



**GREATER
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**Cambridgeshire
County Council**

The Cambridge South East Transport Order

Transport And Works Act 1992

Transport And Works (Applications And Objections Procedure) (England And Wales) Rules 2006

Appendix 2.0 Economic Appraisal Technical Note

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1. Introduction and Background

The Cambridge South East Transport was identified by GCP to improve journey times, reliability and link communities and employment sites in the area south east of Cambridge. The CSET project is made up of two phases detailed below, and aims to offer better public transport and active travel options for the A1307 and A1301 area:

- Phase 2 of CSET (CSET2) involves a new public transport route from the A11 via Sawston and Shelford to the Cambridge Biomedical Campus and a new Travel Hub near the A11/A1307 junction.

The CSET2 extends from Cambridge Biomedical Campus (CBC) at its north -western edge to the junctions of the A11 with the A1307 and A505, providing improved connectivity for peripheral communities such as: Linton, the Abingtons, Babraham, Pampisford, Sawston, Stapleford and Great and Little Shelford.

It is proposed that CSET2 will deliver a new dedicated public transport route between a new Travel Hub near the A11/A1307/A505 junction and the CBC via Sawston, Stapleford and Great Shelford. The new Travel Hub will supplement capacity and facilities at the Babraham Road Park & Ride site.

At the Biomedical Campus, the new route is proposed to run on dedicated public transport lanes on Francis Crick Avenue, connecting to the existing Guided Busway, enabling services to continue to the station and Cambridge city centre via the Busway.

Stops on the new route are proposed for the Biomedical Campus, Great Shelford, Stapleford, Sawston and the new Travel Hub site. The Biomedical Campus stop would be located near to the proposed Cambridge South Station to enable easy interchange with rail services in the future.

All stops would have the following facilities:

- Platforms with shelter and real-time passenger information
- Drop off facilities
- Disabled parking and
- Cycle parking and cycle lockers.

The proposed Travel Hub will provide an interchange between different modes of transport such as walking, cycling, existing bus services, and access to the new public transport route by car. The Travel Hub will be similar to a Park & Ride and offer similar facilities such as indoor waiting areas, however, it is intended to be more sustainable than a typical Park & Ride to allow it to be expanded or increased in size in future.

2. Approach to Economic Appraisal

2.1. Transport Economic Efficiency

The aim of economic assessment is to assess the performance of the scheme, in terms of the total benefits generated by the scheme against the total associated scheme investment costs and costs associated with operations and maintenance of the scheme. The economic impact of the scheme was determined by comparing the Do Something scenario with the Do Minimum scenario. The scheme files consist of information on demand, journey distance and travel time matrices for each user class, time period and forecast year for the DM and DS scenarios.

The appraisal of the economic elements associated with the scheme has been undertaken in accordance with TAG unit A1-1 Cost-Benefit Analysis. The scope of this economic appraisal comprises of the assessment of:

Transport user Benefits

- Transport Economic Efficiency – evaluated using TUBA version 1.9.17.2, Economic parameter file 1.9.18). The standard economic parameter file was updated in line with the CSETs model parameters which is detailed out in Section 2.3.

Marginal External Costs (MECs) which includes:

- a. Congestion
- b. Infrastructure

- c. Accident
- d. Local Air Quality
- e. Noise
- f. Greenhouse Gases and
- g. Indirect Tax (cost)

User benefits of the scheme relating to highway improvements is derived using TUBA and MECs for a 60-year appraisal period in line with the design life of these investments.

Transport Economic Efficiency (TEE) benefits have been captured in accordance with TAG Unit A1.3 (May 2022). Impacts on transport users and providers typically make up the majority of benefits for transport business cases. This TAG unit provides specific guidance on how impacts on transport users and providers (including travel time and vehicle operating cost savings) should be estimated, valued and reported in a transport appraisal.

The use of road vehicles incurs both private costs borne by the individual traveller (such as fuel costs and personal travel time) and external costs borne by others. These external costs include congestion, local & global air pollution, noise, infrastructure and accident costs. The MEC method is based on the change in these external costs arising from an additional (or removed) vehicle (or vehicle km) on the network. These costs have been estimated from the Department's National Transport Model and Surface Transport Costs and Charges: Great Britain 1998¹. For this appraisal, the benefits from accidents, local air quality, noise and greenhouse gases were assessed using Marginal External Costs (MEC), on distance saved by road users.

Unless otherwise specified, monetised values throughout this report are presented in units of 2010 market prices, discounted to 2010. These units are used consistently for scheme benefits and costs.

2.2. TUBA Assessment

Outputs from the core models for forecast years 2026 and 2041 for the DM and DS scenarios formed the basis of the TUBA inputs.

TUBA software is based on the 'rule of half', which allows for calculation of Transport Economic Efficiency (TEE) costs and benefits between the 'Do Minimum' and 'Do Something' scenarios, in a context where the trip numbers differ between the two cases¹. This includes deriving the journey time and costs savings to consumer and business users, vehicle operating cost impacts and any scheme impacts on indirect taxation. This is converted into a Present Value of Benefits (PVB) associated with users and providers.

Travel time savings are calculated using the 'rule of a half' applied to generalised time skims from the Traffic Model. The 'rule of a half' relates to the change in the consumer surplus resulting from a reduction in travel costs such that existing users receive the full benefit while new users receive half of the benefit.

Vehicle operating costs (VOCs) are calculated for both fuel and non-fuel elements of the journey, based on formulae set out in the DfT's TAG guidance. The 'rule of a half' formula is broadly applied as for travel times, but with vehicle operating costs being based on distance travelled (vehicle-kilometres) and a function of average vehicle speeds.

All assumptions relating to fuel costs, duty and vehicle efficiency are those contained in the default TUBA economics file.

2.3. TUBA Input Parameters

TUBA Modelling Assumptions

An economic assessment to facilitate the quantification and monetisation of scheme costs and benefits is undertaken over a 60-year economic appraisal period in accordance with the requirement of TAG Unit A1.1. Economic assessment results are presented in the form of Transport Economic Efficiency (TEE), Public Accounts (PA), and Analysis of Monetised Costs and Benefits (AMCB) tables.

The following sections provide details of the various elements of the transport model inputs that have been used within the TUBA economic assessment to carry out the economic appraisal.

¹ These calculations depend on the underlying demand in the DM and DS scenarios remaining unchanged, while trip numbers may vary as a result of changes to transport provision, as is captured through the demand modelling process.

Time Periods

The transport model was developed for a base year of 2015. This model has been used to develop forecast models for 2026, which corresponds to the scheme opening year, and 2041 forecast years for a Do Minimum scenario and a Do Something scenario.

Three time periods are modelled in each year:

- i. AM peak hour – (0800 to 0900)
- ii. Inter peak average hour – (1000 - 1600)
- iii. PM peak hour – (1700 - 1800)

User Classes

The modelled user classes were split into 21 user classes as required for the TUBA economic appraisal is described below:

Table 2-1 TUBA User Classes

TUBA User Class	Main Mode	Sub Mode/Purpose
1	Car	Commuting
2	Car	Education
3	Car	Business
4	Car	Other
5	HGV	HGV
6	LGV	LGV
7	Park and Ride	Commuting
8	Park and Ride	Business
9	Park and Ride	Other
10	Park and Active	Commuting
11	Park and Active	Business
12	Park and Active	Other
13	Guided Bus	Commuting
14	Guided Bus	Business
15	Guided Bus	Other
16	Walk	Commuting
17	Walk	Business
18	Walk	Other
19	Cycle	Commuting
20	Cycle	Business
21	Cycle	Other

TUBA employs more user classes as different types of vehicles and their trip purpose have varying values of time and vehicle operating costs. The allocation of these classes to TUBA classes is presented in Table 2-2.

Table 2-2 Model User Classes to TUBA Classes

TUBA User Class	Model User Class
1: Car Commuting	UC1: Car Business

2: Car Education	UC2: Car Commuting
3: Car Business	UC3: Car Other
4: Car Other	UC4: Car Education
5: HGV	UC5: HGV
6: LGV	UC6: LGV

Accordingly, the transport model has produced demand, time and distance skims/matrices required for TUBA assessments for 21 user classes. The skim matrices for the Public transport, Park and Ride, Park and Active and Walk & Cycle are produced from the ME Plan. Thus, the skim matrices for user classes 1-6 were obtained from SATURN models and for user classes 7-21 were obtained from ME plan.

Setting Up TUBA

Appropriate conversion factors for the units for each file shown in Table 2-3 to Table 2-6 was taken from the document 'CSRM2 Technical Assurance (2021-22)'.¹ that sets out which data from CSRM2 could be used to run TUBA as part of scheme appraisal.

Table 2-3 compares the units from the SATURN and MEPLAN input files to enable appropriate conversion to take place.

Table 2-3 TUBA Input File Unit Comparison

Attribute	SATURN Units	MEPLAN Units
Flow	PCU Trips	Person Trips
Distance	Kilometres	Kilometres
Time	Hours	Minutes
Parking Charge / Fare	N/A	Pence (2015 price base)
Toll / Penalty	Pence (2015 price base)	Pence (2015 price base)
Time Period Length	Single hours: AM – 08:00-09:00 Inter Peak – average hour of 10:00-16:00	Modelled periods: AM – 3 hours (07:00-10:00) Inter Peak – 6 hours (10:00-16:00)
	PM – 17:00-18:00 PM – 3 hours (16:00-19:00)	PM – 17:00-18:00 PM – 3 hours (16:00-19:00)

Table 2-4 shows the vehicle occupancies that are embedded within CSRM2, and should be used for converting MEPLAN car demand from person trips to vehicles. They do not vary through time.

Table 2-4 CSRM2 Vehicle Occupancies

Purpose	AM Occupancy	IP Occupancy	PM Occupancy
Commuting	1.171	1.154	1.164
Education	1.675	1.649	1.708
Business	1.195	1.194	1.167

¹ Reference: CSRM2 Data for TUBA v1.4.docx

Table 2-5 shows the PCU factors that are used in CSRM2's SATURN highway component, which should be used for converting SATURN demand from PCU trips to vehicles.

Table 2-5 CSRM2 PCU Factors

Vehicle Type	TUBA User Class	PCU Factor
Motorcycle, Car, Light Goods Vehicle	UC1-4, 6	1.0
Heavy Goods Vehicle	UC5	2.3

Table 2-6 shows the hour-to-period conversion factors that are embedded within CSRM2 and should be used to convert the SATURN car demand from single hours to time periods for an average weekday. Separate factors would need to be derived for goods vehicles.

Table 2-6 CSRM2 Hour to Time Period Conversion Factors for Car Trips

Purpose	AM Factor	IP Factor	PM Factor
Commuting	2.506	6.000	2.348
Education	1.691	6.000	2.721
Business	2.964	6.000	2.883
Other	3.695	6.000	2.946

The TUBA input files are set up in accordance with the CSRM model and TUBA produces output files (.out) which contain a list of errors and warnings during the program execution. Any errors encountered that caused the program to stop were rectified. Other warnings were reviewed and is listed in Appendix A.

3. Transport Economic Appraisal

3.1. Transport Benefits

The Transport user benefits for the economic appraisal of the Core scenario were assessed using:

- TUBA which includes:
 - Travel time benefits
 - Vehicle operating cost benefits
 - Indirect taxation revenues
- Marginal External Cost (MEC) benefits which includes:
 - Accident
 - Local Air Quality
 - Noise
 - Greenhouse Gases

This section discusses the results of the economics assessment of preferred scheme option. Results are presented from TUBA and MEC.

3.2. Monetised Transport Benefits

All benefits and costs were calculated in monetary terms and expressed as present values (PV) in 2010 market prices, discounted to 2010. This enables direct economic comparison with other schemes which may have very different timescales.

The scheme is forecast to produce benefits calculated through TUBA of £95.63m (PV) over the 60-year appraisal period. These benefits are generated by:

- I. travel time savings of £98.83m,
- II. vehicle operating cost benefits of £5.94m due to the proposed scheme generating reductions in congestion which requires less fuel to be consumed per trip and
- III. an indirect tax revenue of -£9.13m.

Table 3-1 represents the outputs described above

Table 3-1 TUBA Benefits

Impact	Benefits (£m)
Travel Time savings	£98.83
VOC benefits	£5.94
Indirect Taxation Revenues	-£9.13
Total	£95.63

All entries are £m in 2010 prices and values. Positive values indicate additional revenue.

Distribution of benefits sector wise and geographically

The benefits by geographical sector over the two forecast year appraisal period are shown in

Table 3-2 and Table 3-3 shows the proportion of benefits by sector. Figure 3-1 shows the location of the sectors which were defined as part of the model development process.

Figure 3-1 Sector Map

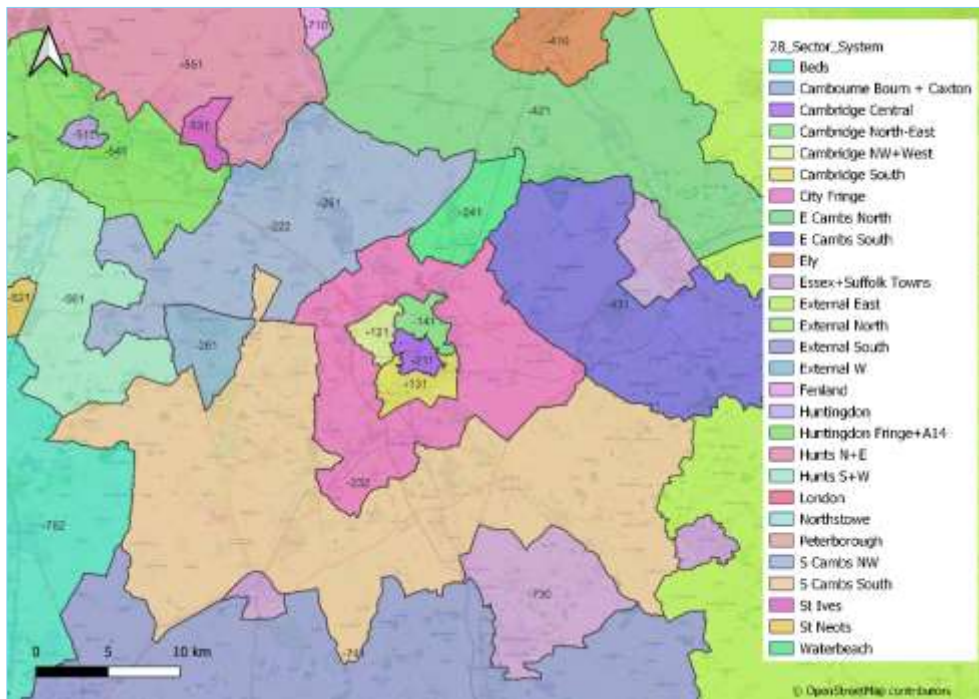


Table 3-2 Benefits by Sector over 2 years (2026 & 2041 in 2010 Prices)

SI#	Sector #	Location	Benefits (Sector Origin)				
			Time	Fuel VOC	Non-Fuel VOC	Indirect Tax	Total
1	-110	Cambridge Central	£772,943	£673,348	£20,431	-£46,556	£1,420,166
2	-121	Cambridge NW+West	£171,061	£154,963	£4,017	-£8,984	£321,057
3	-131	Cambridge South	£265,330	£252,823	£14,336	-£22,385	£510,104
4	-141	Cambridge North-East	£147,182	£143,491	£3,189	-£8,380	£285,482
5	-211	City Fringe	£454,831	£369,699	£34,749	-£51,169	£808,110
6	-222	S Cambs NW	£83,032	£69,450	£10,153	-£10,692	£151,943
7	-232	S Cambs South	£2,245,538	£1,482,436	£139,816	-£248,775	£3,619,016
8	-241	Waterbeach	£43,632	£35,819	£2,155	-£3,313	£78,293
9	-251	Northstowe	£24,101	£19,929	£700	-£1,349	£43,380
10	-261	Cambourne Bourn + Caxton	£65,171	£52,058	£2,385	-£4,314	£115,300
11	-410	Ely	£18,017	£31,148	£4,572	-£3,818	£49,919
12	-421	E Cambs North	£102,758	£87,284	£9,641	-£12,122	£187,562
13	-431	E Cambs South	£95,177	£74,413	£7,947	-£10,255	£167,282
14	-511	Huntingdon	-£39,924	-£35,157	£384	£650	-£74,046
15	-521	St Neots	£16,131	£18,975	£140	-£142	£35,103
16	-531	St Ives	£44,426	£36,708	£1,413	-£2,287	£80,260
17	-541	Huntingdon Fringe+A14	£5,583	£4,375	£2,908	-£2,634	£10,232

18	-551	Hunts N+E	£46,659	£41,689	£3,968	-£4,292	£88,023
19	-561	Hunts S+W	£6,721	£7,651	£909	-£667	£14,614
20	-710	Fenland	£17,672	£14,772	£1,251	-£1,474	£32,221
21	-720	Peterborough	£8,232	£3,566	£1,440	-£1,487	£11,750
22	-730	Essex+Suffolk Towns	£904,386	£700,649	£47,057	-£78,668	£1,573,424
23	-741	External South	£85,644	£76,053	£11,642	-£16,084	£157,255
24	-751	External East	£138,226	£103,383	£28,862	-£28,025	£242,446
25	-761	External North	£15,350	£10,659	£2,984	-£1,558	£27,435
26	-772	External W	£18,512	£14,875	£2,821	-£2,344	£33,864
27	-782	Beds	£16,722	£14,102	£2,112	-£2,063	£30,874
28	-790	London	£146,602	£129,591	£5,519	-£14,531	£267,181

Table 3-3 Proportion of Benefits by Sector

SI#	Sector #	Location	Benefits (Sector Origin)				
			Time	Fuel VOC	Non-Fuel VOC	Indirect Tax	Total
1	-110	Cambridge Central	13%	15%	6%	8%	14%
2	-121	Cambridge NW+West	3%	3%	1%	2%	3%
3	-131	Cambridge South	4%	6%	4%	4%	5%
4	-141	Cambridge North-East	2%	3%	1%	1%	3%
5	-211	City Fringe	8%	8%	9%	9%	8%
6	-222	S Cambs NW	1%	2%	3%	2%	1%
7	-232	S Cambs South	38%	32%	38%	42%	35%
8	-241	Waterbeach	1%	1%	1%	1%	1%
9	-251	Northstowe	0%	0%	0%	0%	0%
10	-261	Cambourne Bourn + Caxton	1%	1%	1%	1%	1%
11	-410	Ely	0%	1%	1%	1%	0%
12	-421	E Cambs North	2%	2%	3%	2%	2%
13	-431	E Cambs South	2%	2%	2%	2%	2%
14	-511	Huntingdon	-1%	-1%	0%	0%	-1%
15	-521	St Neots	0%	0%	0%	0%	0%
16	-531	St Ives	1%	1%	0%	0%	1%
17	-541	Huntingdon Fringe+A14	0%	0%	1%	0%	0%
18	-551	Hunts N+E	1%	1%	1%	1%	1%
19	-561	Hunts S+W	0%	0%	0%	0%	0%
20	-710	Fenland	0%	0%	0%	0%	0%
21	-720	Peterborough	0%	0%	0%	0%	0%

22	-730	Essex+Suffolk Towns	15%	15%	13%	13%	15%
23	-741	External South	1%	2%	3%	3%	2%
24	-751	External East	2%	2%	8%	5%	2%
25	-761	External North	0%	0%	1%	0%	0%
26	-772	External W	0%	0%	1%	0%	0%
27	-782	Beds	0%	0%	1%	0%	0%
28	-790	London	2%	3%	2%	2%	3%

The highest contribution of benefits is obtained from sector S Cambs South (35%) followed by Essex+Suffolk Towns (15%). The new public transport route from the A11 via Sawston and Shelford to the Cambridge Biomedical Campus and a new Travel Hub near the A11/A1307 junction falls within the sectors which has high benefits which is envisioned to have road user benefits to the users.

3.3. Marginal External Cost (MEC) Benefits

The Marginal External Cost (MEC) approach is designed to capture the secondary benefits of the proposed monetised benefit for the change in distance travelled by car (pcu-km).

Certain benefits that are not captured under TUBA assessments which includes accident savings, local air quality, noise and greenhouse gases were calculated using the DfT's Tag Unit A5.4 Marginal External Costs (MECs). A bespoke spreadsheet model which is in line with the TAG guidance is used to capture these benefits.

The method is based on the application of DfT defined costs (pence per kilometre) for a range of predefined factors, as presented in Table 3-4 below. DfT has defined assumptions regarding the increase in these costs over time as indicated by the noticeable increase in congestion. For the assessment of the change on travel along the corridor the values are calculated for the 60-year appraisal period by interpolation of the provided DfT costs up to 2035, after which they are held constant for the remainder of the appraisal period.

Table 3-4 Monetised MEC Benefits

Analysis of Monetised Costs and Benefits (in £000)	
Congestion	£6,306.56
Infrastructure	£52.57
Accident	£952.74
Local Air Quality	£118.36
Noise	£62.98
Greenhouse Gases	£919.08
Indirect Taxation	-£732.42
Total Marginal External costs	£7,679.86
Total Marginal External costs (excluding infrastructure congestion and indirect taxation)	£2,053.15

The total marginal costs benefits are £2.05m which excludes the congestion, infrastructure benefits and Indirect taxation to avoid double counting. The excluded benefits are assessed from TUBA.

3.4. Options Assessment Benefits Summary

The quantitative assessments of impacts made have been summarised in the following appraisal tables.

3.5. Transport Economic Efficiency (TEE) Table

The TEE table brings together the benefits to transport users and providers derived from the TUBA runs, and the cost to business of any developer contributions. The TEE table is a key component in the reporting of the economic assessment. The TEE is presented in Table 3-5 below:

Table 3-5 Transport Economic Efficiency (TEE) table for core scenario (in £000s)

Attribute	Present Value of Benefits, 2010 prices and values
Non-Business: Commuting	
Travel Time	£ 54,675
Vehicle Operating Costs	£ 3,794
User Charges	-£2,612
During Construction & Maintenance	-
Net Non-Business Benefits: Commuting	£55,856
Non-Business: Other	
Travel Time	£31,139
Vehicle Operating Costs	£1,789
User Charges	-£1823
During Construction & Maintenance	-
Net Non-Business Benefits: Other	£31,106
Business User Benefits	
Travel Time	£13,011
Vehicle Operating Costs	£356
User Charges	-£773
During Construction & Maintenance	-
Subtotal	£12,594
Private Sector Provider Impacts	£35,099
Subtotal	
Other Business Impacts	
Developer Contributions	-
Net Business Impact	£47,693
Total	
Present Value of Transport Economic Efficiency	£134,655

Notes: Benefits appear as positive numbers, while costs appear as negative numbers.

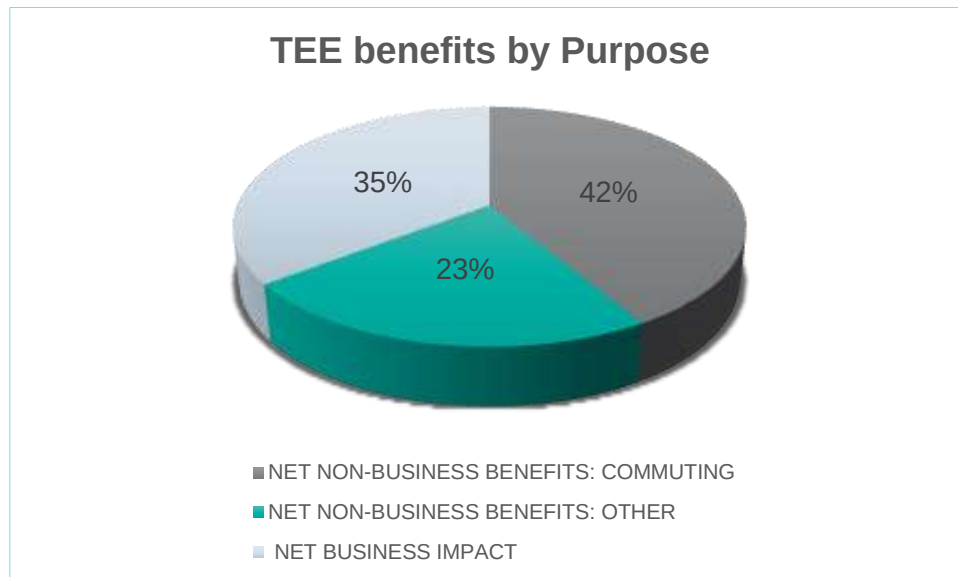
All monetised values are expressed as 2010 present values

The economic appraisal is carried out in compliance with TAG which evaluates the travel time savings and the vehicle operating costs (VOC) that the scheme is forecast to produce.

The scheme is forecast to produce net benefits for all users of £98.83m from the travel time and £5.94m from vehicle operating costs.

Figure 3-2 presents the transport economic benefits accrued from non-business commuting contributing to 42% followed by net non-business other benefits accounting for 23%, and net business users accounting for 35% of the total value of transport economic benefits.

Figure 3-2 Core Scenario Transport economic efficiency structure by travel purpose



3.6. Public Accounts (PA) Table

The PA table brings together the costs of the scheme and the revenue and tax changes which would result in the revenue and tax changes which follow from changes in traffic routes and speeds are derived from the TUBA output, while the capital and operating costs, with no developer contributions, are as described.

Table 3-6 Public Accounts (in £000s)

Attribute	Present Value of Costs, 2010 prices and values
Local Government Funding	
Revenue	-
Operating Costs	
Investment Costs	
Developer Contributions	-
Grant/Subsidy Payments	-
NET IMPACT	
Central Government Funding: Transport	
Revenue	-
Operating costs	-
Investment costs	£127,066,724
Developer Contributions	
Grant/Subsidy Payments	-
NET IMPACT	£127,066,724
Central Government Funding: Non-Transport	
Indirect Tax Revenues	£9,129,361
TOTALS	
Broad Transport Budget	£127,066,724
Wider Public Finances	£9,129,361

Note: Costs appear as positive numbers, while revenues and 'Developer and Other Contributions' appear as negative numbers.

All monetised values are expressed as 2010 present values

The total PVC for the scheme is **£86,790,678**.

3.7. Analysis of Monetised Costs and Benefits (AMCB) Table

The AMCB table brings together quantified scheme costs and benefits to help determine the economic worth of the transport scheme. This table is based on those elements of the economic appraisal which are considered to produce robust monetised estimates of the impacts. The AMCB table includes:

- User benefits, such as time savings and vehicle operating cost saving, over the 60-year appraisal period;
- Cost to business of any developers' contributions
- Changes in user charge revenues
- Indirect taxation benefits

- v. Accident benefits
- vi. Monetised environment impacts and
- vii. Costs of construction and operation.

The benefits less the costs provide an initial estimate of the net benefits for the scheme. The ratio of these benefits to costs is referred to as the Initial BCR.

In the AMCB table, four critical values are presented:

- i. The Present Value of Benefits (PVB) is the summation of the stream of discounted benefits over the appraisal period, reduced by the discounted value of the developer contribution.
- ii. The Present Value of Costs (PVC) is the summation of the stream of discounted costs from the current year forward through the 60-year appraisal period, less the discounted value of the developer contribution, although the majority of investment costs are likely to occur before the scheme opening year. The PVC indicates the total cost of the scheme which will be considered against the benefits.
- iii. The Net Present Value (NPV) is the PVB less the PVC and indicates whether there are positive or negative benefits, and their scale, from a scheme.
- iv. The Benefit-Cost Ratio (BCR) is the ratio of the PVB to the PVC.

The BCR for a scheme provides an indicative measure for the value for money of the investment, whereby a BCR greater than 1.0 indicates that the benefits outweigh the costs. DfT has defined value for money categories, which are as follows:

- i. BCR less than 1: Poor
- ii. BCR between 1 and 1.5: Low
- iii. BCR between 1.5 and 2: Medium
- iv. BCR between 2 and 4: High
- v. BCR of 4 and above: Very High

However, this scoring provides only a starting point for the value for money assessment which also draws on qualitative assessments of non-monetised impacts and measures of certainty of the quantified benefits and costs.

This technical note has outlined each aspect of the economic assessment of the scheme. Table 3-7 below summaries the results of each component from the TUBA and MEC assessments and is presented as the Analysis of Monetised Costs and Benefits for the scheme.

Table 3-7 Analysis of Monetised Costs and Benefits (£)

(2010 Prices, discounted)	Total Benefits	TUBA-Journey Time Benefits	MEC
Noise	£62,978	-	£62,978
Local Air Quality	£118,361	-	£118,361
Greenhouse Gases	£919,077	-	£919,077
Journey Quality	-	-	-
Physical Activity	-	-	-
Accidents	£952,735	-	£952,735
Economic Efficiency: Consumer Users	£55,857,000	£55,857,000	-
Economic Efficiency: Consumer Users (Other)	£31,105,000	£31,105,000	-
Economic Efficiency: Business Users and Providers	£47,693,000	£47,693,000	-
Wider Public Finances (Indirect Taxation)	-£9,129,361	-£9,129,361	-
Present Value of Benefits (PVB)	£127,578,790	£125,525,639	£2,053,151
Broad Transport Budget	£127,066,724	-	-
Present Value of Costs (PVC)	£86,790,678		
OVERALL IMPACTS			
Net Present Value (NPV)	£46,062,276	NPV=PVB-PVC	
Benefit to Cost Ratio (BCR)	1.53	BCR=PVB/PVC	

Note: All monetised values are expressed as 2010 present values

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

4. Summary and Conclusion

The economic appraisal of the proposed scheme was undertaken based on transport economic efficiency measured by TUBA and the Marginal External Cost (MEC) calculated over the 60-year appraisal period.

The economic assessment compares the monetised costs and benefits of the proposed scheme (the Do Something or DS) against the alternative without scheme scenario (the Do Minimum or DM).

The benefits of the scheme are calculated from:

1. User benefits during normal operation, using TUBA
2. Marginal External Costs benefits assessment included are:
 - Accident
 - Local Air Quality
 - Noise
 - Greenhouse Gases

The results of the economic assessment for the core scenario showed PVB associated with Initial BCR of about £127.58m (2010 prices and values) against a PVC of about **£86,790,678** resulting in an Initial BCR of **1.53**. The present value of benefits outweighs the present value of costs by **£40,788,112**. All benefits and costs were calculated in monetary terms and expressed as present values (PV) in 2010 market prices, discounted to 2010. This enables direct economic comparison with other schemes which may have different timescales.

The core scenario is viewed as the 'most likely' future scenario. However, forecasting into the future is inherently uncertain, as unforeseen changes to key underlying assumptions can have implications for future levels of demand and supply. The DfT recommends, therefore, that scenario analysis be undertaken to allow for future uncertainty. Results produced from this analysis show that the initial BCRs range of **1.53** indicating a **medium** Value for Money.

Appendices



Appendix A

TUBA warnings and logic checking

The core scenario assessed in TUBA have had output files reviewed to check warning messages for any possible indications of problems. A record of the review undertaken for the Core Scenario is set out below.

Annualised total trip matrix numbers that were fed as an input to TUBA were cross checked for different peak periods, user classes and forecast years by deriving them independently from SATURN matrices and comparing them to TUBA outputs. All comparisons showed the results to be internally consistent.

Warnings on the Core Scenario TUBA output file, such as the ratio of DM to DS travel distance or travel time being outside the defined range, were investigated. The number of warnings of each type is summarised in Table A-1.

Table A-1– TUBA Warnings for Core Scenario TUBA run

TUBA Warning	Number of types of warning	Comment
Warning: Ratio of DM to DS travel time lower than limit	742	Longer travel times forecasted for a small number of short distance movements. None of such warnings are serious. As part of scheme nodes 6827 and 5187 have been converted to signal from priority which is causing additional delay on very short distance OD pair of 647 to 611 and 650 to 610.
Warning: Ratio of DM to DS travel time higher than limit	41490	Indicates relatively high journey time savings but impacting only very small number of short distance movements. 6 of such warnings are serious. Due to the A34 MRN scheme, there is journey time saving in DS when compared to DM. Serious warnings relate to a single short distance movement falling marginally above this threshold.
Warning: Ratio of DM to DS travel distance lower than limit	90	Longer travel distances forecasted for few small numbers of inter zonal trips (majority of those are of short distance movements). This is due to localised signal optimisation and scheme causing traffic re-routing in model.
Warning: Ratio of DM to DS travel distance higher than limit	97	Shorter travel distances forecasted for a small number of movements. This is due to localised signal optimisation and scheme causing traffic re-routing in model.
Warning: DM speeds less than limit	213400	Warnings relate to DM trips having speeds lower than the minimum speed range of 10km/h-12km/h as specified in TUBA.

		Congestion in the model is causing some high delays thus reduced speeds for short distance movements.
Warning: DM speeds greater than limit	271	<p>Warnings relate to DM trips having speed higher than the maximum speed range of 85km/h-130km/h as specified in TUBA.</p> <p>These warnings are only for few OGV trips between External zones and internal zones at model boundary thus not facing any congestion and leading to higher speed.</p>
Warning: DS speeds less than limit	213430	<p>Warnings relate to DS trips having speeds lower than the minimum speed range of 10km/h-12km/h as specified in TUBA.</p> <p>Congestion in the model is causing some high delays thus reduced speeds for short distance movements.</p>
Warning: DS speeds greater than limit	271	<p>Warnings relate to DS trips having speed higher than the maximum speed range of 85km/h-130km/h as specified in TUBA.</p> <p>These warnings are only for few OGV trips between External zones and internal zones at model boundary thus not facing any congestion and leading to higher speed</p>
Warning: DM time greater than limit	32835	<p>TUBA checks the ratio of the DM to DS cost (time and distance separately) and issues a warning.</p> <p>xxx</p>
Warning: DS time greater than limit	32658	<p>TUBA checks the ratio of the DM to DS cost (time and distance separately) and issues a warning.</p> <p>xxx</p>
Serious Warning: Possible introduction of new mode one of DM and DS distance is zero, but not both	2	Zone centroid connectors checks in the model

AtkinsRéalis Limited

Nova North
11 Bressenden Place
Westminster
London
SW1E 5BY

Tel: +44 (0)20 7121 2000