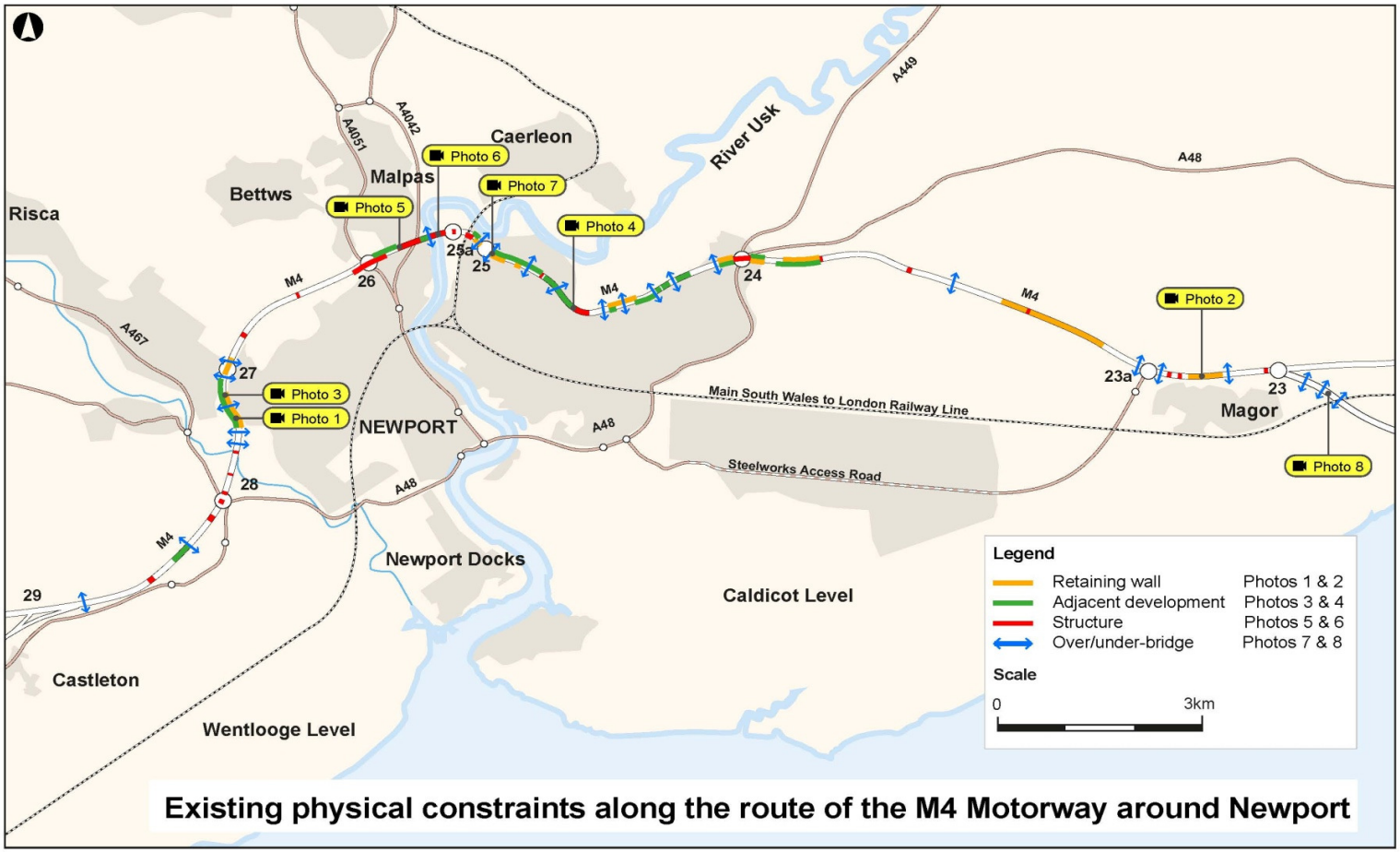
12. The current accident rates on the M4 between Magor and Castleton are higher than average for UK motorways[21];
13. The existing M4 is an inadequate standard compared to modern design standards; and
14. Some people's driving behaviour leads to increased accidents (e.g. speeding, lane hogging, lane switching).

Sustainable Development

15. There is a lack of adequate sustainable integrated transport alternatives for existing road users;
16. Traffic noise from the motorway and air quality are problems for local residents in certain areas; and
17. The existing transport network acts as a constraint to economic growth.

[21] The Variable Speed Limit (VSL) system was introduced in June 2011 between Junctions 24 and 28, in order to improve safety conditions and traffic flow in the short term. The first year of operation has shown a reduction in accidents.

Figure 3.2: Physical Constraints along the Route of the M4



Engineering Constraints

Retaining Walls

Photo 1: Retaining walls near Junction 28

Photo 2: Retaining walls near Junction 23

Adjacent Development

Photo 3: Adjacent development near Junction 28

Photo 4: Adjacent development near Junction 25

Structures

Photo 5: The Brynglas Tunnels eastbound bore

Photo 6: Brynglas Tunnels eastern approach

Bridges Over and Under

Photo 7: Motorway overbridge near Junction 25a

Photo 8: Motorway underbridge near Junction 23

3.3.1 Maintenance Backlog

Maintenance work undertaken on the existing M4 has to be carried out at night and at other off-peak times to minimise the effects on traffic. However, significant investment will be needed to undertake a serious and growing maintenance backlog to ensure the continued safe and effective operation of the route. This will include maintenance and refurbishment works as part of the natural lifecycle of the route such as carriageway strengthening and reconstruction, together with re-waterproofing and joint replacement to the structures.

There are also specific issues that need to be addressed. The tunnels at Brynglas, for instance, require a substantial amount of maintenance and improvement work to bring them in line with the standards described in the current EU Directive for minimum safety standards in tunnels on the Trans-European Road Network[22]

The nature of the activities to be undertaken to carry out maintenance works, together with the existing layout constraints will inevitably necessitate daytime traffic restrictions. These will likely range from lane and slip road closures, to full carriageway closures with associated diversions and contra flow arrangements for prolonged periods.

Such restrictions will cause severe levels of congestion and delays, when in place. If there is no alternative route, the cost to the road user in terms of delay and increased vehicle operating costs of implementing maintenance is estimated at some £375m[23], depending on the traffic management restrictions employed. With a new section of motorway to the south of Newport to provide an alternative route, the costs of maintenance delays may be reduced to around £100m.

3.3.2 Sub-standard Highway Alignment

The M4 motorway between Junctions 24 and 28 was opened in 1967 as a dual 2-lane motorway bypass and included the first tunnels to be part of the UK motorway network. The existing M4 was designed and constructed to the geometric standards of the day but for much lower traffic flows than are currently experienced. Widening to dual 3-lane standard took place in the early 1980s as a short-term measure to relieve congestion. The widening compromised geometric design standards further. In broad terms, the bends are tighter, forward visibility is reduced and in places gradients are steeper than desirable. There are some sections which only have two lanes and considerable lengths of the motorway have discontinuous hard shoulders.

3.3.3 Capacity – Ability to Accommodate Traffic Flows

The M4 around Newport also displays characteristics of an urban motorway, as defined in DMRB, passing through a built up area with closely spaced junctions. The performance of urban roads is assessed by comparing the peak hour flows

[22] The European Parliament and Council Directive no. 2004/54/EC of 29 April 2004 on the minimum safety requirements for tunnels in the Trans-European Road Network
[23] This sum is discounted to 2010 and relates to an appraisal period of 60 years in accordance with HM Treasury Green Book guidance.

against theoretical capacity. The operational assessment has therefore also compared the one-way peak hour flows on the M4 with the theoretical capacity, or maximum hourly throughput, and the results of this assessment are shown in Table 3.1.

Table 3.1: Existing Peak Hour Flows and Capacities, Junction 23a to Junction 29

Section	1-way Capacity (vehs/hr)	Highest Average Peak Hour Flow (neutral month)		Maximum Peak Hour Flow	
		(vehs/hr)	Flow/Cap	(vehs/hr)	Flow/Cap
J23A – J24 (Magor to Coldra)	5,600	3,510	63%	4,170	75%
J24 - J25 (Coldra to Caerleon)	5,600	4,050	72%	4,660	83%
Brynglas Tunnels	3,600*	3,170	88%	3,550	99%
J26 – J27 (Malpas to High Cross)	5,600	4,730	84%	5,220	93%
J27 – J28 (High Cross to Tredegar Park)	5,600	5,170	92%	5,790	103%
J28 – J29 (Tredegar Park to Castleton)	5,600	4,850	87%	5,710	102%

* Capacity of tunnels assumed to be equivalent to D2 AP road owing to absence of hard shoulder.

The table shows two levels of peak hour flow: the maximum observed hourly flow during the year, and the average peak hour flow observed during the neutral months (defined as March-June and September-November). It is generally accepted that once hourly flows reach about 85% of the theoretical capacity, operational problems can also be expected, and the results show that the sections west of the Brynglas Tunnels experience significant peak hour operational problems at times.

Traffic flows on the M4 around Newport are continuously monitored using Automatic Traffic Counts (ATCs) and data from the MIDAS (Motorway Incident Detection and Automatic Signalling) system. Traffic flows are often measured in terms of Annual Average Daily Traffic (AADT), which is the average daily traffic flow in any given year.

Table 3.2 shows the observed AADT obtained from MIDAS for each section of the M4 between Junction 23A and Junction 29 during 2013.

Table 3.2: Observed 2013 AADT, Junction 23a to Junction 29

Section	AADT
J23A – J24 (Magor to Coldra)	77,600
J24 - J25 (Coldra to Caerleon)	92,800
Brynglas Tunnels	73,700
J26 – J27 (Malpas to High Cross)	104,200
J27 – J28 (High Cross to Tredegar Park)	104,400

Section	AADT
J28 – J29 (Tredegar Park to Castleton)	106,400

This data show that there is a substantial increase in traffic on the M4 to the west of the Coldra (Junction 24), as a result of traffic joining the motorway from the Midlands via the A449. While the Malpas Relief Road slips from Junction 25A reduce the traffic on the 2-lane section through the Brynglas Tunnels, there is a further substantial increase in traffic volumes to the west of Junction 26, and the three sections between the Tunnels and Castleton (Junction 29) carry the highest volume of traffic on the M4 around Newport.

An assessment of the operation of the existing M4 between Junctions 23 and 29 has been undertaken. There is no absolute measure of 'congestion', in the same way as there is no trigger point of capacity at which the network fails. It is simply a matter of increased traffic flows leading to decreasing speeds, deterioration of operating conditions or a declining level of service as perceived by road users. The Design Manual for Roads and Bridges[24] uses the concept of the Congestion Reference Flow (CRF) as a measure against which to judge acceptable performance for rural roads.

When the ratio of flow to CRF is 100% it is estimated that congestion will occur in approximately half of the weekday peak periods, in the peak direction. However, problems may occur before the ratio reaches 100%. In the assessment of journey time reliability for rural roads, Transport Analysis Guidance[25] adopts a stress-based approach, which considers the change in the ratio of flow to CRF between 75% and 125%. For the purpose of this assessment, therefore, 75% CRF is taken as the point at which journey time reliability becomes adversely affected and congestion begins to be experienced.

Table 3.3 shows the estimated CRF for the observed 2013 traffic volumes on the different sections of the M4 around Newport.

Table 3.3: Existing Congestion Reference Flows, Junction 23a to Junction 29

Section	CRF	2013 AADT	AADT / CRF
J23A – J24 (Magor to Coldra)	129,000	77,600	60%
J24 - J25 (Coldra to Caerleon)	134,300	92,800	69%
Brynglas Tunnels	82,100*	73,700	90%
J26 – J27 (Malpas to High Cross)	129,300	104,200	81%
J27 – J28 (High Cross to Tredegar Park)	118,000	104,400	88%
J28 – J29 (Tredegar Park to Castleton)	127,600	106,400	83%

* CRF of tunnels assumed to be equivalent of D2AP road owing to absence of hard shoulder.

The results show that all sections from the Brynglas Tunnels through to Junction 29 at Castleton are currently operating with daily flows over 75% of CRF,

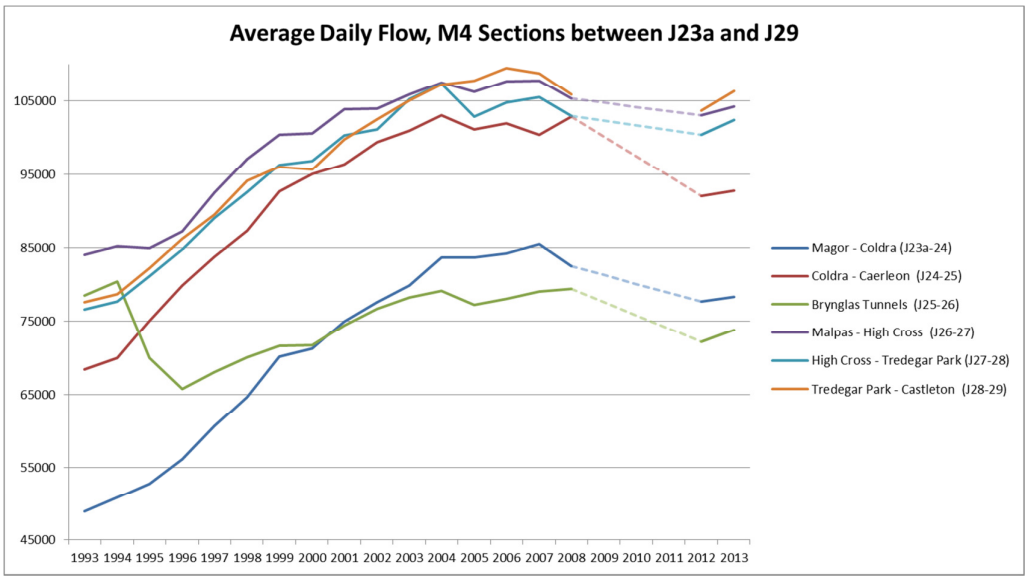
[24] Design Manual for Roads and Bridges, Volume 5, Section 1, Part 3, TA 46/97, Annex D, February 1997
[25] Transport Analysis Guidance, User and Provider Impacts, TAG Unit A1.3, Department for Transport, January 2014

indicating that they are subject to stress at times, with frequent congestion during peak periods.

3.4 Historical Traffic Growth

Figure 3.3 shows the growth in traffic volumes on each section of the M4 around Newport over the past 20 years. In general, the trends are characterised by a consistently strong growth from the early 1990s up to about 2006, at which point traffic volumes appear to commence a downward trend, coinciding with the start of the economic recession. Traffic volumes through the Brynglas Tunnels showed a significant drop in 1995/6 as a result of the opening of the Malpas Relief Road Scheme and the slip road connections from Junction 25a. Thereafter growth in traffic through the tunnels resumed to the point in 2008 where it was only marginally below the traffic volume experienced immediately before the Malpas slips were opened.

Figure 3.3: Average Daily Flows, M4 Junction 23a to Junction 29



Data for the three-year period 2009-2011 is unavailable as during this time major roadworks were in place on the M4 between Junction 24 and Junction 28 which severely disrupted the permanent count sites, and any data that was available is considered unrepresentative owing to the impacts on vehicle operations. Following the completion of the roadworks and the commencement of the variable speed limit operation around Newport, however, the 2012 flows showed a reduction from the 2008 level that would be consistent with the period of economic recession. Data from 2013, however, showed an increase of 1-3% on all sections from 2012, indicating that traffic growth has occurred as the country emerges from recession.

The traffic growth trends on the M4 around Newport are mirrored in the Welsh Government statistics for vehicle kilometres on motorways in Wales (essentially relating to the M4 in South Wales), as shown in Figure 3.4. This shows a similar strong growth in the use of the motorway up to a peak in 2007, followed by a dip

to 2010 as the economic recession took hold. The statistics, however, show two years' of growth from 2010 to 2012, suggesting that the growth around Newport between 2012 and 2013 is likely to represent the resumption of the upward trend in traffic growth.

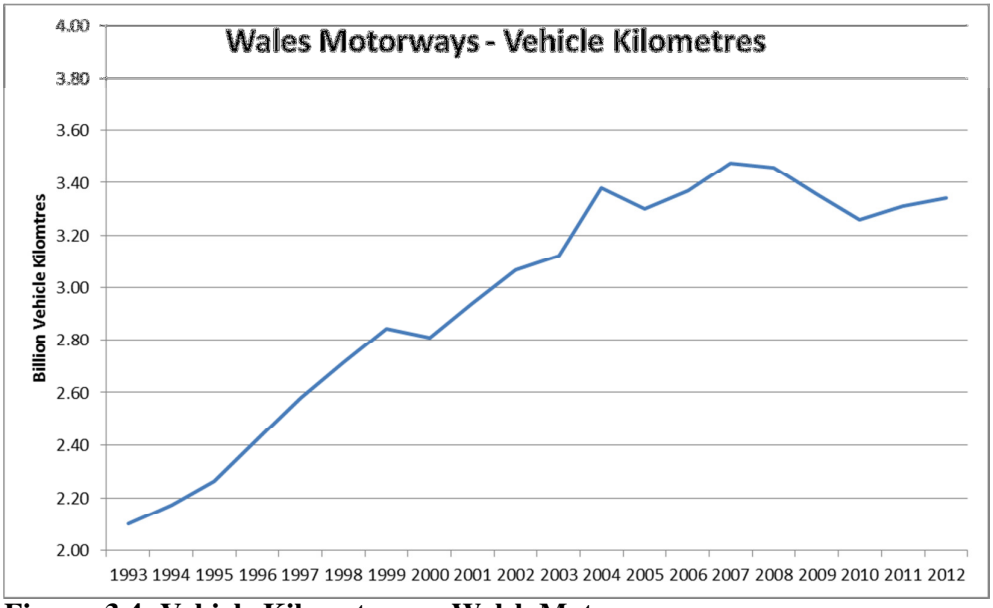


Figure 3.4: Vehicle Kilometres on Welsh Motorways

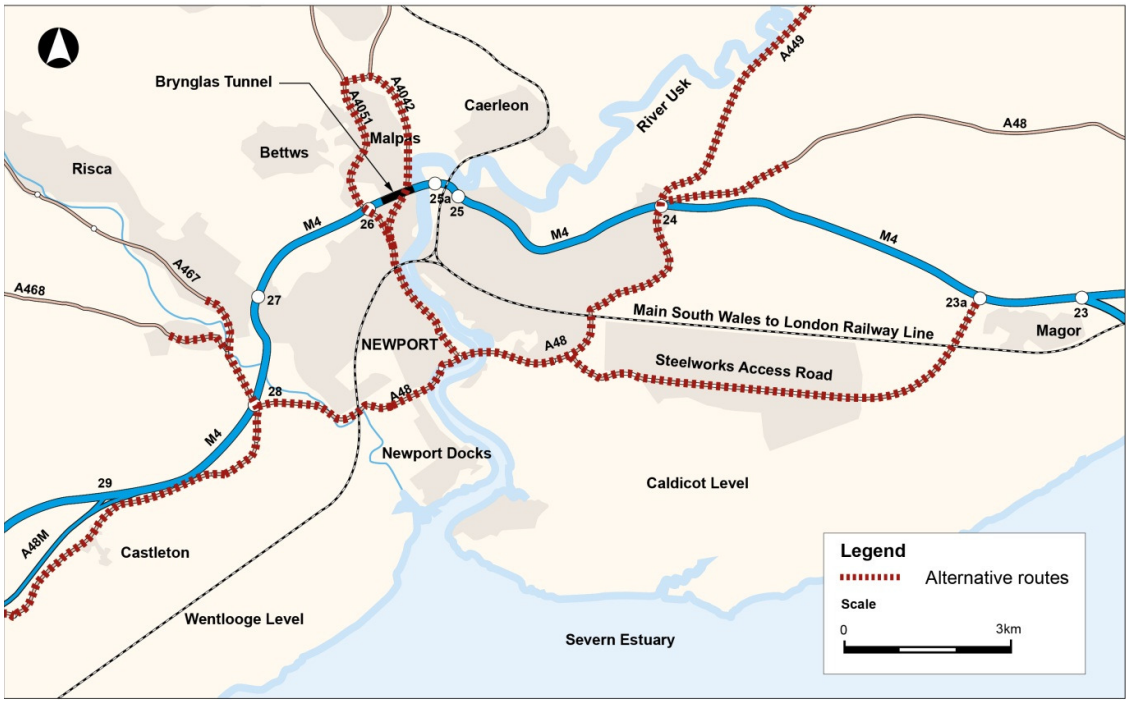
3.4.1 Resilience – Ability to Respond to Incidents/Disruption

Figure 3.5 identifies the alternative routes to the M4. Major maintenance works, particularly at Brynglas Tunnels, could cause significant disruption.

Issues with network resilience along the M4 Corridor include the following:

- There is limited capacity on alternative routes when traffic needs to be diverted off the M4 around Newport;
- Adverse weather conditions can cause disruption to the transport network. This problem is exacerbated given the lack of capacity on alternative routes to the M4;
- Significant maintenance works are needed at the Brynglas Tunnels in order to satisfy an EU Directive; and
- Temporary decreases in highway capacity due to incidents or essential road works result in significant delays and adverse effects on local roads being used as diversions and on the wider road network including the A465 Heads of the Valleys trunk road (some 25 miles to the north of the M4).

Figure 3.5: Problems of Resilience



3.4.2 Road Safety

Sections of the motorway around Newport have sub-standard alignments (steep gradients and tight bends) and discontinuities in the hard shoulder. In addition to this, there are frequent junctions, resulting in many 'weaving' movements with vehicles accelerating and decelerating and changing lanes over relatively short distances. These weaving movements reduce the capacity of the road and can also result in accidents.

The most common accidents on the M4 between junctions 25 and 28 are rear-end shunts on both the westbound and eastbound approaches to the Brynglas Tunnels. This is largely due to the stop-start conditions that occur during peak periods caused by the motorway reducing from 3 lanes to 2 lanes.

The data for 2012 and 2013 show a significant reduction in accident numbers from the average of 63 per year up to 2008, indicating that the implementation of the variable speed limit has been successful in improving the accident record on the M4 around Newport. Several more years of data would be required to establish a reliable accident rate under the variable speed limit, but the indications to date are positive.

Due to the major roadworks undertaken in 2009-11, the accident record during this period is considered to be unrepresentative owing to the presence of the roadworks over much of this time, but in 2012 only 24 personal injury accidents were recorded between Junction 23a and Junction 28, while in the first nine months of 2013 (the latest available data), 32 accidents were recorded.

In March 2009, a temporary mandatory 50mph speed limit was introduced between Junction 24 and Junction 28. This was followed by the introduction of a Variable Speed Limit (VSL) system in June 2011 in order to improve safety conditions and traffic flows. This has proved to be particularly effective in reducing the reported occurrence of accidents.

The average rate for personal injury accidents on motorways is given in the Design Manual for Roads and Bridges[26] as about 0.089 per million vehicle kilometres. Between 2002 and 2008 there were on average 63 personal injury accidents per year between Junction 23a and Junction 29, and the estimated accident rates for each section are shown in Table 3.4.

Table 3.4: Accident Rates 2002-08, Junction 23a to Junction 29

Section	Accidents per million vehicle km
Junction 23a – Junction 24	0.038
Junction 24 – Junction 25	0.111
Brynglas Tunnels	0.109
Junction 26 – Junction 27	0.158
Junction 27 – Junction 28	0.063
Junction 28 – Junction 29	0.047

The data indicates that the sections around Newport (Junction 24 to Junction 27) had an accident rate above the national average for motorways.

3.5 Vision and Objectives

In response to the problems identified, the Welsh Government has set out a vision for the transport system in South East Wales, namely:

To provide, as part of a wider transport strategy for South East Wales, enhanced capacity and resilience on the transport corridor between Magor and Castleton.

High level objectives have been developed and published to enable delivery of this vision. These are:

- *To deliver enhanced accessibility to services and employment opportunities for people, whilst retaining a choice for road users;*
- *To deliver a more efficient transport capability for road traffic on the primary economic gateway to South Wales, to facilitate growth in regional and national prosperity; and*
- *To prevent, reduce and where practicable off-set any significant adverse effects on environmental receptors.*

To make progress towards these high level objectives the Welsh Government has consulted widely to identify the following specific transport planning objectives for the M4 Corridor around Newport:

[26] Design Manual for Roads and Bridges, Volume 13, Section 1, Part 2, The Valuation of Costs and Benefits, May 2004

1. Safer, easier and more reliable travel east-west in South Wales;
2. Improved transport connections within Wales and to England, the Republic of Ireland and the rest of Europe on all modes on the international transport network;
3. More effective and integrated use of alternatives to the M4, including other parts of the transport network and other modes of transport for local and longer distance journeys around Newport;
4. Best possible use of the existing M4, local road network and other transport networks;
5. More reliable journey times along the M4 Corridor;
6. Increased level of choice for all people making journeys within the transport corridor by all modes between Magor and Castleton, commensurate with demand for alternatives;
7. Improved safety on the M4 Corridor between Magor and Castleton;
8. Improved air quality in areas next to the M4 around Newport;
9. Reduced disturbance to people from high noise levels, from all transport modes and traffic within the M4 Corridor;
10. Reduced greenhouse gas emissions per vehicle and/or person kilometre;
11. Improved travel experience into South Wales along the M4 Corridor;
12. An M4 attractive for longer distance journeys that discourages local traffic use;
13. Improved traffic management in and around Newport on the M4 Corridor;
14. Easier access to local key services and residential and commercial centres; and
15. A cultural shift in travel behaviour towards more sustainable choices.

3.6 WelTAG Stage 1 & 2 (Scheme) Appraisal

Welsh Transport Planning and Appraisal Guidance (WelTAG) was formally published by the Welsh Government in 2008. Paragraph 1.1.1 of WelTAG states that the guidance,

"….has been developed by the Welsh Assembly Government with the intention that it is applied to all transport strategies, plans and schemes being promoted or requiring funding from the Welsh Assembly Government".

WelTAG has two primary purposes:

- *"To assist in the development of proposals enabling the most appropriate scheme to be identified and progressed – one that is focused on objectives, maximises the benefits and minimises negative impacts; and*
- *To allow the comparison of competing schemes on a like-for-like basis, so that decision-makers can make funding decisions".*

WelTAG aims to ensure that transport proposals contribute to the wider policy objectives for Wales.

WelTAG sets out that schemes need to be appraised against Transport Planning Objectives (TPOs). For schemes, there is a formal and standardised two-stage appraisal process.

The provision of the proposed new section of motorway to the south of Newport has been appraised under WelTAG Stages 1 and 2. During the WelTAG Appraisal, the motorway to the south of Newport has been compared with the Do Minimum situation and these have been summarised in Appraisal Summary Tables (ASTs). The ASTs are provided at Appendix A to this Business Case 2014 for reference. These show that, against WelTAG criteria and the Transport Planning Objectives (TPOs) set out for the Plan for the M4 Corridor around Newport, the Do Minimum results in increasingly adverse conditions whilst the scheme performs strongly against the majority of the TPOs.

3.7 Summary of the Strategic Case

The M4 transport corridor is the primary gateway into Wales in the south. The M4 motorway carries the bulk of east/west movements along the corridor. The traffic demand during peak travel periods often exceeds the practical capacity of the motorway on sections around Newport. This results in journey time unreliability and delays.

The lack of free flow conditions on the primary gateway into Wales in the south has a negative economic and environmental impact.

The primary transport network in South East Wales relies heavily on the M4 motorway. Consequently, any disruption on the motorway impacts significantly on the ability of the remainder of the network to cope with the demand. This has been demonstrated graphically when there has been an incident/accident, which has resulted in lane/motorway closures. There is thus widespread agreement that the provision of an additional alternative strategic east/west route to the south of Newport would increase network resilience.

Having established the problems and the need to address these, the Welsh Government has involved others in exploring a very wide range of possible ways of solving these problems. To enable the sustained productivity and competitiveness of Wales, and the South East Wales region in particular, additional east/west capacity is needed along the M4 corridor.

Improving transport links between South Wales and Bristol, Heathrow Airport, London and the South East of England is an important priority for wealth creation and investment, as is facilitating movement of goods and people between the industrialised Midlands/North of England and South Wales. The section of the M4 motorway around Newport is an important common link on both of these strategic routes. Reliability and efficient operating conditions on this section of motorway are thus of high importance to the perception of Wales as a place to do business.

The new section of motorway to the south of Newport would provide the

additional east/west motorway capacity needed around Newport. It would also strengthen the resilience of the strategic highway network in South East Wales, so that disruption might be minimised during times of network disturbance. There is thus a strong strategic case to support the implementation of the new section of motorway. The strategic importance of the motorway to the wellbeing of the economy and society in South Wales reaffirms the case for investment in the provision of additional capacity on the M4 Corridor around Newport.

4 Economic Case – Value for Money

4.1 Approach to Appraisal

The economic appraisal for the new section of motorway to the south of Newport recently undertaken is in line with Welsh Government (WelTAG) and DfT (WebTAG) guidance[27] for the assessment of transport investments. The value for money case has been developed in accordance with the DfT's Transport Business Case framework.

The economic appraisal has a number of components, which include:

- *Demand Forecasting* using a re-based (2012) traffic model to forecast future year traffic flows on the road network around Newport (see WebTAG units 3.10 and 3.15);
- *Scheme Costings* which are calculated in accordance with WebTAG unit 3.5.9 and DMRB Volume 13;
- *Transport Economic Efficiency (TEE)* analysis, which covers the impacts ordinarily captured by standard cost-benefit analysis to provide a value for money assessment (see WebTAG unit 3.5 and DMRB Volume 13);
- *Sensitivity Testing* to determine the likely impact of high and low demand scenarios (see WebTAG 3.15.5), removal OF Severn Crossing Tolls and an absolute baseline of no growth;
- *Wider Impacts* assessing a range of indirect or second order socio-economic benefits arising from reduced travel times and improved accessibility (see WebTAG units 2.8 and 3.5.14);
- *Environmental Impact* assessments using traffic model forecasts and field surveys in accordance with WebTAG unit 3.3; and
- *Climate Change* assessment in order to estimate Whole Life Carbon (WLC) production arising as a result of the proposals.

4.1.1 Base Year Traffic Assignment Model

In order that traffic forecasts can be developed, a base year traffic model is required that accurately reflects traffic flows and conditions on the existing highway network.

Values of Time (VoT) and Vehicle Operating Costs (VOC) are published by the Department for Transport in WebTAG. These values are used to derive the generalised cost parameters which govern route choice in the model assignments. The most recent values for VoT and VOC were published in August 2012. A validation has been undertaken of the Corridor around Newport 2012 base year model, incorporating revised variable demand model parameters and revised

[27] WebTAG web-based Transport Analysis Guidance, in particular units 3.1, 3.5, 3.10 and 3.15

generalised cost parameters and a Local Model Validation Report[28] has been prepared.

4.1.2 Economic Appraisal Parameters

A summary of the key assumptions and appraisal parameters that have been adopted for this appraisal are given in Table 4.1.

Table 4.1 - Overall Appraisal Parameters

Parameter	Approach	Source Data / Guidance
Appraisal Period	60 years from 2022	WebTAG 3.5
Price Base	2010 Market Prices	WebTAG 3.5
Discounting	Discounted to 2010 based on the social discount rate of 3.5% for first 30 years and 3.0% thereafter.	HMT The Green Book / WebTAG 3.5

Detailed results of the economic assessment are set out in the standard WelTAG / WebTAG appraisal format in Tables 4.3, 4.4 and 4.5 in section 4.4.

4.1.3 Traffic Forecasts

A Do Minimum network used for the traffic forecasts included those highway schemes that are considered to be committed. These are:

- Tredegar Park Roundabout (Junction 28), and associated improvements;
- A465 Heads of the Valley dualling (Abergavenny to Hirwaun); and
- Newport Eastern Expansion Area, link connecting the Steelworks Access Road to a signalised junction a A48/Cot Hill (2037 forecast year only).

Future year traffic forecasts have been prepared for a Do Minimum scenario and for a road network which includes the motorway to the south of Newport using the re-based 2012 SATURN traffic model. A Traffic Forecasting Report[29] has been prepared in accordance with WebTAG unit 3.15. Variable demand modelling has been deployed using DIADEM (Dynamic Integrated Assignment and Demand Modelling)[30] in accordance with WebTAG unit 3.10.

For appraisal purposes, the following future years are modelled:

- 2022 (assumed year of scheme opening); and
- 2037 (design year).

The DfT's latest TEMPRO (version 6.2) growth forecasts, which became definitive in July 2011, have been used in developing future year demand matrices

[28] Welsh Government, M4 Corridor around Newport, Local Model Validation Report, Arup, June 2014
[29] Welsh Assembly Government, M4 Corridor around Newport – Motorway to the South of Newport, Traffic Forecasting Report, Arup, July 2014
[30] DIADEM – Department for Transport see http://www.dft.gov.uk/topics/appraisal-evaluation/tools/diadem

for private vehicles. The National Transport Model[31] has been used to develop future year demand for freight movements.

The revised TEMPRO forecasts show a lower short-term rate of traffic growth than those used previously. In the longer term, however, the rates of growth of trips during peak periods in Wales have been forecast in TEMPRO to be higher than those previously used. This is based on regional projections for future population, household numbers, jobs and workers.

The treatment of uncertainties over demographic, economic and behavioural trends in forecast traffic growth is described in WebTAG unit M4 ("Forecasting and Uncertainty"). This requires an appropriate range to be explored around the core scenario growth forecast. Application of the guidance for the M4 Corridor around Newport results in the following uncertainty ranges for traffic forecasts:

- ± 7.91% of base year matrix in 2022; and
- ± 12.50% of base year matrix in 2037.

As a consequence, traffic forecasts have been prepared for low, central and high growth scenarios. The main analysis has been based on central forecasts with low and high growth applied as a sensitivity, particularly for the economic assessment.

Traffic forecasts from the three hourly models (AM peak, interpeak and PM peak) have been combined and factored to Annual Average Daily Traffic (AADT) forecasts using factors derived from observed automatic count data on the motorway around Newport. The resulting traffic forecasts for selected road links around Newport are summarised in Table 4.2 for central growth.

Table 4.2 – Annual Average Daily Traffic Forecasts in Vehicles (2-way Central Growth)

Link	2012	2022		2037	
	Base	Do Minimum	Motorway south of Newport	Do Minimum	Motorway south of Newport
J29-J28	102,900	122,000	72,500	142,200	85,800
J28-J27	102,000	116,700	71,600	135,100	86.000
J27-J26	104,200	119,700	74,100	137,000	86,900
J26-J25a (Tunnel)	69,200	80,500	34,900	94,800	44,600
J25a-J25	89,500	105,200	59,400	124,000	72,600
J25-J24	92,600	108,600	62,800	129,300	77,900
J24-J23a	77,300	89,400	38,200	105,900	47,100
J23a-J23	68,300	82,200	36,800	98,600	43,800
J29-Docks (New M4)	-	-	60,000	-	76,700
Docks-Glan Llyn (New M4)	-	-	56,000	-	69,400

[31] Road Traffic Forecasts: Results from the Department for Transport's National Transport Model, Department for Transport, 2013

Link	2012	2022		2037	
	Base	Do Minimum	Motorway south of Newport	Do Minimum	Motorway south of Newport
Glan Llyn-J23 (New M4)	-	-	58,400	-	72,200

The results show that, in the Do Minimum situation (without the new section of motorway to the south of Newport), traffic volumes on links of the existing M4 around Newport would increase by 31-44% by 2037, with the heaviest flows experienced on the links west of the Brynglas Tunnels. The motorway to the south of Newport is predicted to carry some 70,000 – 77,000 vehicles per day by 2037, resulting in a significant reduction in traffic on the existing M4, where flows would be expected to remain below current levels.

Further information on future traffic forecasts for the road network around Newport is contained in the Traffic Forecasting Report for the motorway to the south of Newport.

4.2 Investment Costs

There are three main elements of the project cost estimate[32]:

- *the base cost*[33] – the basic costs of the motorway to the south of Newport before allowing for risks;
- *adjustment for risk* – which covers all the identified risks as assessed and quantified through a Quantified Risk Assessment (QRA) resulting in the risk-adjusted cost estimate; and
- *adjustment for Optimism Bias* – to reflect the well-established and continuing systematic bias for estimated scheme costs and delivery times to be too low and too short respectively. This results in an uplift to the cost estimate.

The investment costs (ie capital costs) are distinguished from operating costs. The main components of investment costs for the new section of motorway to the south of Newport are:

- *Construction* costs including main works, ancillary works, statutory undertakings, site supervision and testing;
- *Land and Property* costs including compensation;
- *Preparation and Administration* costs including project management, design, public consultation, Public Inquiry, gaining statutory powers, surveys, compensation, supervision and testing; and
- *Traffic Related Maintenance* costs including reconstruction, resurfacing, surface dressing etc.

[32] See the Estimation and Treatment of Scheme Costs, WebTAG unit 3.5.9, DfT, August 2012
[33] The basic costs of the motorway to the south of Newport at a Q4 2013 price base including realistic assumptions about real cost increases between 2013 and the years in which costs are incurred. The base costs do not include any adjustments for risk and optimism bias

4.2.1 Risk and Optimism Bias

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 motorway to the south of Newport, a Quantified Risk Assessment (QRA) has been undertaken and this process is outlined in Chapter 5 as part of the Commercial Case.

As the motorway to the south of Newport has been developed, the scheme cost estimate has been refined over time. Allowances have been made for Optimism Bias and Risk. Work will continue to seek opportunities to reduce costs through value engineering and competitive tendering.

4.2.2 Costs for Inclusion in Appraisal

The current estimate of the risk-adjusted scheme forecast cost (including Optimism Bias) is as follows:

Estimated Scheme Cost (excluding VAT): £998m

Work will continue to seek opportunities to reduce costs through value engineering and competitive tendering.

Investment costs are included in Transport Economic Efficiency (TEE) and Public Accounts (PA) tables. The investment base cost estimate is adjusted for risk and Optimism Bias and the DfT's TUBA[34] appraisal software carries out further adjustments required in deriving the "appraisal" cost estimations for input to the TEE and PA tables.

During the appraisal, the risk and Optimism Bias adjusted cost estimate in 2010 prices is discounted to the standard base year (2010) using standard discounted rates. The discount rate is 3.5% for the first 30 years (ie 2022 – 2051) and 3% for each year thereafter (ie 2052 – 2081).

4.3 Economic Assessment

Guidance on undertaking economic assessments for transport schemes is given in WelTAG, DMRB Volume 13 and the WebTAG 3.5 series of Guidance Documents.

The economic impacts are derived by comparing the future year situation with the motorway to the south of Newport (Do Something scenario) against that without the new section of motorway (Do Minimum). 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

[34] Department for Transport – TUBA Guidance – Version 1.9.4, Atkins, June 2014

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; and
- Additional costs to travellers due to disruption during construction and maintenance works.

In undertaking the economic assessment, monetised time, operating cost and accident savings arising as a result of provision of the motorway to the south of Newport together with those occurring on the existing M4 and elsewhere on the road network are compared with the expected future situation without the motorway to the south of Newport. Allowance is made for changes in indirect taxes (eg fuel duty) and monetised values have been put on CO_2 emissions (climate change impacts). The Do Minimum, in this case, includes all recent network modifications (such as the Junction 24 improvement, the VSL system and the Steelworks Access Road) and any committed interventions (such as the Junction 28/Bassaleg Roundabout/Pont Ebbw Roundabout improvement).

In October 2011, the Department for Energy and Climate Change (DECC) published 'Valuation of Energy Use and Greenhouse Gas Emissions for Appraisal and Evaluation', which provides guidance on a new methodology for carbon valuation in UK policy appraisal based on the estimated abatement costs per tonne of carbon dioxide equivalent to achieve the government's emissions targets. This has resulted in an increase in costs associated with CO_2 emissions.

The Department for Transport's TUBA (v1.9.4) software has been used to process the traffic model outputs, together with updated cost data, to produce the economic assessment summarised in Tables 4.7, 4.8 and 4.9 for central growth forecasts. Further details of the economic assessment are included in an Economic Assessment Report[35].

With the motorway to the south of Newport, benefits occur that relate to the 'Economic Efficiency' of the transport system and these are presented in Table 4.6 as a summary of Transport Economic Efficiency (TEE).

The term 'public accounts' relates to costs that might be faced by Government (either local or central), including:

- Operating Costs;
- Investment Costs; and
- Indirect tax revenues, where a positive value indicates a reduction in income (cost) to government though fuel duty etc. as a result of the scheme. A

[35] Welsh Government, M4 Corridor around Newport – Motorway to the South of Newport, Economic Assessment Report, Arup, July 2014

negative value indicates an increase in income to government due to the scheme.

The Public Accounts costs are presented in Table 4.7.

The Analysis of Monetised Costs and Benefits (see Table 4.8) presents a summary of the costs and benefits listed above. It also includes benefits due to savings in accidents and carbon emissions, which would be negative should either of these increase. The total benefits given in the TEE Table are combined with the accident and carbon benefits to give a Present Value of Benefits (PVB). The Present Value of Costs (PVC) is the total costs taken from the Public Accounts Table.

The Analysis of Monetised Costs and Benefits Table also presents 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.

As referred to in 4.1.3, the economic assessment has covered low, central and high traffic forecasts. A summary of the monetised costs and benefits for each growth scenario is provided in Table 4.3 and the summarised Transport Economic Efficiency tables are provided in Appendix B to this Business Case 2014. An Economic Assessment Report[36] has been prepared, which provides further details of the analysis and how the results have been arrived at.

Table 4.3: Summary of Monetised Costs and Benefits by Level of Traffic Growth

	Traffic Growth Forecasts		
	Low	Central	High
Present Value of Benefits (PVB) (£000)	1,536,384	2,005,859	2,807,412
Present Value of Costs (PVC) (£000)	877,231	877,231	877,231
Net Present Value (NPV) (£000)	659,153	1,128,598	1,933,181
Benefit to Cost Ratio (BCR)	1.75	2.29	3.27

Note: All entries are discounted present values in 2010 prices and values

Thus, the benefits that would accrue as a result of the motorway to the south of Newport would be expected to out-weight the costs by between £0.66bn and £1.93bn; and there would be a likely return on the investment of some 175% to 330%.

To further demonstrate the need for the new section of motorway, an economic assessment has been undertaken of the hypothetical situation where traffic levels remain constant at 2012 levels into the future, ie **no traffic growth.** A summary of the monetised costs and benefits is provided in Table 4.4 and the summarised Transport Economic Efficiency (TEE) tables are provided in Appendix B to this Business Case 2014. Table 4.4 shows that, even if there was no additional traffic

[36] Welsh Government, M4 Corridor around Newport – Motorway to the South of Newport, Economic Assessment Report, Arup, July 2014

on the road network beyond 2012, the benefits of the scheme (£939m) would exceed the costs £877m), providing a Net Present Value for the scheme of +£62million.

Table 4.4: Summary of Monetised Costs and Benefits assuming No Traffic Growth (2012 Base)

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

Note: All entries are discounted present values in 2010 prices and values.

In Section 2.3 the removal of the Severn Crossing Tolls by 2022 was discussed. Removal of the tolls and elimination of delays associated with toll collection will result in increased traffic demand. An economic assessment has been undertaken of the likely impact of toll removal for the central growth scenario. The results are shown in Table 4.5 and the summarised Transport Economic Efficiency (TEE) tables are provided in Appendix B.

Table 4.5: Summary of Monetised Costs and Benefits with No Severn Crossing Tolls (Central Growth)

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

Note: All entries are discounted present values in 2010 prices and values.

Removal of the Severn Crossing Tolls would result in increased benefits due to the motorway to the south of Newport such that the Net Present Value of the scheme is estimated to increase to more than £1.4bn with a Benefit to Cost Ratio of 2.64.

Table 4.6: Results of Economic Assessment of the Motorway to the South of Newport (Central Forecasts) – Transport Economic Efficiency

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.

Table 4.7: Results of Economic Assessment of the Motorway to the South of Newport (Central Forecasts) – 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.

Table 4.8: Results of Economic Assessment of the Motorway to the South of Newport (Central Forecasts) – Analysis of Monetised Costs and 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.

4.4 Wider Economic Benefits

The existing M4 currently performs twin roles in terms of support to the regional/national economy, namely:

- Providing inter-regional linkages and linkages between Wales and the rest of the UK; and
- Facilitating movement within the city-region, particularly focussed on Cardiff and Newport.

The strategic importance of the M4 to the Welsh economy, as well as the potential benefits of the project for the Severnside economy as a whole determines that the *wider* economic case for the project is of considerable significance.

4.4.1 Quantifying Wider Impacts

DfT guidance provides a framework for estimating a number of wider economic benefits which are considered to be *additional* to the Transport Economic Efficiency benefits[37]. Therefore it is possible to derive an adjusted benefit-cost ratio which captures the indirect benefits of a transport improvement. The Wider Impacts framework is based on the following elements:

[37] WebTAG 3.5.14

- Agglomeration economies – the productivity benefits for firms of increasing the effective concentration of economic activity;
- Increased output in imperfectly competitive markets– welfare gains to consumers of increased turnover impacts of lower transport costs; and
- Increased labour supply – lower commuting costs encouraging increased labour market participation and changing patterns of employment.

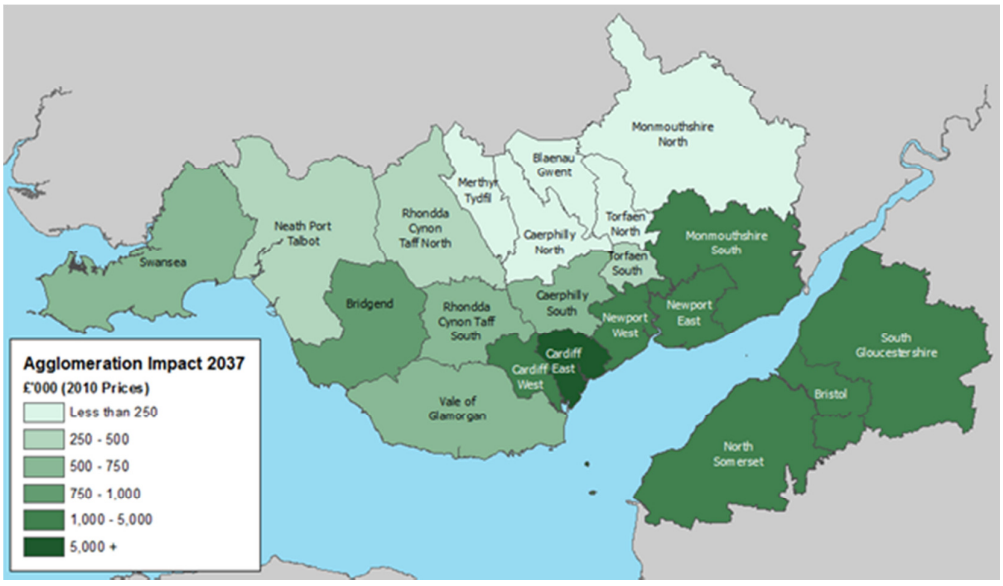
The journey time savings achieved by the scheme will increase the accessibility between areas of economic activity in the study area and improve access to jobs. This will generate wider economic benefits that are additional to the transport user benefits captured in the traditional economic appraisal. Three types of wider economic benefits have been considered: agglomeration impacts, output change in imperfectly competitive markets, and tax revenues arising from labour market impacts.

The calculation of wider economic benefits has been performed in line with Welsh Transport Planning and Appraisal Guidance and the DfT's TAG Unit A2.1.

Agglomeration Assessment

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 4.1).

Figure 4.1: Total Agglomeration Impact in 2037 by zone



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.

In addition, the provision of the Cardiff Capital Region Metro would provide further positive impacts on agglomeration effects.

Output Change in Imperfectly Competitive Markets

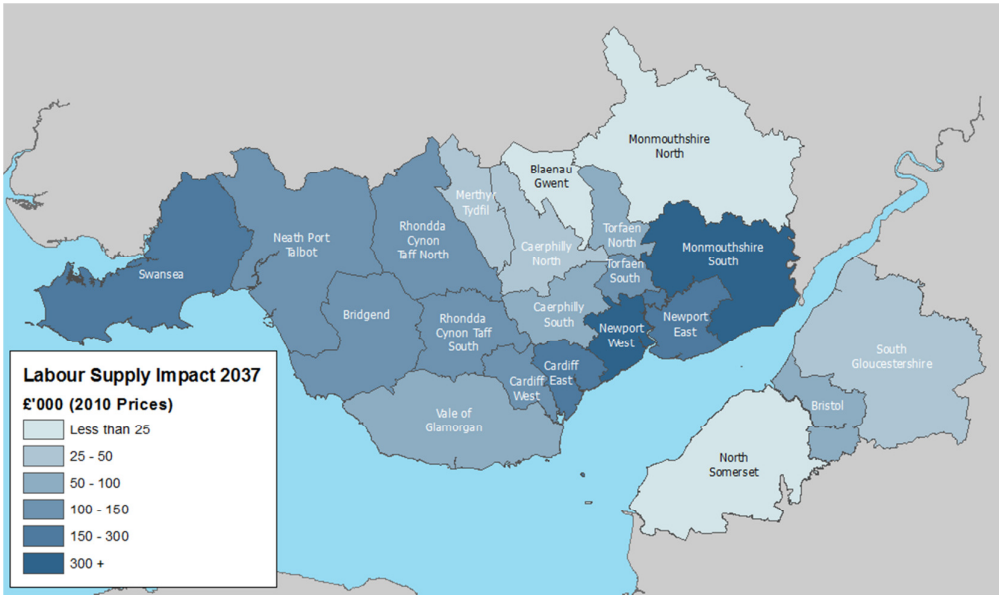
This is the benefit due to increases in the output of goods and services that are valued more highly by consumers than the cost of producing them. As set out in the guidance, this is calculated as a 10% uplift to business user benefits, resulting in an additional benefit of £6.8m in 2037 (2010 prices).

Labour Supply Impacts

Journey time savings reduce the real costs that commuters face to access employment, resulting in an increasing in effective wages. High effective wages will encourage more people into the labour force. 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 economic benefit.

Tax revenues arising from labour market impacts in 2037 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 to reach major employment centres in Cardiff (Figure 4.2).

Figure 4.2 Labour Supply Impact in 2037 by zone



Adjusting the Economic Assessment to Account for Wider Impacts

Over the appraisal period, the above Wider Impacts have a Net Present Value of £715.8m, representing an uplift of 37% on the user benefits contained in the appraisal. Agglomeration effects make up the majority of Wider Impacts.

Table 4.9: Summary of Wider Economic Benefits (£m 2010 Prices)

Wider Impact	Net Present Value (Discounted)
Agglomeration (no employment relocation)	562.7
Output in imperfectly competitive markets	130.0
Labour supply impact (no residential relocation)	23.1
Total	715.8

Therefore, when Wider Impacts are included in the appraisal, the total Net Present Value of the scheme rises from £1.13bn to £1.84bn and the BCR for the scheme rises to 3.10. Therefore, consideration of Wider Impacts further reinforces the conclusion that the scheme offers high value for money. The adjustment to the economic assessment is shown in Table 4.10.

Table 4.10 Summary Business Case including Wider Impacts

	Standard Economic Assessment	Adjusted Economic Assessment (including Wider Impacts)
PVB (£m, 2010)	2,006	2,722
PVC (£m, 2010)	877	877
NPV (£m, 2010)	1,129	1,844
BCR	2.29	3.10

Wider Impacts and GDP

The purpose of the economic assessment is to quantify the impacts of the scheme on welfare such that the societal costs and benefits can be compared. As noted, the inclusion of Wider Impacts acknowledges that the indirect effects of the scheme on the economy result in further benefits that should be taken into account. In part, the Wider Impacts are effects on GDP. Therefore, the analysis provides an overall estimate of the net increase in GDP at a national (UK) level. Table 4.11 summarises the total welfare and GDP benefits from the scheme. Overall, the scheme delivers cumulative GDP impacts of over £2bn in Present Value (2010) terms.

Table 4.11 Summary of Welfare and GDP Benefits

Benefits	Welfare (£m, 2010)	GDP (£m, 2010)
Business user benefits	1,300	1,300
Commuting user benefits	233	
Leisure user benefits	473	
Transport user benefits - conventional appraisal	2,006	
Increase in labour force participation		58
Agglomeration benefits	563	563
Imperfect competition	130	130
Exchequer consequences of increased GDP	23	
Additional to conventional appraisal	716	
Total benefit	2,722	2,050

4.4.2 Local and Regional Economic Impacts

The assessment of Wider Impacts set out above considers the net effects of the scheme on the economy at a UK level. It is also important to consider the distribution of benefits are a local and regional level. An assessment of the impact of the scheme on the 'Severnside' economy has been undertaken, comprising South Wales and part of South West England[38].

Impacts During Construction

The construction phase of the new section of motorway to the south of Newport would provide employment opportunities in the construction sector. Based on standard benchmarks for the labour content of the construction cost, it is expected that the scheme will require in the region of 2,400 person years overall. This corresponds to an average annual labour requirement of 600 full-time workers.

Impacts on GDP and Regional Competitiveness

The new section of motorway to the south of Newport would improve journey times between key centres, reducing the costs of doing business in South Wales and deepening the effective concentration of the economy of the 'Severnside agglomeration'. The combined impact of business cost savings and agglomeration effects is expected to contribute £89.5m (2013 prices) by the design year of 2037.

[38] Blaenau Gwent; Bridgend; Caerphilly; Cardiff; Carmarthenshire; Merthyr Tydfil; Monmouthshire; Neath Port Talbot; Newport; Pembrokeshire; Rhondda, Cynon, Taff; Swansea; Torfaen; Vale of Glamorgan; Bath and North East Somerset; City of Bristol; Forest of Dean; Gloucester; North Somerset; South Gloucestershire and Stroud.

In South Wales specifically, the scheme would deliver an improvement in GDP of £74.1m per annum by 2037.

Because of the strategic importance of the M4 for businesses in Wales to access markets in the rest of the UK, the reduced transport costs and the productivity benefits afforded by the scheme would be expected to improve the competitive position of businesses in south Wales, enabling them to access to access new markets further afield and to compete more effectively in existing markets. Such competition effects and the degree to which they lead to an overall increase in the output of the economy will determine the extent of local economic and employment benefits.

Impacts on the Labour Market

The M4 is heavily used by commuters and there are already significant movements of commuters between Wales and England over the Severn Crossings. In 2011, some 10,600 residents of South East Wales were recorded as driving to workplaces in the greater Bristol area. In contrast, some 3,700 residents of the Bristol area were recorded as driving to workplaces in South[39] Wales. The east to west bias in commuting flows is likely to be the result of higher average wages in the Greater Bristol area than in South East Wales.

In the absence of the motorway to the south of Newport, increased congestion will result in higher journey times for commuters, reducing the effective travel to work area.

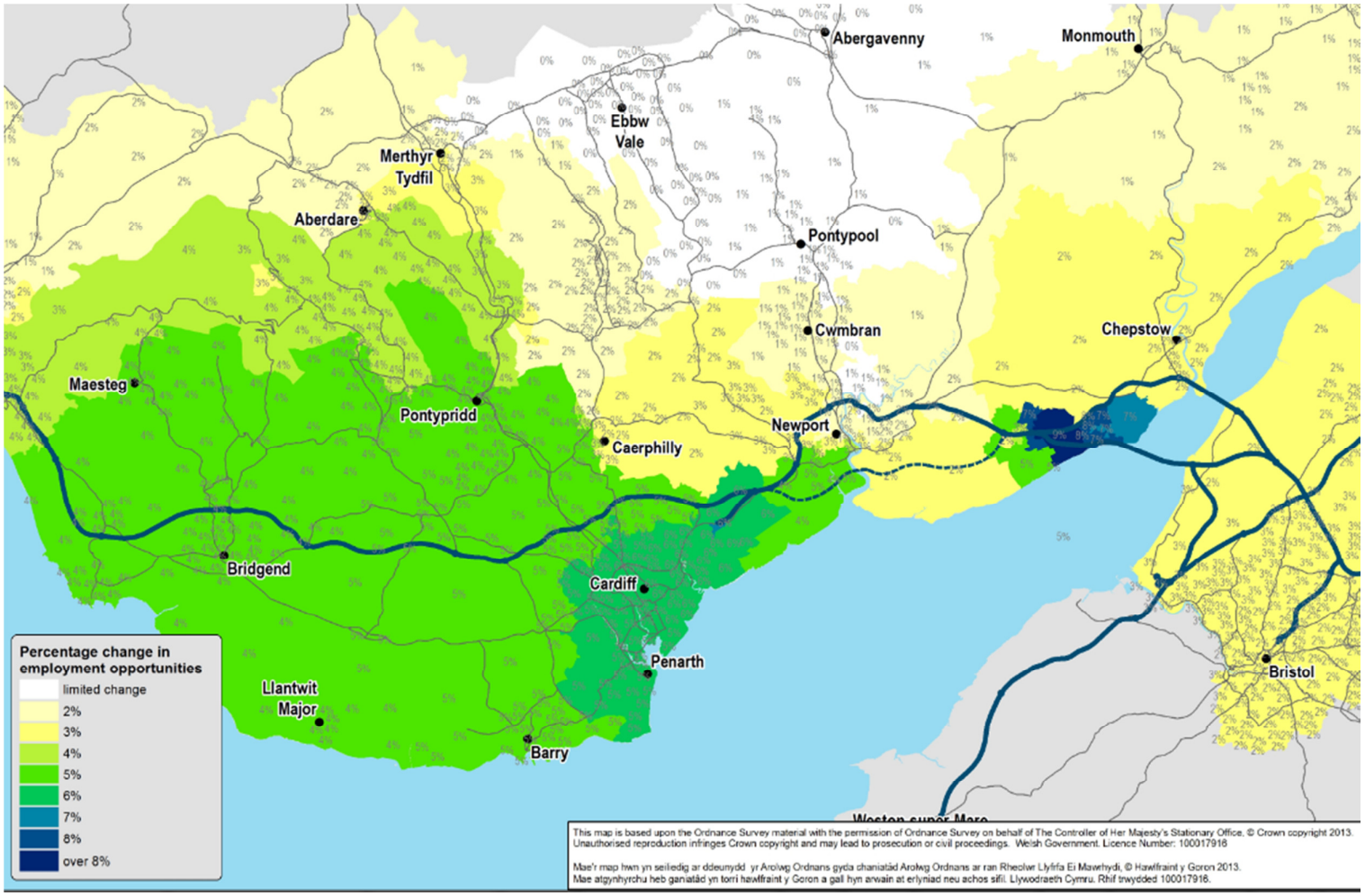
Figure 4.3 shows the forecast impact on employment opportunities in 2037 as a result of the provision of the motorway to the south of Newport. This indicates significant increases in employment opportunities along the M4 corridor from Bridgend across the Severn Estuary to Severnside. It also shows that there are likely to be increased opportunities for employment for residents of the Vale of Glamorgan, much of the South Wales Valleys and Monmouthshire leading into Gloucestershire.

The motorway to the south of Newport will increase access to employment for the benefit of residents as well as employers on both sides of the Severn Crossings who will experience an equivalent improvement in access to a labour.

Investment in public transport (Cardiff Capital Region Metro) would deliver further positive impacts on the labour market.

[39] Office for National Statistics (2013), Annual Population Survey, 2011

Figure 4.3 – Change in Access to Employment Opportunities, 2037 with the Motorway to the South of Newport



Impact on Land Use and Inward Investment

The motorway to the south of Newport will play an important enabling role for major development projects and regeneration. As well as improved operating conditions on the existing M4 around Newport, the new section of motorway will create two new junctions to the south of Newport, greatly improving access to the national motorway network. This will greatly benefit a number of existing and new employment sites in the south of Newport, notably at Newport Docks and Llanwern.

Other strategically important sites in South Wales and Greater Bristol will benefit from the motorway to the south of Newport, albeit to a lesser extent. In particular, the Central Park business park is located adjacent to the M49, just to the east of the Severn Crossings, and is marketed as a logistics centre with excellent links to the motorway network.

At a wider scale, reducing the actual and perceived journey times between South Wales and the rest of the UK, notably London and Heathrow Airport, will make South Wales a more attractive business location for a range of business functions.

4.5 Environmental Impacts

4.5.1 Introduction

The environmental impacts of any transport proposal are distinguished by those attributable to the physical components of the development (land take, drainage and so on) and those that follow from changes in the pattern of traffic movement (resulting, for example, in changes in air quality or noise). The main impacts broadly occur:

- Along the existing route;
- In association with proposed development (along the route of the motorway to the south of Newport); and
- On the remainder of the transport network experiencing change.

These may be termed the three principal "environmental impact areas".

Whilst secondary impacts can occur outside these three areas, the purpose of this business case is to distinguish the main environmental implications of the motorway to the south of Newport that may require mitigation of adverse effects. This purpose can be largely satisfied by focussing on the main areas of change.

Considerable consultation has taken place with the environmental agencies, through both informal and formal mechanisms and consequently there is a good understanding of the mitigation expectations of relevant stakeholders.

4.5.2 Environmental Characteristics of the Area

Existing M4

The existing M4 passes through complex topography and built up areas on the north side of Newport, being most constrained in the areas of St Julians, around the Brynglas Tunnels and at High Cross where housing areas lie adjacent to and/or above the road. That the presence of the M4 has adverse impacts on the environment is evidenced by the fact that four out of Newport's seven Air Quality Management Areas (AQMAs), listed below, are associated with the M4 (indicated in italics).

- *Glasllwch AQMA - located south of the Junction 27 off Basseleg Road, extending either side of the M4.*
- *Shaftesbury/Crindau AQMA - located around Junction 26 of the M4 including part of Malpas Road.*
- *St Julians AQMA – located at the north end of Denbigh Street immediately adjacent to the slip road at Junction 25 of the M4.*
- Malpas Road AQMA - located along both sides of Malpas Road in the vicinity of the junction with Redland Street.
- Caerleon Road AQMA - located on the western side of Caerleon Road between the junctions with Durham Road and York Road.
- *Royal Oak Hill AQMA - located adjacent to the M4 motorway just west of where Royal Oak Hill crosses the motorway.*

- Caerleon High Street AQMA - located along either side of the High Street in Caerleon.

High traffic volumes and traffic congestion along the M4 contribute not only to poor air quality but also noise pollution, compromising the aural amenity of neighbouring residential communities.

Motorway to the South of Newport

The environs of the route of the motorway to the south of Newport are characterised by flat coastal lands (Gwent Levels), which are sparsely developed and populated. The Gwent Levels are a man-made landscape created by systematic reclamation, since Roman times, of salt marsh alongside the Severn Estuary. The reen drainage system supports a diversity of flora and fauna, largely protected by SSSI (Site of Special Scientific Interest) designations. In addition, the Levels are registered as landscape of Outstanding Historic Interest in Wales, acknowledging their evolution and archaeology.

Land in the Gwent Levels is mainly agricultural, in moderate to good categories, comprising a mixture of dairy, arable, poultry and mixed livestock units. Air quality is good and the Levels meet many of the criteria for a "tranquil area" – denoting low disturbance from urban influences – particularly true closer to the coast but not so further inland where their part of the boundaries are adjacent to both light and heavy industries.

The motorway to the south of Newport follows the northern edge of the designated areas, where the countryside interfaces with those industrial areas of Newport and the urban regeneration site (former steelworks) at Llanwern. The alignment of the road has been selected to minimise its impact on the integrity of the Levels landscape and unique character.

Transport Network

The transport network potentially affected by changes to the M4 Corridor around Newport is variable and can best be characterised as predominantly urban, with housing areas and local communities potentially affected by changes to amenity, accessibility and severance caused by an increase or decrease in traffic volumes or change in the type of traffic.

Summary Evaluation

There is a clear distinction between the environmental qualities of the corridors of existing M4 and new section of motorway, which allow characterisation of impacts along the former as predominantly "people" related and along the latter as predominantly affecting "natural and historic" resources. In the wider transport network area the picture is less consistent but tends towards more residential amenity effects.

4.5.3 Without the Motorway to the South of Newport

The Do Minimum scenario, whilst resulting in some trip suppression due to congestion effects, means that annual traffic growth (vehicle kilometres) will be distributed across the existing road network. For through trips this is expected to lead to more congested conditions on the M4 and diversion onto local roads such as the A48 Newport Southern Distributor Road (SDR).

Assuming no improvements to vehicle emissions technology, the increased flows and stop start conditions will give rise to more vehicle emissions along these routes.

The primary environmental advantage of the Do Minimum scenario is the absence of environmental impacts from the construction of the new road (see below).

4.5.4 Significant Environmental Effects of the Motorway to the South of Newport

The motorway south of Newport has significant environmental effects which focus on the preferred route corridor for the motorway to the south of Newport and arise from the construction of the road and its subsequent use. The main impacts are summarised below:

Table 4.12: Environmental Impacts of the Motorway to the South of Newport

Topic	Likely Impact
Ecology and Nature Conservation	The Preferred Route will cross 8.5km of Sites of Special Scientific Interest (SSSI). The primary interest of the SSSI stems from the flora and fauna of the reen network. Impacts on the SSSI and associated reens habitat will be mitigated through extensive construction environmental mitigation, a strategy of replacement reens and potentially replacement habitat for the loss of designated SSSI. The route also crosses the River Usk SAC (Special Area of Conservation), for which further assessment under the Habitats Regulations (2010) will be required. The scheme will require sensitive design and the inclusion of mitigation measures to avoid effects on designated sites including European Sites.
Geology, Hydrogeology and Soils	No designated geological sites are present along the Preferred Route corridor. The potential for pollution incidents will be managed through the implementation of a Construction Code of Practice. Some areas of contamination along the path of the road have been identified requiring removal or stabilisation on site.
Materials	Cutting will be required at Castleton to accommodate the new interchange, and to a lesser extent at Magor. Re-use of materials within the scheme will seek to minimise the import and export of materials, including off-site transportation of landfill waste. The Preferred Route corridor aims to minimise impacts associated with crossing the Docks Way Landfill site.
Landscape	Large landscape impacts are expected as a result of the construction of the scheme across sensitive landscape character areas. A large bridge crossing structure is proposed across the River Usk, which would have impacts on central Newport, including the Transporter Bridge. The bridge design and materials, and the design and planting of embankments will be carefully considered. A new bridge could be seen as a positive addition to the Newport townscape and current suite of bridges in the city. Replacement of existing planting around Castleton and Magor will be essential for landscaping. Additional planting around residential areas would help mitigate effects.
Cultural Heritage	The Preferred Route corridor passes through parts of the Gwent Levels registered historic landscape. The Grade II listed Magor Vicarage would be demolished as a result of the scheme. One Scheduled Monument lies close to the preferred route corridor, and several others within 500m of the scheme. There is a potential for encountering as yet undiscovered archaeological deposits, particularly across the Gwent Levels.

Table 4.12: Environmental Impacts of the Motorway to the South of Newport

Topic	Likely Impact
Community and Private Assets	Based on the footprint of the Preferred Route corridor the scheme will result in the loss of approximately 500 hectares of Grade 2 and Grade 3 agricultural land, and require the demolition of approximately 40 residential/commercial/community buildings. In addition, a number of businesses in the Docks area, and agricultural businesses are likely to be impacted. This does not take into account individual circumstances, or changes that may arise as the detailed design develops.
Road Drainage and the Water Environment	The Preferred Route corridor will require a number of watercourse crossings and culverts constructed to maintain hydrological connectivity. The existing reen network will be maintained and enhanced through a system of culverting, diversions and replacement reens. Detailed design measures will include Sustainable Urban Drainage (SUDS) features. Water Treatment Areas, including reed-bed filtration will be incorporated into the scheme to manage quality and quantity of surface water discharge.
Air Quality	Reductions in pollution levels will be experienced in areas alongside the existing M4 in Newport. The road will give rise to deterioration in air quality near the preferred route corridor, affecting approximately 187 properties. Improvements in air quality are expected along the existing M4, which benefits over 7900 properties. Critical loads for nitrogen deposition on the SSSI are not expected to be exceeded.
Noise and vibration	The Gwent Levels have relatively low ambient noise levels, and therefore introducing a new source of noise is likely to increase noise levels to parts of the Gwent Levels by 10bB(A) or more at residential receptors close to the preferred route corridor. A greater number of residential properties will benefit from improvements in background noise levels of up to 5dB(A). Most properties at Magor and Castleton are expected to experience a decrease in noise, arising from the construction of the scheme to low noise motorway standards in comparison with the existing M4, upgrading of the existing carriageway and topographical screening.
Effects on all Travellers	Some disruption to pedestrians, cyclists and equestrians is expected during construction but will be minimised in the longer term through the provision of new improved route alternatives. Driver views and stress are likely to be improved, in accordance with the objectives of the scheme.

4.5.5 Appraisal against desired environmental outcomes

Desired environmental goals originate from the Wales Transport Strategy and are represented in WelTAG at national (Welsh Impact Area) level. These are:

Environmental

- Increase the use of more sustainable materials;
- Reduce the contribution of transport to greenhouse gas emissions;
- Adapt to the impacts of climate change;
- Reduce the contribution of transport to air pollution and other harmful emissions;
- Improve the impact of transport on the local environment;
- Improve the impact of transport on our heritage; and
- Improve the impact of transport on biodiversity.

Table 4.13 summarises the environmental appraisal criteria of the motorway to the south of Newport, having regard to the above desired goals.

Table 4.13 Environmental Appraisal Summary Table

Options Criteria	Do Minimum	Motorway to the South of Newport
Noise	More traffic on existing route and local roads adding to the noise environment.	Improvements on the existing route with trips diverted onto the New M4. Some improvements at peak hour in Magor due to new junction arrangement.
Air	Poorer local air conditions along the existing route and wider road network. Higher C02 emissions due to stop/start conditions.	Increased emissions and deterioration of air quality on new route. Improved conditions alongside existing route and improved local air conditions in Magor from reduced through/queuing traffic.
Landscape	No direct change	Road is an intrusive feature across the open Levels landscape. Cutting and embankment at Castleton. Major new bridge feature in Newport is a townscape opportunity. Some intrusion from the junction east of Magor.
Nature conservation	Ecology: No direct change	Road crosses 8.5km SSSI and the River Usk SAC and passes close to the Newport Wetlands and Severn Estuary SPA and Ramsar site. Habitat loss around junction east of Magor.
Heritage	No direct change	Road crosses historic landscape with surface and sub-surface disturbance. Also results in loss of listed building and movement of scheduled standing stone.
Water	No direct change	Road constructed across managed reen drainage system and on flood plain.

4.6 Summary of Economic Case

The SATURN traffic model for the M4 Corridor around Newport has undergone a present year validation in 2012. The traffic model has then been used to prepare future year traffic forecasts. Variable demand modelling has been deployed and economic assessment has been undertaken. The resulting Transport Economic Efficiency (TEE) analysis compares the discounted value of transport benefits arising from the motorway to the south of Newport with the discounted value of costs of implementing and operating the motorway to the south of Newport. The performance, in terms of Net Present Value (NPV) and Benefit to Cost Ratio (BCR), is as follows:

- Net Present Value of the motorway to the south of Newport is estimated to be £1.1bn; and
- Benefit to Cost Ratio of the project is forecast to be 2.29.

The transport economic efficiency benefits that would accrue as a result of the motorway to the south of Newport would be expected to out-weigh the investment costs by more than £1bn; so that there would be a return of more than double on the investment made.

The motorway to the south of Newport will provide a reliable journey along the east/west corridor and will capture agglomeration benefits to businesses in this Bristol/Cardiff corridor as 'separation' is reduced. The existing M4 currently performs twin roles in terms of support to the regional/national economy, namely:

- Providing inter-regional linkages and linkages between Wales and the rest of the UK; and
- Facilitating movement within the city-region, focusing on Cardiff/Newport.

With regard to the former of these, the motorway to the south of Newport will provide the linkage more reliably and efficiently. Wider economic evidence has shown that access to London and the South East is important and the provision of the New M4 will thus strengthen economic opportunity for the region.

Provision of the motorway to the south of Newport will free up capacity on the existing M4 around Newport. This will improve the functioning of the city-region and hence improve employment opportunities within the region. Improved operating conditions on the existing M4 around Newport will open up potential to improve the local transport networks within the city of Newport, and will generally increase local accessibility. Estimates for the motorway to the south of Newport suggest that wider impacts will be likely to increase scheme benefits in the order of 37%.

The economic appraisal has shown that implementation of the motorway to the south of Newport represents high value for money as defined in the Department for Transport's guidance for the economic case as part of the Transport Business Case.[40]

[40] Value for Money Guidance, Economic Case, Transport Business Case, Department for Transport, 27 April 2011

5 Commercial Case – Viability

5.1 Background

In December 2011, the Autumn Statement by the Chancellor of the Exchequer announced that there would be discussions with Welsh Government regarding he options for improvements to the M4, including the provision of additional finance, which could impact upon plans for a new M4 relief road.

In July 2013, the Welsh Minister for Economy, Science and Transport delivered a Written Statement on Transport. This statement highlighted key road projects for delivery. Amongst these projects was a new section of motorway to be built to the south of Newport.

A Public Private Partnership (PPP) option to deliver this project is likely to be more expensive than an Early Contractor Involvement (ECI) option, largely driven by the extra financing requirement and the higher cost of capital.

During the April 2014 Budget announcement and visit by Chancellor George Osborne to South East Wales, there have been high level political discussions and statements made to the media, associated with proposed improvements to the M4 corridor around Newport. On 19 March 2014, Mr Osborne announced:

"Tomorrow we introduce legislation to give new tax and borrowing powers to the Welsh Government to fund their infrastructure needs, and they can start now on work to improve the M4 in South Wales".

During his visit to South Wales in the same month the Chancellor then told BBC Wales that the M4 around Newport is:

"one of the bottlenecks for the entire United Kingdom and, again, not dealt with for years and years and years, and damaging to the Welsh Economy".

In reference to the Welsh Government being given more borrowing and tax powers, he went on to state:

"We don't want to wait for those borrowing powers to be in place, we want the Welsh Assembly Government to get on and to be able to fund this earlier. Why wait for a vital improvement that will support jobs in the area?"

The commercial case for the motorway to the south of Newport thus depends on the availability and security of a hypothecated revenue source to service any debt arising from preferential borrowing, which in itself will need to demonstrate that it is a cost effective means of financing the capital cost of the project. Since dialogue is on-going at Government level, assumptions need to be made regarding availability of funds and the cost of capital.

As well as Welsh Government budgets, it is planned to utilise UK borrowing powers afforded by recent initiatives, including discussions between the Welsh Government and HM Treasury/Department for Transport, as well as the work of the Silk Commission[41], which has created future potential funding opportunities for Welsh Government infrastructure projects.

[41] The 'Silk' Commission of Devolution in Wales, which is reviewing the case for the devolution of fiscal powers and reviewing the powers of the National Assembly for Wales.

5.2 Risk

This section gives a summary of the Quantitative Risk Assessment (QRA) methodology adopted for the motorway to the south of Newport project. It covers the identification of hazards, the elicitation of information on the likelihood and impact of the hazards, and the development and application of a Monte Carlo model from which to predict the potential additional costs to the project resulting from the identified hazards.

5.2.1 Identifying the Hazards

The first stage in the QRA methodology is to compile the Risk Register. This involves first categorising the contributors to risk and then populating these categories with more detailed potential hazards.

A number of studies of the M4 Corridor around Newport have been carried out that informed the risk assessment process and identified a number of potential risks. The risk register has been developed over a number of years with the starting point being the version modified as part of the Preferred Route Review undertaken in 2005/2006.

In March/April 2014, Quantitative Risk Assessment (QRA) workshops were held. The workshops reviewed the risks already identified and looked at each section of the design in turn and sought to identify any additional risks that could impact on the success of the project in meeting the Welsh Government's policy and objectives.

The operational and maintenance risks included within the risk register require further development and will be analysed further at the next stage of project development.

5.2.2 Quantifying the Hazard Outcomes

Quantitative information is required for each of the significant hazards. This includes the likelihood of the hazard occurring and the potential severity of its consequence. Where possible these judgements have been based on information from previous studies and documentation, and otherwise on the experience within the project team.

Likelihood was assessed as the percentage probability of occurrence. The minimum, maximum and most likely financial consequences were then assessed, for each event should it occur. Potential delays for individual risk events were assessed, taking into account the assessed criticality and concurrency of the individual potential delays to arrive at the potential financial impact of programme slippage both before and during construction.

A matrix scoring system was then used to provide an indication of risk ranking and used as a management tool.

The information obtained from the workshop was recorded in the risk register, which then provided the main source of information for the QRA model. Hazards and outcomes were identified at a level appropriate to the overall decision-making process that the assessment is intended to inform. Having identified the hazards,

these were reviewed to screen out any duplication and to ensure that the frequencies and impacts (costs) were consistently applied across all hazards.

5.2.3 Expected Risk Allocation

Table 5.1 sets out the typical risk allocation and transfer that can be achieved under a standard commercial contract. This table demonstrates the risk that would remain, wholly or in part with the Welsh Government when establishing a contract to deliver the motorway to the south of Newport and then the risks associated with the on-going operational responsibilities.

Table 5.1: Typical Risk Allocation

Risk Type	Welsh Government	Contractor
Approval risk of statutory procedures	✓	
Environmental Risks	✓	✓
Increase in construction costs	✓	✓
Completion risk	✓	✓
Welsh Government Transport Group risks (ie action from WG which affect the costs of undertaking the project)	✓	
Political risk	✓	
Legal Risk	✓	
Force Majeure	✓	✓
Operational risk	✓	
Traffic Volume Risk	✓	
New technical / environmental standards	✓	✓
Increase in operational costs	✓	

5.2.4 Risks of Delay to the Project

The risk of delay to the project can be thought of in two distinct ways:

- the risk of delay to the contract completion or financial close of the project, which will remain with the Welsh Government under any event, and;
- the risk of delay to the completion of construction (or the start of operations), a risk which will transfer to the private sector unless directly attributable to the actions of the Welsh Government.

5.2.5 Process and Stakeholder Risk

Public Local Inquiry (PLI) carries risk of delay in the development and delivery of this scheme. The scheme forms part of a Plan for the M4 Corridor around Newport, which may be at risk of procedural challenge. The current delivery programme for the new section of motorway to the south of Newport is as presented in Appendix C. It is intended to mitigate this risk through thorough preparation of the details of the project, especially with regard to the Environmental Impact Assessment (EIA) that will identify the potential effects on

the habitat, Special Areas of Conservation and the defined Special Sites of Scientific Interests.

A public consultation on the Welsh Government's draft Plan for the M4 Corridor around Newport was held between September and December 2013.

As part of press releases, Newport City Council has expressed broad support for an M4 relief road[42], whilst it is the 'number one priority for CBI Wales members'[43].

The participation process associated with the M4 Corridor around Newport is summarised within a Participation Report[44]. Continued dialogue with statutory consultees and other interested parties has been central to the development of the M4 Corridor around Newport Plan, and will continue to play a key role in delivering the motorway to the south of Newport.

In terms of the statutory consultees and affected landowners a comprehensive communications and liaison programme has been established. Although no formal responses have been sought, to date the key issues for these group are as follows:

- Magor, Rogiet and Undy: the residents are concerned that the route is close to the western end of Magor and it will lead to further traffic through their communities along the B4245. The communities would welcome the provision of a junction to the east of Magor between the B4245 and the M48;
- Corus Llanwern Steelworks and St Modwen: this group has expressed concerns re the routeing of the motorway to the south of Newport and the effects the road would have on their site and future developments especially if the route was moved further north in that area; and
- ABP Newport: the route of the motorway to the south of Newport passes through the Newport Docks and will impact certain operations. Negotiations with ABP are ongoing to understand and mitigate these risks. .

5.3 Project Delivery: Early Contractor Involvement

From the outset, it will be important to successful delivery for the Welsh Government to demonstrate clear support and commitment to the project in order to generate confidence in the market. Effective competition is essential if value for money is to be delivered from the procurement process.

The commercial case assumes an Early Contractor Involvement (ECI) delivery model. ECI is proven to be a good approach because ECI is beneficial in adding value for the Welsh Government by providing greater programme and cost certainty, designing in contractor's construction methodology, driving down cost and overall reducing the level of risk as the commencement of the construction contract. This form of contract allows the contractor to consider buildability construction methods and sustainable use of materials at the early stages in the design development. ECI is expected to delivery better value for money from the public investment made by Welsh Government.

[42] http://www.bbc.co.uk/news/uk-wales-south-east-wales-25748541
[43] http://www.walesonline.co.uk/business/business-news/m4-relief-road-around-newport-7227326
[44] M4 Corridor around Newport Participation Report (July 2014)

6 Financial Case – Affordability

The financial analysis of the motorway to the south of Newport assumes the project is delivered through Early Contractor Involvement (ECI), funded partly through borrowing at public sector rates and partly funded from Welsh Government's capital budget.

The high level cost estimate for the new section of motorway is around £1bn. This estimate includes allowances for optimism bias and for risk. Work will continue to seek opportunities to reduce costs through value engineering and competitive tendering. As well as Welsh Government budgets, it is planned to utilise UK borrowing powers afforded by recent initiatives, including discussions between the Welsh Government and HM Treasury/Department for Transport, as well as the work of the Silk Commission, which has created future potential funding opportunities for Welsh government infrastructure projects.

7 Management Case – Achievability

7.1 Introduction

Delivery of the motorway to the south of Newport will be overseen by Welsh Government and will be subject to OGC gateway processes. A governance structure and necessary resources are identified to achieve this. Welsh Government will be assisted by legal, financial, technical and contract specialists.

It will be important to the successful delivery of the motorway to the south of Newport for the Welsh Government to demonstrate clear support and commitment to the project in order to generate confidence in the market. Effective competition is essential if value for money is to be delivered from the procurement process.

One of the key factors that will impact upon the competitiveness of the market is the level of certainty that the project will proceed through to a successful delivery.

7.2 Project Management and Governance Arrangements

A Project Team from within Welsh Government has been established to manage and delivery the project. The Project Team will report to a Project Board of Senior Management, which will oversee the strategic direction of the project. The Project Board will comprise senior personnel from the Department for Economy, Science and Transport.

7.2.1 Project Board

The Project Board will comprise senior personnel from the Department for Economy, Science and Transport responsible for defining the direction of the Project and ensuring its smooth progression. The Project Board will:

- Consider and approve the business case;
- Agree the final procurement option;
- Approve the preferred bidder;
- Agree a high level project timetable for delivery;
- Create an environment in which the project can thrive;
- Advise and support the Project Team; and
- Review the project against policy objectives at agreed milestones and provide continued commitment and endorsement where appropriate.

7.2.2 Core Project Team

The Core Project Team is provided by Welsh Government staff and is responsible for the day-to-day detailed management of the project. The primary activities include:

- Promoting the project both internally and to external partners and stakeholders;
- Ensuring the project delivered is the optimum solution;
- Ensuring project activities comply with Welsh Government policy;
- Exercising appropriate executive control over Technical, Environmental, Financial and Procurement Advisors;
- Ensuring the project is delivered to programme;
- Ensuring the project delivers Value for Money within delegated financial commitments;
- Ensuring the project is designed to appropriate standards and value engineering principles;
- Ensuring the Statutory Process is implemented in the delivery of the project;
- Reporting to the Project Board and Minister responsible for Transport on progress at agreed milestones, and seeking approval for project development to continue; and
- Dealing with queries on project related matters.

7.2.3 Project Governance

The Project Management within the Department for Economy, Science and Transport will be governed in accordance with the Welsh Government's Procedures Guidance for Roads Projects. The Guidance is structured along a linear 6-stage Key Stage Approval (KSA) System (see Appendix D) which provides a financial approval gateway review for schemes in the Trunk Road Forward Programme through to construction and opening. Each key stage will be subject to a review by members of the Project Board to seek approval to continue to the next stage.

The Project Assurance group will provide quality assurance and control for all stages of the project and will involve functional experts, officials, stakeholders and environmental groups.

In parallel to the KSA reviews, the project will be subject to periodic End Stage Reviews, and where required under Welsh Government procedures, Gateway Reviews at key decision points to provide assurance that the project can progress successfully to the next stage. The Department for Economy, Science and Transport has introduced four internal End Stage Reviews in evaluation of its projects and programmes. For Gateway Reviews, these will follow the process for projects described by the Office of Government Commerce (OGC). End Stage and Gateway Reviews will be carried out prior to, and the results reported as part of, the Key Stage Approval submission.

7.3 Risk Management Approach

In this ECI Contract, the parties share and jointly manage the risk for delivering the project, although some risks remain with the Welsh Government. During Key Stage 4 of the ECI process, the Welsh Government will bear most of the project risk as the contractor's obligation during this stage is to deliver the draft Orders through an objection period, local public inquiry and making of the Orders.

ECI procurement has significant advances in relation to risk as it enables thorough and transparent analysis. This provides opportunity to develop and agree appropriate mitigation measures before detailed design commences. At the start of construction (KS6), risks are clearly allocated to either the Welsh Government or the contractor on the basis of which party is best able to positively influence the outcome. Appropriate financial contingencies are made based on probability and impact. Draw down and on-going management of the remaining risk budget would be jointly and proactively managed by the both parties.

A dedicated Risk Manager is provided on the contract to oversee the risk management process along with a risk management plan which provides a co-ordinated strategy for managing project risk. Using a quantitative risk assessment methodology set out in the risk management plan, a risk register has been developed for all project activities.

The risk register is a live document, which would be added to and updated on a weekly basis by the Programme and Risk manager. Significant Early Warnings and major risk would be immediately brought to the attention of the Project Manager. Following more de tailed appraisal all risk would be allocated to an individual owner. The owner would be the person most able to influence the outcome irrespective of employer. The owner would develop individual risk management proposals supported by the Programme and Risk Manager.

7.3.1 Establishing a QRA Model

In order to obtain an overall assessment of the project risk, it is necessary to combine the likelihood and severities associated with each identified risk, taking into account the uncertainties in these estimates. For this a stochastic (Monte Carlo) @Risk version 6.0.0 model has been used, based on Excel spreadsheets.

Having populated the QRA model with the information from the Risk Register it was then possible to identify the significant risks and to use the model itself to explore the influence of the various contributors to risk. Preliminary findings from the model are fed back to the project team as a consistency check ensuring the model gave a balanced view of the various contributors to risk.

7.3.2 Taking the Risk Assessment Forward

The process of risk identification and estimation will continue throughout the project life. The QRA is intended to be a live document which will be subject to periodic review to take account of any changes in order that it is a proactive rather than reactive risk management tool and as such form part of the project management framework.

As the project moves forward, monthly risk meetings with discipline leads will be undertaken to maintain a live register and any changes identified and discussed to assign the severity and probability ratings. A quarterly risk register review will be undertaken to step through all the risks identified and ensure that the register is used as a working tool and reflects the current status of the project.

The Risk Manager will be responsible for updating the risk register following from the risk meetings, maintaining the master copy of the risk register and updating the risk register with any changes throughout the life of the project. The discipline leads will be responsible for monitoring risks related to their specific

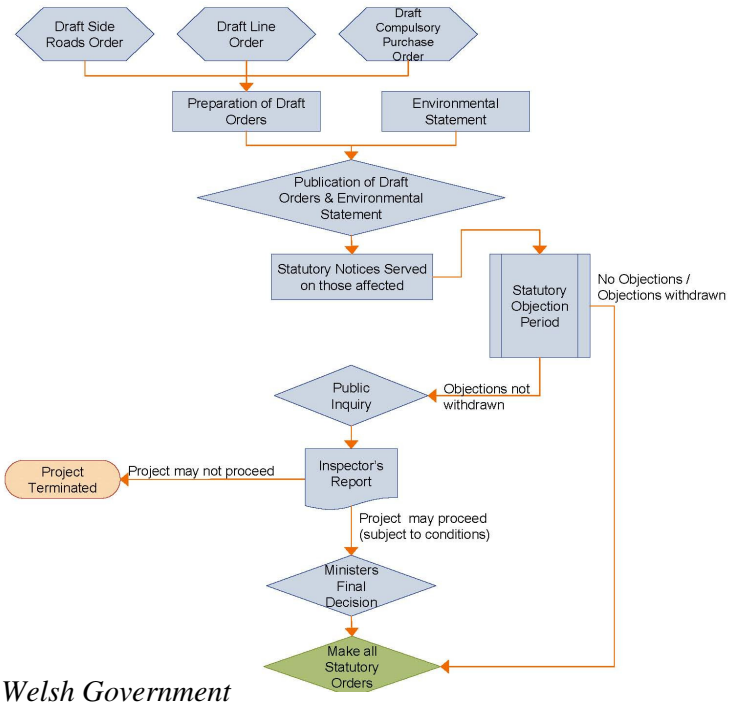
discipline and will inform the Risk Manager of any changes required to be made to the risk register.

Risk indicators will be utilised to alert the Risk Manager of key dates or indications to be monitored to ensure that the risk stays within tolerable limits. Major risks for the project warrant more detailed attention and mitigation measures to be implemented to ensure that the risks are managed and do not crystallise and this will be done as the project progresses. Mitigation measures will be implemented for low category risks if the effort is proportionate to the benefit of implementing the additional measures. Monitoring of the low category risks will be undertaken to ensure that the risks are not escalated throughout the life of the project.

7.4 Statutory Processes

The key statutory processes and approvals which the motorway to the south of Newport is likely to involve are illustrated in the flowchart in Figure 7.3.

Figure 7.3: Statutory and Regulatory Processes



Source: Welsh Government

The statutory and regulatory processes will involve the following activities:

- Production of a set of draft Orders these will include a draft Line Order which will authorises the construction of a Special Road (motorway) along the prescribed route, including where it would cross the Rivers Usk and Ebbw and Newport Docks; draft Side Roads Order which will enable the stopping-up of existing highways, private means of access, footways, as well as improving highways and re-providing new highways and access routes; and a draft Compulsory Purchase Order which enables the purchase of land and property

affected by the new road and acquires the appropriate rights and easements over land;

- Ascertain effects on European Sites, including Special Areas of Conservation (Habitats Regulations Assessment)m, consult with the Statutory Nature Conservation Body (Natural Resources Wales) and have regard to any representations made by that body;
- Production of a draft Environmental Statement;
- Draft Orders and Environmental Statement will then be published;
- Following publication, those affected by the draft Orders will be served with notices;
- The public will then be given an opportunity to object to, and comment on, the proposals;
- If statutory objections are not withdrawn the proposal will go to a Public Local Inquiry with an independent Inspector;
- The Inspector will then recommend, following the Inquiry, whether the construction of the project can proceed and what changes or conditions, if any, should be made;
- Necessary statutory consents will be obtained;
- Obtain approval of Habitats Regulations Assessment by the Welsh Government Minister for Natural Resources and Food; and
- The Welsh Government Minister responsible for Transport will then decide whether to accept or modify the Inspector's recommendations before the project can proceed.

The Welsh Government, as promoter of this project, is fully cognizant with the statutory and regulatory processes and associated risks. The Welsh Government has the necessary resources, experience and expertise to deliver this project.

Appendices

Appendix A

Appraisal Summary Tables (AST)

Appendix B

Transport Economic Efficiency Tables

Appendix C

Delivery Programme

Appendix D

Key Stage Approval (KSA) System

Appendix A

Appraisal Summary Tables (AST)

A1 Appraisal Summary Tables (AST)

Appraisal Summary Tables (ASTs) for the Do Minimum Scenario and the scheme have been prepared using the seven point scale of impact significance set out in Paragraph 3.7.1 of WelTAG.

Following each impact appraisal for both Stages 1 and 2, WelTAG recommends that the significance of impact for each criterion is assessed using a seven point scale detailed in Paragraph 3.7.1[1] of the WelTAG guidance. This scale includes the following assessment criteria:

- Large beneficial (+++);
- Moderate beneficial (++);
- Slight beneficial (+);
- Neutral (0);
- Slight adverse (-);
- Moderate adverse (--);
- Large adverse (---).

The assessment of impact on each of the Welsh Impact Areas is to be provided in Appraisal Summary Tables (ASTs).

WelTAG also requires, in Paragraph 3.5.1[2], that the distribution of impacts is carefully considered. This part of the assessment refers to how impacts might be distributed geographically and how they might affect different groups in society.

Table 1[3]: Assessment of the Do Minimum Scenario against WelTAG Criteria and Transport Planning Objectives (TPOs)

Criteria	Assessment	Distribution	Significance
Transport Economic Efficiency (TEE)	Congestion on the M4 between junctions 24 and 29 is already thought to be impacting on business performance and the level of congestion is expected to increase. Cardiff and Newport have ambitious regeneration strategies and Monmouthshire is developing areas around Junction 23a of the M4. Traffic congestion on the M4 could hamper these plans and impact negatively on regional economic development. Assessment has shown that no improvement to the motorway would lose the opportunity to create £2 bn to £2.7 bn (including wider impacts) in benefits.	All	(---)

[1] Source: Welsh Transport Planning and Appraisal Guidance – June 2008
[2] Source: Welsh Transport Planning and Appraisal Guidance – June 2008
[3] Tables 1 – 4 Source: WelTAG Stage 1 and 2 (Scheme) Appraisal Report, Draft 2, July 2014

Criteria	Assessment	Distribution	Significance
Economic Activity and Location Impact (EALI)	Congestion on the M4, particularly around Cardiff and Newport, is sighted by the business community in South Wales as a barrier to economic growth. Where congestion increases, the cost of transport for businesses, commuters and consumers and economic performance can be affected. Increased congestion will adversely impact on the movement of commuters. The M4 is heavily used by commuters and there are already significant movements of commuters between Wales and England over the Severn Crossings. Increased congestion will result in higher journey times for commuters, reducing the effective travel to work area.	All	(---)
Noise	High traffic volumes along the M4 contribute to noise pollution, compromising the aural amenity of neighbouring residential communities.	Properties along the existing M4	(--)
Local Air Quality	High traffic volumes along the M4 contribute to poor air quality, compromising the amenity of neighbouring residential communities. This will affect the condition of four out of Newport's nine Air Quality Management Areas (AQMAs) that are associated with the M4.	Properties along the existing M4	(--)
Greenhouse Gas Emissions	Traffic conditions are expected to deteriorate and slow-moving, stop/start driving conditions can lead to higher CO_2 emissions than free-flowing traffic.	No significant distributional impacts	(-)
Landscape and townscape	There would be no or limited change as a result of the Do Minimum Scenario.	No significant landscape impacts	(0)
Biodiversity	There would be no or limited change as a result of the Do Minimum Scenario.	No significant distributional impacts	(0)
Heritage	There would be no or limited change as a result of the Do Minimum Scenario.	No significant distributional impacts	(0)
Water environment	There would be no or limited change as a result of the Do Minimum Scenario.	No significant distributional impacts	(0)
Soils	There would be no or limited change as a result of the Do Minimum Scenario.	No significant distributional impacts	(0)
Transport safety	The more congested road conditions become, the greater the risk of incidents and accidents occurring. The most common accidents on the M4 between junctions 25 and 28 are rear-end shunts on both the westbound and eastbound approaches to the Brynglas Tunnels. This is largely due to the stop-start conditions that occur during peak periods.	All road users	(--)
Personal security	The Do Minimum Scenario would lead to continuing traffic congestion on the existing motorway which would impact on journey time reliability. There would be limited improvements to infrastructure which would negatively impact on many vulnerable groups who rely on transport modes other than the car to access activities and services.	No significant distributional impacts	(0)

Criteria	Assessment	Distribution	Significance
Permeability	The Do Minimum Scenario would lead to continuing traffic congestion on the existing motorway which would impact on journey time reliability. This would bring negative impacts to those reliant on the car to access facilities, services and employment opportunities, as well as those utilising public transport for this purpose, with traffic diverting to local roads during peak periods.	No significant distributional impacts	(-)
Physical fitness	Air quality and noise issues could also continue to increase along the existing motorway corridor, impacting on residential areas to the north of Newport.	No significant distributional impacts	(0)
Social inclusion	The Do Minimum Scenario would lead to continuing traffic congestion on the existing motorway which would impact on journey time reliability. This would adversely impact on access to services, facilities and employment opportunities for all those with access to a car, and who rely on public transport due to continued problems associated with motorway traffic diverting onto local roads to avoid peak congestion. The continuing problems would further hamper economic growth and prosperity in the region.	No significant distributional impacts	(-)
Equality, Diversity & Human Rights	The Do Minimum Scenario would lead to continuing traffic congestion on the existing motorway which will impact on journey time reliability. This would impact those vulnerable groups reliant on the car to access services, facilities and employment opportunities. This continuation of reported problems would also continue to hamper economic growth potential of the region, restricting the movement of people and freight, particularly at peak periods.	No significant distributional impacts	(0)
TPOs			
1	As congestion increases, safety conditions and journey time reliability will deteriorate.	All	(---)
2	Travel conditions on the M4 are forecast to worsen over time, reducing accessibility on the transport network.	All	(--)
3	There would be no or limited change as a result of the Do Minimum Scenario.	All	(0)
4	There would be no or limited change as a result of the Do Minimum Scenario.	All	(0)
5	Increased levels of congestion will reduce journey time reliability, particularly at peak travel times.	All	(--)
6	There would be no or limited change as a result of the Do Minimum Scenario.	All	(0)
7	Increased congestion will exacerbate the risk of incidents and accidents occurring.	All	(--)
8	Increased traffic volumes and stop/start conditions will exacerbate poor air quality, particularly in the AQMAs along the route of the M4 around Newport.	All	(--)
9	Higher traffic volumes along the M4 will contribute to noise pollution.	All	(--)
10	Traffic conditions are expected to deteriorate and stop/start driving conditions will lead to higher emissions.	All	(--)
11	Traffic conditions are expected to deteriorate and stop/start driving conditions will create an adverse travel experience, leading to higher levels of driver stress.	All	(---)

Criteria	Assessment	Distribution	Significance
12	Increased congestion on the M4 may lead to severe disruption and congestion on the local and regional highway network, with significant delays and adverse effects on local roads being used as diversions.	All	(---)
13	There would be no or limited change as a result of the Do Minimum Scenario.	All	(0)
14	There would be no or limited change as a result of the Do Minimum Scenario.	All	(0)
15	There would be no or limited change as a result of the Do Minimum Scenario.	All	(0)
Public acceptability	Traffic congestion during peak periods results in unreliable journey times, which impacts on the ability of individuals to take up job opportunities and discourages investment from high value businesses. Transport congestion also has environmental impacts affecting local communities. Increasing levels of congestion are unlikely to be acceptable to the public.		
Acceptability to other stakeholders	The M4 motorway plays the vital role in providing the east/west strategic road link that underpins the economy of South Wales and facilitates the mass movement of people and goods to stimulate economic and social activity within the region and beyond. Any disruption to the operation of the motorway in South Wales has a negative impact upon economic development, particularly around Cardiff, Newport and beyond. Congestion is sighted by the business community in South Wales as a barrier to economic growth and increasing levels of congestion are unlikely to be acceptable to stakeholders.		
Technical and operational feasibility	Planned or committed schemes as part of the Do Minimum Scenario have demonstrated their feasibility as part of their associated planning stages.		
Financial affordability and deliverability	Planned or committed schemes as part of the Do Minimum Scenario have demonstrated their affordability and deliverability as part of their associated planning stages.		
Risks	There are no or limited risks associated with planned or committed schemes as part of the Do Minimum Scenario.		

Table 2: Assessment of the motorway to the South of Newport against WelTAG Criteria and Transport Planning Objectives

Criteria	Assessment	Distribution	Significance
Transport Economic Efficiency (TEE)	The new section of motorway to the south of Newport will alleviate problems of congestion on the highway network, thus leading to journey time savings and improved journey time reliability. The new section of motorway will also provide significant resilience to the network and will be likely to result in lower accident rates. The scheme is expected to deliver high value for money. The Net Present Value of the scheme is forecast to be in the range of +£660 million to +£2 billion depending upon future traffic growth. For central growth, the Benefit to Cost Ratio is estimated to be 2.3 increasing to 3.1 when wider impacts are included.	All road users	(+++)
Economic Activity and Location Impact (EALI)	A new section of motorway to the south of Newport will deliver significant travel time savings and reliability benefits for businesses leading to lower production costs and contributing to the competitiveness of transport dependent business in Wales. The new section of motorway could significantly improve perceptions of access to South Wales, potentially making Wales a more attractive place to do business. Additional junctions to the south of Newport would increase the potential of employment sites. The new section of motorway is forecast to add £89.5 million to the GDP in 2037. Up to 6,750 net additional jobs might be created. The new section of motorway is thus expected to deliver a major positive impact on the economy of South Wales.	All road users	(+++)
Noise	With the new section of motorway, traffic flows are reduced on the existing alignment as through traffic is diverted along the new alignment to the south of Newport, through areas with a very low population density. As such there is a significant reduction in noise level at many residential properties close to the existing alignment and significant increases at a lot fewer properties near the new alignment. Consequently, the WelTAG analysis of the scheme shows a reduction of -825 people annoyed due to noise and a monetary benefit in the net present value of £33 million over a 60 year period.	Properties along the M4	(+)
Local Air Quality	The new section of motorway will provide reductions in the levels of atmospheric pollution to a large number of local receptors alongside the existing M4 through Newport, by removing traffic from areas where the existing motorway is frequently congested. 155 properties are predicted to experience deterioration in PM10 concentrations and 32 properties are predicted to experience deterioration in NO_2 concentrations, while 7780 properties are predicted to experience an improvement in PM10 concentrations and 7900 properties are predicted to experience an improvement in NO_2 concentrations. It has been assumed that a number of isolated properties along the proposed Route Options will be demolished in order to construct the scheme. Deterioration in air quality occurs near the new section of motorway. The effects of this, however, would be of limited significance given the low number of properties affected. National Air Quality Standards would not be exceeded.	Properties along the M4	(++)

Criteria	Assessment	Distribution	Significance
Greenhouse Gas Emissions	Carbon dioxide emissions have been estimated to increase over the 60 year appraisal period by approximately 335,945 tonnes. The Net Present Value of CO_2 emissions is -£15,729,559. However, the impact of congestion and stop-start conditions along the existing M4 without the scheme may not have been fully taken into account. More detailed simulation of future conditions would be likely to identify additional benefits as a result of the new section of motorway.	No significant distributional impacts	(-)
Landscape and townscape	Section A passes through Landscape Character Areas considered of medium to very high sensitivity. The location of the Castleton Interchange on elevated ground combined with the loss of mature vegetation, which currently provides some screening of the existing motorway, would create a more open landscape with long distance views of the scheme. Due to the size, scale and the duration of the effect on the landscape the magnitude of change on the landscape character is considered to be very high. Likewise the Wentlooge Levels are considered a tranquil landscape with little development and therefore the size and scale of the effect and the duration of the effect on the landscape is considered to be very high. Effects on views vary from location to location from Moderate for receptors in Michaelston-Y-Fedw, to Large in particular locations in Marshfield and Castleton, among others. In Section B there would be views of the new roads, the main Bridge over the Usk and from elevated road ways either end on viaducts and then tapered embankments bringing the road back down to grade. Effects on three sensitive landscape character areas range from Large to Very Large in terms of significance. Effects on views vary from location to location from Moderate for receptors in Uskmouth area, to Large effects on the visual settings of the Transporter Bridge and its two Anchor Chambers, amongst others. Section C crosses four Landscape Character Areas. Across the Calidcot levels visibility of the scheme throughout the area would be significantly restricted due to the existing tree cover of existing woodland and tree-lined field boundaries. There are over 100 dwellings on the west and north edges of Magor, Residents would experience views of the scheme at close range on an embankment in the southwest and at grade to the north. The magnitude of changes to these views is predicted to be high and effects on the visual amenity of these receptors would be of Very Large significance. Considerable amounts of woodland screen planting would be introduced around this junction to mitigate the effects visual amenity of footpath users and local residents. It is anticipated that visual effects on the visual amenity of Public Rights of Way (PRoW) users and residents would be of Slight and Moderate significance respectively.	Local landscape impacts	(---)

Criteria	Assessment	Distribution	Significance
Biodiversity	The new section of motorway would cross approximately 9km of Sites of Special Scientific Interest (SSSI) resulting in the loss of up to 60ha (less than 1.5%) of the total SSSI. The principal ecological interest of the Gwent Levels SSSI lies in the reen drainage system. One small area of ancient woodland at Berryhill Farm is located directly beneath the footprint of the scheme, which will therefore be removed during construction. Other designated sites along or within the vicinity of the route include the River Usk (SAC) and (SSSI), the River Severn (SPA), the River Severn Ramsar Site, and Local Nature Reserves (LNR). The scheme would impact on a number of SINC sites along the length including at the River Ebbw, the saltmarsh along the River Usk, Spencer Works SINC and at the Solutia chemical plant.	Potential impact on River Usk SAC and SSSI	(---)
Heritage	The new section of motorway crosses a number of distinct topographic zones, the cultural heritage of which is characterised by particular attributes related to landform and historic land use. Much of the motorway would cross the marginal wetlands of the Gwent Levels, which is identified as an Historic Landscape of Outstanding Historic Interest. The area is also designated as being archaeologically sensitive in the adopted Newport UDP and the area has potential for encountering as yet undiscovered archaeological deposits. The built heritage of the area includes the historic Newport Docks, a number of individual listed buildings and structures and a range of buildings characteristic of the vernacular architecture of the area. A Grade II listed building, Magor Vicarage, would need to be demolished and a standing stone Scheduled Ancient Monument (SAM) at Llanfihangel would have to be relocated in order to accommodate the scheme.	Distribution assessment not required (Para. 7.10.7 of WelTAG June 2008)	(--)
Water environment	A new section of motorway could lead to adverse effects on water quality, hydrological regimes, flood plains and areas of flood risk. However, it is assumed that any significant adverse effects to these environments from highway runoff and spillages would be minimised through sensitive design, for example by provision of drainage features, such as petrol interceptors, spillage tanks and Sustainable Urban Drainage Systems (SUDs). New reens would also be constructed to offset those lost as a result of the scheme. The scheme crosses the highly sensitive River Usk and the reens within the St Brides SSSI. It would also run through the Gwent Levels: Whitson and Redwick and Llandevenny SSSI's and would require up to 50 watercourse crossings. There would be a cumulative impact associated with multiple reen crossings within a SSSI designated site. Although the New M4 would be constructed on the floodplain of the Severn Estuary, the Gwent Levels are protected by a sea wall from inundation. The presence of the Usk Bridge would lead to a slight increase in flood levels upstream, particularly during construction, but these would be of negligible significance.	No significant distributional impacts	(--)

Criteria	Assessment	Distribution	Significance
Soils	A major cutting will be required at Castleton to accommodate the new interchange. The overall effect on surface geological features is of negligible significance. However, the proposed development would result in permanent loss of approximately 504ha of Best and Most Versatile Agricultural Land (i.e. land within Grade 1, 2 or 3a). There are some areas of contamination along the route, particularly in Section B which is dominated by industrialised areas, namely the Newport Docks, industrial estates on the eastern bank of the Usk River and Solutia chemical works. In addition, a large active landfill site, the Docks Way Landfill, is also located in this part of the scheme.	No significant distributional impacts	(--)
Transport safety	The new section of motorway which will be designed to current standards, will provide a significant improvement in transport safety for users of the new route, located south of the urban area of Newport. Reduced congestion and delays on the existing M4 route would also provide benefits to transport safety. Total accidents saved by the scheme are estimated to be about 19 per year.	All road users	(+++)
Personal security	Improved traffic flow and less congestion will reduce the potential for delays, which may reduce travellers' perceptions of vulnerability to crime.	All road users	(+)
Permeability	The new section of motorway will affect a number of existing public rights of way and local routes, which cross or adjoin the route, to which continuity of access should be maintained by means of footpath diversions and appropriate crossing facilities. However, the new section of motorway will help reduce congestion on the existing motorway and local road network, to benefit severance issues around Newport. A Non-Motorised User Study will aim to maximise opportunities to enhance accessibility by walking, cycling and on horse-back, maintain existing routes where possible, and limit any potential severance issues.	All road users	(+)
Physical fitness	The new section of motorway is unlikely to lead to any changes in travel by active modes.	Car users	(0)
Social inclusion	Relieving congestion and improved traffic flows will lead to improvements in the reliability and journey times of strategic bus services, which use the motorway network, offering an opportunity to improve accessibility to key centres. Improved transport safety will benefit all groups of people.	Distribution assessment not required (Para. 8.6.31 of WelTAG June 2008)	(+)
Equality, Diversity & Human Rights	A new section of motorway could improve access to key facilities and employment opportunities for all groups. However, detailed issues of safety and personal security will be considered at the detailed design stage.	All road users	(+)
TPOs			
1	An additional high quality road is likely to create a significantly safer, easier and more reliable transport link along the M4 between Magor and Castleton.	All	(+++)
2	The new section of motorway will form part of the European transport network and provide increased accessibility along the M4.	All	(+++)
3	The new section of motorway will provide an alternative route to the existing M4 around Newport with capacity to reduce congestion along the existing route and provide increased resilience on the network.	All	(+++)

Criteria	Assessment	Distribution	Significance
4	A new section of motorway could improve traffic conditions on the existing network.	All	(+++)
5	A new section of motorway would provide increased network resilience and could significantly improve journey time reliability.	All	(+++)
6	The new section of motorway would provide an additional route between Magor and Castleton.	All	(++)
7	A new section of motorway would provide a safe alternative route.	All	(+++)
8	A new route to the south of Newport would help reduce air pollution along the route of the current M4, improving conditions in the Air Quality Management Areas.	All	(++)
9	Noise impacts would be reduced along the route of the existing M4, which would reduce the noise nuisance to nearby residential properties.	All	(+)
10	The new section of motorway will help to reduce congestion and vehicle emissions; however it is not clear whether the additional road capacity would lead to an overall increase in emissions in the longer term.	All	(+)
11	A new section of motorway would provide a high quality and free flowing highway to the south of Newport.	All	(+++)
12	A new section of motorway would provide a high quality route for strategic journeys.	All	(+++)
13	A new section of motorway could improve traffic conditions on the existing network.	All	(+++)
14	A new section of motorway could improve access to key facilities and employment opportunities.	All	(+++)
15	A new section of motorway would not support a behavioural change towards more sustainable modes but may encourage additional car use on a free flowing route.	All	(--)
Public acceptability	A new section of motorway to the south of Newport attracted the most comments of preference during the public consultation on the draft Plan, with support for its ability to address the problems and objectives for the M4 Corridor around Newport. There is a co-ordinated opposition largely from local interest groups, Wales Wildlife Trusts, RSPB and Friends of the Earth Cymru. Most comments arising from the public consultation on the draft Plan were made on the topic of the environment, with a third of these concerning potential impact on the Gwent Levels. The acceptability of the new section of motorway will be tested at public local inquiry.		
Acceptability to other stakeholders	Business interests are generally supportive, while environmental groups generally oppose the scheme. The CBI strongly promotes the scheme as a key priority for their members. Further engagement is likely to be needed with specific land owners who may be affected directly by the scheme, including ABP. The acceptability of the new section of motorway will be tested at public local inquiry.		
Technical and operational feasibility	The new section of motorway is a challenging scheme with a large estuarial crossing, major earthworks, soft ground, contamination, two motorway interchanges and intermediate junctions. It would considerably improve network resilience by providing a new strategic route to the south of Newport.		
Financial affordability and deliverability	Affordability is an important issue both in terms of timescale and the amount of capital required.		
Risks	There is a risk of a protracted public local inquiry for this scheme.		

A1.1 Comparative Performance

The comparative performance of the proposed scheme for the M4 Corridor around Newport against doing nothing more than what is already planned or committed is summarised against WelTAG criteria in Table 3 and against Transport Planning Objectives (TPOs) and acceptability/feasibility/deliverability criteria in Table 4.

Table 3: Comparative Performance against WelTAG Criteria

Criteria	Doing Nothing	Black Route Motorway
Economy		
Transport Economic Efficiency (TEE)	**(---)**	(+++)
Economic Activity and Location Impact (EALI)	**(---)**	(+++)
Environment		
Noise	(--)	(+)
Local Air Quality	(--)	(++)
Greenhouse Gas Emissions	(-)	(+)
Landscape and townscape	(0)	(---)
Biodiversity	(0)	(---)
Heritage	(0)	(--)
Water environment	()	(--)
Soils	(0)	(--)
Social		
Transport safety	(--)	(+++)
Personal security	(0)	(+)
Permeability	(-)	(+)
Physical fitness	(0)	(0)
Social inclusion	(-)	(+)
Equality, Diversity & Human Rights	(0)	(+)

Table 4: Comparative Performance against Objectives, Acceptability, Feasibility, Deliverability and Risk

Transport Planning Objectives	Doing Nothing	With the Scheme
1	(---)	(+++)
2	(--)	(+++)
3	(0)	(+++)
4	(0)	(+++)
5	(--)	(+++)
6	(0)	(++)
7	(--)	(+++)
8	(--)	(++)
9	(--)	(+)
10	(--)	(+)
11	(---)	(+++)
12	(---)	(+++)
13	(0)	(+++)
14	(0)	(+++)
15	(0)	(--)
Criteria	**Doing Nothing**	**With the Scheme**
Public acceptability	Traffic congestion during peak periods results in unreliable journey times, which impacts on the ability of individuals to take up job opportunities and discourages investment from high value businesses. Transport congestion also has environmental impacts affecting local communities. Increasing levels of congestion are unlikely to be acceptable to the public.	The new road could create economic and social benefits. There is a co-ordinated opposition largely from local interest groups and Friends of the Earth. Most comments arising from the 2006 series of public exhibitions were made on the topic of the environment, with a third of these concerning noise. The location receiving the most comments was Magor/Undy. The acceptability of the project will be tested at public inquiry.
Acceptability to other stakeholders	The M4 motorway plays the vital role in providing the east/west strategic road link that underpins the economy of South Wales and facilitates the mass movement of people and goods to stimulate economic and social activity within the region. Any disruption to the operation of the motorway in South Wales has a negative impact upon economic development, particularly around Cardiff and Newport. Congestion is sighted by the business community in South Wales as a barrier to economic growth and increasing levels of congestion are unlikely to be acceptable to stakeholders.	Newport City Council and Newport Unlimited are supportive of the New M4 project. Business interests are generally supportive, while environmental groups generally oppose the scheme. The CBI strongly promote the scheme and it is included in SEWTA's Regional Transport Plan. Further engagement is likely to be needed with specific land owners who may be affected directly by the scheme, including ABP. The acceptability of the project will be tested at public inquiry.
Technical and operational feasibility	N/A	The New M4 is a challenging scheme with a large estuarial crossing, major

		earthworks, soft ground, contamination, two motorway interchanges and two intermediate junctions. It would considerably improve network resilience by providing a new strategic route to the south of Newport.
Financial affordability and deliverability	N/A	The implementation of the New M4 will be dependent upon the availability of funding. Therefore, affordability is an important issue both in terms of timescale and the amount of capital required.
Risks	N/A	There is a risk of a protracted public inquiry for this scheme. A quantified risk assessment has been undertaken for the scheme.

A1.2 Summary of Appraisal

Appraisal of the Do Minimum Scenario demonstrates the need to do something, with largely negative or neutral impacts on all WelTAG criteria.

The motorway to the south of Newport scheme scores strongly against the TPOs; very positively against 10 of the 15 objectives resulting in large beneficial impacts. There is an adverse impact against only one objective; achieving a cultural shift in travel behaviour towards more sustainable choices. It should be acknowledged that the motorway to the south of Newport scheme forms part of the wider M4 Corridor around Newport Plan, which is cognisant of the Cardiff Capital Region Metro proposals and the proposed section of new motorway and its complementary measures will complement public transport improvements.

Overall, the scheme scores strongly against the WelTAG assessment criteria. It results in large beneficial economic impacts, with the scheme performing attractively with less distance to be travelled and hence lower journey times. The scheme performs positively against the social criteria. Appraisal indicates moderate to large adverse impacts on the environment (biodiversity, landscape and townscape in particular).

It should be noted that WelTAG appraisal does not take into account mitigation measures, which might address any potential adverse impacts. Further information should be made available as part of an Environmental Impact Assessment at the next stage of appraisal, should the scheme be progressed.

It should also be noted that should the Second Severn Crossing Tolls be reduced or removed; the impacts on the objectives and WelTAG criteria are likely to be further positive, in light that traffic congestion problems would be exacerbated in the Do Minimum Scenario.

The appraisal at this stage indicates that the scheme, as assessed in accordance with WelTAG Stage 2, should be progressed.

Appendix B

Transport Economic Efficiency Tables

B1 Central Growth

Economic Efficiency of the Transport System – Transport Economic Efficiency (TEE) Results

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.

B2 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.

B3 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.

B4 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.

B5 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.

Appendix C

Delivery Programme

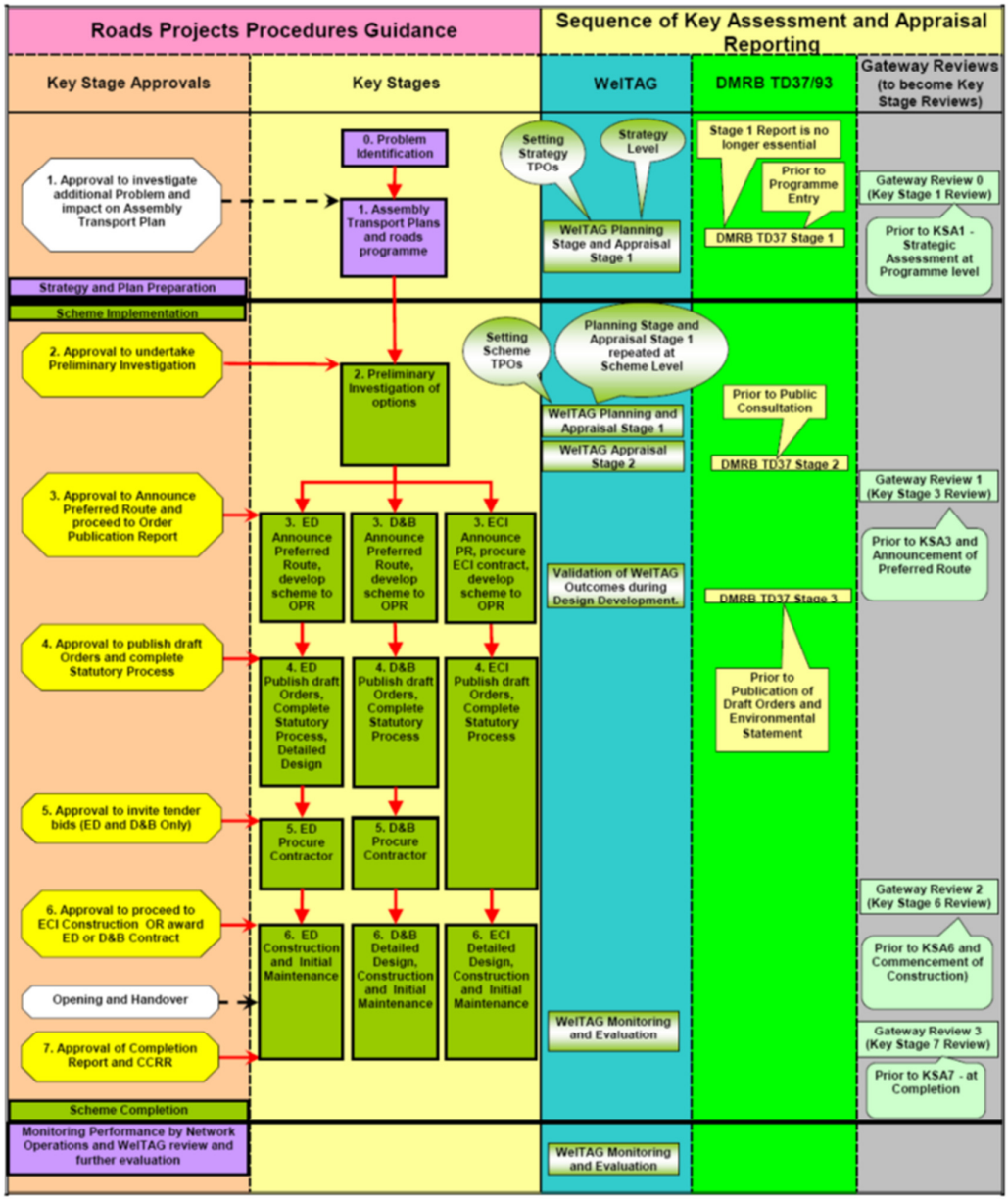
C1 Delivery Programme

Award ECI (Early Contractor Involvement) Contract	***Winter 2015/2016***
Publication of Scheme's draft Orders, Environmental Impact and Habitats Regulations Assessment.	***Spring 2016***
Public Local Inquiry.	***Winter 2016/2017***
Start of Construction.	***Spring 2018***
Completion of Motorway Construction.	***Autumn 2021***
Completion of work associated with reclassification of existing motorway.	***Spring 2022***

Appendix D

Key Stage Approval (KSA) System

D1 Key Stage Approval (KSA) System



Procedures Guidance for Roads Projects
Main Key Stage Flowchart

Version December 2010