Llywodraeth Cymru
Welsh Government

M4 Junction 28 Improvements

Economic Assessment Report

M4J28-ARP-HGN-SWG-RP-YT-100007

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1 Introduction

1.1 Scheme Background

The scheme location includes three major junctions, as follows:

- M4 Junction 28 is a key interchange on both the local and strategic highway networks. It provides access to West Newport, a major employments area, the M4 motorway and Southern Distributor Road (SDR) from the western valleys. Junction 28 is part-time signal controlled.
- Bassaleg Roundabout to the north is linked to Junction 28 via the A467 Forge Road. It is not signal-controlled.
- To the east, Pont Ebbw Roundabout is linked to Junction 28 via the SDR. Pont Ebbw junction is part-time signal controlled, triggered by traffic flow and queuing thresholds, such that the junction is signal-controlled during the AM and PM peak periods but operates as a roundabouts during off-peak periods.

The Welsh Government's aim (as set out in the project document 'Volume 2 Works Information') is to provide strategic capacity improvements and alleviate congestion throughout this key corridor – and hence improvements are planned at the A48/A4072/M4 Tredegar Park junction, at the A4072 Bassaleg roundabout to the north, and at the A48 Pont Ebbw roundabout to the east.

This Economic Assessment Report is a follow-up to previous reports which describe the project methodology, options development, traffic model validation and traffic forecasting.

It should be noted that traffic travelling 'over' Junction 28 wholly on the M4 is not included in the Economic Assessment. In practice, through-traffic on the M4 could in future be delayed by queues backing up onto the motorway from Junction 28 in its 'unimproved' state - but this impact has not been included in the assessment (which represents a conservative approach).

1.2 Junction Improvement Scheme

Junction improvements at Basseleg, M4 Junction 28, and Pont Ebbw have been developed through an iterative technical analysis. The proposed improvements are summarised as follows:

- **Pont Ebbw Junction:** The proposed improvement scheme consists of
  - Full-time signal control at all gyratory/entry lane junctions
  - Two through-lanes (signal controlled) in each direction (on the SDR/A48) through the centre of the gyratory
  - A 3-stage junction on the south side of the gyratory – with separate signal stages for: the entry arm from the Intellectual Property Office (IPO) / Office of National Statistics (ONS) site; the main gyratory; and the SDR Through-about lanes).
- **Junction 28 (Tredegar Park):** The proposed scheme consists of
  - an extended gyratory (to the west) which passes beneath the existing westbound motorway entry slip road, retaining the existing bridge,
  - an eastbound through link between the M4 eastbound exit slip and the A48 eastbound from Castleton to the A48 eastbound towards Newport;
  - Full-time signal control at all gyratory/entry lane junctions
- **Bassaleg Junction:** The proposed improvement scheme consists of
  - Signalised roundabout with extended footprint to southwest
  - Signal control at the main entry/gyratory junctions; namely at A467 Forge Road southbound, A467 northbound, A468 Caerphilly Road.
  - Give-way access onto the roundabout will be operated at the Park View and Court Crescent entry lanes.
  - The existing pedestrian crossing on the A468 Caerphilly Road will be retained, and operated in co-ordination with the main gyratory signals.

1.3 Objective of this Report

The purpose of this Economic Assessment Report is to provide details of the methodology and assumptions adopted in undertaking the economic assessment, and to present the results of the assessment.

1.4 Report Structure

Following this introduction, the report is structured as follows:

- Chapter 2 provides information on the approach to Economic Assessment;
- Chapter 3 describes the methodology for estimation of economic benefits;
- Chapter 4 outlines the approach used for the economic assessment in respect of Construction and Maintenance;
- Chapter 5 provides details of the road safety benefits;
- Chapter 6 details the cost estimates for the scheme used in the assessment;
- Chapter 7 provides the results of the economic assessment; and
- Chapter 8 contains concluding comments.

2 Approach to Economic Assessment

2.1 Principles of Assessment

Guidance on undertaking economic assessments for transport schemes is given in WebTAG[1,2]. The economic assessment appraises the costs and benefits of a transport scheme that are accrued over a 60 year period in monetary terms. In order to ensure consistency, all monetary values are discounted to a common price base to give 'present values'. The current price base year for economic assessments stipulated by the Guidance is 2010.

The travel benefits are made up of the following:

- journey time savings;
- vehicle operating cost savings;
- user charges, such as tolls;
- accident savings;
- carbon emission savings

Other traffic (journey time and vehicle operating cost) benefits, or disbenefits, can accrue due to disruption during construction works. Also, benefits can accrue during future road infrastructure maintenance works, particularly if the improvement scheme allows maintenance to be undertaken with less disruption to traffic than would otherwise be the case.

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

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

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

The overall Analysis of Monetised Costs and Benefits also includes benefits due to savings in accidents and carbon emissions. These would be negative if they were to increase. The total benefits are compared with the total costs from the

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

public accounts identified above, in order to determine the value for money of the scheme.

2.2 Software

TUBA (**T**ransport **U**ser **B**enefit **A**ppraisal) software (version 1.9.5) has been used to undertake the economic assessment for the motorway to the south of Newport. This software has been produced by the Department for Transport to carry out transport scheme economic appraisal using a 'willingness to pay' approach with fixed or variable demand. The economic impacts of a scheme are derived by comparing the future year situation with the scheme (Do Something scenario) to the situation without the scheme (Do Minimum).

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

3 Methodology for Estimation of Benefits

3.1 Traffic Forecasts

3.1.1 Traffic Scenarios

The local road network (i.e. Bassaleg, Junction 28 and Pont Ebbw junctions) has been subject to microsimulation modelling (using VISSIM). Traffic models of future years have been prepared for 2017 (the assumed year opening) and 2032 (15 years after opening). The approach to producing forecast traffic flows is described in detail in the Forecasting Report.

Two sets of traffic forecasts have been produced to reflect the uncertainty in respect of implementation of a new motorway route around the south of Newport (currently being developed by the Welsh Government in the M4 Corridor around Newport project).

The modelled scenarios for the 'with' and 'without' the new M4 Corridor around Newport are set out Table 3.1. The modelled forecast flows produced for these scenarios are the basis for the TUBA-based economic assessment analysis.

Table 3.1: VISSIM Traffic Forecast Models for Economic Assessment

Status of M4 CAN	Do-Minimum 1 (without J28 improvement)	Do-Something [2] (with J28 improvement)
without the M4 CAN	2017	2017
	2032	2032
with the M4 CAN	2017 [1]	2017 [1]
	2032	2032

Notes:

1. Traffic data is for 'without the M4 CAN' as the M4 scheme will not be in place at this time. For purposes of this report it is assumed that traffic flows between 2017 and 2032 can be interpolated.

2. For purposes of this Economic Assessment *only*, the traffic flows in the Do Something VISSIM models have been factored to ensure that the total flows are equal to the Do Minimum scenario in order to produce a like-for-like comparison. Additional VISSIM model runs were then undertaken with the factored Do-Something flows – and the travel time results fed into the economic assessment. It should be noted that this represents a conservative approach as the travel time benefits for the additional (reassigned) traffic travelling within the Junction 28 corridor are ignored. This approach to assessing economic benefits was set out in the Work Programme Report.

3.1.2 Change in Vehicle-km

In relation to the methodology (outlined in Section 3.1.1) of factoring Do-Something VISSIM flows to match Do-Minimum flows (for purposes of Economic Assessment), the change in vehicle-kms has been reviewed for the Do-Minimum and Do-Something scenarios. This check is necessary to check whether the change of routing which occurs with the scheme in place (produced from area-wide SATURN assignments – as described in the Forecasting Report) has a significant influence on the overall travel distance and journey time used in the Economic Assessment.

Table 3.2 presents the overall vehicle-kms for each Do-Minimum/Do-Something case, and as can be seen the differences are not significant at between 6% and 11% . Further analysis of this difference of distance travelled has been undertaken – by looking at the notional pre-peak traffic scenario produced in the VISSIM model i.e. the build-up period just prior to the peak hour. This assessment (see Table 3.3) reveals that the difference in vehicle-kms (between Do Minimum and Do Something) is much less – at less than 1%. Hence it can be concluded that the difference in Vehicle-kms is largely due to incomplete journeys in the Do Minimum VISSIM model – and it is further concluded that the TUBA analysis represents a conservative approach as the travel distance in the Do Something case is between 5% and 11% greater than the Do Minimum (which will tend to result in an under-estimation of benefits.

In the context of assessing the impact of travel distance, it is emphasised that the benefits of the improvement schemes are largely due to a reduction in congestion (and hence travel time). Output TUBA results for a single year is presented in Section 7.3, shows that (for example) for 2032 (without the M4 in place) the user costs are reduced by around 56% (from £67.1M to £29M, see Table 7.7) – which includes for an 11% *increase* in vehicle-kms. This comparison shows that changes to travel times related to congestion mitigation are significantly more influential (in Economic Assessment) than small changes to travel distance.

Overall, it is concluded that the approach taken to factoring Do-Something VISSIM flows to match Do-Minimum flows is reasonable and provides robust conservative, outputs to the Economic Assessment.

Table 3.2: Vehicle-km values for Forecast Scenarios (with congestion effects)

Status of M4 CAN	Year	Do-Minimum 1 (veh-km without J28 scheme)	Do-Something 2 (veh-km with J28 scheme)	Difference (%) *Do Som – Do Min* / *Do-Min*
without the M4 CAN	2017	2.40	2.55	6%
	2032	2.31	2.56	11%
with the M4 CAN	2017	-	-	-
	2032	2.31	2.48	7%

Note: Values are produced by whole period VISSIM outputs which include incomplete journeys in congested Do Minimum case peak periods

Table 3.3: Vehicle-km values for Forecast Scenarios (no congestion effects)

Status of M4 CAN	Year	Do-Minimum 1 (veh-km without J28 scheme)	Do-Something 2 (veh-km with J28 scheme)	Difference (%) *Do Som – Do Min* / *Do-Min*
without the M4 CAN	2017	2.75	2.75	0.05%
	2032	2.79	2.80	0.39%
with the M4 CAN	2017	-	-	-
	2032	2.71	2.71	-0.03%

Note: Values are produced by VISSIM outputs which are based on pre-peak periods with less congestion effects and hence limited incomplete journeys in Do Minimum case

3.2 Economic Parameters

WebTAG Guidance[3] provides details of the default economic data that should be adopted for the economic assessment of transport schemes. TUBA (Version 1.9.5) has a standard economics file that contains the default data from WebTAG which includes the following:

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

The economic parameters file also includes default journey purpose splits for each vehicle type. In this case, values for journey purpose have been extracted from the M4CAN SATURN model.

3.3 Assessment Period and Modelled Years

The proposed opening year for the scheme is 2017. It is assumed that construction of the scheme would take 2 years. The assessment covers a 60 year period, starting with the scheme opening year, 2017, up to 2076.

The TUBA assessment has taken data from the traffic model forecasts, which have been prepared for 2017 and 2032. TUBA calculates the benefits for each of the modelled forecast years and then interpolates to calculate the benefits for the intervening years. After the last modelled year, the default TUBA assumption is that there is no change in traffic patterns and so the benefits do not change, but they are discounted back over a longer period of time to the economic base year of 2010.

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

3.4 Annualisation Factors

The TUBA program requires annualisation factors to convert the hourly modelled traffic demand to the annual demand. The process to establish appropriate annualisation factors is set out below.

Traffic Count Data for Annualisation factors: MIDAS traffic count data for the M4 between Junction 23a and Junction 29 has been used as the source of Annualisation factors (as this represents the best 'local' source of long-term traffic data, and inspection of available traffic data for local roads indicates a similar peak/inter-peak profile to the M4 at this location).

Identification of Peak Periods: For this project the key benefit is alleviation of congestion during the AM and PM peak periods. Hence for purposes of robustness and to ensure a conservative approach, any benefits during the overnight off-peak period and at weekends have been ignored in this assessment, which is thus limited to the 12-hour (7am – 7pm) period.

To establish an appropriate weighting of peak and interpeak congestion benefits, the length of time over which significant congestion occurs has been investigated using Trafficmaster observed travel time data (as described in Technical Note: Trafficmaster Journey Time Analysis (M4J28-ARP-HGN-SWG-FN-YT-000003 Rev P02). This analysis (summarised in Table 3.4) indicates that the peak AM and PM periods are best represented as two 2-hour peaks (assuming that the periods are represented as multiples of single hours), as indicated in Table 3.5. The remaining eight hours of the 12-hour weekday is thus represented by extrapolating the average interpeak hour model. This approach is in line with TUBA guidance[4], which states, in Section 2.5.3 (Time Periods), that ….*the annualisation factors for the inter-peak hours maybe increased to cover [the] shoulders, with a corresponding reduction in the annualisation factors for the peak periods.*

Table 3.4: Trafficmaster Journey Times and Congestion Periods

Route[2]	AM Peak Congestion Period[1]	PM Peak Congestion Period[1]
A A467 to SDR Eastbound	07:00 to 09:30	-
B SDR to A467 westbound	07:45 to 08:30	15:00 to 18:15
C A48 Cardiff Road to M4 north slip road	07:30 to 08:45	16:15 to 17:45
D M4 north slip road to A48 Cardiff Road	07:15 to 08:45	-
E M4 west slip road to SDR eastbound	07:45 to 09:00	16:15 to 17:45
F SDR to M4 west slip road	07:45 to 08:45	15:45 to 18:15
G A468 to M4 Slip road southbound	07:00 to 09:30	-
H M4 slip road to A468 northbound	07:30 to 09:00	16:15 to 18:00

Note: 1.) Congestion periods have been identified as those periods when travel time is significantly longer than the normal travel time during interpeak periods 2.) From Technical Note: Trafficmaster Journey Time Analysis (M4J28-ARP-HGN-SWG-FN-YT-000003 Rev P02

[4] TUBA: Guidance For Checking Outputs, Version 1.9.6, January 2016, DfT

Table 3.5: Modelled Source of TUBA input data

TUBA input periods	Source of TUBA input data	Period Represented in TUBA modelling
AM peak	8am-9am hour VISSIM model	2 hours
Interpeak	10am-4pm average hour VISSIM model	8 hours
PM peak	5pm-6pm hour VISSIM model	2 hours
Offpeak	N/A	N/A
Weekend	N/A	N/A

Application of Annualisation Factors: Annualisation factors have been produced by applying traffic-based factors in three steps, as follows:

1. Factor to convert modelled *peak hour* flows to *peak and interpeak period* flows. The peak hour flows are factored to a 2 hour peak period. The interpeak hour is factored to the interpeak period, and also factored to the two peak shoulder hours that immediately precede or succeed the interpeak period.

2. Factor to convert modelled *period* flows to *annual* flows for each respective period; and

3. Multiply the above two factors to convert the modelled *peak or interpeak hour* flows to the respective proportion of *annual* flows for each period.

The Annualisation Factors for each of the above 3 steps are shown in Table 3.6.

Table 3.6: Calculation of Annualisation Factors

Period	Step 1: Peak Hour to Period Factor	Step 2: Period to Annual Factor	Step 3: Hour to Annual Factor
AM Peak Period (7:00 hrs to 9:00 hrs)	2.066	253	523
AM Peak Period Shoulder (9:00 hrs to 10:00 hrs)	1.128	253	285
Inter Peak Period (10:00 hrs to 16:00 hrs)	6.000	253	1518
PM Peak Period Shoulder (16:00 hrs to 17:00 hrs)	1.442	253	365
PM Peak Period (17:00 hrs to 19:00 hrs)	1.795	253	454

3.5 Traffic Input to TUBA

3.5.1 Distances and Travel Times Input to TUBA

TUBA requires output model data to be input from the Do Minimum and Do Something traffic models, to enable the software to calculate benefits to transport users.

The following data is required as TUBA input:

- Vehicle trip numbers, which give the number of trips travelling in the traffic model for each modelled scenario;
- travel time, which represents the average time of travel for vehicles in the traffic model for each modelled scenario; and
- travel distance, which represents the average distance of travel for vehicles in the traffic model for each modelled scenario.

The TUBA program is typically used to assess the benefits of highway improvements based on strategic network models using macroscopic modelling programs such as SATURN. These models provide outputs in a matrix format, with each cell in the matrix consisting of data for a particular origin-destination pair.

For this assessment, a detailed VISSIM model of the local network has been produced, which provides forecast journey time outputs based on optimised signal control staging and offsets. The VISSIM output data is in the form of aggregate values for vehicle-distance and vehicle-time (from Network Performance statistics produced by VISSIM), rather than for specific origin-destination pairs. The Network Performance statistics have thus been used to calculate the following:

- Distance travelled by average vehicle in modelled hour
- Time taken by average vehicle in modelled hour

This data was extracted from the VISSIM traffic models for 2017 and 2032 for input to TUBA.

3.5.2 Extraction of Distance and Travel Time from VISSIM

For input to TUBA, the VISSIM output data has been factored

Each VISSIM model consists of a pre-peak hour, the peak hour and a post-peak ½ hour. The TUBA program requires the average distance and times for the peak hour demand only (as it uses annualisation factors to calculate the remaining times). Therefore, the peak hour demand and the average distances and times have to be distinguished from the overall 2½ hour demand in each VISSIM model.

The peak hour demand includes the following:

a) Peak hour traffic that enters the model in the peak hour and exits the model in the peak hour;

b) Peak hour traffic that enters the model in the peak hour and exits the model in the post peak ½ hour; and

c) Peak hour latent demand traffic that enters the model in the post peak ½ hour and is assumed to leave the model in the post peak ½ hour.

For the economic assessment, the peak hour demand does not include the following:

- Pre-peak traffic that enters the model in the pre-peak hour and exits the model in the peak hour; and
- Pre-peak latent traffic demand that enters the model in the peak hour.

The VISSIM Network Performance statistics are used to estimate the average trip distances and times for the peak hour demand.

The average journey time is estimated as follows:

1. Calculate average travel time during peak hour by dividing total travel time by the total vehicles in the model for this hour;
2. Calculate average travel time during post peak hour by dividing total travel time in post peak hour by the total vehicles in the model for this hour;
3. Calculate average travel time for peak hour latent demand by dividing the total peak hour latent delay by the latent demand for the peak hour; and
4. Calculate the overall average travel times by weighting the above by the respective demand numbers given in a), b) and c) above.

The average journey distance is estimated as follows:

1. Calculate average travel distance during peak hour by dividing total travel distance by the total vehicles in the model for this hour;
2. Calculate average travel distance during post peak hour by dividing total travel distance in post peak hour by the total vehicles in the model for this hour; and
3. Calculate the overall average travel distances by weighting the above by the respective demand numbers given in a), b) and c) above.

3.5.3 User Classes

The TUBA program uses Values of Time and other parameters which are specific to the following user classes:

1. Car Employer Business
2. Car Other
3. Car Commuting
4. LGV
5. OGV1
6. OGV2

The VISSIM program does not include this level of disaggregation in demand because the observed traffic turning data does not contain this level of disaggregation.

Therefore, the input demand data for the TUBA program was divided into user classes using proportions which were calculated from the following sources of data:

1. Classified Turning Counts – to divide the total demand into Cars, LGV; OGV1 and OGV2.
2. M4 CAN SATURN Model – to divide Cars into Car Employer Business, Car Other and Car Commuting.

The proportions calculated are given in Table 3.7.

Table 3.7: User Class Proportions by Time Period

User Class	AM Peak	Inter Peak	PM Peak
Car Employer Business	0.05	0.09	0.07
Car Other	0.44	0.57	0.47
Car Commuting	0.38	0.14	0.37
LGV	0.08	0.12	0.06
OGV1	0.03	0.04	0.01
OGV2	0.02	0.03	0.01

4 Construction & Maintenance Travel Costs

4.1 Travel Costs during Scheme Construction

For purposes of this Economic Assessment, the annual travel time and vehicle operating cost impact during construction has not been calculated in detail (as this is unlikely to have a significant impact on the overall Net Present Value). A 'rule-of-thumb' approach has been adopted, which is - that travel time during roadworks will be twice the current travel time. This represents a significant travel cost and hence a robust approach for purposes of economic assessment. In practice, the actual delays during construction will vary throughout each day (and each construction phase) and will be subject to the approach taken in respect of traffic management – such as roadworks advance information, detour signage, hour-by-hour traffic management adjustments etc. On this basis, the following assumptions have been made in order to include an allowance for construction disbenefits (i.e. traffic delays):

- The annual Do Something travel time 'cost' for the construction period will be a maximum of twice that of the Do Minimum case for 2017
- The construction period is between one and two years (depending on required extent of reconstruction of the existing carriageway).

This additional travel time disbenefit 'cost' due to travel delays during construction has been added to the overall PVB, based on

	Do-Minimum User Costs 2017 *[No construction]*
-	***Do-Something User Costs (2 x Do-Minimum User Costs 2017)*** *[Construction]*
x	***Years of Construction***
=	***PVB for Construction Period.***

The estimated disbenefits accruing due to construction are set out in Section 7, and are relatively minor compared to the overall scheme benefits; hence the approach set out (above) is considered to provide an appropriate input to evaluation of the economic benefits.

4.2 Travel Costs during Planned Maintenance

The 'shape' of the road network on the Basseleg – Junction 28 – Pont Ebbw corridor remains largely unchanged after the improvement scheme has been implemented, and hence there will be an insignificant change to overall travel conditions during future major maintenance works. Therefore, for purposes of this Report, travel 'costs' during future planned maintenance works have been ignored, which represents a conservative approach, since the improvements (local road widening at junctions and signalisation) will undoubtedly offer flexibility and efficiencies for maintenance activities.

5 Safety Benefits

5.1 Approach to Assessing Safety Benefits

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

COBA-LT compares accidents by severity and associated costs across the network in the Do Minimum Scenario with those in the Do Something scenario, using details of link and junction characteristics and forecast traffic volumes. Accident rates and costs used in COBA-LT are consistent with those defined in the Design Manual for Roads and Bridges[5].

The configuration of the highway network does not change substantially due to the scheme, with the roads away from the 3 junctions remaining unchanged. Therefore, the accident rates are not expected to be significantly different due to the scheme.

5.2 Safety Benefit Results

Results from COBA-LT for the 'with' and 'without' M4 Around Newport scenarios are shown in Table 5.1.

Table 5.1: Road Safety Benefits

Status of M4 Around Newport	Present Value of Benefits, PVB (£000) (2010 prices, discounted to 2010)
Without M4 Around Newport	5,430
With M4 Around Newport	5,910

As can be seen, accidents benefits of around £5.43M accrue for the Improvement, without the M4 CAN scheme, and of around £5.91M with the M4 CAN scheme; these safety benefits calculated by COBA-LT are added to the main TUBA assessment for the scheme (see Section 7).

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

6 Costs

6.1 Investment Costs

Three construction cost options have been assessed as follows:

- Option A: £11.0M (over a 1 year period)
- Option B: £19.5M (over a 2 year period)
- Option C: £15.0M (over a 1 ½ year period)

The construction cost is assumed to be spent in the period immediately prior to the planned scheme opening in 2017.

6.2 Maintenance Costs

An economic assessment needs to consider the road maintenance costs without and with the M4 J28 improvement. The factors which influence the impact of this aspect on the overall Economic Assessment have been considered, as follows:

- the 'shape' of the road network on the Basseleg – Junction 28 – Pont Ebbw corridor remains largely unchanged after the improvement scheme has been implemented – and hence the overall maintenance costs for the whole local network will be similar with and without the scheme.
- The improvement scheme itself will involve some upgrading to existing carriageway and hence some maintenance costs for the Do-Minimum situation would be avoided – which will provide a saving over a 60 year assessment period.
- Maintenance costs associated the additional carriageway area and associated signal control equipment will be offset by the significant savings made for traffic management costs with the scheme in place since the additional roadspace and signal-controlled environment will provide greater scope for efficient management of traffic flows during maintenance works.
- Maintenance of signal control equipment will be required in both the Do Minimum and Do Something cases since two of the three junctions are already signal controlled. The introduction of centrally controlled UTC equipment will increase the efficiency of signal management and maintenance (and would be likely to be required even if the scheme does not proceed).

Therefore, overall, it is concluded that implementation of the improvement measures do not significantly change the long-term maintenance costs for the local road network including the three junctions, and hence the future maintenance profile and costs have not been considered in the Economic Assessment. The key aspect of this conclusion is that the overall network is largely unchanged by the improvement scheme, and that the upgraded junction areas will provide scope for efficient traffic management.

7 Economic Assessment Results

7.1 Assessment Process

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

The 'Public Accounts' are made up of the costs incurred by Government as a result of the scheme, including investment and operating costs. Revenues to Government are also included (as negative costs) which are made up of changes in tax revenues as a result of the scheme. Changes in tax revenues are directly linked to changes in fuel expenditure, which is a function of speed and distance of travel. The Present Value of Costs (PVC) is the net total from the public accounts table.

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

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

7.2 Scheme Benefits

A summary of the economic assessment results for the scheme, without the M4 CAN, and with the M4 CAN, are shown in Tables 7.1 to 7.6, while the full results are given in Appendix A (A1 to A6 for each case).

The BCR takes into account transport user benefits and accident benefits over a 60 year period. It also takes into account disruption caused as a result of construction work, but it is assumed that there are no net maintenance benefits during the assessment period.

Table 7.1: Economic Assessment, J28 Improvement, without the M4 CAN, Construction Option A

Benefits	Cost or Benefit Item	Results (2010 prices, discounted to 2010) £M
User costs only	Present Value of Benefits, PVB	1,145M
	Present Value of Costs, PVC Option A	9.4M
	Net Present Value, NPV	**1,135M**
	Benefit-to-Cost Ratio, BCR	**122**
Includes Construction Period User Costs and Accidents	Present Value of Benefits, PVB Construction Period	-57M [1]
	Present Value of Benefits, PVB Accidents	5.4M
	PVB including construction period and accidents	1,115M
	NPV including construction period and accidents	**1,105M**
	BCR including construction period and accidents	**119**

Note: (1) Based on 2 x User Travel Costs in 2017 per year, x 1 years for Do-Something

Table 7.2: Economic Assessment, J28 Improvement, without the M4 CAN, Construction Option B

Benefits	Cost or Benefit Item	Results (2010 prices, discounted to 2010) £M
User costs only	Present Value of Benefits, PVB	1,145M
	Present Value of Costs, PVC Option B	16.9M
	Net Present Value, NPV	**1,128M**
	Benefit-to-Cost Ratio, BCR	**68**
Includes Construction Period User Costs and Accidents	Present Value of Benefits, PVB Construction Period	-115M [1]
	Present Value of Benefits, PVB Accidents	5.4M
	PVB including construction period and accidents	1,079M
	NPV including construction period and accidents	**1,063M**
	BCR including construction period and accidents	**64**

Note: (1) Based on 2 x User Travel Costs in 2017 per year, x 2 years for Do-Something

Table 7.3: Economic Assessment, J28 Improvement, without the M4 CAN, Construction Option C

Benefits	Cost or Benefit Item	Results (2010 prices, discounted to 2010) £M
User costs only	Present Value of Benefits, PVB	1,145M
	Present Value of Costs, PVC Option C	12.9M
	Net Present Value, NPV	**1,132M**
	Benefit-to-Cost Ratio, BCR	**89**
Includes Construction Period User Costs and Accidents	Present Value of Benefits, PVB Construction Period	-86M [1]
	Present Value of Benefits, PVB Accidents	5.4M
	PVB including construction period and accidents	1,097M
	NPV including construction period and accidents	**1,084M**
	BCR including construction period and accidents	**85**

Note: (1) Based on 2 x User Travel Costs in 2017 per year, x 1.5 years for Do-Something

Table 7.4: Economic Assessment, J28 Improvement, with the M4 CAN, Construction Option A

Benefits	Cost or Benefit Item	Results (2010 prices, discounted to 2010) £M
User costs only	Present Value of Benefits, PVB	855M
	Present Value of Costs, PVC Option A	9.4M
	Net Present Value, NPV	**845M**
	Benefit-to-Cost Ratio, BCR	**91**
Includes Construction Period User Costs and Accidents	Present Value of Benefits, PVB Construction Period [1]	-57M
	Present Value of Benefits, PVB Accidents	5.9M
	PVB including construction period and accidents	825M
	NPV including construction period and accidents	**816M**
	BCR including construction period and accidents	**88**

Note: (1) Based on 2 x User Travel Costs in 2017 per year, x 1 years for Do-Something

Table 7.5: Economic Assessment, J28 Improvement, with the M4 CAN, Construction Option B

Benefits	Cost or Benefit Item	Results (2010 prices, discounted to 2010) £M
User costs only	Present Value of Benefits, PVB	855M
	Present Value of Costs, PVC Option B	16.9M
	Net Present Value, NPV	**838M**
	Benefit-to-Cost Ratio, BCR	**50**
Includes Construction Period User Costs and Accidents	Present Value of Benefits, PVB Construction Period [1]	-115M
	Present Value of Benefits, PVB Accidents	5.9M
	PVB including construction period and accidents	790M
	NPV including construction period and accidents	**773M**
	BCR including construction period and accidents	**47**

Note: (1) Based on 2 x User Travel Costs in 2017 per year, x 2 years for Do-Something

Table 7.6: Economic Assessment, J28 Improvement, with the M4 CAN, Construction Option C

Benefits	Cost or Benefit Item	Results (2010 prices, discounted to 2010) £M
User costs only	Present Value of Benefits, PVB	855M
	Present Value of Costs, PVC Option C	12.9M
	Net Present Value, NPV	**842M**
	Benefit-to-Cost Ratio, BCR	**66**
Includes Construction Period User Costs and Accidents	Present Value of Benefits, PVB Construction Period [1]	-86M
	Present Value of Benefits, PVB Accidents	5.9M
	PVB including construction period and accidents	807M
	NPV including construction period and accidents	**795M**
	BCR including construction period and accidents	**63**

Note: (1) Based on 2 x User Travel Costs in 2017 per year, x 1.5 years for Do-Something

The results indicate that (for the most conservative case, with the M4 CAN), the scheme has a positive NPV of £773M and a BCR of 47. This indicates that the scheme is extremely positive in economic terms as the scheme costs will be significantly outweighed by the improvements in transport economic efficiency, and that the scheme therefore represents very high value for money.

7.3 Breakdown of User Costs

The TUBA program provides the total user costs for the Do-Minimum and Do-Something scenarios for the two modelled years of 2017 and 2032. The user costs are given in the following categories:

- Time Costs;
- Fuel Vehicle Operating Costs; and
- Non-Fuel Vehicle Operating Costs.

The benefits due to the scheme are calculated from the difference between the Do-Minimum user costs and the Improvement Scheme user costs. The greater the reduction in total user costs due to the scheme, the greater the benefits.

The total user costs for the scenario without and with the M4 CAN are given in Tables 7.7 and 7.8 below.

Table 7.7: Annual User Costs, J28 Improvement, without the M4 CAN (£M)

Without M4 CAN	DM total time	DM total fuel	DM total nonfuel	DM total user costs	DS total time	DS total fuel	DS total nonfuel	DS total user costs
2017	28.2	4.2	3.1	**35.4**	11.9	3.1	2.9	**17.9**
2032	35.6	3.4	2.3	**41.3**	12.8	2.3	2.0	**17.2**

Table 7.8: Annual User Costs, J28 Improvement, with the M4 CAN (£M)

With M4 CAN	DM total time	DM total fuel	DM total nonfuel	DM total user costs	DS total time	DS total fuel	DS total nonfuel	DS total user costs
2017	28.2	4.2	3.1	**35.4**	11.9	3.1	2.9	**17.9**
2032	29.6	3.0	2.1	**34.6**	13.2	2.2	1.9	**17.3**

As can be seen from the table above, there is a large reduction in the total user costs due to the J28 Improvement (for both cases, with and without the M4 CAN). The annual user costs for the Do Minimum are around twice the user costs with the improvements in place; this explains the high NPV and BCR results presented in Tables 7.1 to 7.6. It should be noted that for the Year of Opening 2017, the 'without M4'annual user costs are used for both the 'without' and 'with' M4 CAN scenarios – since the M4 scheme will not be in place in 2017 and hence only the 'without M4' case is relevant.

Travel Costs during Construction: As set out in Section 5, the User Costs for 2017 Do Minimum (£35.4M) has been utilised as the basis for an assumed value of delay costs for the construction period (based on an assumed doubling of delay costs during construction, and a 1 to 2 year construction period. Calculated user benefits (which are negative values, and hence disbenefits) are as follows for each case:

User Costs Option A (1 year)	= 1 yr x (35.4 – 2 x 35.4) = £35.4M disbenefit
User Costs Option B (2 years)	= 2 yr x (35.4 – 2 x 35.4) = £70M disbenefit
User Costs Option C (1½ year)	= 1½ yr x (35.4 - 2 x 35.4) = £53M disbenefit

8 Summary

This report has described the work undertaken to assess the economic impact of the M4 J28 Improvement. The impact of the M4 J28 improvement with and without the M4 CAN improvement has been assessed.

The economic assessment has been undertaken using the TUBA software. Accident benefits have been estimated separately using COBA-LT. The assessments have been carried out over a 60-year period, in accordance with the Department for Transport Guidance (WebTAG).

The results indicate that the **Junction 28 (and Bassaleg and Pont Ebbw) scheme would provide high value for money**, producing an overall benefit to cost ratio (BCR) of 47 with a 2 year construction period (and cost of £19.5M) with the M4 CAN scheme in place (which is the most conservative scenario). Without the M4 CAN, the BCR increases to 119 with Construction Option A.

The high benefits which accrue to the improvement scheme are largely due to travel time benefits, and in this respect, TUBA analysis indicates that travel costs with the improvement scheme in place are around half of the travel costs without the scheme.

Appendix A

Economic Assessment Tables

A1 TEE Table – Without M4 CAN, Construction Option A

Economic Efficiency of the Transport System (TEE)

Consumers						
User Benefits (£000)	**All Modes**		**Road**			**Bus**
Personal Travel	**Total**		Personal			Passengers
Travel Time	735,517		735,517			0
Vehicle Operating Costs	24,307		24,307			0
User Charges	0		0			0
During Construction & Maintenance	-35,433		-35,433			
NET CONSUMER BENEFITS	**724,391**	*(1)*	724,391			0
Business						
User Benefits			Personal	Freight		Passengers
Travel Time	368,147		206,514	161,633		0
Vehicle Operating Costs	30,419		7,958	22,461		0
User Charges	0		0	0		0
During Construction & Maintenance	0		0	0		
Subtotal	**398,566**	*(2)*	214,472	184,094		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	**398,566**	*(5) = (2) + (3) + (4)*				
TOTAL (£000)						
Present Value of Transport Economic Efficiency Benefits	**1,122,957**	*(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 Total		Road	Bus
Local Government Funding				
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	0		0	0
Investment Costs	9,407		9,407	0
Developer & Other Contributions	0		0	0
Grant/Subsidy Payments	0		0	0
NET IMPACT	**9,407**	*(8)*	9,407	0
Central Government Funding: Non-Transport				
Indirect Tax Revenues	23,825		23,825	
TOTALS				
Broad Transport Budget	**9,407**	*(9) = (7) + (8)*		
Wider Public Finances	**23,825**			

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	10,334	
Consumer User Benefits	724,391	
Business User Benefits	398,566	
Private Sector Provider Impacts	0	
Other Business Impacts	0	
Accident Benefits	5,431	
Wider Public Finances(Indirect Taxation Revenu	-23,825	
Present Value of Benefits (PVB)	**1,114,897**	
Local Government Funding	0	
Central Government Funding	9,407	
Present Value of Costs (PVC)	**9,407**	
OVERALL IMPACTS		
Net Present Value (£000)	**1,105,490**	NPV=PVB-PVC
Benefit to Cost Ratio	**118.52**	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.

A2 TEE Table – Without M4 CAN, Construction Option B

Economic Efficiency of the Transport System (TEE)

Consumers						
User Benefits (£000)	**All Modes**		**Road**			**Bus**
Personal Travel	**Total**		Personal			Passengers
Travel Time	735,517		735,517			0
Vehicle Operating Costs	24,307		24,307			0
User Charges	0		0			0
During Construction & Maintenance	-70,866		-70,866			
NET CONSUMER BENEFITS	**688,958**	*(1)*	688,958			0
Business						
User Benefits			Personal	Freight		Passengers
Travel Time	368,147		206,514	161,633		0
Vehicle Operating Costs	30,419		7,958	22,461		0
User Charges	0		0	0		0
During Construction & Maintenance	0		0	0		
Subtotal	**398,566**	*(2)*	214,472	184,094		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	**398,566**	*(5) = (2) + (3) + (4)*				
TOTAL (£000)						
Present Value of Transport Economic Efficiency Benefits	**1,087,524**	*(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 Total		Road	Bus
Local Government Funding				
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	0		0	0
Investment Costs	16,939		16,939	0
Developer & Other Contributions	0		0	0
Grant/Subsidy Payments	0		0	0
NET IMPACT	**16,939**	*(8)*	16,939	0
Central Government Funding: Non-Transport				
Indirect Tax Revenues	23,825		23,825	
TOTALS				
Broad Transport Budget	**16,939**	*(9) = (7) + (8)*		
Wider Public Finances	**23,825**			

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	10,334	
Consumer User Benefits	688,958	
Business User Benefits	398,566	
Private Sector Provider Impacts	0	
Other Business Impacts	0	
Accident Benefits	5,431	
Wider Public Finances(Indirect Taxation Revenu	-23,825	
Present Value of Benefits (PVB)	**1,079,464**	
Local Government Funding	0	
Central Government Funding	16,939	
Present Value of Costs (PVC)	**16,939**	
OVERALL IMPACTS		
Net Present Value (£000)	**1,062,525**	NPV=PVB-PVC
Benefit to Cost Ratio	**63.73**	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.

A3 TEE Table – Without M4 CAN, Construction Option C

Economic Efficiency of the Transport System (TEE)

Consumers					
User Benefits (£000)	**All Modes**		**Road**		**Bus**
Personal Travel	**Total**		Personal		Passengers
Travel Time	735,517		735,517		0
Vehicle Operating Costs	24,307		24,307		0
User Charges	0		0		0
During Construction & Maintenance	-53,150		-53,150		
NET CONSUMER BENEFITS	**706,675**	*(1)*	706,675		0
Business					
User Benefits			Personal	Freight	Passengers
Travel Time	368,147		206,514	161,633	0
Vehicle Operating Costs	30,419		7,958	22,461	0
User Charges	0		0	0	0
During Construction & Maintenance	0		0	0	
Subtotal	**398,566**	*(2)*	214,472	184,094	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	**398,566**	*(5) = (2) + (3) + (4)*			
TOTAL (£000)					
Present Value of Transport Economic Efficiency Benefits	**1,105,241**	*(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 Total		Road	Bus
Local Government Funding				
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	0		0	0
Investment Costs	12,918		12,918	0
Developer & Other Contributions	0		0	0
Grant/Subsidy Payments	0		0	0
NET IMPACT	**12,918**	*(8)*	12,918	0
Central Government Funding: Non-Transport				
Indirect Tax Revenues	23,825		23,825	
TOTALS				
Broad Transport Budget	**12,918**	*(9) = (7) + (8)*		
Wider Public Finances	**23,825**			

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	10,334	
Consumer User Benefits	706,675	
Business User Benefits	398,566	
Private Sector Provider Impacts	0	
Other Business Impacts	0	
Accident Benefits	5,431	
Wider Public Finances(Indirect Taxation Revenu	-23,825	
Present Value of Benefits (PVB)	**1,097,181**	
Local Government Funding	0	
Central Government Funding	12,918	
Present Value of Costs (PVC)	**12,918**	
OVERALL IMPACTS		
Net Present Value (£000)	**1,084,263**	NPV=PVB-PVC
Benefit to Cost Ratio	**84.93**	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.

A4 TEE Table – With M4 CAN, Construction Option A

Economic Efficiency of the Transport System (TEE)

	All Modes		Road		Bus
Consumers					
User Benefits (£000)	**All Modes**		**Road**		**Bus**
Personal Travel	**Total**		Personal		Passengers
Travel Time	551,933		551,933		0
Vehicle Operating Costs	19,264		19,264		0
User Charges	0		0		0
During Construction & Maintenance	-35,433		-35,433		
NET CONSUMER BENEFITS	**535,764**	*(1)*	535,764		0
Business					
User Benefits			Personal	Freight	Passengers
Travel Time	271,806		158,585	113,221	0
Vehicle Operating Costs	22,219		6,325	15,894	0
User Charges	0		0	0	0
During Construction & Maintenance	0		0	0	
Subtotal	**294,025**	*(2)*	164,910	129,115	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	**294,025**	*(5) = (2) + (3) + (4)*			
TOTAL (£000)					
Present Value of Transport Economic Efficiency Benefits	**829,789**	*(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 Total		Road	Bus
Local Government Funding				
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	0		0	0
Investment Costs	9,407		9,407	0
Developer & Other Contributions	0		0	0
Grant/Subsidy Payments	0		0	0
NET IMPACT	**9,407**	*(8)*	9,407	0
Central Government Funding: Non-Transport				
Indirect Tax Revenues	18,120		18,120	
TOTALS				
Broad Transport Budget	**9,407**	*(9) = (7) + (8)*		
Wider Public Finances	**18,120**			

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	7,614	
Consumer User Benefits	535,764	
Business User Benefits	294,025	
Private Sector Provider Impacts	0	
Other Business Impacts	0	
Accident Benefits	5,907	
Wider Public Finances(Indirect Taxation Revenu	-18,120	
Present Value of Benefits (PVB)	**825,190**	
Local Government Funding	0	
Central Government Funding	9,407	
Present Value of Costs (PVC)	**9,407**	
OVERALL IMPACTS		
Net Present Value (£000)	**815,783**	NPV=PVB-PVC
Benefit to Cost Ratio	**87.72**	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.

A5 TEE Table – With M4 CAN, Construction Option B

Economic Efficiency of the Transport System (TEE)

	All Modes Total		Road Personal	Road Freight	Bus Passengers
Consumers					
User Benefits (£000)	**All Modes**		**Road**		**Bus**
Personal Travel	**Total**		Personal		Passengers
Travel Time	551,933		551,933		0
Vehicle Operating Costs	19,264		19,264		0
User Charges	0		0		0
During Construction & Maintenance	-70,866		-70,866		
NET CONSUMER BENEFITS	**500,331**	*(1)*	500,331		0
Business					
User Benefits			Personal	Freight	Passengers
Travel Time	271,806		158,585	113,221	0
Vehicle Operating Costs	22,219		6,325	15,894	0
User Charges	0		0	0	0
During Construction & Maintenance	0		0	0	
Subtotal	**294,025**	*(2)*	164,910	129,115	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	**294,025**	*(5) = (2) + (3) + (4)*			
TOTAL (£000)					
Present Value of Transport Economic Efficiency Benefits	**794,356**	*(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 Total		Road	Bus
Local Government Funding				
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	0		0	0
Investment Costs	16,939		16,939	0
Developer & Other Contributions	0		0	0
Grant/Subsidy Payments	0		0	0
NET IMPACT	**16,939**	*(8)*	16,939	0
Central Government Funding: Non-Transport				
Indirect Tax Revenues	18,120		18,120	
TOTALS				
Broad Transport Budget	**16,939**	*(9) = (7) + (8)*		
Wider Public Finances	**18,120**			

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	7,614	
Consumer User Benefits	500,331	
Business User Benefits	294,025	
Private Sector Provider Impacts	0	
Other Business Impacts	0	
Accident Benefits	5,907	
Wider Public Finances(Indirect Taxation Revenu	-18,120	
Present Value of Benefits (PVB)	**789,757**	
Local Government Funding	0	
Central Government Funding	16,939	
Present Value of Costs (PVC)	**16,939**	
OVERALL IMPACTS		
Net Present Value (£000)	**772,818**	NPV=PVB-PVC
Benefit to Cost Ratio	**46.62**	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.

A6 TEE Table – With M4 CAN, Construction Option C

Economic Efficiency of the Transport System (TEE)

	All Modes		Road		Bus
Consumers					
User Benefits (£000)	**Total**		Personal		Passengers
Personal Travel					
Travel Time	551,933		551,933		0
Vehicle Operating Costs	19,264		19,264		0
User Charges	0		0		0
During Construction & Maintenance	-53,150		-53,150		
NET CONSUMER BENEFITS	**518,048**	*(1)*	518,048		0
Business					
User Benefits			Personal	Freight	Passengers
Travel Time	271,806		158,585	113,221	0
Vehicle Operating Costs	22,219		6,325	15,894	0
User Charges	0		0	0	0
During Construction & Maintenance	0		0	0	
Subtotal	**294,025**	*(2)*	164,910	129,115	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	**294,025**	*(5) = (2) + (3) + (4)*			
TOTAL (£000)					
Present Value of Transport Economic Efficiency Benefits	**812,073**	*(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 Total		Road	Bus
Local Government Funding				
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	0		0	0
Investment Costs	12,918		12,918	0
Developer & Other Contributions	0		0	0
Grant/Subsidy Payments	0		0	0
NET IMPACT	**12,918**	*(8)*	12,918	0
Central Government Funding: Non-Transport				
Indirect Tax Revenues	18,120		18,120	
TOTALS				
Broad Transport Budget	**12,918**	*(9) = (7) + (8)*		
Wider Public Finances	**18,120**			

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	7,614	
Consumer User Benefits	518,048	
Business User Benefits	294,025	
Private Sector Provider Impacts	0	
Other Business Impacts	0	
Accident Benefits	5,907	
Wider Public Finances(Indirect Taxation Revenu	-18,120	
Present Value of Benefits (PVB)	**807,474**	
Local Government Funding	0	
Central Government Funding	12,918	
Present Value of Costs (PVC)	**12,918**	
OVERALL IMPACTS		
Net Present Value (£000)	**794,556**	NPV=PVB-PVC
Benefit to Cost Ratio	**62.51**	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.