Central Bedfordshire Council

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Central Bedfordshire Permit Scheme Cost Benefit Analysis

for

Road Works and Street Works Traffic Management Act 2004

Document Information	
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1 EXECUTIVE SUMMARY

Central Bedfordshire Council is a major investor of public resources and as such, should ensure that new developments make a positive contribution to the local economy and society.

Any new proposal should always answer these two basic questions:

- What are the specific outcomes sought?
- Will these outcomes deliver a positive benefit to the local economy and society?

Cost Benefit Analysis (CBA) is a decision-making tool that helps provide assurance around these questions by quantifying all costs and benefits in monetary terms.

Central Bedfordshire Council's Highways Team has been working on just such a new development and this Cost Benefit Analysis supports its introduction by demonstrating the positive financial outcome delivering its objectives will provide.

Minimising congestion is a key transport challenge for any Council and especially for a busy authority like Central Bedfordshire.

The ability of people and goods to move freely around the authority, meeting the needs of business, accessing essential services and for social and leisure purposes depends largely on the road network operating effectively.

The proposed Central Bedfordshire Permit Scheme tackles head-on one of the major causes of congestion, road and street works, in a robust and positive way and is a major opportunity to positively reduce congestion and the disruption it causes on the road network.

The proposed Central Bedfordshire Permit Scheme is designed to deliver effective co-ordination and management of essential road works by introducing a new Permit Authority in Central Bedfordshire.

The new Permit Authority is not intended to prevent activities necessary for the maintenance or improvement of the road network or the services running underneath it. It is designed to make available the necessary resources to achieve an appropriate balance between the interests of the various parties and where possible, bring about effective co-ordination between all the different competing interests.

Summary findings of the Central Bedfordshire Permit Scheme Cost Benefit Analysis

Values based on 25 Year Operation of the proposed Scheme (2010 prices)	
Value of benefits to economy and society	£107,888,294
Set-up and operating costs	£10,338,728
Financial benefit to the local economy from introducing the Scheme	£97,549,567
Benefit to Cost Ratio	**10.44**

2 INTRODUCTION

2.1 Permit Scheme Objectives

Swift Argent Ltd was commissioned by Central Bedfordshire Council (CBC) in 2014 to develop a road works Permit Scheme known as the Central Bedfordshire Permit Scheme (CBPS), part of which includes the development of a detailed Cost Benefit Analysis.

The principal objective of the Central Bedfordshire Permit Scheme is to improve the strategic and operational management of the highway network through better planning, scheduling and management of activities to minimise disruption to road users.

The Central Bedfordshire Permit Scheme will enable better co-ordination of activities throughout the highway network, ensuring those competing for space or time in the street, including traffic, to be resolved in a positive and constructive way.

The objectives and benefits of the Central Bedfordshire Permit Scheme are:

- Reduced congestion on the road network
- Improvements to overall network management
- A reduction in delays to the travelling public
- A reduction in costs to businesses caused by delays
- Promotion of a safer environment
- Reduced carbon emissions

2.2 Scope of work

The development of a detailed Cost Benefit Analysis is a requirement of the formal application to the Secretary of State for a Permit Scheme.

The analysis assesses the impact of Permits over the full range of required social and economic variables that have been specifically agreed in consultation with the UK Department for Transport (DfT).

An effective Cost Benefit Analysis is a mechanism to assess the benefits and costs of an investment both in terms of its overall viability and in relation to other options.

In this analysis, all benefits and costs are quantified in monetary terms and discounted over the length of the proposal to allow comparison on a common basis.

The output of the Cost Benefit Analysis is the presentation of a Benefit to Cost Ratio (BCR) which presents a scale of the Scheme benefits over costs and a Net Present Value (NPV) that is the sum total of the discounted benefits and costs.

This report will identify the additional costs of operating the Scheme, which are to be met by the Permit fees charged to Utility companies and from the Central Bedfordshire Council existing budget, against the value of the benefits it will deliver to the wider area of Central Bedfordshire.

It will identify the data used and the methodology undertaken to prepare the Cost Benefit Analysis and present the statutory outputs including the BCR and NPV of the Scheme.

2.3 Report Structure

After this introduction, the report is set out as follows:

- Section 3 Analysis and Context;
- Section 4 Input Data;
- Section 5 Delay Modelling;

- Section 6 Permit Scheme Operation;
- Section 7 Financial Calculations;
- Section 8 Statutory Outputs; and
- Section 9 Central Bedfordshire Permit Scheme Cost Benefit Analysis Results

3 ANALYSIS AND CONTEXT

3.1 Introduction

This section presents the legislative and research context for the Central Bedfordshire Permit Scheme Cost Benefit Analysis.

3.2 Legislative context

The legislative guidance used for this study is contained within:

- Traffic Management Act 2004, Permit Schemes, Decision-making and development (2nd Edition), November 2010;
- Traffic Management Act 2004, Code of Practice for Permits, March 2006; and
- WebTAG guidance Values of Time and Operating Costs (TAG Unit 3.5.6 October 2013).
- Department of Transport's (DfT) Halcrow study "Assessing the Extent of Streetworks and Monitoring Effectiveness of Section 74 in Reducing Disruption Volume 3 – Estimation of Cost of the Delay from Utilities' Street Works, June 2004"
- Chapter 8 of the Traffic Signs Manual DfT 2009
- Design Manual for Roads and Bridges Volume 14 Economic Assessment of Road Maintenance

3.3 Traffic Management Act 2004

The Traffic Management Act 2004 (TMA 2004) establishes the guidelines for street works. It has been in operation since April 2008 throughout the United Kingdom. The second edition states that any parties wishing to work on a road will require a Permit from the Highway Authority, who in turn will have additional powers to refuse or specify conditions associated with Permit permission for the overall efficiency of the operation of the road network.

3.4 WebTAG

WebTAG was first issued by the UK Department for Transport in 2003. It is based upon the 'New Approach to Appraisal' developed in the late 1990s and is an internet based multimodal guidance on appraising transport projects. WebTAG was recently updated in October 2013 including changes in value of time and operating costs, accident costs, carbon emissions and traffic growth forecasts as described in Road Transport Forecasts 2013.

3.5 Research

The benchmark study for Permit Scheme appraisal was produced by the Halcrow Consultancy at the time of the TMA in 2004.

3.6 Halcrow Study

In July 2004, Halcrow produced a report for the DfT on the impact of road works. The results (Table 1) estimate an overall cost of disruption caused by Utility works in England in 2002/03 at £4.36 billion.

Table 1 Halcrow study results summary

Impact of Roadworks	Electric	Gas	Telco	Water	Total
Number of Roadworks (000s)	234	223	244	499	1200
Average cost (£000) per Roadworks	£5.30	£5.40	£2.20	£2.80	£15.70
Annual Roadwork Disruption cost (£bn)	£1.24	£1.20	£0.54	£1.40	£4.38

Source: Halcrow Group, quoted in DfT draft Permit Schemes Regulatory Impact Assessment (RIA), July 2007

3.7 Implications for Central Bedfordshire Permit Scheme

Using the DfT sanctioned report, it is possible to get an idea for the likely implication of the Central Bedfordshire Permit Scheme either using a 'top down' approach from the overall saving or a 'bottom up' calculation based upon the implied rate per road works.

From a top down perspective, with an estimated 0.62% of utility road works occurring in Central Bedfordshire and a 5% reduction in road works associated with the Permit Scheme, it may be expected to produce annual savings of £1.34m in 2002 prices, (£2.24 million in 2010 prices).(Table 2)

Table 2 Forecast Benefits – Top Down approach

Halcrow Study	£
Annual UK cost of roadworks (£bn)	£ 4.36
Proportion of roadworks in Central Bedfordshire	0.62%
Annual Central Bedfordshire cost of roadworks (£m)	£ 26.83
Roadwork Reduction from Permit Scheme	5%
Estimated Permit Scheme saving (2002 prices) (£m)	**£ 1.34**
Estimated Permit Scheme saving (2010 prices) (£m)	**£ 2.24**

However, working up from the actual number of Noticed Works in Central Bedfordshire and using the 'rule of thumb' estimate from the DfT report of £600 per works per day and an average 6 days, the projected annual savings would be £1.33m in 2002 prices (£2.22 million in 2010 prices). (Table 3)

Table 3 Forecast Benefits – Bottom up approach

Annual Number of Utility Works	Total
Pre-scheme Number of Utility Works	7,385
Utility Works after 5% reduction	7,016
Total Utility Permit reduction	369
Average Days Duration from Halcrow Study	6
Number of road work days saved	2,216
Total Cost at £600 per works per day (£ m) (2002 prices)	**£ 1.33**
Total Cost at £600 per works per day (£ m) (2010 prices)	**£ 2.22**

The figures above give an estimate of the upper and lower expectations from the Central Bedfordshire Permit Scheme of between £2.22m and £2.24m in 2010 prices. As the two methods are within 5% this is

considered a reliable estimate. Both methods do have a degree of uncertainty as they are based on sample national data which may not be a correct representation at a local level.

4 INPUT DATA

4.1 Introduction

This section outlines the information sources and assumptions used in the Central Bedfordshire Permit Scheme Cost Benefit Analysis. The Cost Benefit Analysis has been prepared with 2010 as the price base year for presentation values as set out in WebTAG.

4.2 Cost Benefit Assumption

The objective of the Central Bedfordshire Permit Scheme is a reduction in the disruption caused by road works through improved control and co-ordination.

The central assumption of the analysis is that the introduction of the Permit Scheme will cause a 5% fall in Permit applications, and have a commensurate effect on roadwork activity and all associated aspects of the analysis. This 5% reduction is known as the Permit Scheme reduction factor.

Table 4 Central Assumptions

CBA modelled variable	Rate
Permit Scheme Reduction Factor	5%
Target year for reduction in works	1
Ratio of Utility permits to overall permits	50%

The analysis worked on the operating assumption that the effects of the Permit Scheme will start on Scheme opening with reductions occurring after operational lead-time in the second month. The breakdown of annual Permit numbers are presented in Table 5 below.

Table 5 Annual Permit Summary

Annual Permits	Total
Pre-scheme Number of Utility Permits	7,385
Utility Permits after 5% reduction	7,016

4.3 Data sources

The Cost Benefit Analysis has been produced from four sources of information:

- Government guidance;
- A completed Permit Fees Matrix in a format provided by the DfT;
- Local data provided by Central Bedfordshire Council; and
- DfT Traffic Flow Data

Standard Cost Benefit Analysis assumptions and sensitivity factors have been used in line with recommendations in DfT's Annex C of TMA 2004 Decision-making and development (2nd edition).

The Local data provided by Central Bedfordshire Council contained both the number of permits by type and specific information on Scheme operation and costs.

4.4 Discount and Risk Factors

The study uses the DfT recommended discount rate for assessment periods under 30 years of 3.5%.

The risk factors are applied to capital expenditure costs and are taken from standard values in Annex C of TMA 2004 Decision-making and development (2nd Edition) and shown in 6.

Table 6 Discount and Risk Factors

CBA modelled variable	Rate
Discount Rate	3.5%
Risk Bias Factor	20%
Optimism Bias Factor	15%
Combined Risk-Optimism Bias Factor	38%

4.5 Model Variable specification

This section identifies the treatment of costs in the period after Scheme implementation. All values used are standard values taken from Annex C of TMA 2004 Decision-making and development (2nd edition) and shown in Table 7.

Table 7 Model Variable specification

CBA modelled variable	Rate
Cost reduction based on permit reduction	50%
Reliability benefit factor	20%
Allowance for Phased Works	20%
Proportion of Annually recurring set up costs	0%

The introduction of the Permit Scheme will bring about a reduction in Permit applications, which in turn will mean lower Scheme costs. The TMA 2004 suggested 50% proportion used means that the reduction in Permit numbers of 5% will produce a 2.5% reduction in Scheme costs.

The reliability benefit factor is an approved standard uplift to the time benefit attributed to the reduction of road works. The allowance for phased works is a factor applied to the number of Permits applications to get a total number of Permits upon which the calculations are based.

No costs associated with the establishment of the Permit Scheme are projected to extend beyond the Scheme opening.

4.6 Statutory information associated with Permit Schemes

This study uses the guidance outlined in the TMA 2004 at the time of the study. The maximum charge per Permit type is shown in Table 8 below.

Table 8 Statutory Permit Fee rates

Revised maximum fee structure for each category of works and for a hierarchy of main and minor roads - Road category refers to the reinstatement category of the street under the New Roads and Street Works Act 1991		
Work Type	**Road Category 0-2 or Traffic-sensitive**	**Road Category 3-4 and non traffic-sensitive**
Provisional Advance	£105	£75

Major works – over 10 days and all major works requiring a traffic regulation order.	£240	£150
Major works – 4 to 10 days	£130	£75
Major works – up to 3 days	£65	£45
Activity Standard	£130	£75
Activity Minor	£65	£45
Immediate Activity	£60	£40
Permit Variation	£45	£35

4.7 Central Bedfordshire Council data

Central Bedfordshire Council supplied the following data and policy decisions:

- Policy data; and
- Road works Data.

4.8 Policy data

The policy decisions related to Permit Scheme operation outlined in Table 9 were obtained from Central Bedfordshire Council.

Table 9 Operational Variables

CBA modelled variable	Period
Number of months to establish Permit Scheme	1
Number of months to implement Permit Scheme	1
Recovery period for set-up costs (Years)	3
Debtor days	30

4.9 Road works Data

Central Bedfordshire Council provided the information on the number of road works and shown on Table 10 below.

Table 10 Roadwork Totals

Central Bedfordshire Notice Volumes						
Work Type	RC 0-2		RC 3-4		Total Volume	
	Number	%	Number	%	Number	%
Major	34	2%	152	3%	186	3%
Standard	277	15%	964	17%	1,241	17%
Minor with Exc	984	55%	2,891	52%	3,875	52%
Minor without Exc	58	3%	53	1%	111	2%
Urgent	331	18%	1,231	22%	1,562	21%
Special Urgent	-	0%	-	0%	-	0%
Emergency	108	6%	302	5%	410	6%
Totals	1,792	24%	5,593	76%	7,385	

The table expresses work type by two types; RC 0-2 Traffic Sensitive Streets and RC 3-4 Non Traffic Sensitive Streets. RC is an abbreviation of Reinstatement Category which is a function of Commercial Vehicles (CV) traffic volumes.

4.10 DfT data

The following data was obtained from the Halcrow Study, traffic management requirements and published traffic count data:

4.11 Works Data

The Halcrow Study found that the average size of carriageway works is 2 metres width by 20 metres length. Data was collected from 25 authorities across the whole of England on permit notices and the percentages of notices by reinstatement category and excavation length is summarised on Table 11 below. This shows that there is a very high proportion of works on minor roads RC 3-4.

Table 11 Percentage of Notices by Reinstatement Category and Excavation Length

DfT Study Table 2 - Percentages of Notices by RC and Excavation Length Vol 3: Extents of Works and Monitoring Disruption						
RC		**10m**	**30m**	**50m**	**100m**	**200m**
RC 0-2	% of all works	16.3%	0.1%	1.0%	0.8%	1.0%
	% of RC 0-2	85%	1%	5%	4%	5%
RC 3-4	% of all works	70.0%	4.2%	2.6%	2.1%	1.7%
	% of RC 3-4	87%	5%	3%	3%	2%

The study also reported the average duration by work type and utility. The average for each utility was proportioned by the number of notices to derive an average duration by work type and is summarised in Table 12 below. It was noted that there was a high percentage of water utility works.

Table 12 Average duration by work type by utility

DfT Study Average duration by work type by utility					
Work Type	**Elec**	**Gas**	**Telecom**	**Water**	**Avg Duration All Utilities**
Major	41	40	23	30	33
Standard	7	7	9	15	9
Minor with Exc	3	4	2	2	2
Minor without Exc	3	4	6	2	3
Urgent	6	5	3	3	4
Special	3	3	3	2	2
Emergency	6	7	2	3	7

Works require traffic management to keep workers safe and the requirements are detailed in Chapter 8 of the Traffic Signs Manual DfT 2009 and is summarised in Table 13 below for different road types.

Table 13 Traffic Management for Street works

Traffic Management for Street works Traffic Signs Manual Chapter 8							
Road Type	**Single 30mph or less (m)**	**Single 40mph (m)**	**Single 50mph or more (m)**	**Dual 40mph or less (m)**	**Dual 50mph or 60mph (m)**	**Dual NS (m)**	**Dual NS Congested (m)**
Taper	50	80	100	100	150	200	200
Approach signs	45	110	450	300	800	1609	3218
Min vis to sign	60	60	75	60	75	120	120
End of works sign from end	30	45	45	45	90	90	90
Totals excl works	185	295	670	505	1115	2019	3628

The Halcrow study reported the daily cost of street works by road type and excavation length and is summarised in Tables 14 and 15 below.

Table 14 Daily Cost of Rural Works

DfT Study Table 4 Daily Cost of Rural Works (£) by Reinstatement Category and Length					
Reinstatement Category	**Typical AADT**	**10m**	**50m**	**100m**	**200m**
0	<32,000	2,500	3,000	3,300	4,000
1	16000	7,850	9,050	10,250	11,000
2	12000	1,610	2,100	2,600	3,530
3	8000	780	970	1,200	1,625
4	4000	335	415	515	700

Table 15 Daily Cost of Urban Works

DfT Study Table 5 Daily Cost of Urban Works (£) by Reinstatement Category and Length					
Reinstatement Category	**Typical AADT**	**10m**	**50m**	**100m**	**200m**
0	40000	25,000	25,000	25,000	25,000
1	24000	9,000	12,000	15,000	17,000
2	16000	3,450	5,150	7,000	8,800
3	10000	385	535	710	1,025
4	6000	200	280	375	550

4.12 Traffic Data

Traffic data was obtained from the DfT who monitor annual traffic flows for all authorities in the UK,

For Central Bedfordshire there are 67 site locations on 'A' principal roads and minor roads for Annual Average Daily Flow (AADF) classified by vehicle type.

The latest data for 2013 is shown on Tables 16 to 21 below and location plan shown on Figure 1.

The RC has been derived from the typical AADT flows as shown in Table 14 and 15.

Table 16 DfT Traffic Flow Site Data 2013 (Sheet 1 of 6)

Central Bedfordshire DfT Traffic Flow Site Data 2013 (Sheet 1 of 6)												
Ref No	**Road**	**Start Junction**	**End Junction**	**All Motor Vehicles**	**%Lights**	**%Heavy**	**% Car**	**% LGV**	**%OGV1**	**%OGV2**	**%PSV**	**Data Type**
1	A6001	A6001 Shortmead St	B1040	11148	0.982	0.018	0.857	0.103	0.011	0.007	0.012	URBAN
2	A4012	A5(T)	Park St/Leighton St	4225	0.938	0.062	0.800	0.127	0.039	0.023	0.002	RURAL
3	A5065	Cradock Rd	Chaul End Lane	24912	0.980	0.020	0.833	0.135	0.013	0.007	0.005	RURAL
4	A418	Stewkley Road	A505	19275	0.956	0.044	0.813	0.128	0.024	0.021	0.008	RURAL
5	A5120	Churh Road	A507	17460	0.964	0.036	0.803	0.144	0.020	0.016	0.006	RURAL
6	A600	Turnpike Lane	Station Rd	10467	0.971	0.029	0.805	0.151	0.018	0.011	0.007	URBAN
7	A600	Station Rd	A507	8838	0.968	0.032	0.803	0.150	0.022	0.010	0.004	URBAN
8	A507	A600	A600	18552	0.941	0.059	0.725	0.207	0.042	0.018	0.005	URBAN
9	A4012	Park St/Leighton St	A5130	10937	0.961	0.039	0.793	0.157	0.019	0.019	0.005	RURAL
10	A4146	Ringshall Road	Hudnall Lane	8197	0.943	0.057	0.786	0.145	0.028	0.029	0.001	RURAL
11	A5130	A4012	Aspley Hill	6275	0.988	0.012	0.863	0.110	0.010	0.003	0.004	RURAL
12	A505	A1081	B653	14799	0.966	0.034	0.831	0.118	0.018	0.015	0.012	RURAL
13	A507	A5120	A6	18422	0.957	0.043	0.812	0.136	0.024	0.019	0.004	RURAL
14	A6	B655 Luton Rd	B655 Bedford Rd	20111	0.970	0.030	0.825	0.134	0.021	0.009	0.004	RURAL
15	A505	Station Rd	A5065	25712	0.973	0.027	0.840	0.112	0.013	0.014	0.015	URBAN
16	A6	B655	A507	18176	0.964	0.036	0.791	0.162	0.024	0.012	0.004	RURAL
17	A5120	B579	M1	11932	0.954	0.046	0.762	0.176	0.022	0.024	0.009	RURAL
18	A505	A5	Station Rd	17915	0.970	0.030	0.838	0.108	0.019	0.011	0.017	URBAN
19	A6	Turnpike Drive	B655 Luton Rd	26057	0.970	0.030	0.803	0.157	0.019	0.011	0.004	RURAL
20	A507	A6	A600	15399	0.942	0.058	0.779	0.151	0.032	0.026	0.006	RURAL
21	A600	A507	B658	12962	0.971	0.029	0.819	0.138	0.018	0.011	0.005	RURAL
22	A4012	Appenine Way, Leighton Buzzard	A5(T)	5439	0.961	0.039	0.735	0.199	0.030	0.009	0.015	RURAL

Table 17 DfT Traffic Flow Site Data 2013 (Sheet 2 of 6)

Central Bedfordshire DfT Traffic Flow Site Data 2013 (Sheet 2 of 6)								
Ref No	**Road**	**Start Junction**	**End Junction**	**2-way/1-way/bus lane**	**Data Type**	**Road Class**	**RC**	**Speed Limit (mph)**
1	A6001	A6001 Shortmead St	B1040	2-WAY	URBAN	8	1	30
2	A4012	A5(T)	Park St/Leighton St	2-WAY	RURAL	1	2	60
3	A5065	Cradock Rd	Chaul End Lane	2-WAY	RURAL	1	1	60
4	A418	Stewkley Road	A505	2-WAY	RURAL	1	2	60
5	A5120	Churh Road	A507	2-WAY	RURAL	1	2	60
6	A600	Turnpike Lane	Station Rd	2-WAY	URBAN	10	2	30
7	A600	Station Rd	A507	2-WAY	URBAN	10	2	60
8	A507	A600	A600	2-WAY	URBAN	10	1	60
9	A4012	Park St/Leighton St	A5130	2-WAY	RURAL	1	2	30
10	A4146	Ringshall Road	Hudnall Lane	2-WAY	RURAL	1	3	60
11	A5130	A4012	Aspley Hill	2-WAY	RURAL	1	2	60
12	A505	A1081	B653	2-WAY	RURAL	2	2	70
13	A507	A5120	A6	2-WAY	RURAL	1	1	60
14	A6	B655 Luton Rd	B655 Bedford Rd	2-WAY	RURAL	2	1	70
15	A505	Station Rd	A5065	2-WAY	URBAN	7	1	30
16	A6	B655	A507	2-WAY	RURAL	1	2	60
17	A5120	B579	M1	2-WAY	RURAL	1	2	30
18	A505	A5	Station Rd	2-WAY	URBAN	8	1	30
19	A6	Turnpike Drive	B655 Luton Rd	2-WAY	RURAL	2	1	70
20	A507	A6	A600	2-WAY	RURAL	1	1	60
21	A600	A507	B658	2-WAY	RURAL	1	2	60
22	A4012	Appenine Way, Leighton Buzzard	A5(T)	2-WAY	RURAL	1	3	60

Table 18 DfT Traffic Flow Site Data 2013 (Sheet 3 of 6)

Central Bedfordshire DfT Traffic Flow Site Data 2013 (Sheet 3 of 6)												
Ref No	**Road**	**Start Junction**	**End Junction**	**All Motor Vehicles**	**%Lights**	**%Heavy**	**% Car**	**% LGV**	**%OGV1**	**%OGV2**	**%PSV**	**Data Type**
23	A5120	A5(T)	A5120 Bedford Rd	14465	0.976	0.024	0.828	0.135	0.017	0.007	0.010	URBAN
24	A5120	High Street (Houghton Regis)	B579	7175	0.932	0.068	0.711	0.204	0.051	0.017	0.010	RURAL
25	A6001	A6001 High St	Sun St	12113	0.977	0.023	0.833	0.135	0.017	0.006	0.006	URBAN
26	A6001	B1040	A1	11809	0.979	0.021	0.842	0.128	0.012	0.009	0.005	URBAN
27	A507	A600	A659	16935	0.948	0.052	0.731	0.205	0.034	0.019	0.004	URBAN
28	A4146	Slapton Lane	A505	8335	0.899	0.101	0.755	0.127	0.064	0.037	0.006	RURAL
29	A4146	A418	A4012	21928	0.945	0.055	0.791	0.144	0.022	0.034	0.004	RURAL
30	A1081	M1	A505	45986	0.973	0.027	0.883	0.078	0.013	0.014	0.007	RURAL
31	A1081	A505	Airport Way	19034	0.975	0.025	0.858	0.102	0.016	0.009	0.008	RURAL
32	A1081	Front Street	M1	14318	0.980	0.020	0.846	0.118	0.015	0.005	0.008	RURAL
33	A6001	A1	Pegasus Drive, Biggleswade	10747	0.979	0.021	0.842	0.128	0.012	0.009	0.005	RURAL
34	A6001	Sun Street	A1	11022	0.977	0.023	0.833	0.135	0.017	0.006	0.006	RURAL
35	A4012	A4146	Appenine Way	7732	0.981	0.019	0.844	0.114	0.012	0.007	0.015	URBAN
36	A5065	A505	Cradock Rd	27651	0.980	0.020	0.833	0.136	0.013	0.007	0.005	URBAN
37	A5120	A5120 High St	Thorn Road	8323	0.932	0.068	0.711	0.204	0.051	0.017	0.010	URBAN
38	A5120	A507	A5120	11741	0.973	0.027	0.810	0.148	0.015	0.012	0.010	URBAN
39	A505	A4012	A505	14053	0.918	0.082	0.768	0.138	0.026	0.056	0.005	RURAL
40	A505	B488	A4146	21928	0.945	0.055	0.791	0.144	0.022	0.034	0.004	RURAL
41	A4146	B4032	A418	21633	0.942	0.058	0.803	0.131	0.024	0.034	0.002	RURAL
42	A6	A507	Chapel End Road	16801	0.946	0.054	0.769	0.164	0.026	0.027	0.005	RURAL
43	A600	B658	Silver End Road	9536	0.968	0.032	0.814	0.129	0.023	0.009	0.011	RURAL
44	A603	Barford Road	A1	14554	0.937	0.063	0.774	0.149	0.030	0.034	0.008	RURAL

Table 19 DfT Traffic Flow Site Data 2013 (Sheet 4 of 6)

Central Bedfordshire DfT Traffic Flow Site Data 2013 (Sheet 4 of 6)								
Ref No	**Road**	**Start Junction**	**End Junction**	**2-way/1-way/bus lane**	**Data Type**	**Road Class**	**RC**	**Speed Limit (mph)**
23	A5120	A5(T)	A5120 Bedford Rd	2-WAY	URBAN	7	1	30
24	A5120	High Street (Houghton Regis)	B579	2-WAY	RURAL	1	1	60
25	A6001	A6001 High St	Sun St	2-WAY	URBAN	7	2	30
26	A6001	B1040	A1	2-WAY	URBAN	7	3	30
27	A507	A600	A659	2-WAY	URBAN	10	1	60
28	A4146	Slapton Lane	A505	2-WAY	RURAL	1	3	60
29	A4146	A418	A4012	2-WAY	RURAL	2	1	60
30	A1081	M1	A505	2-WAY	RURAL	2	0	70
31	A1081	A505	Airport Way	2-WAY	RURAL	2	2	70
32	A1081	Front Street	M1	2-WAY	RURAL	1	2	60
33	A6001	A1	Pegasus Drive, Biggleswade	2-WAY	RURAL	2	2	40
34	A6001	Sun Street	A1	2-WAY	RURAL	1	2	30
35	A4012	A4146	Appenine Way	2-WAY	URBAN	7	2	30
36	A5065	A505	Cradock Rd	2-WAY	URBAN	10	1	30
37	A5120	A5120 High St	Thorn Road	2-WAY	URBAN	10	2	30
38	A5120	A507	A5120	2-WAY	URBAN	8	2	30
39	A505	A4012	A505	2-WAY	RURAL	2	2	60
40	A505	B488	A4146	2-WAY	RURAL	2	1	60
41	A4146	B4032	A418	2-WAY	RURAL	2	1	70
42	A6	A507	Chapel End Road	2-WAY	RURAL	1	2	60
43	A600	B658	Silver End Road	2-WAY	RURAL	1	2	60
44	A603	Barford Road	A1	2-WAY	RURAL	1	2	30

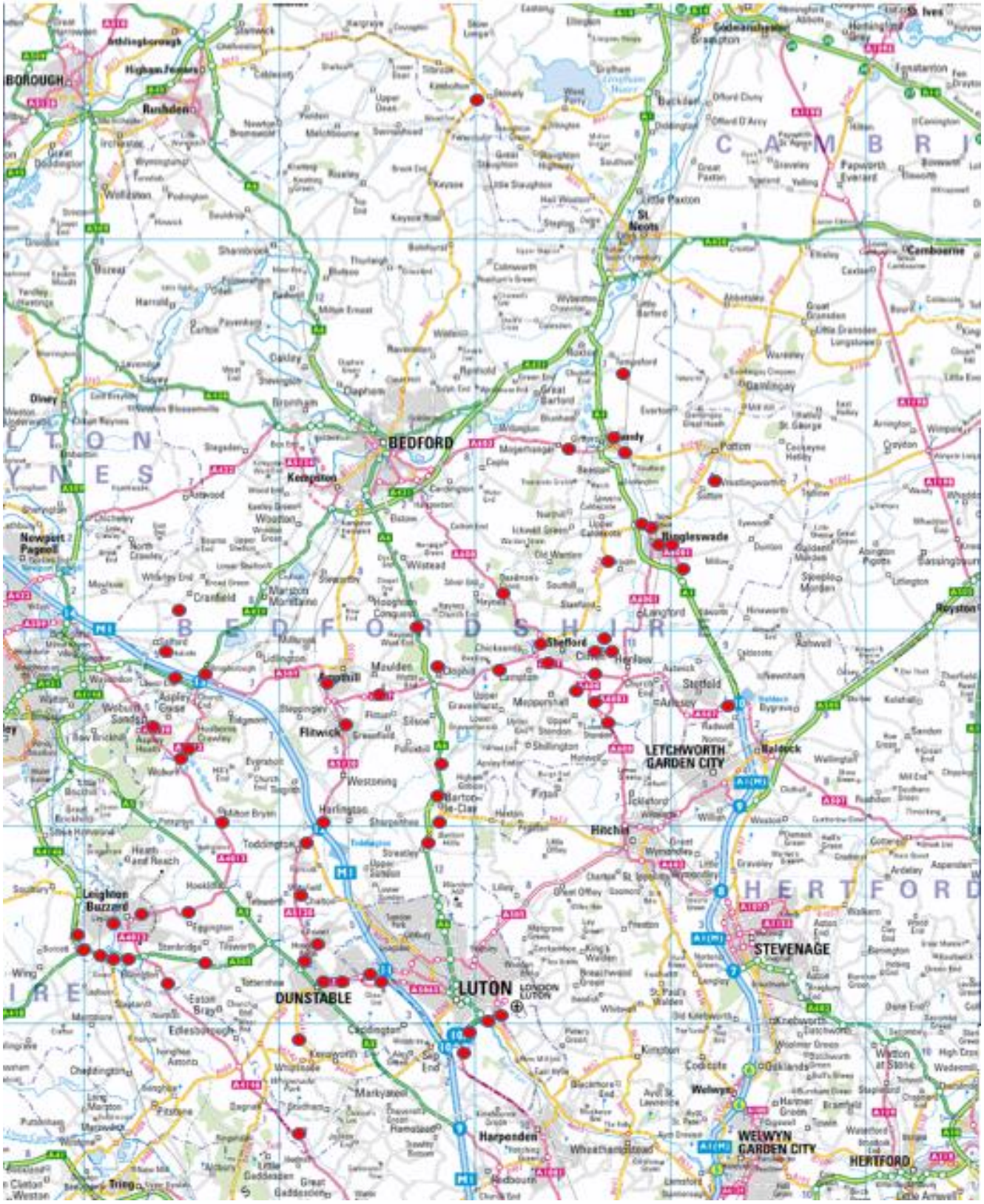
Table 20 DfT Traffic Flow Site Data 2013 (Sheet 5 of 6)

Central Bedfordshire DfT Traffic Flow Site Data 2013 (Sheet 5 of 6)												
Ref No	**Road**	**Start Junction**	**End Junction**	**All Motor Vehicles**	**%Lights**	**%Heavy**	**% Car**	**% LGV**	**%OGV1**	**%OGV2**	**%PSV**	**Data Type**
45	A507	A4012	A5120	10546	0.916	0.084	0.748	0.161	0.036	0.048	0.001	RURAL
46	A4012	A5130	A507	5902	0.937	0.063	0.737	0.190	0.032	0.032	0.002	RURAL
47	A507	A421 Roundabout	A4012	15346	0.898	0.102	0.753	0.134	0.045	0.057	0.003	RURAL
48	A421	Newport Road	A421 North before M1	27934	0.909	0.091	0.770	0.132	0.030	0.061	0.002	RURAL
49	A507	A6001	A1(M)	21439	0.958	0.042	0.799	0.150	0.021	0.021	0.003	RURAL
50	A505	A4146	A5	15801	0.911	0.089	0.722	0.179	0.043	0.045	0.004	RURAL
51	B4541	42	84	5242	0.963	0.037	0.810	0.133	0.032	0.005	0.004	RURAL
52	B655	30	38	5505	0.982	0.018	0.856	0.112	0.017	0.000	0.008	RURAL
53	B658	18	56	7204	0.964	0.036	0.806	0.144	0.021	0.016	0.006	RURAL
54	B1042	116	45	10991	0.981	0.019	0.859	0.112	0.013	0.006	0.005	URBAN
55	Cranfield Road	33	23	2569	0.993	0.007	0.888	0.094	0.007	0.001	0.001	RURAL
56	Tempsford Road	12	13	1026	0.958	0.042	0.784	0.162	0.026	0.016	0.000	RURAL
57	Chapel Road	34	19	1491	0.975	0.025	0.816	0.142	0.017	0.008	0.004	RURAL
58	Shefford Road	117	32	4564	0.985	0.015	0.881	0.071	0.012	0.002	0.026	URBAN
59	Stanford Lane	27	36	2948	0.987	0.013	0.858	0.109	0.011	0.002	0.008	RURAL
60	Salford Road	12	63	5386	0.981	0.019	0.858	0.108	0.016	0.003	0.003	RURAL
61	Newis Crescent	11	3	1193	0.988	0.012	0.866	0.120	0.010	0.002	0.000	URBAN
62	Church Road	17	8	1060	0.995	0.005	0.833	0.155	0.004	0.001	0.000	URBAN
63	Chambers Way	44	38	3426	0.990	0.010	0.867	0.096	0.009	0.001	0.016	URBAN
64	Glebe Road	27	2	1042	0.998	0.002	0.885	0.106	0.002	0.000	0.006	URBAN
65	B1042	7	18	2467	0.979	0.021	0.842	0.121	0.015	0.006	0.009	RURAL
66	Church Road	25	7	891	0.983	0.017	0.842	0.118	0.015	0.002	0.016	RURAL
67	Readshill	17	9	444	0.986	0.014	0.838	0.128	0.014	0.000	0.000	URBAN

Table 21 DfT Traffic Flow Site Data 2013 (Sheet 6 of 6)

Central Bedfordshire DfT Traffic Flow Site Data 2013 (Sheet 6 of 6)								
Ref No	**Road**	**Start Junction**	**End Junction**	**2-way/1-way/bus lane**	**Data Type**	**Road Class**	**RC**	**Speed Limit (mph)**
45	A507	A4012	A5120	2-WAY	RURAL	1	1	60
46	A4012	A5130	A507	2-WAY	RURAL	1	2	60
47	A507	A421 Roundabout	A4012	2-WAY	RURAL	1	1	60
48	A421	Newport Road	A421 North before M1	2-WAY	RURAL	1	1	60
49	A507	A6001	A1(M)	2-WAY	RURAL	1	1	60
50	A505	A4146	A5	2-WAY	RURAL	1	2	60
51	B4541	42	84	2-WAY	RURAL	1	3	60
52	B655	30	38	2-WAY	RURAL	1	3	30
53	B658	18	56	2-WAY	RURAL	1	2	60
54	B1042	116	45	2-WAY	URBAN	8	1	30
55	Cranfield Road	33	23	2-WAY	RURAL	1	3	60
56	Tempsford Road	12	13	2-WAY	RURAL	1	4	60
57	Chapel Road	34	19	2-WAY	RURAL	1	4	60
58	Shefford Road	117	32	2-WAY	URBAN	10	4	30
59	Stanford Lane	27	36	2-WAY	RURAL	1	4	60
60	Salford Road	12	63	2-WAY	RURAL	1	4	60
61	Newis Crescent	11	3	2-WAY	URBAN	10	4	30
62	Church Road	17	8	2-WAY	URBAN	7	4	30
63	Chambers Way	44	38	2-WAY	URBAN	7	4	30
64	Glebe Road	27	2	2-WAY	URBAN	7	4	30
65	B1042	7	18	2-WAY	RURAL	1	1	60
66	Church Road	25	7	2-WAY	RURAL	1	4	60
67	Readshill	17	9	2-WAY	URBAN	7	4	30

Figure 1 DfT AADT Locations Central Bedfordshire



5 DELAY MODELLING

5.1 Delay Modelling Methodology

The estimation of delay is detailed in the Halcrow study. Two methods of measurement are listed

(a) live site measured method; and

(b) modelling techniques to replicate works on the ground.

The measured method is described as a restricted illustrative example of the impact at works and a general model is more industry recognised as the more robust technique that can be audited and validated.

There are three types of modelling software that can be used to model delay at works namely;

QUADRO – models queues and delays at road works;

SATURN – macro assignment;

and VISSIM – micro simulation.

The Halcrow study stated in Section 2.1 that on evaluation there were inconsistencies with the latter two types and that QUADRO would give the most consistent results although it is suited more to rural locations with little diversion routes but it is able to model the additional delay on diversion routes when the maximum queuing delay on the main route is exceeded.

QUADRO is able to appraise individual works that are planned in the future on different types of road by modelling the delay experienced by road users, quantify the delay and estimate the cost of the delay.

The software is able to calculate and convert delays in to monetary figures as detailed in WebTAG Unit 3.5.6. with assumptions in regard to valuation of time, operating costs and accidents.

Users are required to input base link specific details including network classification, traffic flows, road type characteristics and any diversion routes. Works details including site length, works type such as lane closures and shuttle working. The latest version released in January 2014 Version 4 release 12 will be used for the Cost Benefit Analysis. The QUADRO Manual is included in the Design Manual for Roads and Bridges Volume 14 Economic Assessment of Road Maintenance DfT 2002.

5.2 The valuation of costs in quadro

5.2.1 The Valuation of Time

QUADRO calculates the delays at works and translates these into monetary figures using standard values of time.

The latest values are provided in WebTAG Unit 3.5.6 and is shown in Table 22 and 23 below. QUADRO converts the resource cost to market price to be consistent with the Economic Efficiency of the Transport System (TEE) table. The market price is calculated by multiplying the resource value by (1 + *t*) where *t* is the average rate of indirect taxation in the economy.

Table 22 WebTAG - Value of Time by Mode and Trip Purpose

Table A 1.3.1: Values of Working (Employers' Business) Time by Mode (£ per hour, 2010 prices, 2010 values)			
Mode	**Resource Cost**	**Perceived Cost**	**Market Price**
Car driver	22.74	22.74	27.06
Car passenger	17.25	17.25	20.52
LGV (driver or passenger)	10.24	10.24	12.18
OGV (driver or passenger)	12.06	12.06	14.35
PSV driver	12.32	12.32	14.66
PSV passenger	13.97	13.97	16.63
Taxi driver	10.89	10.89	12.96
Taxi / Minicab passenger	21.96	21.96	26.13
Rail passenger	26.86	26.86	31.96
Underground passenger	22.08	22.08	26.28
Walker	17.54	17.54	20.88
Cyclist	17.47	17.47	20.78
Motorcyclist	19.42	19.42	23.11
Average of all working persons	22.75	22.75	27.07

Values of Non-Working Time by Trip Purpose (£ per hour, 2010 prices, 2010 values)			
Trip Purpose	**Resource Cost**	**Perceived Cost**	**Market Price**
Commuting	5.72	6.81	6.81
Other	5.08	6.04	6.04

Table 23 WebTAG - Value of Time per Vehicle per hour

Table A 1.3.5: Market Price Values of Time per Vehicle based on distance travelled (£ per hour, 2010 prices and 2010 values)								
Vehicle Type	Journey Purpose	Weekday					Weekend	All Week
		7am – 10am	10am – 4pm	4pm – 7pm	7pm – 7am	Average		
Car	Work	31.56	30.81	30.34	30.58	30.99	32.54	30.99
	Commuting	7.83	7.77	7.65	7.66	7.71	7.72	7.71
	Other	10.06	10.46	10.74	10.48	10.49	11.61	10.90
	Average Car	12.92	14.20	12.03	11.93	12.98	11.95	12.73
LGV	Work (freight)	14.62	14.62	14.62	14.62	14.62	15.35	14.62
	Commuting & Other	9.15	9.15	9.15	9.15	9.15	12.72	9.15
	Average LGV	13.96	13.96	13.96	13.96	13.96	15.03	13.96
OGV1	Working	14.35	14.35	14.35	14.35	14.35	14.35	14.35
OGV2	Working	14.35	14.35	14.35	14.35	14.35	14.35	14.35
PSV (Occupants)	Work	22.57	18.72	22.57	26.22	21.56	17.70	22.57
	Commuting	24.93	9.22	30.41	31.66	21.19	5.32	24.93
	Other	48.74	64.08	43.88	41.44	52.43	67.84	48.74
	Total	96.24	92.02	96.86	99.32	95.18	90.86	94.06

5.2.2 The Valuation of Vehicle Operating Costs

QUADRO calculates the vehicle operating costs (VOC) incurred by traffic with and without works.

VOC may increase during works if speeds are reduced or a long diversion route. The effects of temporary blockages caused by accidents are solely assessed on journey time and operating costs are not calculated. As the resource cost of fuel, fuel efficiency and fleet composition change independently, the relationship of resource cost (per kilometre) to market prices changes annually.

The programme is informed of changes in tax rates over time and are shown in Tables 24, 25 and 26 below.

Values for 2010 VOC are shown in Table 27 below.

Carbon emissions are considered in terms of the change in the equivalent tonnes of carbon Table 28 and estimated from fuel consumption Table 29 below.

Table 24 Taxation Rates Base

TAXATION RATES (%)					
FUEL TYPE	AVERAGE FINAL	FUEL		NON-FUEL	
		FINAL	INTER	FINAL	INTER
PETROL	19	339.7	274.2	20	0
DIESEL	19	310.1	249.1	20	0

Table 25 Changes to Taxation Rates % Petrol

CHANGES TO TAXATION RATES (%) PETROL						
AVERAGE	FUEL		NON-FUEL		FROM	TO
FINAL	FINAL	INTER	FINAL	INTER	YEAR	YEAR
0	-9.87	-10.41	0	0	2002	2003
0	-9.73	-10.32	0	0	2003	2004
0	-19.56	-20.88	0	0	2004	2005
0	-11	-11.94	0	0	2005	2006
0	0.63	0.69	0	0	2006	2007
0	-18.64	-20.19	0	0	2007	2008
0	29.04	36.78	0	0	2008	2009
0	-16.11	-20.38	0	0	2009	2010
0	-13.72	-18.56	0	0	2009	2010
0	-3.34	-3.85	0	0	2010	2011
0	-1.94	-2.24	0	0	2011	2012
0	-1.6	-1.85	0	0	2012	2013
0	0.53	0.62	0	0	2013	2014
0	0.81	0.95	0	0	2014	2015
0	1.19	1.39	0	0	2015	2016
0	0.98	1.14	0	0	2016	2017
0	0.79	0.92	0	0	2017	2018
0	0.61	0.71	0	0	2018	2019
0	0.43	0.49	0	0	2019	2020
0	0.25	0.29	0	0	2020	2021
0	0.25	0.28	0	0	2021	2022
0	0.29	0.34	0	0	2022	2023
0	0.35	0.4	0	0	2023	2024
0	0.31	0.36	0	0	2024	2025
0	0.36	0.42	0	0	2025	2026
0	0.31	0.35	0	0	2026	2027
0	0.32	0.36	0	0	2027	2028
0	0.32	0.37	0	0	2028	2029
0	0	0	0	0	2030	2099

Table 26 Changes to Taxation Rates % Diesel

CHANGES TO TAXATION RATES (%) DIESEL						
AVERAGE	FUEL		NON-FUEL		FROM	TO
FINAL	FINAL	INTER	FINAL	INTER	YEAR	YEAR
0	-7.7	-8.16	0	0	2002	2003
0	-8.4	-8.95	0	0	2003	2004
0	-23.5	-25.18	0	0	2004	2005
0	-9.53	-10.44	0	0	2005	2006
0	3.85	4.26	0	0	2006	2007
0	-27.29	-29.85	0	0	2007	2008
0	37.84	48.13	0	0	2008	2009
0	-10.45	-14.64	0	0	2009	2010
0	-16.24	-21.43	0	0	2009	2010
0	-4.42	-5.14	0	0	2010	2011
0	-3.49	-4.09	0	0	2011	2012
0	-1.56	-1.84	0	0	2012	2013
0	0.54	0.64	0	0	2013	2014
0	0.81	0.96	0	0	2014	2015
0	1.2	1.41	0	0	2015	2016
0	0.98	1.15	0	0	2016	2017
0	0.79	0.93	0	0	2017	2018
0	0.62	0.73	0	0	2018	2019
0	0.45	0.53	0	0	2019	2020
0	0.26	0.3	0	0	2020	2021
0	0.26	0.3	0	0	2021	2022
0	0.31	0.36	0	0	2022	2023
0	0.35	0.41	0	0	2023	2024
0	0.32	0.38	0	0	2024	2025
0	0.35	0.41	0	0	2025	2026
0	0.34	0.39	0	0	2026	2027
0	0.32	0.37	0	0	2027	2028
0	0.32	0.38	0	0	2028	2029
0	0	0	0	0	2030	2099

Table 27 WebTAG – Non-Fuel Resource Vehicle Operating Costs

Table A 1.3.14: Non-Fuel Resource Vehicle Operating Costs (2010 prices and 2010 values)			
Vehicle Category		**Parameter Values**	
		a1 p / km	**b1 p / hr**
Car	Work Petrol	4.966	135.946
	Work Diesel	4.966	135.946
	Work Electric	1.157	135.946
	Non-Work Petrol	3.846	0.000
	Non-Work Diesel	3.846	0.000
	Non-Work Electric	1.157	0.000
LGV	Work	7.213	47.113
	Non-Work	7.213	0.000
	Average	7.213	41.458
OGV1	Work	6.714	263.817
OGV2	Work	13.061	508.525
PSV	Work	30.461	694.547

Table 28 WebTAG – Carbon dioxide emissions per litre of fuel burnt / kWh used

Table A 3.4: Non Traded Values, £ per Tonne of CO2e (2010 prices)			
Year	**Low**	**Central**	**High**
2010	27.06	54.12	81.18
2011	27.46	54.93	82.39
2012	27.88	55.75	83.63
2013	28.29	56.59	84.88
2014	28.72	57.44	86.16
2015	29.15	58.30	87.45
2016	29.59	59.17	88.76
2017	30.03	60.06	90.09
2018	30.48	60.96	91.44
2019	30.94	61.88	92.82
2020	31.40	62.81	94.21

Table 29 WebTAG – Fuel consumption parameter values

Table A 1.3.8:	Fuel consumption parameter values (litres per km, 2010)			
	Parameters			
Vehicle Category	**a**	**B**	**c**	**d**
Petrol Car	0.96402	0.04145	0.00005	2.01346E-06
Diesel Car	0.43709	0.05862	0.00052	4.12709E-06
Petrol LGV	1.55646	0.06425	0.00074	1.00552E-05
Diesel LGV	1.04527	0.05790	0.00043	8.02520E-06
OGV1	1.47737	0.24562	0.00357	3.06380E-05
OGV2	3.39070	0.39438	0.00464	3.59224E-05
PSV	4.11560	0.30646	0.00421	3.65263E-05
	Energy consumption parameter values (kWh per km, 2011)			
Electric Car	0.12564			
Electric LGV				
Electric OGV1				
Electric OGV2				
Electric PSV				

5.2.3 The Valuation of Accidents

Additional accidents may be expected in works and there are two types of cost incurred the cost of delay and the direct cost.

The direct cost includes the casualty, damage to property, insurance administration, police time and an allowance to damage only accidents. QUADRO calculates these values on the network using DfT standard values for average personal injury accidents on various types of road.

Values of most elements are proportional to national income and for 2010 are shown in Table 30 and 31 below. Accident values increase in line with GDP as shown in Table 32 below. Accident rates are calculated with and without works, combined link and junction rates are used in QUADRO,

Table 33 shows accident rates for 15 road types without works and Table 34 shows accident rates for each type and traffic management layout. Local data can be used only if available for both the without and with works in this Cost Benefit Analysis these default values are used.

Table 35 shows the number of casualties per accident.

Table 30 WebTAG – Cost per Casualty

Cost per Casualty	
Severity	**Cost £**
Fatal	1,645,822
Serious	184,944
Slight	14,257

Table 31 WebTAG – Cost per Accident

Cost per Accident							
Severity	Insurance Administration	Damage to Property			Police Cost		
		Urban	Rural	Motorway	Urban	Rural	Motorway
Fatal	302	7,870	13,347	16,978	16,977	17,433	17,636
Serious	188	4,218	6,085	14,487	1,875	2,341	2,472
Slight	114	2,488	4,033	7,329	485	665	554
Damage	54	1,779	2,660	2,556	36	20	17

Table 32 WebTAG – Accident Growth Rates

Annual Rates of Growth of Accident Values	
Range of Years	Growth Rate (% p.a.)
2002 - 2003	3.54
2003 - 2004	2.67
2004 - 2005	2.56
2005 - 2006	2.16
2006 - 2007	2.75
2007 - 2008	-1.44
2008 - 2009	-5.77
2009 - 2010	0.89

Table 33 WebTAG – Accident Without Works

Combined Link / Junction: Accident Rates and Change Factors 2000 Base				
Road Type	**Speed Limit (mph)**	**Accident Rate**	**Beta Factor**	**Road Description**
1	50/60/70	0.098	1.001	Motorways
2	50/60/70	0.098	1.001	Motorways
3	50/60/70	0.098	1.001	Motorways
4	30/40	0.844	0.984	Modern S2 Roads
4	>40	0.293	0.973	Modern S2 Roads
5	30/40	0.844	0.984	Modern S2 Roads with HS
5	>40	0.232	0.973	Modern S2 Roads with HS
6	30/40	0.844	0.984	Modern WS2 Roads
6	>40	0.190	0.973	Modern WS2 Roads
7	30/40	0.844	0.984	Modern WS2 Roads w. HS
7	>40	0.171	0.973	Modern WS2 Roads w. HS
8	30/40	0.844	0.984	Older S2 A Roads
8	>40	0.381	0.973	Older S2 A Roads
9	30/40	0.844	0.983	Other S2 Roads
9	>40	0.404	0.998	Other S2 Roads
10	30/40	1.004	0.984	Modern D2 Roads
10	>40	0.174	0.973	Modern D2 Roads
11	30/40	1.004	0.984	Modern D2 Roads with HS
11	>40	0.131	0.973	Modern D2 Roads with HS
12	30/40	1.004	0.984	Older D2 Roads
12	>40	0.226	0.973	Older D2 Roads
13	30/40	1.004	0.984	Modern D3+ Roads
13	>40	0.174	0.973	Modern D3+ Roads
14	30/40	1.004	0.984	Modern D3+ Roads w. HS
14	>40	0.131	0.973	Modern D3+ Roads w. HS
15	30/40	1.004	0.984	Older D3+ Roads
15	>40	0.226	0.973	Older D3+ Roads

Table 34 WebTAG – Accident With Works

Combined Link / Junction: Accident Rates and Change Factors 2000 Base				
Road Type	Speed Limit (mph)	Accident Rate	Beta Factor	Road Description
16	direction with crossovers	0.130	1.001	D2M
17	direction with lane closure only	0.150	1.001	D2M
18	direction with crossovers	0.130	1.001	D3M
19	direction with lane closure only	0.150	1.001	D3M
20	direction with crossovers	0.130	1.001	D4M
21	direction with lane closure only	0.150	1.001	D4M
22	shuttle working	2.296	0.984	S2 Roads 30/40
22		1.036	0.973	S2 Roads >40
23	lane closure	2.296	0.984	S2 Roads 30/40
23		1.036	0.973	S2 Roads >40
24	shuttle working	2.296	0.984	WS2 Roads 30/40
24		1.036	0.973	WS2 Roads >40
25	lane closure	2.296	0.984	WS2 Roads 30/40
25		1.036	0.973	WS2 Roads >40
28	direction with crossovers	1.788	0.984	D2 Roads 30/40
28		0.31	0.973	D2 Roads >40
29	direction with lane closure only	1.255	0.984	D2 Roads 30/40
29		0.217	0.973	D2 Roads >40
32	direction with crossovers	1.788	0.984	D3+ Roads 30/40
32		0.31	0.973	D3+ Roads >40
33	direction with lane closure only	1.255	0.984	D3+ Roads 30/40
33		0.217	0.973	D3+ Roads >40

Table 35 WebTAG – Casualties per P.I.A.

Combined Link / Junction: Casualty Rates					
Road Type	Speed Limit (mph)	Casualties per P.I.A.			Road Description
		Fatal	Serious	Slight	
1 – 3	50 / 60 / 70	0.022	0.1520	1.462	Motorways
4 – 8	30 / 40	0.0092	0.1392	1.157	S2 A Roads
4 – 8	>40	0.0436	0.2855	1.286	S2 A Roads
9	30 / 40	0.0075	0.1379	1.124	Other S2 Roads
9	>40	0.0262	0.2513	1.245	Other S2 Roads
10 - 15	30 / 40	0.0093	0.1253	1.222	Dual Carriageways
10 - 15	>40	0.0286	0.1861	1.314	Dual Carriageways

5.3 DELAY MODELLING IN QUADRO

5.3.1 Elements of Delay

The delay at works are made up of a number of elements that include the reduce running speeds through the site, traffic signal control for shuttle working, insufficient capacity causing queuing and diversion and are calculated by the General Delay Sub-Model.

Accidents and breakdowns can cause further delay and will depend on location, amount of width and time of day and if alternative routes are available and are calculated by the Incident Delay Sub-Model.

5.3.2 The General Delay Sub-Model

This model is run in each direction and for the four day types Monday to Thursday, Friday, Saturday and Sunday for each hour, the remaining queue is added to the following hour.

The assumption is that regular drivers would travel on the route that minimises the journey time. A driver may minimise journey time by diverting to an alternative before the work site and re-join past the site or divert the route completely.

If traffic is not expected to divert at a particular site and instead queue this implies there are unattractive routes. It can be found that a specification of a diversion route can be particularly difficult and QUADRO is able to be run with a maximum queuing delay.

For the purpose of the Cost Benefit Analysis this has been used, sample run data is included in the QUADRO manual for different types of road for maximum queuing delay and shown on Table 36 below. Once the maximum queue time is exceeded drivers will divert to a route and assumed that this would equal the journey time through the work site.

Table 36 Max-Q-Delay

Typical Max-Q-Delay QUADRO	
Type of Road	**Max-Q-Delay (mins)**
S2	5
WS2	5
D2AP	10
D3AP	15

5.3.3 The Incident Delay Sub-Model

If a breakdown or accident occurs within the site length this will restrict the capacity further.

Unlike the General Model drivers will not divert as this would not be a common event. This model is not run for shuttle working sites as it is assumed that the obstruction would be speedily removed.

This sub model is run twice once for breakdown and once for accidents. The sub model assumes that breakdowns occur at a rate shown in Table 37 below. Accident Rates were tabled earlier in Section 4.2.

Table 37 Breakdown Rates

Default Breakdown Rates QUADRO	
Vehicle Type	**Rate (vkm)**
Light	10 per 10^6
Heavy	5 per 10^6

5.4 TRAFFIC input

5.4.1 Network and Route Type Description

For each of the work sites certain characteristics are required by QUADRO including the length of the works site, adjoining sections up and downstream of the site (both directions) and the diversion route.

For the purpose of this Cost Benefit Analysis the diversion length is not modelled as the maximum queue delay method has been used.

The main route is considered to be consistent along its length and no flow variations. A road class is specified as shown on Table 38 below to calculate a speed/flow relationship with default values shown on Table 39 and 40.

For each road class the user is able to input geometric parameters such as road width, hilliness, accesses along route, visibility, for the purpose of this Cost Benefit Analysis, typical values have been applied as set out in Table 41 below. The work site type is defined by the number of lanes open or shuttle working as shown on Table 42 below that selects a default capacity.

QUADRO contains values for average duration of incidents and are shown on Table 43 below.

Table 38 Road Classes

QUADRO Road Classes	
Road Class	**Description**
Class 1	Rural single carriageway
Class 2	Rural all-purpose dual 2 lane carriageway
Class 3	Rural all-purpose dual 3 or more lane carriageway
Class 4	Motorway (urban or rural), dual 2 lanes
Class 5	Motorway (urban or rural), dual 4 or more lanes
Class 6	Motorway (urban or rural), dual 3 lanes
Class 7	Urban road, Central, single or dual carriageway
Class 8	Urban road, Non-central, single or dual carriageway
Class 9	Small town road, single or dual carriageway
Class 10	Suburban Main Road, single carriageway
Class 11	Suburban Main Road, dual carriageway

Table 39 Minimum Speeds

Default minimum speeds QUADRO	
Road Class	**Minimum speed (kph)**
Classes 1 to 6	45
Class 7	25
Class 8	15
Class 9	30
Class 10	25
Class 11	35

Table 40 Speed/Flow

Default Speed/flow Parameters QUADRO									
CLASS	LIGHT-V (kph) Kph	GRAD-A reduction (kph) per 1000 veh	GRAD-B reduction (kph) per 1000 veh	HEAVY-V kph	GRAD-A reduction (kph) per 1000 veh	GRAD-B reduction (kph) per 1000 veh	CHANGE Factor or vph per lane	MINS kph	Qc vph per lane
1	72.1	15	50	78.2	5.2	5.2	1920	45	2400
2	108	6	33	86	0	0	1080	45	2100
3	115	6	33	86	0	0	1080	45	2100
7	64.5	30	30	64.5	30	30		25	800
8	39.5	30	30	39.5	30	30		15	800

Table 41 Geometric Parameters

Default Geometric Parameters QUADRO												
CLASS	TYPE	DESCRIPTION	CWID	HILLS	DEVEL	INT	BEND	MAXS	SWID	VWID	JUNC	VIS
1	RURAL	Single Carriageway	7.3	15			75	96	0	1	0.6	200
2	RURAL	Dual 2 lanes	14.6	15			30	113				
3	RURAL	Dual 3 lanes	22	15			30	113				
7	URBAN	Non-central	10	15	70							
8	URBAN	Central	11	15		4.5						

Table 42 Work Types

QUADRO Work Types	
Works Type	**Description**
0	No lanes open in this direction
1	One lane open in this direction
2	Two lanes open in this direction
3	Three lanes open in this direction
4	Four lanes open in this direction
5	Five lanes open in this direction
9	Shuttle working
add 10	if layout features contra-flow working

Table 43 Incident Duration

Default Breakdown and Accident Durations in QUADRO		
Type of Road	**Breakdown Duration (mins)**	**Accident Duration (mins)**
Motorway	25	30
Single and Dual AP	40	45

5.4.2 Variation in Traffic Flow

Traffic flows vary by hour, day, week and month and different type of vehicles.

QUADRO calculates user costs daily and normally for a 7 day week using the four day types. For the purpose of this Cost Benefit Analysis AADT flows have been used and QUADRO converts this to Annual Average Hourly Traffic (AAHT) to generate an hourly flow profile.

The QUADRO model uses directional flow as each direction is modelled separately.

Two-way input flows are split by tidal behaviour for example the direction into town in the morning peak and the direction is specified by the user.

5.4.3 Vehicles in Work Time and Vehicle Occupancies

QUADRO considers the disaggregation of time spent in work and non-work mode for each vehicle type.

The National Travel Survey (NTS) showed the average car mileage in work mode, commuting mode and non-working mode and are further disaggregated by average hourly percentages.

Averages for weekdays and weekends, vehicles and journey types are shown on Table 44 below.

Table 44 WebTAG – Trip Proportions

Table A 1.3.4:		Proportion of travel in work and non-work time							Proportion of trips made in work and non-work time						
Mode / Vehicle Type & Journey Purpose		Weekday 7am – 10am	Weekday 10am – 4pm	Weekday 4pm – 7pm	Weekday 7pm – 7am	Weekday Average	Weekend Average	All Week Average	Weekday 7am – 10am	Weekday 10am – 4pm	Weekday 4pm – 7pm	Weekday 7pm – 7am	Weekday Average	Weekend Average	All Week Average
		Percentage of Distance Travelled by Vehicles							Percentage of Vehicle Trips						
Car	Work	18.1	19.9	13.0	12.3	16.4	3.2	13.1	6.8	8.3	5.5	3.6	6.5	1.7	5.0
	Commuting	46.0	11.4	40.8	36.2	31.0	8.5	25.3	40.6	11.6	32.3	26.4	25.4	9.1	20.3
	Other	35.9	68.7	46.2	51.5	52.5	88.3	61.6	52.7	80.1	62.2	70.0	68.1	89.3	74.7
LGV	Work (freight)	88.0	88.0	88.0	88.0	88.0	88.0	88.0	88.0	88.0	88.0	88.0	88.0	88.0	88.0
	Non – Work	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
OGV1	Work	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
OGV2	Work	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
		Percentage of Distance Travelled by Occupants							Percentage of Person Trips						
Car	Work	15.4	13.8	10.2	9.9	12.6	2.0	9.2	5.2	2.2	4.1	1.2	4.7	1.1	3.4
	Commuting	38.3	8.1	32.2	29.1	23.9	5.1	18.0	33.3	15.6	25.8	10.9	20.0	6.4	15.2
	Other	46.4	78.1	57.6	61.0	63.5	92.9	72.7	61.5	82.2	70.1	87.9	75.3	92.5	81.4
PSV	Work	3.9	2.0	3.9	5.7	3.4	1.5	2.9	1.5	1.2	1.8	2.6	1.5	1.0	1.4
	Commuting	30.0	11.1	36.6	38.1	25.5	6.4	20.5	41.7	10.6	43.0	47.4	26.9	12.4	24.3
	Other	66.1	86.9	59.5	56.2	71.1	92.0	76.6	56.8	88.2	55.2	50.0	71.5	86.6	74.3

5.5 Site specific quadro input data

5.5.1 Sample Site Data

The 67 sites shown on Tables 16 and 21 showed a good spread of data over the Central Bedfordshire network.

For each site, data files were created and works were run for the site lengths carried out with the Halcrow Study 10, 30, 50, 100 and 200 metres.

In total 335 outputs were created and are provided in Appendix A. The Daily Cost of all sites was averaged for Rural and Urban roads by RC and excavation length and is shown on Table 45 and 46 below.

The number of samples used for the Cost Benefit Analysis is required to be proportioned to the actual number of works and statistically confident in the data.

The number of samples used for each work type are shown on Table 47 below with the percentages matching the proportions of actual works shown in Table 10. This has been statistically verified at a 95% confidence level with a confidence interval of 5%. A confidence interval within +/- 5% is considered to be reliable.

The samples used for the Cost Benefit Analysis were selected by ranking the 67 sites by impact and making the average cost of sites selected equal the mean. The sample sites were also proportioned by excavation length so that the percentages match the Halcrow study and are shown on Table 46 below.

The sample sites average duration for each work type was matched to the Halcrow Study as shown in Table 11. For example, for Major Works the average duration was 33 days, duration were run between 41 and 23 days and compares to values in the Halcrow Study. High and Low cost forecasts were derived, for High the highest duration of days was applied to the highest ranking site by impact, for Low the highest duration of days was applied to the lowest ranking site by impact. The average of the two forecasts was used to obtain the Total Delay of Works. Summarised impacts are provided in Appendix B.

Table 45 Central Bedfordshire Delay Modelling Daily Cost of Rural Works

Central Bedfordshire							
Daily Cost of Rural Street Works (£) by Reinstatement Category and Length							
Reinstatement Category	Typical AADT	Average AADT	10m	30m	50m	100m	200m
0	<32,000	45,986	13,777	13,841	13,971	14,250	14,776
1	16,000	18,236	25,979	25,989	30,151	36,265	42,154
2	12,000	12,751	2,372	2,375	4,137	8,660	14,858
3	8,000	5,881	147	147	243	478	924
4	4,000	2,348	52	52	86	169	328

Table 46 Central Bedfordshire Delay Modelling Daily Cost of Urban Works

Central Bedfordshire							
Daily Cost of Urban Street Works (£) by Reinstatement Category and Length							
Reinstatement Category	Typical AADT	Average AADT	10m	30m	50m	100m	200m
0	40,000	N/A	N/A	N/A	N/A	N/A	N/A
1	24,000	17,921	25,818	25,826	29,730	38,501	50,840
2	16,000	9,869	261	261	431	876	1,769
3	10,000	11,809	332	332	547	1,094	2,417
4	6,000	1,955	42	42	69	135	262

Table 47 Central Bedfordshire Work Samples

Central Bedfordshire Street Work Samples				
Work Type	RC 0-2		RC 3-4	
	Sample Size	%	Sample Size	%
Major	6	2%	10	3%
Standard	49	15%	62	17%
Minor with Exc	174	55%	186	52%
Minor without Exc	10	3%	3	1%
Urgent	58	18%	79	22%
Emergency	19	6%	19	5%
Totals	**316**		**360**	

Table 48 Central Bedfordshire Delay Modelling Percentage of Works by RC and Excavation Length

Central Bedfordshire CBA Percentages of Works by RC and Excavation Length							
RC		10m	30m	50m	100m	200m	Total Samples
RC 0-2	Sample Nos	269	2	16	13	16	316
	Sample %	85.1%	0.6%	5.1%	4.1%	5.1%	
	Halcrow Study %	84.7%	0.7%	5.2%	4.2%	5.2%	
RC 3-4	Sample Nos	311	19	12	9	8	360
	Sample %	86.4%	5.3%	3.3%	2.5%	2.2%	
	Halcrow Study %	86.8%	5.2%	3.2%	2.6%	2.1%	

5.6 Monetized Costs and Benefits

The socio-economic benefits derived from a 5% and 10% Permit Scheme reduction are shown for the opening year in summary on Table 49.

The statutory guidance on reliability benefits achieved from a reduction in the variability in travel times for road users is provided by WebTAG Unit 3.5.7, which recommends a mark-up on travel time-savings for urban roads of between 10% to 20%.

Recent research from Transport for London (TfL) GPS data for inner and central London estimated an uplift figure of 22% for changes in the mean journey time (Modelling journey time variability to assist in designing a journey time variability performance indicator for the transport for London Road Network, Jonathan Turner 2008). This supports the use of the upper end value of 20% for this study and is included as a reliability adjustment in the monetized costs and benefits.

The User Benefits are proportioned between consumer and business users for Vehicle Operating Cost and Travel Time Cost.

The QUADRO rates demonstrate much higher incidents of accidents within road works. The introduction of the Permit Scheme will bring about a proportionate reduction in road works, which will lead to accident cost savings.

Table 49 Central Bedfordshire Monetized Costs and Benefits

Central Bedfordshire Sample Sites QUADRO Results Summary			
Delay Modelling Totals			
	Total Impact	**Consumer Vehicle Operating Cost**	**Consumer Travel Time Cost**
High	£ 98,284,411	£ 3,611,137	£ 49,569,491
Low	£ 74,336,860	£ 2,708,351	£ 37,431,072
Average	£ 86,310,635	£ 3,159,744	£ 43,500,282
Cost Saving 5%	£ 4,315,532	£ 157,987	£ 2,175,014
Cost Saving 10%	£ 8,631,064	£ 315,974	£ 4,350,028
	Business Vehicle Operating Cost	**Business Travel Time Total**	**PSP Bus & Coach Operating Cost**
High	£ 1,825,081	£ 41,477,147	£ 254,385
Low	£ 1,369,066	£ 31,342,271	£ 196,680
Average	£ 1,597,073	£ 36,409,709	£ 225,533
Cost Saving 5%	£ 79,854	£ 1,820,485	£ 11,277
Cost Saving 10%	£ 159,707	£ 3,640,971	£ 22,553
	Total Business	**Accident Cost**	**Carbon**
High	£ 43,556,613	£ 1,369,431	£ 667,083
Low	£ 32,908,017	£ 1,155,071	£ 501,942
Average	£ 38,232,315	£ 1,262,251	£ 584,512
Cost Saving 5%	£ 1,911,616	£ 63,113	£ 29,226
Cost Saving 10%	£ 3,823,232	£ 126,225	£ 58,451

6 PERMIT SCHEME OPERATION

6.1 Introduction

This section assesses the process tasks required to establish and operate the Central Bedfordshire Permit Scheme. It will consist of the following sections:

- Fees Matrix, presentation of anticipated Permit applications by type
- Scheme Costs, presentation of staff costs associated with the level of Permit variations

6.2 Fees Matrix

The fees matrix is a DfT prescribed format for presenting the volume and type of Permit applications and anticipated variations. The estimated number of Permits by type was provided by Central Bedfordshire Council and is shown on Table 50 below. The Fees Matrix is attached in Appendix C.

Table 50 Utility Permit Volume before Scheme opening

Central Bedfordshire Notice Volumes						
Work Type	**RC 0-2**		**RC 3-4**		**Total Volume**	
	Number	**%**	**Number**	**%**	**Number**	**%**
Major	34	2%	152	3%	186	3%
Standard	277	15%	964	17%	1,241	17%
Minor with Exc	984	55%	2,891	52%	3,875	52%
Minor without Exc	58	3%	53	1%	111	2%
Urgent	331	18%	1,231	22%	1,562	21%
Special Urgent	-	0%	-	0%	-	0%
Emergency	108	6%	302	5%	410	6%
Totals	1,792	24%	5,593	76%	7,385	

The Utility Permit volumes by road categories are shown in Table 51 and Table 52 and with costings based upon statutory fee rates outlined in Table 8.

Table 51 Permit Volume on Category 0-2 roads

Total Permit Scheme Cost					
Activity Type	**Estimated No. of Permits**	**Cost per Permit**	**Estimated No. of Permit Variations**	**Cost per Permit Variation**	**Total Cost per Activity Type**
Provisional Advance Authorisation	41	124	N/A	N/A	5,084
Major	47	231	10	45	11,307
Standard	338	147	34	45	51,216
Minor	1,128	81	57	45	93,933
Immediate	466	61	24	45	29,506
Sub Total	2,020	N/A	125	45	191,046

Table 52 Permit Volume on Category 3-4 roads

Category 3-4 Non-Traffic Sensitive Streets					
Activity Type	**Estimated No. of Permits**	**Cost per Permit**	**Estimated No. of Permit Variations**	**Cost per Permit Variation**	**Total Cost per Activity Type**
Provisional Advance Authorisation	182	93	N/A	N/A	16,914
Major	160	158	32	35	26,267
Standard	998	65	100	35	68,882
Minor	3,090	32	155	35	105,265
Immediate	1,600	39	80	35	65,435
Sub Total	6,030	N/A	366	35	282,763

Permit fees are excluded from Public Accounts reporting in line with the DfT guidance. The volume of Utility Permit by road type will fall by 5% across all road types.

6.3 Scheme Costs

There are two elements to the Permit Scheme costs:

- Start-up costs; and
- Ongoing costs.

6.3.1 Start-up costs

The one-off costs required to establish the Permit Scheme were set at £85,000 by Central Bedfordshire Council. See Table 53 below.

Table 53 Scheme set up costs

Scheme Set-up Costs		
Start up Cost Centre	**Set-up (recovered from future fees)**	**Year 1 +**
Consultancy	£45,000	
KPI Production		£30,000
Permit Scheme Invoicing		£35,000
IT system/support & Capital Expenditure Adjustment	£15,000	£5,000
Unauthorised / Abandoned works		£30,000
Management Overhead		£20,000
Training	£15,000	£10,000
Staff	£10,000	
Set-up costs recovery (3 years)		£28,000
Totals	**£85,000**	**£158,000**

The 'IT Capital expenditure adjustment' is a provision calculated by applying the 'risk bias factor' outlined in section 4.4 to the purchase of the IT system. The operational policy outlined in Table 9 that proposed that no costs associated with the implementation of the Scheme will be carried on to future years and that that all set up costs are incurred in the month before the Permit Scheme becomes operational.

1.1.1 Operational costs

The Permit Scheme required three specific job roles:

- Street Works Officers;
- Street Works Co-ordinators; and
- Traffic Managers.

The overall staffing costs of Permit Scheme operation are based on information from Central Bedfordshire Council and statutory rates and are outlined in Table 54.

Table 54 Staff Costing

Staff Costing			
Personnel Type	**Annual Salary**	**Final Hourly Rate**	**Total Annual Cost**
Street Works Officer	£ 24,931	£ 25.55	£ 42,931.18
Street Works Co-ordinator	£ 34,050	£ 34.90	£ 58,634.10
Traffic Manager	£ 43,852	£ 44.95	£ 75,513.14

National Insurance (%)	9
Pension (superannuation) (%)	14
Working hours/annum	1680
Employee Overhead Rate	1.4

The breakdown of costing per task for each of the three grades of Permit Scheme workers is shown in Table 55 below.

Table 55 Breakdown of Employer Costing per Permit Task

Employee Costing per Permit Task						
Category 0-2 and Traffic Sensitive Streets						
Street Works Officers						
	PAA	**Major**	**Standard**	**Minor**	**Immediate**	**TOTAL**
Hours per Permit	0.68	1.46	1.06	0.64	0.51	4.35
Total Permits	41	47	338	1128	466	2020
Total Hours	28	69	359	723	238	8796
No. of Posts Required	0.02	0.04	0.21	0.43	0.14	0.84
Employee Costs	£710	£1,756	£9,184	£18,472	£6,083	£36,205
Street Works Co-ordinators						
	PAA	**Major**	**Standard**	**Minor**	**Immediate**	**TOTAL**
Hours per Permit	1.27	2.10	1.55	0.56	0.56	6.05
Total Permits	41	47	338	1128	466	2020
Total Hours	52	99	523	635	262	12212
No. of Posts Required	0.03	0.06	0.31	0.38	0.16	0.94
Employee Costs	£1,821	£3,446	£18,241	£22,161	£9,155	£54,824
Traffic Managers						
	PAA	**Major**	**Standard**	**Minor**	**Immediate**	**TOTAL**
Hours per Permit	0.49	1.02	0.42	0.19	0.19	2.31
Total Permits	41	47	338	1128	466	2020
Total Hours	20	48	141	218	87	4672
No. of Posts Required	0.01	0.03	0.08	0.13	0.05	0.31
Employee Costs	£907	£2,159	£6,354	£9,784	£3,924	£23,128
Category 3-4 Non-Traffic Sensitive Streets						
Street Works Officers						
	PAA	**Major**	**Standard**	**Minor**	**Immediate**	**TOTAL**
Hours per Permit	0.62	0.94	0.52	0.36	0.45	2.89
Total Permits	182	160	998	3090	1600	6030
Total Hours	113	151	522	1112	714	17437
No. of Posts Required	0.07	0.09	0.31	0.66	0.43	1.55
Employee Costs	£2,882	£3,851	£13,331	£28,427	£18,258	£66,748

Street Works Co-ordinators						
	PAA	**Major**	**Standard**	**Minor**	**Immediate**	**TOTAL**
Hours per Permit	0.89	1.50	0.59	0.30	0.37	3.64
Total Permits	182	160	998	3090	1600	6030
Total Hours	162	239	588	930	588	21969
No. of Posts Required	0.10	0.14	0.35	0.55	0.35	1.49

Employee Costs	£5,666	£8,332	£20,530	£32,443	£20,517	£87,488

Traffic Managers						
	PAA	**Major**	**Standard**	**Minor**	**Immediate**	**TOTAL**
Hours per Permit	0.36	0.69	0.24	0.05	0.05	1.39
Total Permits	182	160	998	3090	1600	6030
Total Hours	66	110	236	157	85	8372
No. of Posts Required	0.04	0.07	0.14	0.09	0.05	0.39
Employee Costs	£2,958	£4,926	£10,621	£7,060	£3,835	£29,400

The overall costs associated with the operation of the Permit Scheme are summarised in Table 56 below.

Table 56 Staff costing summary

Total Number of Employees and Costs		
Personnel Type	**No.**	**Salaries**
Street Works Officers	2.40	£102,954
Street Works Co-ordinators	2.43	£142,312
Traffic Managers	0.70	£52,528
TOTAL	**5.52**	**£297,793**

With the addition of a provision for the cost of Permit variations, the final Permit Scheme cost is shown in Table 57.

Table 57 Permit Scheme costing summary

Permit Scheme Cost Breakdown	
Cost Type	**Cost**
Permit Application Employee Costs	£297,793
Permit Application Operational Factor Costs	£139,963
Total Permit Application Costs	£437,756

Permit Variation Employee Costs	£9,775
Permit Variation Operational Factor Costs	£8,668
Total Permit Variation Application Costs	£18,443

TOTAL PERMIT SCHEME COSTS	**£456,199**

7 FINANCIAL CALCULATIONS

7.1 Introduction

This section will present the calculation of financial benefits for the statutory outputs:

- Public Accounts - Local Government Funding
- Public Accounts - Central Government Funding
- Transport Economic Efficiency
- Monetized Costs and Benefits

The calculations will be presented for the opening year and for the 25-year Scheme horizon, and will be discounted where required.

7.2 Public Accounts - Local Government Funding

The Local Government public account reporting has the following categories:

- Revenue
- For the purposes of this Cost Benefit Analysis, the Permit fee income is calculated by the multiplication of the estimated Permit fee volume and the average Permit fee, which is derived using the maximum permit fee structure as shown on Table 8. The full cost of the Scheme in the opening year is comprised of the set up costs and the Scheme operating costs summarized in Tables 58 and 64. The average cost-recovery price of Permits is generated by dividing the total cost in the opening year by the estimated number of Permit volumes at the start of the year. The number of Permits in the opening month is a monthly pro-rata value based upon the estimated number of Permits in the opening year along with the 20% uplift for phased works. The Permit Scheme is scheduled to become fully operational in the opening month of the opening year of the assessment and from the second and subsequent months, the 5% reduction in Permit volume will come into effect.
- Operating costs
- Investment costs
- Developer and other contributions
- Grant / subsidy payments

7.2.1 Revenue

For the purposes of this Cost Benefit Analysis, the Permit fee income is calculated by the multiplication of the estimated Permit fee volume and the average Permit fee, which is derived using the maximum permit fee structure as shown on Table 8. The full cost of the Scheme in the opening year is comprised of the set up costs and the Scheme operating costs summarized in Tables 58 and 64. The average cost-recovery price of Permits is generated by dividing the total cost in the opening year by the estimated number of Permit volumes at the start of the year. The number of Permits in the opening month is a monthly pro-rata value based upon the estimated number of Permits in the opening year along with the 20% uplift for phased works. The Permit Scheme is scheduled to become fully operational in the opening month of the opening year of the assessment and from the second and subsequent months, the 5% reduction in Permit volume will come into effect.

7.2.2 Operating costs

The operating costs for the Scheme are comprised of:

- Staff and operation costs;
- Asset maintenance costs; and

- Unrecoverable fees

No provision has been made for on-going asset maintenance of the Permit Scheme.

The Operational Costs of £39,167 in the first month are a pro-rata apportionment of the opening year total of £465,993 contained within Tables 58 and 64.

It has been assumed (Table 7 Model Variable specification) that half of the percentage reduction in Permit volume would be applied to the Scheme costs giving a 2.5% reduction. The full reduction is applied for costs starting in the second year, with a pro-rata increase throughout the opening year.

Non recoverable costs for Highway permits for the Council's on schemes has been included as an administration charge and is carried out by a Highway Administrative Officer based on approximately 5 minute extra administrative time for each work requiring a permit:

Salary - £18,500 per annum and 1,628 hours worked per year.

With pensions and overheads etc this equates to £22 per hour.

£22 / 60mins x 5mins = £1.83 of cost per Permit Application.

Financial calculations for year 2 to 25 are shown on Table 60 to 63 (5% saving) and 66 to 69 (10% saving).

Table 58 Financial Calculations 5% Reduction in Works Annual Cost

Central Bedfordshire Financial Calculations 5% Reduction in Street Works											
	Opening	Closing Values									
Annual Cost of Permit Scheme - Closing Values	Year-0	Year-1	Year-2	Year-3	Year-4	Year-5	Year-6	Year-7	Year-8	Year-9	Year-10
Reduction Factor less Permit flex		2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
Permit Costs	456,199	444,794	444,794	444,794	444,794	444,794	444,794	444,794	444,794	444,794	444,794
Recovery of Set-up Costs	85,000	28,333	28,333	28,333							
Annual Cost For Recovery		479,568	473,128	473,128	444,794	444,794	444,794	444,794	444,794	444,794	444,794
Cost Recovery Price Permit fee income		449,372	485,624	444,794	444,794	444,794	444,794	444,794	444,794	444,794	444,794
Cost Recovery Price Permit fee income (prior year data)		59	67	57	62	58	58	58	58	58	58
(Over) / under-recovery £		30,196	-12,496	28,333	-	-	-	-	-	-	-
(Over) / under-recovery £ (prior year)	-	30,196	-12,496	28,333	-	-	-	-	-	-	-
Annual Cost Highway permits (non recoverable)	14,758	14,758	14,020	14,020	14,020	14,020	14,020	14,020	14,020	14,020	14,020
Annual Income Max Permit Fee	494,782	483,444	482,413	482,413	482,413	482,413	482,413	482,413	482,413	482,413	482,413
Overall Scheme Cost	470,958	518,082	432,298	473,128	444,794	444,794	444,794	444,794	444,794	444,794	444,794
Profit/Loss	23,825	-34,638	50,114	9,285	37,618	37,618	37,618	37,618	37,618	37,618	37,618

Table 59 Financial Calculations 5% Reduction in Works First Year Cost

Financial Calculations 5% Reduction in Street Works	Year	Year-1											
Annual Cost of Permit Scheme - Closing Values	**Month**	**Month-1**	**Month-2**	**Month-3**	**Month-4**	**Month-5**	**Month-6**	**Month-7**	**Month-8**	**Month-9**	**Month-10**	**Month-11**	**Month-12**
Permit Cost	38,017	37,937	37,865	37,798	37,737	37,681	37,630	37,583	37,540	37,501	37,464	37,431	37,066
Permit Volumes	-	671	637	637	637	637	637	637	637	637	637	637	637
Cost Recovery Price Permit fee income	-	58.50	58.50	58.50	58.50	58.50	58.50	58.50	58.50	58.50	58.50	58.50	58.50
Multiplied by number of Permits	-	39,246	37,284	37,284	37,284	37,284	37,284	37,284	37,284	37,284	37,284	37,284	37,284
Income derived on Cost recovery basis	-	39,246	37,284	37,284	37,284	37,284	37,284	37,284	37,284	37,284	37,284	37,284	37,284
Cost Highway permits (non recoverable)	1,230	1,230	1,230	1,230	1,230	1,230	1,230	1,230	1,230	1,230	1,230	1,230	1,230
Income derived from Max Permit Fee	41,232	41,232	40,201	40,201	40,201	40,201	40,201	40,201	40,201	40,201	40,201	40,201	40,201
Permit Scheme - Operational Costs		-39,167	-39,095	-39,028	-38,967	-38,911	-38,860	-38,813	-38,770	-38,730	-38,694	-38,661	-38,296

Table 60 Financial Calculations 5% Reduction in Works Second Year Cost

Financial Calculations 5% Reduction in Street Works	Year	Year-2											
Annual Cost of Permit Scheme - Closing Values	Month	Month -1	Month -2	Month -3	Month -4	Month -5	Month -6	Month -7	Month -8	Month -9	Month -10	Month -11	Month -12
Permit Cost	-	37,066	37,066	37,066	37,066	37,066	37,066	37,066	37,066	37,066	37,066	37,066	37,066
Permit Volumes	-	637	637	637	637	637	637	637	637	637	637	637	637
Cost Recovery Price Permit fee income	-	67.45	67.45	67.45	67.45	67.45	67.45	67.45	67.45	67.45	67.45	67.45	67.45
Multiplied by number of Permits	-	42,985	42,985	42,985	42,985	42,985	42,985	42,985	42,985	42,985	42,985	42,985	42,985
Income derived on Cost recovery basis	-	42,985	42,985	42,985	42,985	42,985	42,985	42,985	42,985	42,985	42,985	42,985	42,985
Cost Highway permits (non recoverable)	1,230	1,230	1,230	1,230	1,230	1,230	1,230	1,230	1,230	1,230	1,230	1,230	1,230
Income derived from Max Permit Fee	40,201	40,201	40,201	40,201	40,201	40,201	40,201	40,201	40,201	40,201	40,201	40,201	40,201
Permit Scheme - Operational Costs	-	-38,296	-38,296	-38,296	-38,296	-38,296	-38,296	-38,296	-38,296	-38,296	-38,296	-38,296	-38,296

Table 61 Financial Calculations 5% Reduction in Works Third Year Cost

Financial Calculations 5% Reduction in Street Works	Year	Year-3											
Annual Cost of Permit Scheme - Closing Values	Month	Month -1	Month -2	Month -3	Month -4	Month -5	Month -6	Month -7	Month -8	Month -9	Month -10	Month -11	Month -12
Permit Cost	-	37,066	37,066	37,066	37,066	37,066	37,066	37,066	37,066	37,066	37,066	37,066	37,066
Permit Volumes	-	637	637	637	637	637	637	637	637	637	637	637	637
Cost Recovery Price Permit fee income	-	56.53	56.53	56.53	56.53	56.53	56.53	56.53	56.53	56.53	56.53	56.53	56.53
Multiplied by number of Permits	-	36,025	36,025	36,025	36,025	36,025	36,025	36,025	36,025	36,025	36,025	36,025	36,025
Income derived on Cost recovery basis	-	36,025	36,025	36,025	36,025	36,025	36,025	36,025	36,025	36,025	36,025	36,025	36,025
Cost Highway permits (non recoverable)	1,230	1,230	1,230	1,230	1,230	1,230	1,230	1,230	1,230	1,230	1,230	1,230	1,230
Income derived from Max Permit Fee	-	40,201	40,201	40,201	40,201	40,201	40,201	40,201	40,201	40,201	40,201	40,201	40,201
Permit Scheme - Operational Costs	-	- 38,296	- 38,296	- 38,296	- 38,296	- 38,296	- 38,296	- 38,296	- 38,296	- 38,296	- 38,296	- 38,296	- 38,296

Table 62 Financial Calculations 5% Reduction in Works 4-14 Year Cost

Financial Calculations 5% Reduction in Street Works	Year	Year-4	Year-5	Year-6	Year-7	Year-8	Year-9	Year-10	Year-11	Year-12	Year-13	Year-14
Annual Cost of Permit Scheme - Closing Values												
Permit Cost	-	444,794	444,794	444,794	444,794	444,794	444,794	444,794	444,794	444,794	444,794	444,794
Permit Volumes	-	7,648	7,648	7,648	7,648	7,648	7,648	7,648	7,648	7,648	7,648	7,648
Cost Recovery Price Permit fee income	-	61.87	58.16	58.16	58.16	58.16	58.16	58.16	58.16	58.16	58.16	58.16
Multiplied by number of Permits	-	473,128	444,794	444,794	444,794	444,794	444,794	444,794	444,794	444,794	444,794	444,794
Income derived on Cost recovery basis	-	473,128	444,794	444,794	444,794	444,794	444,794	444,794	444,794	444,794	444,794	444,794
Cost Highway permits (non recoverable)	-	14,020	14,020	14,020	14,020	14,020	14,020	14,020	14,020	14,020	14,020	14,020
Income derived from Max Permit Fee	-	482,413	482,413	482,413	482,413	482,413	482,413	482,413	482,413	482,413	482,413	482,413
Permit Scheme - Operational Costs		-458,815	-458,815	-458,815	-458,815	-458,815	-458,815	-458,815	-458,815	-458,815	-458,815	-458,815

Table 63 Financial Calculations 5% Reduction in Works 15-25 Year Cost

Financial Calculations 5% Reduction in Street Works	Year	Year-15	Year-16	Year-17	Year-18	Year-19	Year-20	Year-21	Year-22	Year-23	Year-24	Year-25
Annual Cost of Permit Scheme - Closing Values												
Permit Cost	-	444,794	444,794	444,794	444,794	444,794	444,794	444,794	444,794	444,794	444,794	444,794
Permit Volumes		7,648	7,648	7,648	7,648	7,648	7,648	7,648	7,648	7,648	7,648	7,648
Cost Recovery Price Permit fee income		58.16	58.16	58.16	58.16	58.16	58.16	58.16	58.16	58.16	58.16	58.16
Multiplied by number of Permits		444,794	444,794	444,794	444,794	444,794	444,794	444,794	444,794	444,794	444,794	444,794
Income derived on Cost recovery basis		444,794	444,794	444,794	444,794	444,794	444,794	444,794	444,794	444,794	444,794	444,794
Cost Highway permits (non recoverable)		14,020	14,020	14,020	14,020	14,020	14,020	14,020	14,020	14,020	14,020	14,020
Income derived from Max Permit Fee		482,413	482,413	482,413	482,413	482,413	482,413	482,413	482,413	482,413	482,413	482,413
Permit Scheme - Operational Costs		- 458,815	- 458,815	- 458,815	- 458,815	- 458,815	- 458,815	- 458,815	- 458,815	- 458,815	- 458,815	- 458,815

Table 64 Financial Calculations 10% Reduction in Works Annual Cost

Central Bedfordshire Financial Calculations 10% Reduction in Street Works											
	Opening	Closing Values									
Annual Cost of Permit Scheme - Closing Values	Year-0	Year-1	Year-2	Year-3	Year-4	Year-5	Year-6	Year-7	Year-8	Year-9	Year-10
Reduction Factor less Permit flex		5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
Permit Costs	456,199	433,389	433,389	433,389	433,389	433,389	433,389	433,389	433,389	433,389	433,389
Recovery of Set-up Costs	85,000	28,333	28,333	28,333	-	-	-	-	-	-	-
Annual Cost For Recovery	-	474,603	461,723	461,723	433,389	433,389	433,389	433,389	433,389	433,389	433,389
Cost Recovery Price Permit fee income	-	427,787	471,680	433,389	433,389	433,389	433,389	433,389	433,389	433,389	433,389
Cost Recovery Price Permit fee income (prior year data)	-	59	72	58	64	60	60	60	60	60	60
(Over) / under-recovery £	-	46,816	-9,957	28,333	-	-	-	-	-	-	-
(Over) / under-recovery £ (prior year)	-	46,816	-9,957	28,333	-	-	-	-	-	-	-
Annual Cost Highway permits (non recoverable)	14,758	14,758	13,283	13,283	13,283	13,283	13,283	13,283	13,283	13,283	13,283
Annual Income Max Permit Fee	494,782	472,105	470,043	470,043	470,043	470,043	470,043	470,043	470,043	470,043	470,043
Overall Scheme Cost	470,958	523,297	423,432	461,723	433,389	433,389	433,389	433,389	433,389	433,389	433,389
Profit/Loss	23,825	-51,192	46,611	8,321	36,654	36,654	36,654	36,654	36,654	36,654	36,654

Table 65 Financial Calculations 10% Reduction in Works First Year Cost

Financial Calculations 10% Reduction in Street Works	Year	Year-1											
Annual Cost of Permit Scheme - Closing Values	Month	Month-1	Month-2	Month-3	Month-4	Month-5	Month-6	Month-7	Month-8	Month-9	Month-10	Month-11	Month-12
Permit Cost	38,017	37,858	37,713	37,580	37,458	37,346	37,244	37,150	37,063	36,984	36,912	36,846	36,116
Permit Volumes	-	671	604	604	604	604	604	604	604	604	604	604	604
Cost Recovery Price Permit fee income	-	58.50	58.50	58.50	58.50	58.50	58.50	58.50	58.50	58.50	58.50	58.50	58.50
Multiplied by number of Permits	-	39,246	35,322	35,322	35,322	35,322	35,322	35,322	35,322	35,322	35,322	35,322	35,322
Income derived on Cost recovery basis	-	39,246	35,322	35,322	35,322	35,322	35,322	35,322	35,322	35,322	35,322	35,322	35,322
Cost Highway permits (non recoverable)	1,230	1,230	1,230	1,230	1,230	1,230	1,230	1,230	1,230	1,230	1,230	1,230	1,230
Income derived from Max Permit Fee	41,232	41,232	39,170	39,170	39,170	39,170	39,170	39,170	39,170	39,170	39,170	39,170	39,170
Permit Scheme - Operational Costs	-	- 37,858	- 37,713	- 37,580	- 37,458	- 37,346	- 37,244	- 37,150	- 37,063	- 36,984	- 36,912	- 36,846	- 36,116

Table 66 Financial Calculations 10% Reduction in Works Second Year Cost

Financial Calculations 10% Reduction in Street Works	Year	Year-2											
Annual Cost of Permit Scheme - Closing Values	Month	Month-1	Month-2	Month-3	Month-4	Month-5	Month-6	Month-7	Month-8	Month-9	Month-10	Month-11	Month-12
Permit Cost	-	36,116	36,116	36,116	36,116	36,116	36,116	36,116	36,116	36,116	36,116	36,116	36,116
Permit Volumes	-	604	604	604	604	604	604	604	604	604	604	604	604
Cost Recovery Price Permit fee income	-	71.57	71.57	71.57	71.57	71.57	71.57	71.57	71.57	71.57	71.57	71.57	71.57
Multiplied by number of Permits	-	43,208	43,208	43,208	43,208	43,208	43,208	43,208	43,208	43,208	43,208	43,208	43,208
Income derived on Cost recovery basis	-	43,208	43,208	43,208	43,208	43,208	43,208	43,208	43,208	43,208	43,208	43,208	43,208
Cost Highway permits (non recoverable)	1,230	1,230	1,230	1,230	1,230	1,230	1,230	1,230	1,230	1,230	1,230	1,230	1,230
Income derived from Max Permit Fee	-	39,170	39,170	39,170	39,170	39,170	39,170	39,170	39,170	39,170	39,170	39,170	39,170
Permit Scheme - Operational Costs	-	-36,116	-36,116	-36,116	-36,116	-36,116	-36,116	-36,116	-36,116	-36,116	-36,116	-36,116	-36,116

Table 67 Financial Calculations 10% Reduction in Works Third Year Cost

Financial Calculations 10% Reduction in Street Works	Year	Year-3											
Annual Cost of Permit Scheme - Closing Values	Month	Month-1	Month-2	Month-3	Month-4	Month-5	Month-6	Month-7	Month-8	Month-9	Month-10	Month-11	Month-12
Permit Cost	-	36,116	36,116	36,116	36,116	36,116	36,116	36,116	36,116	36,116	36,116	36,116	36,116
Permit Volumes	-	604	604	604	604	604	604	604	604	604	604	604	604
Cost Recovery Price Permit fee income	-	58.44	58.44	58.44	58.44	58.44	58.44	58.44	58.44	58.44	58.44	58.44	58.44
Multiplied by number of Permits	-	35,286	35,286	35,286	35,286	35,286	35,286	35,286	35,286	35,286	35,286	35,286	35,286
Income derived on Cost recovery basis	-	35,286	35,286	35,286	35,286	35,286	35,286	35,286	35,286	35,286	35,286	35,286	35,286
Cost Highway permits (non recoverable)	1,230	1,230	1,230	1,230	1,230	1,230	1,230	1,230	1,230	1,230	1,230	1,230	1,230
Income derived from Max Permit Fee	-	39,170	39,170	39,170	39,170	39,170	39,170	39,170	39,170	39,170	39,170	39,170	39,170
Permit Scheme - Operational Costs	-	-36,116	-36,116	-36,116	-36,116	-36,116	-36,116	-36,116	-36,116	-36,116	-36,116	-36,116	-36,116

Table 68 Financial Calculations 10% Reduction in Works 4-14 Year Cost

Financial Calculations 10% Reduction in Street Works	Year	Year-4	Year-5	Year-6	Year-7	Year-8	Year-9	Year-10	Year-11	Year-12	Year-13	Year-14
Annual Cost of Permit Scheme - Closing Values												
Permit Cost	-	433,389	433,389	433,389	433,389	433,389	433,389	433,389	433,389	433,389	433,389	433,389
Permit Volumes	-	7,245	7,245	7,245	7,245	7,245	7,245	7,245	7,245	7,245	7,245	7,245
Cost Recovery Price Permit fee income	-	63.73	59.82	59.82	59.82	59.82	59.82	59.82	59.82	59.82	59.82	59.82
Multiplied by number of Permits	-	461,723	433,389	433,389	433,389	433,389	433,389	433,389	433,389	433,389	433,389	433,389
Income derived on Cost recovery basis	-	461,723	433,389	433,389	433,389	433,389	433,389	433,389	433,389	433,389	433,389	433,389
Cost Highway permits (non recoverable)	-	13,283	13,283	13,283	13,283	13,283	13,283	13,283	13,283	13,283	13,283	13,283
Income derived from Max Permit Fee	-	470,043	470,043	470,043	470,043	470,043	470,043	470,043	470,043	470,043	470,043	470,043
Permit Scheme - Operational Costs	-	- 433,389	- 433,389	- 433,389	- 433,389	- 433,389	- 433,389	- 433,389	- 433,389	- 433,389	- 433,389	- 433,389

Table 69 Financial Calculations 10% Reduction in Works 5-25 Year Cost

Financial Calculations 10% Reduction in Street Works	Year	Year-15	Year-16	Year-17	Year-18	Year-19	Year-20	Year-21	Year-22	Year-23	Year-24	Year-25
Annual Cost of Permit Scheme - Closing Values												
Permit Cost	-	433,389	433,389	433,389	433,389	433,389	433,389	433,389	433,389	433,389	433,389	433,389
Permit Volumes	-	7,245	7,245	7,245	7,245	7,245	7,245	7,245	7,245	7,245	7,245	7,245
Cost Recovery Price Permit fee income	-	60	60	60	60	60	60	60	60	60	60	60
Multiplied by number of Permits	-	433,389	433,389	433,389	433,389	433,389	433,389	433,389	433,389	433,389	433,389	433,389
Income derived on Cost recovery basis	-	433,389	433,389	433,389	433,389	433,389	433,389	433,389	433,389	433,389	433,389	433,389
Cost Highway permits (non recoverable)	-	13,283	13,283	13,283	13,283	13,283	13,283	13,283	13,283	13,283	13,283	13,283
Income derived from Max Permit Fee	-	470,043	470,043	470,043	470,043	470,043	470,043	470,043	470,043	470,043	470,043	470,043
Permit Scheme - Operational Costs	-	- 433,389	- 433,389	- 433,389	- 433,389	- 433,389	- 433,389	- 433,389	- 433,389	- 433,389	- 433,389	- 433,389

7.2.3 Investment costs
The investment costs of £85,000 are incurred in the month before the Permit Scheme opening and recovered throughout the opening year through Permit Scheme income. The detailed breakdown of costs is presented in Table 53.

7.2.4 Developer and other contributions
There are no developer or other contributions in the Local Government Public accounts reporting.

7.2.5 Grant / subsidy payments
There are no grant or subsidy payments in the Local Government Public accounts reporting.

7.3 Public Accounts - Central Government Funding
The Central Government public account reporting has the following categories:

- Revenue
- Operating costs
- Investment costs
- Developer and other contributions
- Grant / subsidy payments
- Indirect tax revenues

7.3.1 Revenue
There is no revenue in the Central Government Public accounts reporting.

7.3.2 Operating costs
There are no operating costs in the Central Government Public accounts reporting.

7.3.3 Investment costs
There are no investment costs in the Central Government Public accounts reporting.

7.3.4 Developer and other contributions
There are no developer or other contributions in the Central Government Public accounts reporting.

7.3.5 Grant / subsidy payments
There are no developer or other contributions in the Central Government Public accounts reporting.

7.3.6 Indirect tax revenues
The indirect tax revenue calculation is based upon the loss of fuel taxation revenues to Central Government from the more efficient functioning of the highway network from the reduction in road works.

7.4 Transport Economic Efficiency
The Transport Economic Efficiency (TEE) table reports on user benefits by consumer and business sections for time, fuel and non-fuel vehicle operating impacts.

7.4.1 Consumer User Benefits
The consumer user benefit consists of private car and bus travel time, and vehicle operating costs.

7.4.2 Business User Benefits
The business user benefits are for commercial car travel and private sector providers for Travel time and vehicle operating costs.

8 STATUTORY OUTPUTS

8.1 Introduction

This section presents the statutory outputs required for the Central Bedfordshire Permit Scheme Cost Benefit Analysis.

The results are presented in the opening year and over the 25-year horizon in 2010 prices as advised in WebTAG.

The discounted totals are presented at the bottom of each table. The calculation basis of each category has been presented in Sections 5, 6 and 7.

The statutory outputs consist of three categories:

8.2 Transport Economic Efficiency (TEE)

The TEE table presents the net user benefits of travel time, fuel and non-fuel vehicle operating costs disaggregated by trip purpose between non-business consumers and business users, including transport operators and are below on Tables 70 to 73.

8.3 Public Accounts

The Public Accounts tables show the net impact to Local and Central Government and are below on Tables 74 to 77.

8.4 Cost Benefit Analysis

The items for inclusion in the central case Cost Benefit Analysis BCR and NPV are based upon the guidance specified in Annex C of TMA 2004 Decision-making and development (2nd edition) which specifies:

- Permit Fees are excluded from the Public Accounts table;
- Indirect Taxation is excluded from the Public Accounts table; and
- Permit Fees are not treated as a dis-benefit to business.

Revenue received from Permit Fees has been assumed to be reinvested in the authority and therefore offset in the economic appraisal as a capital cost.

Tables 78 to 81 are below.

8.5 Statutory Cost Benefit Analysis

The study has addressed all aspects of the implementation of the Central Bedfordshire Permit Scheme through both the direct financial and socio-economic criteria to quantify the overall economic merit of the Scheme.

The Scheme has a Benefit Cost Ratio of and Net Present Value of in current prices (2010 prices). The appraisal results demonstrate that the introduction of the Permit Scheme will have a net positive economic benefit.

Table 70 TEE Table 5% Work Saving Year 1

Transport Economic Efficiency (TEE) Table (5% Work Saving) Year 1

Consumers	**ALL MODES**		**ROAD**	**Bus & Coach**	**RAIL**	**Other**
User benefits	**TOTAL**		**Private Cars and LGVs**	**Passengers**	**Passengers**	
Travel time	2,175,014		2,059,167	115,847	-	-
Vehicle operating costs	157,987		157,987			-
User charges	-		-	-	-	-
During Construction & Maintenance	-		-	-	-	-
NET CONSUMER BENEFITS	2,333,001	*-1*	2,217,154	115,847	-	-

Business								
User benefits			**Goods Vehicles**	**Business Cars & LGVs**	**Passengers**	**Freight**	**Passengers**	
Travel time	1,820,485		774,436	1,014,168	31,881	-	-	-
Vehicle operating costs	79,854		60,137	19,717				-
User charges	-		-	-	-	-	-	-
During Construction & Maintenance	-		-	-	-	-	-	-
Subtotal	1,900,339	*-2*	834,573	1,033,885	31,881	-	-	-
Private sector provider impacts						**Freight**	**Passengers**	
Revenue	-				-	-	-	-
Operating costs	11,277				11,277	-	-	-
Investment costs	-				-	-	-	-
Grant/subsidy	-				-	-	-	-
Subtotal	11,277	*-3*			11,277	-		-
Other business impacts								
Developer contributions	-	*-4*	-		-	-	-	-
NET BUSINESS IMPACT	1,911,616	*(5) = (2) + (3) + (4)*						

TOTAL		
Present Value of Transport Economic Efficiency Benefits	4,244,617	*(6) = (1) + (5)*

Notes: Benefits appear as positive numbers, while costs appear as negative numbers. All entries are discounted present values, in 2010 prices and values. All values £s.

Table 71 TEE Table 10% Work Saving Year 1

Transport Economic Efficiency (TEE) Table (10% Work Saving) Year 1

Consumers	**ALL MODES**		**ROAD**	**Bus & Coach**	**RAIL**	**Other**
User benefits	**TOTAL**		**Private Cars and LGVs**	**Passengers**	**Passengers**	
Travel time	4,350,028		4,118,334	231,694	-	-
Vehicle operating costs	120,274		120,274			-
User charges	-		-	-	-	-
During Construction & Maintenance	-		-	-	-	-
NET CONSUMER BENEFITS	4,470,302	*-1*	4,238,608	231,694	-	-

Business								
User benefits			**Goods Vehicles**	**Business Cars & LGVs**	**Passengers**	**Freight**	**Passengers**	
Travel time	3,640,971		1,548,872	2,028,336	63,763	-	-	-
Vehicle operating costs	159,707		120,274	39,434				-
User charges	-		-	-	-	-	-	-
During Construction & Maintenance	-		-	-	-	-	-	-
Subtotal	3,800,678	*-2*	1,669,146	2,067,770	63,763	-	-	-
Private sector provider impacts						**Freight**	**Passengers**	
Revenue	-				-	-	-	-
Operating costs	22,553				22,553	-	-	-
Investment costs	-				-	-	-	-
Grant/subsidy	-				-	-	-	-
Subtotal	22,553	*-3*			22,553	-	-	-
Other business impacts								
Developer contributions	-	*-4*	-		-	-	-	-
NET BUSINESS IMPACT	3,823,232	*(5) = (2) + (3) + (4)*						

TOTAL		
Present Value of Transport Economic Efficiency Benefits	8,293,533	*(6) = (1) + (5)*

Notes: Benefits appear as positive numbers, while costs appear as negative numbers. All entries are discounted present values, in 2010 prices and values. All values in £s.

Table 72 TEE Table 5% Work Saving 25 Years

Transport Economic Efficiency (TEE) Table (5% Work Saving) 25 Years

Consumers	**ALL MODES**		**ROAD**	**Bus & Coach**	**RAIL**	**Other**
User benefits	**TOTAL**		**Private Cars and LGVs**	**Passengers**	**Passengers**	
Travel time	54,375,352		51,479,176	2,896,176	-	-
Vehicle operating costs	3,949,680		3,949,680			-
User charges	-		-	-	-	-
During Construction & Maintenance	-		-	-	-	-
NET CONSUMER BENEFITS	58,325,032	*-1*	55,428,856	2,896,176	-	-

Business								
User benefits			**Goods Vehicles**	**Business Cars & LGVs**	**Passengers**	**Freight**	**Passengers**	
Travel time	45,512,136		19,360,901	25,354,204	797,032	-	-	-
Vehicle operating costs	1,996,342		1,503,422	492,920				-
User charges	-		-	-	-	-	-	-
During Construction & Maintenance	-		-	-	-	-	-	-
Subtotal	47,508,478	*-2*	20,864,323	25,847,123	797,032	-	-	-
						Freight	**Passengers**	
Revenue	-				-	-	-	-
Operating costs	281,916				281,916	-	-	-
Investment costs					-	-	-	-
Grant/subsidy					-	-	-	-
Subtotal	281,916	*-3*			281,916	-	-	-
Developer contributions	-	*-4*	-		-	-	-	-
NET BUSINESS IMPACT	47,790,394	*(5) = (2) + (3) + (4)*						

TOTAL

Present Value of Transport Economic Efficiency Benefits	106,115,426	*(6) = (1) + (5)*

Notes: Benefits appear as positive numbers, while costs appear as negative numbers. All entries are discounted present values, in 2010 prices and values. All values in £s.

Table 73 TEE Table 10% Work Saving 25 Years

Transport Economic Efficiency (TEE) Table (10% Work Saving) 25 Years

Consumers	**ALL MODES**		**ROAD**	**Bus & Coach**	**RAIL**	**Other**
User benefits	**TOTAL**		**Private Cars and LGVs**	**Passengers**	**Passengers**	
Travel time	108,750,704		102,958,352	5,792,352	-	-
Vehicle operating costs	3,006,844		3,006,844			-
User charges	-		-	-	-	-
During Construction & Maintenance	-		-	-	-	-
NET CONSUMER BENEFITS	111,757,548	*-1*	105,965,195	5,792,352	-	-

Business								
User benefits			**Goods Vehicles**	**Business Cars & LGVs**	**Passengers**	**Freight**	**Passengers**	
Travel time	91,024,273		38,721,802	50,708,408	1,594,064	-	-	-
Vehicle operating costs	3,992,683		3,006,844	985,839				-
User charges	-		-	-	-	-	-	-
During Construction & Maintenance	-		-	-	-	-	-	-
Subtotal	95,016,956	*-2*	41,728,646	51,694,247	1,594,064	-	-	-
Private sector provider impacts						**Freight**	**Passengers**	
Revenue	-				-	-	-	-
Operating costs	563,832				563,831.57	-	-	-
Investment costs	-				-	-	-	-
Grant/subsidy	-				-	-	-	-
Subtotal	563,832	*-3*			563,831.57	-	-	-
Other business impacts								
Developer contributions	-	*-4*	-		-	-	-	-
NET BUSINESS IMPACT	95,580,788	*(5) = (2) + (3) + (4)*						

TOTAL		
Present Value of Transport Economic Efficiency Benefits	207,338,335	*(6) = (1) + (5)*

Notes: Benefits appear as positive numbers, while costs appear as negative numbers. All entries are discounted present values, in 2010 prices and values. All values in £s.

Table 74 PA Table 5% Work Saving Year 1

Public Accounts (PA) Table (5% Work Saving) Year 1

	ALL MODES		ROAD	BUS and COACH	RAIL	OTHER
Local Government Funding	**TOTAL**		**INFRASTRUCTURE**			
Revenue	-432,219		-			-432,219
Operating Costs	416,617		-			416,617
Investment Costs	508,213		-			508,213
Developer and Other Contributions	-		-	-	-	-
Grant/Subsidy Payments	-		-	-	-	-
NET IMPACT	492,611	*-7*	-	-	-	492,611
Central Government Funding: Transport						
Revenue	-		-			-
Operating costs	-		-			-
Investment Costs	-		-			-
Developer and Other Contributions	-		-	-	-	-
Grant/Subsidy Payments	-		-	-	-	-
NET IMPACT	-	*-8*	-	-	-	-
Central Government Funding: Non-Transport						
Indirect Tax Revenues	0	*-9*	0	-	-	-

TOTALS

Broad Transport Budget	492,611	*(10) = (7) + (8)*
Wider Public Finances	0	*(11) = (9)*

Notes: Costs appear as positive numbers, while revenues and 'Developer and Other Contributions' appear as negative numbers.
All entries are discounted present values in 2010 prices and values. All values in £s.

Table 75 PA Table 10% Work Saving Year 1

Public Accounts (PA) Table (10% Work Saving) Year 1

	ALL MODES		ROAD	BUS and COACH	RAIL	OTHER
Local Government Funding	**TOTAL**		**INFRASTRUCTURE**			
Revenue	-422,082		-			-422,082
Operating Costs	398,984		-			398,984
Investment Costs	498,075		-			498,075
Developer and Other Contributions	-		-	-	-	-
Grant/Subsidy Payments	-		-	-	-	-
NET IMPACT	474,977	*-7*	-	-	-	474,977
Central Government Funding: Transport						
Revenue	-		-			-
Operating costs	-		-			-
Investment Costs	-		-			-
Developer and Other Contributions	-		-	-	-	-
Grant/Subsidy Payments	-		-	-	-	-
NET IMPACT	-	*-8*	-	-	-	-
Central Government Funding: Non-Transport						
Indirect Tax Revenues	0	*-9*	0	-	-	-

TOTALS

Broad Transport Budget	474,977	*(10) = (7) + (8)*
Wider Public Finances	0	*(11) = (9)*

Notes: Costs appear as positive numbers, while revenues and 'Developer and Other Contributions' appear as negative numbers.
All entries are discounted present values in 2010 prices and values. All values in £s.

Table 76 PA Table 5% Work Saving 25 Years

Public Accounts (PA) Table (5% Work Saving) 25 Year

	ALL MODES		ROAD	BUS and COACH	RAIL	OTHER
Local Government Funding	**TOTAL**		**INFRASTRUCTURE**			
Revenue	-10,783,360		-			-10,783,360
Operating Costs	10,262,734		-			10,262,734
Investment Costs	10,859,353		-			10,859,353
Developer and Other Contributions	-		-	-	-	-
Grant/Subsidy Payments	-		-	-	-	-
NET IMPACT	10,338,728	*-7*	-	-	-	10,338,728
Central Government Funding: Transport						
Revenue	-		-			-
Operating costs	-		-			-
Investment Costs	-		-			-
Developer and Other Contributions	-		-	-	-	-
Grant/Subsidy Payments	-		-	-	-	-
NET IMPACT	-	*-8*	-	-	-	-
Central Government Funding: Non-Transport						
Indirect Tax Revenues	0	*-9*	0	-	-	-
TOTALS						
Broad Transport Budget	10,338,728	*(10) = (7) + (8)*				
Wider Public Finances	0	*(11) = (9)*				

Notes: Costs appear as positive numbers, while revenues and 'Developer and Other Contributions' appear as negative numbers.
All entries are discounted present values in 2010 prices and values. All values in £s.

Table 77 PA Table 10% Work Saving 25 Years

Public Accounts (PA) Table (10% Work Saving) 25 Year

	ALL MODES		ROAD	BUS and COACH	RAIL	OTHER
Local Government Funding	**TOTAL**		**INFRASTRUCTURE**			
Revenue	-10,507,809		-			-10,507,809
Operating Costs	9,698,228		-			9,698,228
Investment Costs	10,583,802		-			10,583,802
Developer and Other Contributions	-		-	-	-	-
Grant/Subsidy Payments	-		-	-	-	-
NET IMPACT	9,774,222	*-7*	-	-	-	9,774,222
Central Government Funding: Transport						
Revenue	-		-			-
Operating costs	-		-			-
Investment Costs	-		-			-
Developer and Other Contributions	-		-	-	-	-
Grant/Subsidy Payments	-		-	-	-	-
NET IMPACT	-	*-8*	-	-	-	-
Central Government Funding: Non-Transport						
Indirect Tax Revenues	0	*-9*	0	-	-	-
TOTALS						
Broad Transport Budget	9,774,222	*(10) = (7) + (8)*				
Wider Public Finances	0	*(11) = (9)*				

Notes: Costs appear as positive numbers, while revenues and 'Developer and Other Contributions' appear as negative numbers.
All entries are discounted present values in 2010 prices and values. All values in £s.

Table 78 AMCB 5% Work Saving Year 1

Analysis of Monetised Costs and Benefits (5% Work Saving) Year 1

Noise	-	*-12*
Local Air Quality	-	*-13*
Greenhouse Gases	29,226	*-14*
Journey Quality	-	*-15*
Physical Activity	-	*-16*
Accidents	63,113	*-17*
Economic Efficiency: Consumer Users (Commuting)	2,333,001	*(1a)*
Economic Efficiency: Consumer Users (Other)	-	*(1b)*
Economic Efficiency: Business Users and Providers	1,911,616	*-5*
Wider Public Finances (Indirect Taxation Revenues)	21,423	*- (11) - sign changed from PA table, as PA table represents costs, not benefits*
Present Value of Benefits (see notes) (PVB)	4,315,532	*(PVB) = (12) + (13) + (14) + (15) + (16) + (17) + (1a) + (1b) + (5) - (11)*
Broad Transport Budget	492,611	
Present Value of Costs (see notes) (PVC)	492,611	
OVERALL IMPACTS		
Net Present Value (NPV)	3,822,921	
Benefit to Cost Ratio (BCR)	8.76	

Note : 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. All values in £s.

Table 79 AMCB 10% Work Saving Year 1

Analysis of Monetised Costs and Benefits (10% Work Saving) Year 1

Noise	-		*-12*
Local Air Quality	-		*-13*
Greenhouse Gases	58,451		*-14*
Journey Quality	-		*-15*
Physical Activity	-		*-16*
Accidents	126,225		*-17*
Economic Efficiency: Consumer Users (Commuting)	4,470,302	*(1a)*	
Economic Efficiency: Consumer Users (Other)	-	*(1b)*	
Economic Efficiency: Business Users and Providers	3,823,232		*-5*
Wider Public Finances (Indirect Taxation Revenues)	42,847	*- (11) - sign changed from PA table, as PA table represents costs, not benefits*	
Present Value of Benefits (see notes) (PVB)	8,521,057	*(PVB) = (12) + (13) + (14) + (15) + (16) + (17) + (1a) + (1b) + (5) - (11)*	
Broad Transport Budget	474,977		*-10*
Present Value of Costs (see notes) (PVC)	474,977	*(PVC) = (10)*	
OVERALL IMPACTS			
Net Present Value (NPV)	8,046,079	NPV=PVB-PVC	
Benefit to Cost Ratio (BCR)	17.94	BCR=PVB/PVC	

Note : 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. All values in £s.

Table 80 AMCB 5% Work Saving 25 Years

Analysis of Monetised Costs and Benefits (5% Work Saving) 25 Years

Noise	-		*-12*
Local Air Quality	-		*-13*
Greenhouse Gases	730,641		*-14*
Journey Quality	-		*-15*
Physical Activity	-		*-16*
Accidents	1,577,814		*-17*
Economic Efficiency: Consumer Users (Commuting)	58,325,032	*(1a)*	
Economic Efficiency: Consumer Users (Other)	-	*(1b)*	
Economic Efficiency: Business Users and Providers	47,790,394		*-5*
Wider Public Finances (Indirect Taxation Revenues)	535,586	*- (11) - sign changed from PA table, as PA table represents costs, not benefits*	
Present Value of Benefits (see notes) (PVB)	107,888,294	*(PVB) = (12) + (13) + (14) + (15) + (16) + (17) + (1a) + (1b) + (5) - (11)*	
Broad Transport Budget	10,338,728		*-10*
Present Value of Costs (see notes) (PVC)	10,338,728	*(PVC) = (10)*	
OVERALL IMPACTS			
Net Present Value (NPV)	97,549,567	NPV=PVB-PVC	
Benefit to Cost Ratio (BCR)	10.44	BCR=PVB/PVC	

Note : 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. All values in £s.

Table 81 AMCB 10% Work Saving 25 Years

Analysis of Monetised Costs and Benefits (10% Work Saving) 25 Years

Noise	-		*-12*
Local Air Quality	-		*-13*
Greenhouse Gases	1,461,281		*-14*
Journey Quality	-		*-15*
Physical Activity	-		*-16*
Accidents	3,155,628		*-17*
Economic Efficiency: Consumer Users (Commuting)	111,757,548	*(1a)*	
Economic Efficiency: Consumer Users (Other)	-	*(1b)*	
Economic Efficiency: Business Users and Providers	95,580,788		*-5*
Wider Public Finances (Indirect Taxation Revenues)	1,071,172	*- (11) - sign changed from PA table, as PA table represents costs, not benefits*	
Present Value of Benefits (see notes) (PVB)	210,884,072	*(PVB) = (12) + (13) + (14) + (15) + (16) + (17) + (1a) + (1b) + (5) - (11)*	
Broad Transport Budget	9,774,222		*-10*
Present Value of Costs (see notes) (PVC)	9,774,222	*(PVC) = (10)*	
OVERALL IMPACTS			
Net Present Value (NPV)	201,109,851	NPV=PVB-PVC	
Benefit to Cost Ratio (BCR)	21.58	BCR=PVB/PVC	

Note : 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. All values in £s.

9 CENTRAL BEDFORDSHIRE PERMIT SCHEME COST BENEFIT ANALYSIS RESULTS

9.1 Introduction

This section will summarises the findings of the Central Bedfordshire Permit Scheme Cost Benefit Analysis and consider the impact on the Highway Authority.

9.2 Central Bedfordshire Highway Authority Cost Benefit Analysis

In addition to the statutory results presentation, an additional BCR and NPV is presented from the perspective of the Highways Authority (Table 82), which includes the cost recovery from Permit Fee income and includes the effect of indirect taxation. The summary of benefits is presented in Table 83.

Table 82 Highway Authority Central Bedfordshire Cost Benefit results

Highway Authority Assessment 5% reduction in works impact	**Opening Year**	**25 Year**
Net Present Value of Benefits	£4,315,532	£107,888,294
Net Present Value of Costs	£492,611	£10,338,728
Net Present Value of Permit Scheme	£3,822,921	£97,549,567
Benefit to Cost Ratio	**8.76**	**10.44**

Highway Authority Assessment 10% reduction in works impact	**Opening Year**	**25 Year**
Net Present Value of Benefits	£8,521,057	£210,884,072
Net Present Value of Costs	£474,977	£9,774,222
Net Present Value of Permit Scheme	£8,046,079	£201,109,851
Benefit to Cost Ratio	**17.94**	**21.58**

The Scheme has a Benefit Cost Ratio of 10.44 and Net Present Value of £97.5m 2010 prices at 5% reduction in works which suggests the Central Bedfordshire Permit Scheme would be both viable and beneficial for the Highway Authority and the population of Central Bedfordshire.

The higher BCR and NPV are attributable to the net benefit of adding Permit Fee income and indirect taxation to the assessment and the difference in opening year and overall assessment BCR is due to the changing relationship of costs and benefits over the assessment period.

The projected discounted benefits in the opening year of £4.3m includes a reliability adjustment of 20% and has been assessed at a local level that has increased the estimated suggested benefit in the DfT report in Section 3.7. This is also influenced by high number of single carriageway roads that are subject to shuttle working creating higher delays.

9.3 Sensitivity Analysis

A series of sensitivity tests have been performed on the 25-year appraisal to further understand the economic performance of the Scheme and its effects at different policy levels. The Highway Authority central case assumption of a 5% reduction in works activity produced a BCR of 10.44.

The results in Table 84 below shows the standard sensitivity test of the level of works reduction required to produce a BCR of 2.0 and a BCR of 1.0.

Table 84 Standard Sensitivity

Standard Sensitivity		
BCR	1%	2%
Works Reduction	0.48%	0.97%

Table 85 below presents the BCR achieved based upon the level of works reduction achieved.

Table 85 Works Reduction Sensitivity

Works Reduction Sensitivity	
Works Reduction	**BCR**
1% Saving	2.07
2% Saving	4.15
3% Saving	6.26
4% Saving	8.39
5% Saving	10.54
6% Saving	12.71
7% Saving	14.91
8% Saving	17.12
9% Saving	19.37
10% Saving	21.63

Table 86 shows the level of roadwork reduction achieved at different BCR levels.

Table 86 BCR Sensitivity

BCR Sensitivity	
BCR	**Works Reduction**
1	0.48%
2	0.97%
3	1.45%
4	1.93%
5	2.41%
6	2.88%
7	3.35%
8	3.82%
9	4.29%
10	4.75%

10 APPENDIX A

QUADRO Data

See Attached

11 APPENDIX B

Sample Sites QUADRO Results Summary

See attached

12 APPENDIX C

Permit Fees Matrix

See attached

A great place to live and work

Contact us…
by telephone: 0300 300 4553
by email: highwaysadmin@centralbedfordshire.gov.uk
on the web: www.centralbedfordshire.gov.uk

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