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Economic Assessment Report

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A55 JUNCTIONS 15 AND 16 IMPROVEMENTS ECONOMIC ASSESSMENT REPORT (STAGE 3)

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A55 JUNCTIONS 15 AND 16 IMPROVEMENTS
ECONOMIC ASSESSMENT REPORT (STAGE 3)

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CONTENTS

APPENDICES

1. INTRODUCTION

1.1.1 Ramboll has undertaken an assessment of the transport economic benefits for the proposed A55 Junctions 15 and 16 Improvement works.

1.1.2 The Welsh Government (WG) originally appointed Carillion in October 2017 to develop the design of the proposed A55 Junctions 15 and 16 Improvements up to publication of Draft Orders. Ramboll was the lead designer to Carillion. In January 2018, Carillion went into liquidation and WG appointed Ramboll directly to take forward the scheme appraisal.

1.1.3 Ramboll have undertaken a transport study on the A55 trunk road Junctions 15 and 16, following the Welsh Transport Planning and Appraisal Guidance 2017 (WelTAG). The study includes a Stage 3 Appraisal, building upon work already undertaken during the previous WelTAG stages 1 and 2.

1.1.4 It is proposed to improve the layout of the A55 Junctions 15 and 16 to improve safety and journey times, to make maintenance easier and improve responses to emergencies. A preferred scheme for the improvement works at both Junctions 15 and 16 has been determined. Both schemes replace the existing roundabouts at Junction 15 and 16 with grade separated junctions that will allow traffic on the A55 to flow more smoothly without having to slow down at each of the roundabouts.

1.2 Purpose of the Report

1.2.1 The purpose of this Economic Assessment Report (EAR) is to describe and justify the methodology and data inputs and, to present the results of the economic assessment for this stage (stage 3). The economic assessment uses the Department for Transport (DfT) TUBA (Transport Users Benefit Assessment) software, Cost and Benefit to Accidents – Light Touch (COBA-LT and Queues and Delays at Roadworks (QUADRO) software. The report considers the COBA-LT, TUBA and QUADRO inputs and provides justification on the use of local survey data, accident data, and vehicle proportions. A summary of the overall results combining benefits with scheme costs for both preferred schemes for Junctions 15 and 16 is provided. The assessments are based on data from local surveys and the A55 Transport Model (A55TM).

1.2.2 The two preferred junction improvement schemes for Junctions 15 and 16 are presented in Appendix 1 and detailed in the Traffic Forecasting Report (TFR) (Ref: A55J15J16-RAM-60-XX-RP-T-0013).

1.3 Structure of Report

1.3.1 This report presents the economic case development for both A55 Preferred Scheme improvements at Junctions 15 and 16 for the Core Scenario, Low Economic growth assumptions and High Economic growth assumptions. The report is split into following chapters:

- **Economic Assessment Methodology & Assumptions** – outlines the methodology and assumptions determined for the economic assessments.
- **TUBA Economic Assessment** – this chapter presents the Transport User Benefit Appraisal (TUBA), Transport Economic Efficiency (TEE) and Wider Economic Benefits both preferred junction improvement schemes.
- **COBALT Economic Assessment** – this chapter presents the Cost and Benefit to Accidents – Light Touch (COBALT) analysis of the impact on accidents for both preferred junction improvement schemes.
- **Quadro Economic Assessment** – this chapter presents the assessment of the total cost of major road maintenance works for both preferred junction improvement schemes; and
- **Value for Money Summary** – this chapter provides an overview of the full economic assessment undertaken for both preferred junction improvement schemes.

2. ECONOMIC ASSESSMENT METHODOLOGY & ASSUMPTIONS

2.1 Methodology

This section describes the economic appraisal that has been undertaken for the 'Do Something' Core Scenario, Low Growth and High Growth improvement schemes. This appraisal has been carried out by following the guidance in WebTAG Unit A1.1 'Cost Benefit Analysis and uses Transport User Benefit Appraisal (TUBA) software version 1.9.13. TUBA has been used to compare the two preferred improvement schemes against the 'Do Minimum' over a 60-year appraisal period. The following impacts were monetised, with respect to the proposed improvements:

- Travel times
- Vehicles Operating Costs

2.2 Assessment Period

2.2.1 The WebTAG recommended assessment period of 60 years has been adopted. The schemes are due for implementation during 2023. In order to be proportionate in the modelling effort for the assessment, the economic appraisal has been based on traffic modelling for 2022, 2037 and 2051 where data is readily available from SATURN. Data from the SATURN models for the Core Scenario, Low Growth and High Growth were input to the TUBA assessments. These results are then interpolated and extrapolated accordingly (in the modelling and assessment tools) to obtain economic benefits for all other years, which are then discounted to 2010.

2.3 Modelled Time Periods

2.3.1 The traffic modelling has been undertaken for the following weekday time periods:

- AM Peak (08:00–09:00)
- Inter Peak (Average Hour 10:00–16:00)
- PM Peak (17:00–18:00)

2.3.2 For assessment, time period factors are used to convert the model outputs to be representative of annual totals as described in Section 2.5.

2.4 Model Inputs

2.4.1 SATURN model assignments have been run for both 'Do Minimum' and 'Do Something' scenarios for the Junction 15 Preferred Schemes and Junction 16 Preferred Schemes for 2022, 2037 and 2051. These models for the Core Scenario, Low Growth and High Growth and are reported in the Traffic Forecasting Report (TFR). Traffic volumes, time and distance skims from these assignments have been passed through to the economic appraisal in TUBA.

2.5 Annualisation

2.5.1 Economic appraisal requires a consideration of the benefits to all road users, many of which will not be travelling at times represented by the transport model. Benefits per vehicle vary throughout the day and throughout the year to the extent that traffic levels impact on the benefit per vehicle.

2.5.2 The calculation of total benefits to all transport users over the 60-year appraisal period requires the calculation of annualisation factors to quantify the way in which the scheme might affect those travelling during weekdays outside of the modelled hours or on weekends and public holidays. Factors for annualisation are utilised to growth the produced results from the modelled periods to represent all hours during the year.

2.5.3 For the calculation of the annualisation factors, traffic data covering the whole of 2017 has been used from the Traffic Wales permanent count site 17, located on the A55 at Conwy Crossing. Annualisation factors were calculated in line with the guidance set out in WebTAG Unit A1.3 section 9.1.1. Separate factors were calculated for the three modelled periods based on the assumption that each modelled period will represent days and times as follows:

- AM Peak: weekdays between 0700 and 1000
- Inter Peak: weekdays between 1000 and 1600 (off-peak evenings, weekends and public holidays)
- PM Peak: weekdays between 1600 and 1900

2.5.4 For 2016 there were 253 weekdays and 104 weekend days. The weekday daytime 12-hour period (07:00-19:00) can be represented directly by the weekday models (AM, Inter-Peak and PM). The weekday off peak and weekends will be represented by the inter peak model.

2.5.5 Given that the AM and PM models cover the peak hours, i.e. 08:00 – 09:00 and 17:00 – 18:00, as opposed to the extended AM and PM peak periods (07:00 – 10:00 and 16:00 – 19:00), the flows have been multiplied by 2.565 and 2.676 respectively to account for the total period flows. These flows were ascertained through comparing peak hour and period totals from the model ATC count data.

2.5.6 The permanent count site was used to determine a factor between the average Inter Peak flows and average Off Peak flows and the average weekend flows. These were then multiplied by 253 to determine the annualization factors for these periods.

2.5.7 A summary of the final annualisation factors for the modelled time periods, AM Peak, Inter Peak and PM Peak are shown in Table 2.1. The table also shows the weekday annualisation factors, Off Peak annualisation factors and weekend annualisation factors.

Time Period	Annualisation Factor	Weekday Factor	Off Peak Factor	Weekend Factor
AM Peak	675	675		
Inter Peak	3187	1467	366	1354
PM Peak	677	677		

Table 2.1: Annualisation Factors

2.6 Scheme Costs

2.6.1 Construction costs for each of the preferred improvement schemes for Junction 15 and 16 have been calculated by experienced highway cost consultants. Scheme costs and the allocation of Risk have been reviewed and agreed with Welsh Government and their advisors. These are essentially the same set of criteria used for similar Welsh Government schemes such as Newtown Bypass. The proportion of risk, including Optimism Bias, attached to the scheme costs is 8.5%. Scheme costs are based on current prices in late 2019.

2.6.2 This section summarises the construction costs for each preferred improvement scheme for Junction 15 and 16 and a detailed breakdown of these costs is presented in Appendix 6.

2.6.3 The impact of travel delays due to planned maintenance works along A55 for the duration of the economic appraisal was considered. The maintenance regime for the existing A55 would, essentially, be the same as for the route with improvements included except that with the new scheme, maintenance is likely to be required less frequently. The introduction of greater lengths of concrete central reserve barriers, removal of lighting at roundabouts and introduction of more efficient lighting systems all contribute to this reduced maintenance requirement. Thus, the appraisal considers differences between the 2 scenarios, and includes these slight maintenance cost reductions in the Quadro assessment.

2.7 Junction 15 – Preferred Scheme Construction Costs

2.7.1 The total estimated scheme cost (excluding VAT) of Junction 15 Preferred Scheme is £30.788m and the detail of this can be seen in Appendix 6. The elements allowed for in the scheme cost are described as follows.

2.7.2 Main construction works – the Cost Consultant defined the scope of works for Junction 15 Preferred Scheme and built up the cost of £17.987m. This allows for all activities to construct the scheme, such as site clearance, earthworks, structures, roadworks and landscaping and included Traffic Management costs during construction.

2.7.3 Contractor's Risk Allowance and Fee account for £2.048m.

2.7.4 Works by other authorities – the utility diversions required to allow the construction of the scheme and de-trunking costs were estimated at £0.996m due to the complex junction arrangement and likelihood of diversion requirements.

2.7.5 Land – to allow for the compulsory purchase of land and compensation payments to land and property owners during construction, and the impact of the completed highway, a value of £1.500m has been established using market prices. These costs include for the purchase of the newly constructed and existing properties at the W/B off slip and blighting of the existing properties at the W/B on slip.

2.7.6 Preparation and supervision – as part of the scheme delivery, costs of £5.961m have been allowed for Key Stage 3, Key Stage 4 and Employer's Agent professional fees.

2.7.7 Employer's risk allowance – to allow for the Welsh Government's risks during the scheme, a sum of £2.296m has been calculated.

2.8 Junction 16 – Preferred Scheme Construction Costs

2.8.1 The total estimated scheme cost of Junction 16 Preferred Option Mitigated (excluding VAT) is £23.108m and the detail of this can be seen in Appendix 6. The elements allowed for in the scheme cost are described as follows.

2.8.2 Main construction works – the Cost Consultant defined the scope of works for Junction 15 Preferred Scheme and built up the cost of £13.168m. This allows for all activities to construct the scheme, such as site clearance, earthworks, structures, roadworks and landscaping and included Traffic Management costs during construction.

2.8.3 Contractor's Risk Allowance and Fee account for £1.628m.

2.8.4 Works by other authorities – the utility diversions required to allow the construction of the scheme and de-trunking costs were estimated at £0.740m due to the complex junction arrangement and likelihood of diversion requirements.

2.8.5 To allow for the compulsory purchase of land and compensation payments to land and property owners during construction, and the impact of the completed highway, a value of £0.500m has been established using market prices.

2.8.6 Preparation and supervision – as part of the scheme delivery, costs of £4.775m have been allowed for Key Stage 3, Key Stage 4 and Employer's Agent professional fees.

2.8.7 To allow for the Welsh Government's risks during the delivery of the scheme a sum of £2.296m has been calculated.

3. TUBA ECONOMIC ASSESSMENT

3.1.1 This chapter presents the Transport User Benefit Appraisal (TUBA), Transport Economic Efficiency (TEE) and Wider Economic Benefits for the two preferred improvement schemes at Junction 15 and 16, for the Core Scenario, Low Growth and High Growth economic assumptions. TUBA version 1.9.13 was used for the economic appraisal.

3.2 The Transport Economic Assessment (Core Scenario)

3.2.1 The transport economic assessment has been carried out in line with DfT guidance in order to produce an indicative Value for Money (VfM) assessment and maximise use of available modelling evidence. As indicated, the DfT's TUBA software has been used to calculate the main transport economic benefits. The analysis uses transport modelling results from SATURN that reflect travel time and traffic reassignment impacts of the two preferred improvement options.

3.2.2 The summaries of the TUBA assessments for both junctions are shown in the Table 3.1 below. Details for the Transport Economic Efficiency assessment of each scheme is shown in Appendix 2. Similarly, the Public Accounts summaries are in Appendix 4 and the analysis of monetised costs and benefits is shown in Appendix 5.

TUBA Appraisal Summary Table (£1,000 2010 prices discounted to 2010)	**Junction 15 Preferred Scheme**	**Junction 16 Preferred Scheme**
Land Costs in 2019 prices	£1,500	£500
Scheme Costs in 2019 prices	£30,788	£23,108
Analysis of Monetised Costs and Benefits (AMCB)		
Greenhouse Gases	-£219	-£199
Economic Efficiency: Consumer Users, Commuting	£5,547	£5,484
Economic Efficiency: Consumer Users, Other	£5,363	£5,128
Economic Efficiency: Business Users and Providers	£8,091	£8,226
Wider Public Finances (Indirect Taxation Revenues)	£383	£336
Value for Money Summary		
Present Value of Costs (PVC)	£20,590	£15,314
Present Value of Benefits (PVB)	£19,165	£18,975
Net Present Value (NPV)	-£1,425	£3,661
Benefit to Cost Ratio (BCR)	**0.931**	**1.239**

Table 3.1: TUBA Appraisal Summary Table – Junction 15 & 16 Preferred Schemes (Core Scenario)

3.2.3 The summary of the two preferred junction improvements shows that both schemes produce a slight increase in Greenhouse Gas emissions, with both schemes also providing a slight benefit for Indirect Tax Revenues for the government.

3.2.4 Transport User Benefits are of a similar order for both junction improvements. These are around £5.5m for Commuters, £5.2m for Other users and £8.1m for Business Users.

3.2.5 Discounted scheme costs are around £20.6m for Junction 15 and £15.3m for Junction 16. These include an element of cost savings for maintenance of the highway infrastructure during the appraisal period. The higher specification of the scheme design will require less ongoing maintenance, particularly for central reserve, where concrete barriers are to be provided. These cost reductions account for £0.47m for Junction 15 and £0.47m for Junction 16.

The benefits for the Junction 15 improvement amount to £19.2m. This represents a reduction of £1.4m compared to the scheme costs and results in a Benefit to Cost Ratio (BCR) of 0.931. The

benefits for the Junction 16 improvement amount to £18.9m; an increase of £3.7m compared to the scheme costs, resulting in a BCR of 1.239.

3.3 The Transport Economic Assessment (Low Growth)

3.3.1 The transport economic assessment has been carried out in line with DfT guidance in order to produce an indicative Value for Money (VfM) assessment and maximise use of available modelling evidence. As indicated, the DfT's TUBA software has been used to calculate the main transport economic benefits. The analysis uses transport modelling results from SATURN that reflect travel time and traffic reassignment impacts of the two preferred improvement options.

3.3.2 The summaries of the TUBA assessments for both junctions are shown in the Table 3.2 below. Details for the Transport Economic Efficiency assessment of each option is shown in Appendix 2. Similarly, the Public Accounts summaries are in Appendix 4 and the analysis of monetised costs and benefits is shown in Appendix 5.

TUBA Appraisal Summary Table (£1,000 2010 prices discounted to 2010)	**Junction 15 Preferred Scheme**	**Junction 16 Preferred Scheme**
Land Costs in 2019 prices	£1,500	£500
Scheme Costs in 2019 prices	£30,788	£23,108
Analysis of Monetised Costs and Benefits (AMCB)		
Greenhouse Gases	-£57	-£5
Economic Efficiency: Consumer Users, Commuting	£3,176	£2,933
Economic Efficiency: Consumer Users, Other	£3,460	£3,158
Economic Efficiency: Business Users and Providers	£5,140	£5,103
Wider Public Finances (Indirect Taxation Revenues)	£114	£10
Value for Money Summary		
Present Value of Costs (PVC)	£20,590	£15,314
Present Value of Benefits (PVB)	£11,833	£11,199
Net Present Value (NPV)	-£8,757	-£4,115
Benefit to Cost Ratio (BCR)	**0.575**	**0.731**

Table 3.2: TUBA Appraisal Summary Table – Junction 15 & 16 Preferred Schemes (Low Growth)

3.3.3 The summary of the two preferred junction improvements shows that both schemes produce a very slight increase in Greenhouse Gas emissions, with both schemes also providing a slight benefit for Indirect Tax Revenues for the government.

3.3.4 Transport User Benefits are of a similar order for both junction improvements. These are around £3.0m for Commuters, £3.3m for Other users and £5.1m for Business Users.

3.3.5 Discounted scheme costs are around £20.6m for Junction 15 and £15.3m for Junction 16. These include an element of cost savings for maintenance of the highway infrastructure during the appraisal period. The higher specification of the scheme design will require less ongoing maintenance, particularly for central reserve, where concrete barriers are to be provided. These cost reductions account for £0.47m for Junction 15 and £0.47m for Junction 16.

The benefits for the Junction 15 improvement amount to £11.8m. This represents a reduction of £8.8m compared to the scheme costs and results in a Benefit to Cost Ratio (BCR) of 0.575. The benefits for the Junction 16 improvement amount to £11.2m; a decrease of £4.1m compared to the scheme costs, resulting in a BCR of 0.731.

3.4 The Transport Economic Assessment (High Growth)

3.4.1 The transport economic assessment has been carried out in line with DfT guidance in order to produce an indicative Value for Money (VfM) assessment and maximise use of available modelling evidence. As indicated, the DfT's TUBA software has been used to calculate the main transport economic benefits. The analysis uses transport modelling results from SATURN that reflect travel time and traffic reassignment impacts of the two preferred improvement options.

3.4.2 The summaries of the TUBA assessments for both junctions are shown in the Table 3.3 below. Details for the Transport Economic Efficiency assessment of each option is shown in Appendix 2. Similarly, the Public Accounts summaries are in Appendix 4 and the analysis of monetised costs and benefits is shown in Appendix 5.

TUBA Appraisal Summary Table (£1,000 2010 prices discounted to 2010)	**Junction 15 Preferred Scheme**	**Junction 16 Preferred Scheme**
Land Costs in 2019 prices	£1,500	£500
Scheme Costs in 2019 prices	£30,788	£23,108
Analysis of Monetised Costs and Benefits (AMCB)		
Greenhouse Gases	-£765	-£764
Economic Efficiency: Consumer Users, Commuting	£14,682	£15,549
Economic Efficiency: Consumer Users, Other	£11,919	£12,033
Economic Efficiency: Business Users and Providers	£18,390	£19,202
Wider Public Finances (Indirect Taxation Revenues)	£1,238	£1,226
Value for Money Summary		
Present Value of Costs (PVC)	£20,590	£15,314
Present Value of Benefits (PVB)	£45,464	£47,246
Net Present Value (NPV)	£24,874	£31,932
Benefit to Cost Ratio (BCR)	**2.208**	**3.085**

Table 3.3: TUBA Appraisal Summary Table – Junction 15 & 16 Preferred Schemes (High Growth)

3.4.3 The summary of the two preferred junction improvements shows that both schemes produce a moderate increase in Greenhouse Gas emissions, with both schemes also providing a moderate benefit for Indirect Tax Revenues for the government.

3.4.4 Transport User Benefits are of a similar order for both junction improvements. These are around £14.7m to £15.5m for Commuters, £12.0m for Other users and £18.4m to £19.2m for Business Users.

3.4.5 Discounted scheme costs are around £20.6m for Junction 15 and £15.3m for Junction 16. These include an element of cost savings for maintenance of the highway infrastructure during the appraisal period. The higher specification of the scheme design will require less ongoing maintenance, particularly for central reserve, where concrete barriers are to be provided. These cost reductions account for £0.47m for Junction 15 and £0.47m for Junction 16.

The benefits for the Junction 15 improvement amount to £45.5m. This represents an increase of £24.9m compared to the scheme costs and results in a Benefit to Cost Ratio (BCR) of 2.208. The benefits for the Junction 16 improvement amount to £47.3m; an increase of £31.9m compared to the scheme costs, resulting in a BCR of 3.085.

3.5 Wider Economic Benefits

3.5.1 At this stage of scheme appraisal, no detailed Wider Economic Benefits study has been carried out. However, WebTAG Unit A2.1 has been referenced to estimate these benefits where possible. There are 3 aspects to Wider Economic Benefits as described in Unit 2.1, namely: Agglomeration, Output Change in Imperfectly Competitive Markets and Tax Revenue from Labour Market Impacts. These are explained in Unit 2.1 Section 4 but, in line with the guidance, it is considered that only benefits associated with *Change in Imperfectly Competitive Markets* are applicable to these A55 improvement options.

3.5.2 The guidance in TAG Unit A2.1, 4.1.8 has been used to calculate these Wider Economic Benefits. The Unit suggests these benefits can be estimated as a proportion of total user benefits for business journeys, calculated as a 10% uplift to business user benefits. These impacts are calculated from the business user benefits in the Transport Economic Efficiency (TEE) analysis. Thus, for each option, the Wider Economic Benefits have been taken from the TUBA analysis, as 10% of the overall business user benefits.

3.6 Wider Economic Benefits (Core Scenario)

3.6.1 The Wider Economic Benefits for the Preferred Schemes for Junction 15 and 16 (Core Scenario) are shown in Table 3.4 and show a positive impact on user benefits.

Imperfectly Competitive Market Benefits (£1,000)		
	J15 PREFERRED SCHEME	**J16 PREFERRED SCHEME**
10% Business User Benefits	£809	£823

Table 3.4: Wider Economic Benefits – Junction 15 & 16 (Core Scenario)
(£1,000 2010 prices discounted to 2010)

3.7 Wider Economic Benefits (Low Growth)

3.7.1 The Wider Economic Benefits for the Preferred Schemes for Junction 15 and 16 (Low Growth) are shown in Table 3.5 and show a positive impact on user benefits.

Imperfectly Competitive Market Benefits (£1,000)		
	J15 PREFERRED SCHEME	**J16 PREFERRED SCHEME**
10% Business User Benefits	£514	£510

Table 3.5: Wider Economic Benefits – Junction 15 & 16 (Low Growth)
(£1,000 2010 prices discounted to 2010)

3.8 Wider Economic Benefits (High Growth)

3.8.1 The Wider Economic Benefits for the Preferred Schemes for Junction 15 and 16 (High Growth) are shown in Table 3.6 and show a positive impact on user benefits.

Imperfectly Competitive Market Benefits (£1,000)		
	J15 PREFERRED SCHEME	**J16 PREFERRED SCHEME**
10% Business User Benefits	£1,839	£1,920

Table 3.6: Wider Economic Benefits – Junction 15 & 16 (High Growth) (£1,000 2010 prices discounted to 2010)

4. COBALT ECONOMIC ASSESSMENT

4.1.1 This chapter presents the COBALT assessment of the impact on accidents for the two preferred junction improvement schemes. The aim of COBALT is to carry out economic appraisal in accordance with WelTAG and WebTAG. Analysis has been carried out for the Core Scenario, Low Growth and High Growth economic assumptions.

4.2 Accident Benefits

4.2.1 The COBALT (Cost and Benefit to Accidents – Light Touch) program has been used to derive the accident benefits of the scheme for both preferred improvement options. The most recent economic parameter data, version 2018.10, has been used in the assessment. COBALT compares the predicted numbers of accidents with and without a scheme and converts them into monetary values by multiplying the numbers of accidents by their monetised costs. The benefits for each year are discounted to 2010 prices and summed over the 60-year assessment period.

4.3 COBALT Network

4.3.1 COBALT uses nodes and links to represent the Base, 'Do Minimum' and 'Do Something' highway networks.

4.3.2 The COBALT network for A55 improvement schemes covers a road network which is included in the SATURN model for the 'Do Minimum' and 'Do Something' scenarios and is shown in Figure 4.1. Coding of links and nodes was carried out in accordance with the COBALT User Manual. Link and junction parameters including speed limits, distances, road class and junction type were obtained from survey data, GIS and Google Earth.

Map data © 2018 Google

Figure 4.1 – COBALT A55 Road Network

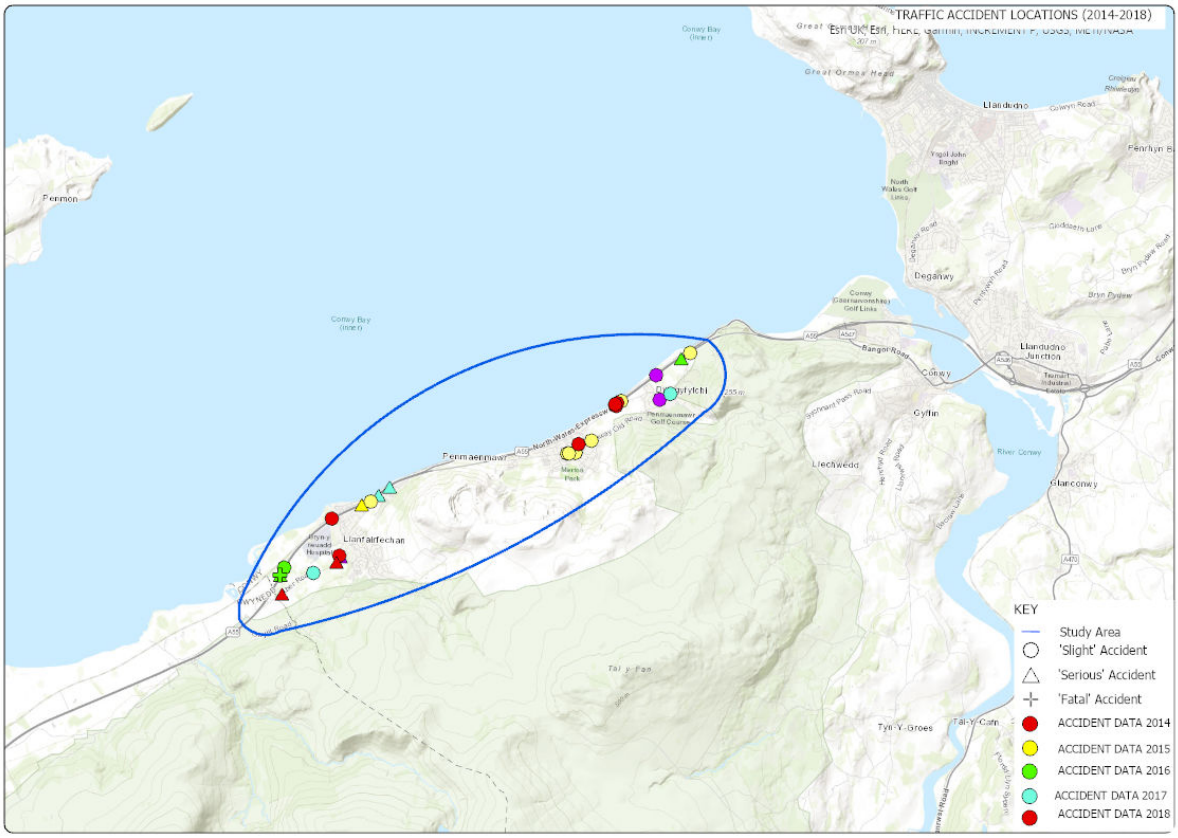
4.4 Accident Rates

4.4.1 COBALT calculates the number of accidents over a 60-year period from either default (national average) or observed (local) accident rates.

4.4.2 Observed accident rates for the study area were calculated in COBALT from personal injury accident (PIA) data for the five-year period from 2014 to 2018. This was the most up-to-date information available at the time of undertaking the analysis. The data was obtained from the

STATS19 database (www.datagov.uk). This data was used to create a scheme input text file (one of two COBALT input files) which contains the number of accidents within the study area over the 5-year period and references the COBALT parameter input file (second COBALT input file) to produce accident rates that are assigned to the COBALT links and junctions within the network. Where a modelled link or junction had no accidents over the 5-year period, the default COBA accident rate was applied.

4.4.3 Figure 4.2 presents a plot of the collated accident data by severity within the A55 study area over the 5-year period from 2014 to 2018. The figure can also be found in Appendix 3 for greater detail.



Accident Data © data.gov.uk

Figure 4.2: Accidents by Severity (2014-2018)

4.4.4 Table 4.3 presents a summary of five years accident data (2014-2018) for the A55TM study area split between accident severities; fatal, serious and slight.

Table 4.3 - Summary of PIA data (cobalt network)					
Year	Severity			Total Casualties	Total Accidents
	Slight	Serious	Fatal		
2014	6	2	0	10	8
2015	8	1	0	14	9
2016	2	2	1	7	5
2017	2	2	0	4	4
2018	3	0	0	3	3
Total	21	7	1	38	29

Table 4.3: Accident Data by Year and Severity

4.4.5 Analysis of the data has revealed during this time there have been 29 accidents. Of these, one accident was recorded as fatal, seven accidents were serious and 21 were slight.

4.4.6 Traffic flows used in the calculation of accident benefits are Annual Average Daily Traffic (AADT) flows based on outputs from the SATURN traffic model. Using interpolation of the flow data for the Base Year and the 3 future years (2022, 2037 and 2051), COBALT derives the flows and number of accidents for each year over the 60-year appraisal period.

4.5 Accident Benefits Results (Core Scenario)

4.5.1 The COBALT output shows accident benefits and disbenefits for the A55TM.

4.5.2 With the improvement works on Junctions 15 and 16 constructed, local traffic redistributes within the study area due to improved road conditions (as part of the study road network is designed to modern standards) which could result in a reduction or increase in accidents within the study area.

4.5.3 The accident results for the study area due to the construction of the improvement works for both preferred schemes are presented below:

- J15 Preferred Scheme – Decrease by 34 accidents
- J16 Preferred Scheme – Decrease by 32 accidents

4.5.4 Table 4.4 below shows the predicted number of accidents and casualties over the 60-year appraisal period for the study area for both preferred schemes and summarises the accident benefits to be gained from each improvement scheme.

Summary of Accident Benefits	J15 PREFERRED SCHEME	J16 PREFERRED SCHEME
Total Accidents saved by Scheme	34.2	32.0
Total Casualties Saved by Scheme		
Fatal	0.7	0.5
Serious	4.3	3.2
Slight	42.5	39.2
Monetary Value (£1,000, 2010 prices discounted to 2010)		
Total Accident Benefits Saved by Scheme	£1,583.5	£1,347.9

Table 4.4: Core Scenario Summary of Accident Benefits (Junction 15 & 16)

4.5.5 Table 4.4 indicates with the construction of the Junctions 15 and 16 improvement works, there is a resulting reduction in accidents within the study area predicted of 34 and 32 (respectively) over a 60-year period.

4.5.6 Through the removal of the roundabout the speed and flow per lane should become more consistent. In addition, the new junction would be designed in accordance with design standards, street lighting and clear signage would also be present. Fear of potential accidents would reduce due to the removal of the roundabout, and its associated traffic movements.

4.6 Accident Benefits Results (Low Growth)

4.6.1 The COBALT output shows accident benefits and disbenefits for the A55TM.

4.6.2 With the improvement works on Junctions 15 and 16 constructed, local traffic redistributes within the study area due to improved road conditions (as part of the study road network is designed to modern standards) which could result in a reduction or increase in accidents within the study area.

4.6.3 The accident results for the study area due to the construction of the improvement works for both preferred schemes are presented below:

- J15 Preferred Scheme – Decrease by 29 accidents
- J16 Preferred Scheme – Decrease by 25 accidents

4.6.4 Table 4.5 below shows the predicted number of accidents and casualties over the 60-year appraisal period for the study area for both preferred options and summarises the accident benefits to be gained from each improvement scheme.

Summary of Accident Benefits	J15 PREFERRED SCHEME	J16 PREFERRED SCHEME
Total Accidents saved by Scheme	29.2	25.2
Total Casualties Saved by Scheme		
Fatal	0.6	0.4
Serious	3.6	2.5
Slight	36.3	30.9
Monetary Value (£1,000, 2010 prices discounted to 2010)		
Total Accident Benefits Saved by Scheme	£1,369.2	£1,065.6

Table 4.5: Low Growth Summary of Accident Benefits (Junction 15 & 16)

4.6.5 Table 4.5 indicates with the construction of the Junctions 15 and 16 improvement works, there is a resulting reduction in accidents within the study area predicted of 29 and 25 (respectively) over a 60-year period.

4.6.6 Through the removal of the roundabout the speed and flow per lane should become more consistent. In addition, the new junction would be designed in accordance with design standards, street lighting and clear signage would also be present. Fear of potential accidents would reduce due to the removal of the roundabout, and its associated traffic movements.

4.7 Accident Benefits Results (High Growth)

4.7.1 The COBALT output shows accident benefits and disbenefits for the A55TM.

4.7.2 With the improvement works on Junctions 15 and 16 constructed, local traffic redistributes within the study area due to improved road conditions (as part of the study road network is designed to modern standards) which could result in a reduction or increase in accidents within the study area.

4.7.3 The accident results for the study area due to the construction of the improvement works for both preferred schemes are presented below:

- J15 Preferred Scheme – Decrease by 38 accidents
- J16 Preferred Scheme – Decrease by 47 accidents

4.7.4 Table 4.6 below shows the predicted number of accidents and casualties over the 60-year appraisal period for the study area for both preferred options and summarises the accident benefits to be gained from each improvement scheme.

Summary of Accident Benefits	**J15 PREFERRED SCHEME**	**J16 PREFERRED SCHEME**
Total Accidents saved by Scheme	38.7	47.1
Total Casualties Saved by Scheme		
Fatal	0.7	0.7
Serious	4.8	5.1
Slight	48.0	56.8
Monetary Value (£1,000, 2010 prices discounted to 2010)		
Total Accident Benefits Saved by Scheme	£1,781.0	£1,921.0

Table 4.6: High Growth Summary of Accident Benefits (Junction 15 & 16)

4.7.5 Table 4.6 indicates with the construction of the Junctions 15 and 16 improvement works, there is a resulting reduction in accidents within the study area predicted of 38 and 47 (respectively) over a 60-year period.

4.7.6 Through the removal of the roundabout the speed and flow per lane should become more consistent. In addition, the new junction would be designed in accordance with design standards, street lighting and clear signage would also be present. Fear of potential accidents would reduce due to the removal of the roundabout, and its associated traffic movements.

4.7.7 In the later assessment years (2037 and 2051) there is a slight difference in the local distribution of traffic around Dwygyfylchi compared to the Opening Year, 2022. Essentially, there is greater use of the Link Road between Junction 16 and Junction 16A and relatively less traffic travelling through the village. This reassignment is predominately for westbound traffic heading to the western part of Dwygyfylchi. The switch of traffic from a route with a higher Accident Rate to one with a lower rate produces greater benefits in the economic assessment. Therefore, the High Growth scenario presents greater accident benefits at J16 in relative terms to the other scenarios and J15.

5. QUADRO ECONOMIC ASSESSMENTS

5.1.1 This chapter presents the assessment of the total cost of travel delays during the construction period for the improvement options and any major road maintenance works. The DfT program QUADRO (Queues and Delays at Roadworks), the latest version of the program being, 2018 version 4 release 16, was used to carry out the economic appraisal of travel delay costs.

5.2 Maintenance Works

5.2.1 The impact of travel delays due to planned maintenance works along A55 for the duration of the economic appraisal was considered. The maintenance regime for the existing A55 would, essentially, be the same as for the route with improvements included except that with the new scheme, maintenance is likely to be required less frequently. Thus, the appraisal considers differences between the 2 scenarios, and includes these slight benefits in the Quadro assessment.

5.3 Delays during Construction (Core Scenario)

5.3.1 Throughout the construction phase for both schemes, there will be restrictions for side road traffic entering and leaving the A55 and speed restrictions through the Traffic Management section of the works. The nature and duration of the Traffic Management required to build each option will differ. Table 5.1 and 5.2, provides details of the duration and nature of these Traffic Management arrangements for both preferred schemes. These Traffic Management proposals have been derived by experienced highway construction specialists.

A55 Junction 15 Preferred Scheme – Traffic Management during Construction			
Traffic Movement	**TM Duration**	**TM Length**	**TM Speed Restriction**
A55 Eastbound	90 Weeks	3.0km	80kph
A55 Westbound	90 Weeks	3.0km	80kph
Turning Movement Eastbound On	90 Weeks	No Access	
Turning Movement Eastbound On	4 Weeks	1.25km	80kph
Turning Movement Eastbound Off	90 Weeks	No Access	
Turning Movement Eastbound Off	4 Weeks	1.25km	80kph
Turning Movement Westbound On	15 Weeks	No Access	
Turning Movement Westbound On	75 Weeks	1.25km	80kph
Turning Movement Westbound Off	15 Weeks	No Access	
Turning Movement Westbound Off	75 Weeks	1.25km	80kph

Table 5.1: Traffic Management Details - Junction 15 Preferred Scheme

A55 Junction 16 Preferred Scheme – Traffic Management during Construction			
Traffic Movement	**TM Duration**	**TM Length**	**TM Speed Restriction**
A55 Eastbound	104 Weeks	4km	80kph
A55 Westbound	104 Weeks	4km	80kph

Table 5.2: Traffic Management Details - Junction 16 Preferred Scheme

5.3.2 Table 5.3 below shows the QUADRO economic appraisal summary (Core Scenario) for both preferred schemes at junctions 15 and 16, based on their differing Traffic Management configurations during the construction periods.

Construction Travel Delay Costs (£1,000)		
	J15 PREFERRED SCHEME	**J16 PREFERRED SCHEME**
Construction Travel Delay Costs	£503	£495

Table 5.3: Economic appraisal of construction delays for Preferred Schemes (Core Scenario) (Costs are expressed as 2010 prices discounted to 2010)

5.3.3 In summary, the major element of the delay cost calculations is directly related to the duration of the works, type of speed restriction and volume of traffic passing through the works site. The Traffic Management along the A55 is around 3km in length on each approach to the works, reflecting the high standard of safety measures required to carry out the works on a dual carriageway of the nature of A55.

5.4 Delays during Construction (Low Growth)

5.4.1 Table 5.4 below shows the QUADRO economic appraisal summary (Low Growth) for both preferred schemes at junctions 15 and 16, based on their differing Traffic Management configurations during the construction periods.

Construction Travel Delay Costs (£1,000)		
	J15 PREFERRED SCHEME	**J16 PREFERRED SCHEME**
Construction Travel Delay Costs	£466	£462

Table 5.4: Economic appraisal of construction delays for Preferred Schemes (Low Growth) (Costs are expressed as 2010 prices discounted to 2010)

5.4.2 In summary, the major element of the delay cost calculations is directly related to the duration of the works, type of speed restriction and volume of traffic passing through the works site. The Traffic Management along the A55 is around 3km in length on each approach to the works, reflecting the high standard of safety measures required to carry out the works on a dual carriageway of the nature of A55.

5.5 Delays during Construction (High Growth)

5.5.1 Table 5.5 below shows the QUADRO economic appraisal summary (High Growth) for both preferred schemes at junctions 15 and 16, based on their differing Traffic Management configurations during the construction periods.

Construction Travel Delay Costs (£1,000)		
	J15 PREFERRED SCHEME	**J16 PREFERRED SCHEME**
Construction Travel Delay Costs	£538	£533

Table 5.5: Economic appraisal of construction delays for Preferred Schemes (High Growth) (Costs are expressed as 2010 prices discounted to 2010)

5.5.2 In summary, the major element of the delay cost calculations is directly related to the duration of the works, type of speed restriction and volume of traffic passing through the works site. The Traffic Management along the A55 is around 3km in length on each approach to the works, reflecting the high standard of safety measures required to carry out the works on a dual carriageway of the nature of A55.

6. VALUE FOR MONEY SUMMARY

6.1.1 This chapter brings together all the different aspects of the economic appraisal for the improvement options and presents a final Value for Money Statement.

6.2 Value for Money Statement (Core Scenario)

6.2.1 The full economic assessments for the two preferred improvement schemes at Junction 15 and 16 are summarised in Table 6.1.

6.2.2 The tables summarise the outputs from TUBA, COABLT and QUADRO and form the basis for the VfM statement. The full VfM assessment includes:

- Wider economic benefits
- Construction delay costs
- Accident saving benefits
- Journey time benefits
- Indirect Tax benefits

6.2.3 The analysis provides an indication of likely economic benefits and BCRs for the package of scheme scenarios using TUBA and other DfT methodologies.

6.2.4 Table 6.1 presents the economic assessments for the two preferred improvement schemes at Junction 15 and 16 (Core Scenario). All costs are discounted to 2010 prices in multiples of a thousand pounds. Positive values in the tables indicate a benefit and negative values indicate a disbenefit.

	J15 Preferred Scheme	J16 Preferred Scheme
Benefits		
Wider Economic Benefits	£809	£823
Accident Benefits	£1,584	£1,348
Travel Time Benefits	£18,369	£18,062
Vehicle Operating Costs	£631	£776
Carbon Emissions Costs	-£219	-£199
Indirect Tax Benefits	£383	£336
Construction Delay	-£503	-£495
Present Value of Benefit (PVB)	**£21,054**	**£20,651**
Costs		
Scheme costs	£20,590	£15,314
Present Value of Costs (PVC)	**£20,590**	**£15,314**
Net Present Value (NPV)	£464	£5,337
Benefit to Cost Ratio (BCR)	**1.022**	**1.349**

Table 6.1: Value for Money Statement – Junction 15 & 16 Preferred Schemes (Core Scenario) (£1,000s, 2010 prices discounted to 2010)

6.2.5 The addition of Wider Economic Benefits, Accident Benefits and Construction Delay costs, give an additional £1.89m benefits to the junction 15 Preferred Scheme. The overall scheme benefits rise to £21.1m, compared to the scheme costs of £20.6m. This produces a Net Present Value

(NPV) of £0.464m and a BCR of 1.022. Under the DfT's Value for Money Categorisation, this represents Low Value for Money for the Core Scenario assumptions.

6.2.6 The addition of Wider Economic Benefits, Accident Benefits and Construction Delay costs, give an additional £1.68m benefits to the junction 16 Preferred Scheme. The overall scheme benefits rise to £20.7m, compared to the scheme costs of £15.3m. This produces a Net Present Value (NPV) of £5.337m and a BCR of 1.349. Under the DfT's Value for Money Categorisation, this represents Low Value for Money for the Core Scenario assumptions.

6.3 Value for Money Statement (Low Growth)

6.3.1 The full economic assessments for the two preferred improvement schemes at Junction 15 and 16 are summarised in Table 6.2.

6.3.2 The tables summarise the outputs from TUBA, COABLT and QUADRO and form the basis for the VfM statement. The full VfM assessment includes:

- Wider economic benefits
- Construction delay costs
- Accident saving benefits
- Journey time benefits
- Indirect Tax benefits

6.3.3 The analysis provides an indication of likely economic benefits and BCRs for the package of scheme options using TUBA and other DfT methodologies.

6.3.4 Table 6.2 presents the economic assessments for the two preferred improvement schemes at Junction 15 and 16 (Low Growth). All costs are discounted to 2010 prices in multiples of a thousand pounds. Positive values in the tables indicate a benefit and negative values indicate a disbenefit.

	J15 Preferred Scheme	**J16 Preferred Scheme**
Benefits		
Wider Economic Benefits	£514	£510
Accident Benefits	£1,369	£1,066
Travel Time Benefits	£10,962	£10,127
Vehicle Operating Costs	£814	£1,066
Carbon Emissions Costs	-£57	-£5
Indirect Tax Benefits	£114	£10
Construction Delay	-£466	-£462
Present Value of Benefit (PVB)	**£13,250**	**£12,312**
Costs		
Scheme costs	£20,590	£15,314
Present Value of Costs (PVC)	**£20,590**	**£15,314**
Net Present Value (NPV)	-£7,340	-£3,002
Benefit to Cost Ratio (BCR)	**0.643**	**0.804**

Table 6.2: Value for Money Statement – Junction 15 & 16 Preferred Schemes (Low Growth) (£1,000s, 2010 prices discounted to 2010)

6.3.5 The addition of Wider Economic Benefits, Accident Benefits and Construction Delay costs, give an additional £1.42m benefits to the junction 15 Preferred Scheme. The overall scheme benefits rise to £13.3m, compared to the scheme costs of £20.6m. This produces a Net Present Value (NPV) of -£7.34m and a BCR of 0.643. Under the DfT's Value for Money Categorisation, this represents Poor Value for Money for the Low Growth Scenario assumptions.

6.3.6 The addition of Wider Economic Benefits, Accident Benefits and Construction Delay costs, give an additional £1.11m benefits to the junction 16 Preferred Scheme. The overall scheme benefits rise to £12.3m, compared to the scheme costs of £15.3m. This produces a Net Present Value (NPV) of -£3.0m and a BCR of 0.804. Under the DfT's Value for Money Categorisation, this represents Poor Value for Money for the Low Growth Scenario assumptions.

6.4 Value for Money Statement (High Growth)

6.4.1 The full economic assessments for the two preferred improvement schemes at Junction 15 and 16 are summarised in Table 6.3.

6.4.2 The tables summarise the outputs from TUBA, COABLT and QUADRO and form the basis for the VfM statement. The full VfM assessment includes:

- Wider economic benefits
- Construction delay costs
- Accident saving benefits
- Journey time benefits
- Indirect Tax benefits

6.4.3 The analysis provides an indication of likely economic benefits and BCRs for the package of scheme options using TUBA and other DfT methodologies.

6.4.4 Table 6.3 presents the economic assessments for the two preferred improvement schemes at Junction 15 and 16 (High Growth). All costs are discounted to 2010 prices in multiples of a thousand pounds. Positive values in the tables indicate a benefit and negative values indicate a disbenefit.

	J15 Preferred Scheme	**J16 Preferred Scheme**
Benefits		
Wider Economic Benefits	£1,839	£1,920
Accident Benefits	£1,781	£1,921
Travel Time Benefits	£45,028	£46,681
Vehicle Operating Costs	-£38	£103
Carbon Emissions Costs	-£765	-£764
Indirect Tax Benefits	£1,238	£1,226
Construction Delay	-£538	-£533
Present Value of Benefit (PVB)	**£48,545**	**£50,554**
Costs		
Scheme costs	£20,590	£15,314
Present Value of Costs (PVC)	**£20,590**	**£15,314**
Net Present Value (NPV)	£27,955	£35,240
Benefit to Cost Ratio (BCR)	**2.358**	**3.301**

Table 6.3: Value for Money Statement – Junction 15 & 16 Preferred Schemes (High Growth) (£1,000s, 2010 prices discounted to 2010)

6.4.5 The addition of Wider Economic Benefits, Accident Benefits and Construction Delay costs, give an additional £3.08m benefits to the junction 15 Preferred Scheme. The overall scheme benefits rise to £48.5m, compared to the scheme costs of £20.6m. This produces a Net Present Value (NPV) of £27.955m and a BCR of 2.358. Under the DfT's Value for Money Categorisation, this represents High Value for Money for the High Growth Scenario assumptions.

6.4.6 The addition of Wider Economic Benefits, Accident Benefits and Construction Delay costs, give an additional £3.31m benefits to the junction 16 Preferred Scheme. The overall scheme benefits rise to £50.6m, compared to the scheme costs of £15.3m. This produces a Net Present Value (NPV) of £35.24m and a BCR of 3.301. Under the DfT's Value for Money Categorisation, this represents High Value for Money for the High Growth Scenario assumptions.

6.4.7 In the later assessment years (2037 and 2051) there is a slight difference in the local distribution of traffic around Dwygyfylchi compared to the Opening Year, 2022. Essentially, there is greater use of the Link Road between Junction 16 and Junction 16A and relatively less traffic travelling through the village. This reassignment is predominately for westbound traffic heading to the western part of Dwygyfylchi. The switch of traffic from a route with a higher Generalised Cost to one with a lower cost produces greater benefits in the economic assessment. Therefore, the High Growth scenario presents greater travel benefits at J16 in relative terms to the other scenarios and J15.

APPENDIX 1
JUNCTION 15 & 16 IMPROVEMENT SCHEMES

JUNCTION 15 PREFERRED OPTION MITIGATED

4-way movement with overbridge over A55

Map data © 2018 Google

JUNCTION 16 PREFERRED OPTION MITIGATED

4-way movement with bridge across A55. New Link road between Junction 16 and Junction 16A

Map data © 2018 Google

APPENDIX 2
TRANSPORT ECONOMIC EFFICIENCY TABLES

Ecnomic Efficiency of the Transport System (TEE)

Non-business: Commuting	**ALL MODES**	**ROAD**
User Benefits	**TOTAL**	**Private Cars & LGVs**
Travel Time	5,466	5,466
Vehicle Operating Costs	81	81
User Charges	0	0
During Construction / Maintenance	0	0
COMMUTING	**5,547**	**5,547**

Non-business: Other	**ALL MODES**	**ROAD**
User Benefits	**TOTAL**	**Private Cars & LGVs**
Travel Time	5,254	5,254
Vehicle Operating Costs	109	109
User Charges	0	0
During Construction / Maintenance	0	0
OTHER	**5,363**	**5,363**

Business	**ALL MODES**		
User Benefits	**TOTAL**	**HGVs**	**LGVs**
Travel Time	7,649	1,655	5,995
Vehicle Operating Costs	441	143	298
User Charges	0	0	0
During Construction / Maintenance	0	0	0
BUSINESS	**8,091**	**1,798**	**6,293**

Private Sector Provider Impacts	
Revenue	0
Operating Costs	0
Investment Costs	0
Grant / Subsidy	0
Sub-Total	**0**

Other Business Impacts	
Developer Contributions	0
NET BUSINESS IMPACT	**8,091**

TOTAL	
Present Value of Transport Economic Efficiency Benefit (TEE)	**19,001**

All entries are discounted present values in 2010 prices and value

Transport Economic Efficiency (TEE) – Junction 15 Preferred Option Core Scenario

A55
Junction 15 Preferred Scheme (Low Growth)

Ecnomic Efficiency of the Transport System (TEE)

Non-business: Commuting		**ALL MODES**	**ROAD**	
User Benefits		**TOTAL**	**Private Cars & LGVs**	
	Travel Time	3,060	3,060	
	Vehicle Operating Costs	116	116	
	User Charges	0	0	
	During Construction / Maintenance	0	0	
COMMUTING		**3,176**	**3,176**	
Non-business: Other		**ALL MODES**	**ROAD**	
User Benefits		**TOTAL**	**Private Cars & LGVs**	
	Travel Time	3,284	3,284	
	Vehicle Operating Costs	176	176	
	User Charges	0	0	
	During Construction / Maintenance	0	0	
OTHER		**3,460**	**3,460**	
Business		**ALL MODES**		
User Benefits		**TOTAL**	**HGVs**	**LGVs**
	Travel Time	4,618	957	3,661
	Vehicle Operating Costs	522	106	416
	User Charges	0	0	0
	During Construction / Maintenance	0	0	0
BUSINESS		**5,140**	**1,063**	**4,077**
Private Sector Provider Impacts				
	Revenue	0		
	Operating Costs	0		
	Investment Costs	0		
	Grant / Subsidy	0		
Sub-Total		**0**		
Other Business Impacts				
	Developer Contributions	0		
NET BUSINESS IMPACT		**5,140**		
TOTAL				
Present Value of Transport Economic Efficiency Benefit (TEE)		**11,776**		

All entries are discounted present values in 2010 prices and value

Transport Economic Efficiency (TEE) – Junction 15 Preferred Option Low Growth

A55
Junction 15 Preferred Scheme (High Growth)

Ecnomic Efficiency of the Transport System (TEE)

Non-business: Commuting		**ALL MODES**	**ROAD**
User Benefits		**TOTAL**	**Private Cars & LGVs**
	Travel Time	14,781	14,781
	Vehicle Operating Costs	-99	-99
	User Charges	0	0
	During Construction / Maintenance	0	0
COMMUTING		**14,682**	**14,682**

Non-business: Other		**ALL MODES**	**ROAD**
User Benefits		**TOTAL**	**Private Cars & LGVs**
	Travel Time	12,055	12,055
	Vehicle Operating Costs	-136	-136
	User Charges	0	0
	During Construction / Maintenance	0	0
OTHER		**11,919**	**11,919**

Business		**ALL MODES**		
User Benefits		**TOTAL**	**HGVs**	**LGVs**
	Travel Time	18,192	3,921	14,271
	Vehicle Operating Costs	197	250	-53
	User Charges	0	0	0
	During Construction / Maintenance	0	0	0
BUSINESS		**18,390**	**4,171**	**14,219**

Private Sector Provider Impacts		
	Revenue	0
	Operating Costs	0
	Investment Costs	0
	Grant / Subsidy	0
Sub-Total		**0**

Other Business Impacts		
	Developer Contributions	0
NET BUSINESS IMPACT		**18,390**

TOTAL	
Present Value of Transport Economic Efficiency Benefit (TEE)	**44,991**

All entries are discounted present values
in 2010 prices and value

Transport Economic Efficiency (TEE) – Junction 15 Preferred Option High Growth

A55
Junction 16 Preferred Scheme (Core Scenario)

Ecnomic Efficiency of the Transport System (TEE)

Non-business: Commuting	**ALL MODES**	**ROAD**
User Benefits	**TOTAL**	**Private Cars & LGVs**
Travel Time	5,395	5,395
Vehicle Operating Costs	89	89
User Charges	0	0
During Construction / Maintenance	0	0
COMMUTING	**5,484**	**5,484**

Non-business: Other	**ALL MODES**	**ROAD**
User Benefits	**TOTAL**	**Private Cars & LGVs**
Travel Time	4,941	4,941
Vehicle Operating Costs	187	187
User Charges	0	0
During Construction / Maintenance	0	0
OTHER	**5,128**	**5,128**

Business	**ALL MODES**		
User Benefits	**TOTAL**	**HGVs**	**LGVs**
Travel Time	7,726	1,697	6,029
Vehicle Operating Costs	500	142	357
User Charges	0	0	0
During Construction / Maintenance	0	0	0
BUSINESS	**8,226**	**1,839**	**6,386**

Private Sector Provider Impacts	
Revenue	0
Operating Costs	0
Investment Costs	0
Grant / Subsidy	0
Sub-Total	**0**

Other Business Impacts	
Developer Contributions	0
NET BUSINESS IMPACT	**8,226**

TOTAL	
Present Value of Transport Economic Efficiency Benefit (TEE)	**18,838**

All entries are discounted present values in 2010 prices and value

Transport Economic Efficiency (TEE) – Junction 16 Preferred Option Core Scenario

A55
Junction 16 Preferred Scheme (Low Growth)

Ecnomic Efficiency of the Transport System (TEE)

Non-business: Commuting		**ALL MODES**	**ROAD**	
User Benefits		**TOTAL**	**Private Cars & LGVs**	
	Travel Time	2,796	2,796	
	Vehicle Operating Costs	136	136	
	User Charges	0	0	
	During Construction / Maintenance	0	0	
COMMUTING		**2,933**	**2,933**	
Non-business: Other		**ALL MODES**	**ROAD**	
User Benefits		**TOTAL**	**Private Cars & LGVs**	
	Travel Time	2,907	2,907	
	Vehicle Operating Costs	251	251	
	User Charges	0	0	
	During Construction / Maintenance	0	0	
OTHER		**3,158**	**3,158**	
Business		**ALL MODES**		
User Benefits		**TOTAL**	**HGVs**	**LGVs**
	Travel Time	4,424	928	3,496
	Vehicle Operating Costs	679	105	574
	User Charges	0	0	0
	During Construction / Maintenance	0	0	0
BUSINESS		**5,103**	**1,033**	**4,070**
Private Sector Provider Impacts				
	Revenue	0		
	Operating Costs	0		
	Investment Costs	0		
	Grant / Subsidy	0		
Sub-Total		**0**		
Other Business Impacts				
	Developer Contributions	0		
NET BUSINESS IMPACT		**5,103**		
TOTAL				
Present Value of Transport Economic Efficiency Benefit (TEE)		**11,194**		

All entries are discounted present values in 2010 prices and value

Transport Economic Efficiency (TEE) – Junction 16 Preferred Option Low Growth

A55
Junction 16 Preferred Scheme (High Growth)

Ecnomic Efficiency of the Transport System (TEE)

Non-business: Commuting		**ALL MODES**	**ROAD**
User Benefits		**TOTAL**	**Private Cars & LGVs**
	Travel Time	15,593	15,593
	Vehicle Operating Costs	-44	-44
	User Charges	0	0
	During Construction / Maintenance	0	0
COMMUTING		**15,549**	**15,549**

Non-business: Other		**ALL MODES**	**ROAD**
User Benefits		**TOTAL**	**Private Cars & LGVs**
	Travel Time	12,041	12,041
	Vehicle Operating Costs	-8	-8
	User Charges	0	0
	During Construction / Maintenance	0	0
OTHER		**12,033**	**12,033**

Business		**ALL MODES**		
User Benefits		**TOTAL**	**HGVs**	**LGVs**
	Travel Time	19,047	4,250	14,796
	Vehicle Operating Costs	155	280	-125
	User Charges	0	0	0
	During Construction / Maintenance	0	0	0
BUSINESS		**19,202**	**4,531**	**14,671**

Private Sector Provider Impacts		
	Revenue	0
	Operating Costs	0
	Investment Costs	0
	Grant / Subsidy	0
Sub-Total		**0**

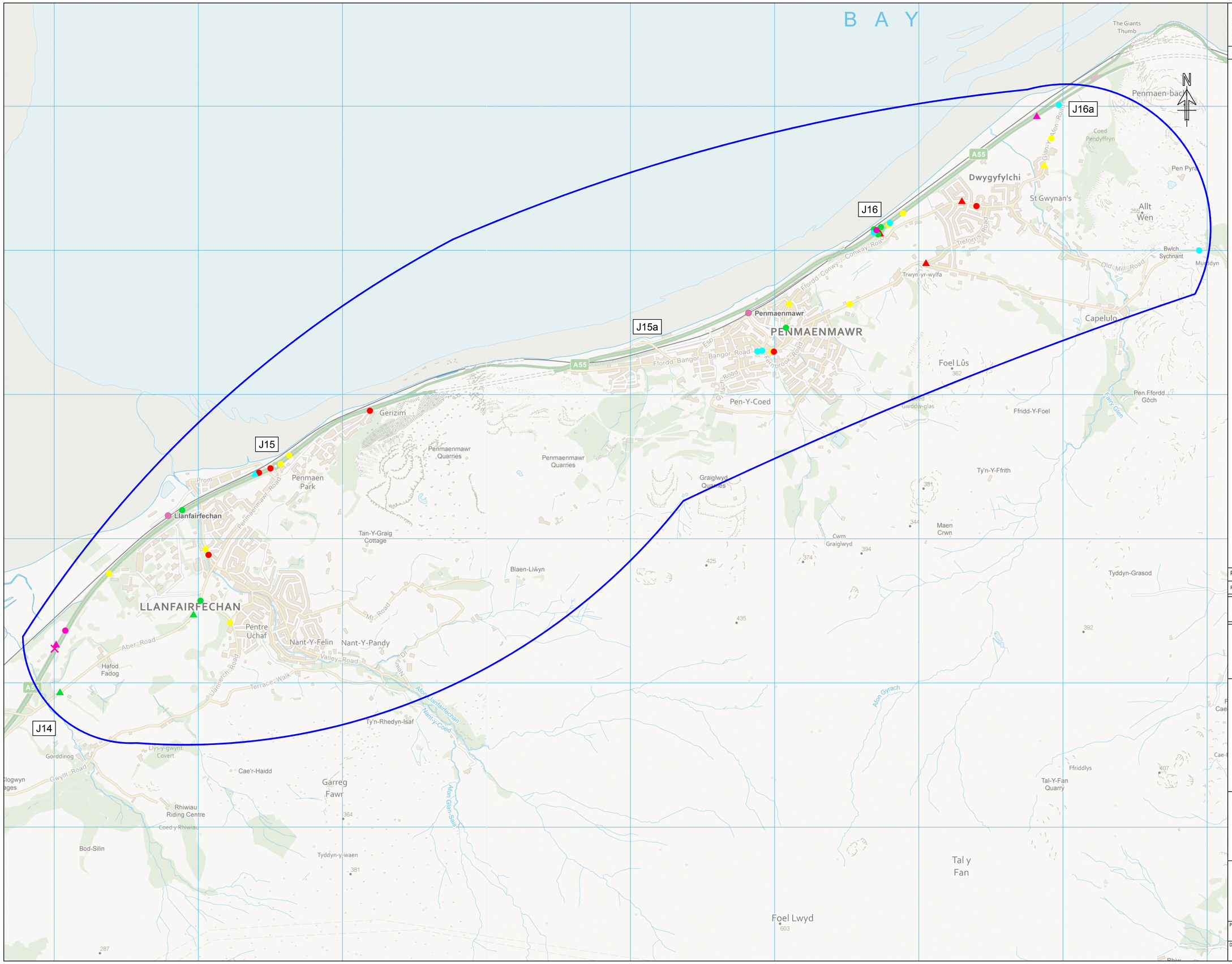
Other Business Impacts		
	Developer Contributions	0
NET BUSINESS IMPACT		**19,202**

TOTAL	
Present Value of Transport Economic Efficiency Benefit (TEE)	**46,784**

All entries are discounted present values
in 2010 prices and value

Transport Economic Efficiency (TEE) – Junction 16 Preferred Option High Growth

APPENDIX 3
FIVE YEAR ACCIDENT DATA PLOT (BY SEVERITY)



Notes

1. DO NOT SCALE FROM THIS DRAWING.
2. ALL DIMENSIONS ARE MILLIMETRES U.N.O.
3. ALL LEVELS ARE IN METRES ABOVE ORDNANCE DATUM U.N.O.
4. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS AND ENGINEERS DRAWINGS AND SPECIFICATIONS.

KEY

- STUDY AREA
- 'SLIGHT' ACCIDENT
- 'SERIOUS' ACCIDENT
- 'FATAL' ACCIDENT
- ACCIDENT DATA 2012
- ACCIDENT DATA 2013
- ACCIDENT DATA 2014
- ACCIDENT DATA 2015
- ACCIDENT DATA 2016

Rev	Description	Date	By	Chk	App
P01	DESCRIPTION	DD/MM YYYY	DRN	CHK	APP

FOR INFORMATION

A55 JUNCTION 15 & 16 IMPROVEMENTS

Llywodraeth Cymru
Welsh Government

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ENGINEERING, ENVIRONMENTAL and LANDSCAPE CONSULTANTS

YGC

RAMBOLL

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TRAFFIC ACCIDENT LOCATIONS (2012-2016)

Project No:	Scale (@A1):	Drawn:	Date:
1620000620	1:12000	JW	DEC 18

Drawing No: RAM-ZZ-ZZ-SK-J-3005

Rev: P01

13/12/2018 14:24:54

APPENDIX 4
PUBLIC ACCOUNTS

Public Accounts (PA) Table

	ALL MODES TOTAL	ROAD
Local Government Funding		
Revenue		
Operating Costs		
Investment Costs		
Developer and Other Contributions		
Grant / Subsidy Payments		
NET IMPACT		
Central Government Funding		
Revenue		
Operating Costs	-471	-471
Investment Costs	21,062	21,062
Developer and Other Contributions		
Grant / Subsidy Payments		
NET IMPACT	**20,590**	**20,590**
Indirect Tax Revenues	-383	-383
Total Present Value of Costs (PVC)	**20,590**	

Public Accounts – Junction 15 Preferred Option All Scenarios

Public Accounts (PA) Table

	ALL MODES TOTAL	ROAD
Local Government Funding		
Revenue		
Operating Costs		
Investment Costs		
Developer and Other Contributions		
Grant / Subsidy Payments		
NET IMPACT		
Central Government Funding		
Revenue		
Operating Costs	-471	-471
Investment Costs	15,786	15,786
Developer and Other Contributions		
Grant / Subsidy Payments		
NET IMPACT	**15,314**	**15,314**
Indirect Tax Revenues	-336	-336
Total Present Value of Costs (PVC)	**15,314**	

Public Accounts – Junction 16 Preferred Option All Scenarios

APPENDIX 5
ANALYSIS OF MONETISED COSTS AND BENEFITS

TUBA Appraisal Summary Table (£1,000 2010 prices discounted to 2010)	**Junction 15 Preferred Scheme**	**Junction 16 Preferred Scheme**
Land Costs in 2019 prices	£1,500	£500
Scheme Costs in 2019 prices	£30,788	£23,108
Analysis of Monetised Costs and Benefits (AMCB)		
Greenhouse Gases	-£219	-£199
Economic Efficiency: Consumer Users, Commuting	£5,547	£5,484
Economic Efficiency: Consumer Users, Other	£5,363	£5,128
Economic Efficiency: Business Users and Providers	£8,091	£8,226
Wider Public Finances (Indirect Taxation Revenues)	£383	£336
Value for Money Summary		
Present Value of Costs (PVC)	£20,590	£15,314
Present Value of Benefits (PVB)	£19,165	£18,975
Net Present Value (NPV)	-£1,425	£3,661
Benefit to Cost Ratio (BCR)	**0.931**	**1.239**

TUBA Appraisal Summary Table – Junction 15 & 16 Preferred Schemes (Core Scenario)

TUBA Appraisal Summary Table (£1,000 2010 prices discounted to 2010)	**Junction 15 Preferred Scheme**	**Junction 16 Preferred Scheme**
Land Costs in 2019 prices	£1,500	£500
Scheme Costs in 2019 prices	£30,788	£23,108
Analysis of Monetised Costs and Benefits (AMCB)		
Greenhouse Gases	-£57	-£5
Economic Efficiency: Consumer Users, Commuting	£3,176	£2,933
Economic Efficiency: Consumer Users, Other	£3,460	£3,158
Economic Efficiency: Business Users and Providers	£5,140	£5,103
Wider Public Finances (Indirect Taxation Revenues)	£114	£10
Value for Money Summary		
Present Value of Costs (PVC)	£20,590	£15,314
Present Value of Benefits (PVB)	£11,833	£11,199
Net Present Value (NPV)	-£8,757	-£4,115
Benefit to Cost Ratio (BCR)	**0.575**	**0.731**

TUBA Appraisal Summary Table – Junction 15 & 16 Preferred Schemes (Low Growth)

TUBA Appraisal Summary Table (£1,000 2010 prices discounted to 2010)	**Junction 15 Preferred Scheme**	**Junction 16 Preferred Scheme**
Land Costs in 2019 prices	£1,500	£500
Scheme Costs in 2019 prices	£30,788	£23,108
Analysis of Monetised Costs and Benefits (AMCB)		
Greenhouse Gases	-£765	-£764
Economic Efficiency: Consumer Users, Commuting	£14,682	£15,549
Economic Efficiency: Consumer Users, Other	£11,919	£12,033
Economic Efficiency: Business Users and Providers	£18,390	£19,202
Wider Public Finances (Indirect Taxation Revenues)	£1,238	£1,226
Value for Money Summary		
Present Value of Costs (PVC)	£20,590	£15,314
Present Value of Benefits (PVB)	£45,464	£47,246
Net Present Value (NPV)	£24,874	£31,932
Benefit to Cost Ratio (BCR)	**2.208**	**3.085**

TUBA Appraisal Summary Table – Junction 15 & 16 Preferred Schemes (High Growth)

APPENDIX 6
SCHEME COSTS

A55 Junctions 15 and 16 - Draft Cost Estimate Summary Oct 2019

Breakdown of Cost Estimate base dated to Q4 2019

COST HEADING	PREFERRED OPTIONS		COMMENTS
	Junction 15	Junction 16	
Ramboll Key Stage 3 and 4 Design and Preparation Base Cost			
Key Stage 3 Base Cost	1,817,660	1,817,660	Split in 2 for the benefit of this exercise
Key Stage 4 Base Cost	625,000	625,000	Split in 2 for the benefit of this exercise
Sub-Total	**2,442,660**	**2,442,660**	**(A)**
D and B Contractor's Key Stage 6 Base Cost			
Site Clearance	148,175	112,588	
Fencing	205,777	141,262	
Road Restraints	873,411	814,086	
Drainage	922,121	1,340,820	
Earthworks	1,333,839	2,685,581	
Pavements	1,434,990	2,808,578	
Kerbs, Footways and Paved Areas	162,640	460,240	
Traffic Signs and Road Markings	167,032	101,127	
Road Lighting	128,850	234,000	
Electrical Works for Road Lighting	119,860	221,913	
Motorway Communications	263,300	200,000	
Structures	10,744,142	2,447,982	
Accommodation Works	50,000	100,000	
Landscaping	58,000	125,000	
Junction Sub-Total	**16,612,137**	**11,793,175**	
Junction 14		-	
Active Travel Measures			
Works Sub-Total	**16,612,137**	**11,793,175**	
Preliminaries	3,815,119	2,918,914	
Detailed Design	1,276,728	987,591	
Traffic Management	1,375,000	1,375,000	Split in 2 for the benefit of this exercise
Sub-Total Net of Fee	**23,078,984**	**17,074,680**	
Contractor's Risk Allowance	404,423	404,423	Split in 2 for the benefit of this exercise
Fee	1,643,838	1,223,537	Allowed at 7%
D & B Contractor's Base Cost Total	**25,127,246**	**18,702,640**	**(B)**
Other Works Costs			
Payments to SU's	945,894	590,412	Lump Sum Allowances for Several
Land and Compensation	1,500,000	500,000	Provisional at this Stage and DV to provide
Detrunking-costs	50,000	150,000	Provisional at this Stage and to be confirmed
Sub-Total	**2,495,894**	**1,240,412**	**(C)**
Employer's Agent Costs	868,874	868,874	Split in 2 for the benefit of this exercise
Employer's Risks	2,295,840	2,295,840	Split in 2 for the benefit of this exercise
Sub-Total	**3,164,713**	**3,164,713**	**(D)**
VAT			Nil rated for BCR calculation
SCHEME FORECAST COST	**30,787,853**	**23,107,766**	**A, B, C, D & VAT**