Southampton permit scheme for roads and street works

Traffic Management Act 2004

Cost Benefit Analysis – July 2014

SOUTHAMPTON CITY COUNCIL

Document Information	
Date:	July 2014
Project Name:	Southampton Permit Scheme (SHPS)
Service Area:	Southampton City Council Highway Network
Directorate:	Highways and Transport
Authors:	Richard Pelham, Technical Consultant Jason Setford-Smith, Scheme Consultant
SRO:	John Harvey, Highways Manager
Version:	V1.3 FINAL

Contents

1 EXECUTIVE SUMMARY

Southampton City 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.

Southampton City Council's Highways Team has been working on just such a new development and this CBA 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 City like Southampton.

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

The proposed Southampton Permit Scheme tackles head-on one 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 Southampton Permit Scheme is designed to deliver effective coordination and management of essential road works by introducing a new Permit Authority in Southampton.

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 coordination between all the different competing interests.

Summary findings of the Southampton Permit Scheme Cost Benefit Analysis

Values based on 25 Year Operation of the proposed Scheme (2010 prices)

Value of benefits to economy and society	£123,798,398
Set-up and operating costs	£23,771,254
Financial benefit to the local economy from introducing the Scheme	£100,027,144
Benefit to Cost Ratio	**5.21**

2 INTRODUCTION

2.1 PERMIT SCHEME OBJECTIVES

Swift Argent Ltd was commissioned by Southampton City Council (SCC) in 2014 to develop a road works Permit Scheme known as the Southampton Permit Scheme (SHPS), part of which includes the development of a detailed Cost Benefit Analysis (CBA).

The principal objective of the Southampton 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 Southampton Permit Scheme will enable better coordination 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 Southampton 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 Southampton City Council existing budget, against the value of the benefits it will deliver to the wider City of Southampton.

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 Southampton Permit Scheme CBA Results

3 ANALYSIS AND CONTEXT

3.1 INTRODUCTION

This section presents the legislative and research context for the Southampton 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 SOUTHAMPTON PERMIT SCHEME

Using the DfT sanctioned report, it is possible to get an idea for the likely implication of the Southampton 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 1.60% of utility road works occurring in Southampton and a 5% reduction in road works associated with the Permit Scheme, it may be expected to produce annual savings of £3.49m in 2002 prices, (£5.83 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 Southampton	1.60%
Annual Southampton cost of roadworks (£m)	£ 69.76
Roadwork Reduction from Permit Scheme	5%
Estimated Permit Scheme saving (2002 prices) (£m)	**£ 3.49**
Estimated Permit Scheme saving (2010 prices) (£m)	**£ 5.83**

However, working up from the actual number of Noticed Works in Southampton 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 £3.44m in 2002 prices (£5.74 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	19,089
Utility Works after 5% reduction	18,135
Total Utility Permit reduction	954
Average Days Duration from Halcrow Study	6
Number of road work days saved	5,727
Total Cost at £600 per works per day (£ m) (2002 prices)	**£ 3.44**
Total Cost at £600 per works per day (£ m) (2010 prices)	**£ 5.74**

The figures above give an estimate of the upper and lower expectations from the Southampton Permit Scheme of between £5.74m and £5.83m 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 Southampton 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 Southampton Permit Scheme is a reduction in the disruption caused by road works through improved control and coordination.

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	19,089
Utility Permits after 5% reduction	18,135

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 Southampton City 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 Southampton City 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 on urban roads. 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 SOUTHAMPTON CITY COUNCIL DATA

Southampton City 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 Southampton City 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

Southampton City council provided the information on the number of road works and shown on Table 10 below.

Table 10 Roadwork Totals

Southampton Notice Volumes						
Work Type	**RC 0-2**		**RC 3-4**		**Total Volume**	
	Number	**%**	**Number**	**%**	**Number**	**%**
Major	54	2%	189	1%	243	1%
Standard	318	11%	828	5%	1,146	6%
Minor with Exc	2,352	79%	13,582	84%	15,934	83%
Minor without Exc	-	0%	-	0%	-	0%
Urgent	204	7%	1,161	7%	1,365	7%
Special Urgent	-	0%	-	0%	-	0%
Emergency	65	2%	336	2%	401	2%
Totals	2,993	16%	16,096	84%	19,089	

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 Southampton City there are 54 site locations on 'A' principal roads and minor roads for Annual Average Daily Flow (AADF) classified by vehicle type.

The latest data for 2012 is shown on Tables 16 to 19 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 2012 (Sheet 1 of 4)

Southampton DfT Traffic Flow Site Data 2012 (Sheet 1 of 4)												
Ref No	Road	Start Junction	End Junction	All Motor Vehicles	%Lights	%Heavy	% Car	% LGV	%OGV1	%OGV2	%PSV	Type
1	A27	A335	Allington Lane	14794	0.991	0.009	0.843	0.142	0.008	0.001	0.006	S2AP
2	A33	A3024	A3035	22886	0.977	0.023	0.871	0.095	0.012	0.011	0.011	D2AP
3	A35	A33	Stoneham Lane	10945	0.982	0.018	0.847	0.126	0.016	0.003	0.008	S2AP
4	A35	M271	A3024	70423	0.920	0.080	0.789	0.123	0.021	0.058	0.008	D3AP
5	A33	A3024 roundabout	A3024/A33 Kingsway	21130	0.971	0.029	0.859	0.109	0.012	0.017	0.003	D2AP
6	A3035	A3024	A335	15318	0.987	0.013	0.826	0.155	0.009	0.004	0.006	S2AP
7	A3057	A3024	A35	10702	0.982	0.018	0.771	0.155	0.017	0.001	0.056	S2AP
8	A35	A35 split	A33	14186	0.991	0.009	0.866	0.120	0.007	0.001	0.005	S2AP
9	A3024	A3035	A334	26169	0.977	0.023	0.828	0.146	0.015	0.008	0.003	D2AP
10	A335	A335	A27/A35	33114	0.974	0.026	0.844	0.124	0.019	0.006	0.006	D2AP
11	A3024	A334	A27	14460	0.956	0.044	0.824	0.118	0.030	0.014	0.014	S2AP
12	A33	A33 Threefield Lane/Marsh Lane	A3024	16013	0.966	0.034	0.838	0.112	0.015	0.018	0.016	D2AP
13	A33	A35	A35	20388	0.978	0.022	0.870	0.095	0.009	0.013	0.013	D2AP
14	A3035	A335	A33	9016	0.994	0.006	0.859	0.126	0.006	0.000	0.009	S2AP
15	A335	A27/A35	M27	31231	0.969	0.031	0.834	0.130	0.000	0.009	0.005	D2AP
16	A27	A33	A35	13319	0.987	0.013	0.864	0.117	0.011	0.002	0.006	S2AP
17	A33	A35	A27	37743	0.980	0.020	0.883	0.091	0.013	0.007	0.006	D2AP
18	A35	A33	A3057	13234	0.981	0.019	0.836	0.140	0.013	0.006	0.005	D2AP
19	A3057	A35	Lower Brownhill Rd	10764	0.995	0.005	0.865	0.120	0.005	0.000	0.010	S2AP
20	A334	A3024	A27	15718	0.984	0.016	0.828	0.144	0.015	0.001	0.011	S2AP
21	A3025	A33	B3033 Botley Rd	12554	0.974	0.026	0.832	0.120	0.018	0.007	0.022	S2AP
22	A33	B3039	A33 split	20980	0.971	0.029	0.825	0.123	0.015	0.014	0.023	S2AP
23	A35	A3057	A35 split	16671	0.986	0.014	0.878	0.104	0.011	0.003	0.004	S2AP
24	A3024	A33	A3035	24132	0.985	0.015	0.830	0.132	0.011	0.004	0.023	D2AP
25	A335	A3035	A35	21962	0.973	0.027	0.817	0.151	0.017	0.010	0.005	D2AP
26	A33	A3025	A33 Evans St	10620	0.970	0.030	0.831	0.138	0.019	0.011	0.002	S2AP
27	A33	A33 Bernard St	A3025	11403	0.978	0.022	0.843	0.127	0.017	0.006	0.007	S2AP
28	A33	A33 Evans St	A33 Terminus Terrace	7190	0.957	0.043	0.838	0.116	0.028	0.015	0.003	S2AP
29	A3024	A35	West Quay Rd	52907	0.971	0.029	0.852	0.108	0.014	0.015	0.010	D3AP
30	A33	A3035	A35	30811	0.980	0.020	0.878	0.092	0.012	0.008	0.009	D2AP
31	A33	A33 West Quay Rd	A3024	7749	0.983	0.017	0.778	0.204	0.012	0.005	0.001	D2AP
32	A33	Town Quay	Terminus Terrace	11548	0.948	0.052	0.797	0.118	0.026	0.026	0.033	S2AP
33	A33	Town Quay	Queen's Terrace	13989	0.946	0.054	0.814	0.101	0.031	0.022	0.031	S2AP

Table 17 DfT Traffic Flow Site Data 2012 (Sheet 2 of 4)

Southampton DfT Traffic Flow Site Data 2012 (Sheet 2 of 4)								
Ref No	Road	Start Junction	End Junction	2-way/1-way/bus lane	Data Type	Road Class	RC	Speed Limit (mph)
1	A27	A335	Allington Lane	2-way	URBAN	10	2	60
2	A33	A3024	A3035	2-way	URBAN	11	1	30
3	A35	A33	Stoneham Lane	2-way	URBAN	7	3	30
4	A35	M271	A3024	2-way	URBAN	7	0	50
5	A33	A3024 roundabout	A3024/A33 Kingsway	2-way	URBAN	7	1	30
6	A3035	A3024	A335	2-way	URBAN	7	2	30
7	A3057	A3024	A35	2-way	URBAN	8	3	30
8	A35	A35 split	A33	2-way	URBAN	7	2	30
9	A3024	A3035	A334	2-way	URBAN	7	1	30
10	A335	A335	A27/A35	2-way	URBAN	7	0	30
11	A3024	A334	A27	2-way	URBAN	7	2	40
12	A33	A33 Threefield Lane/Marsh Lane	A3024	2-way	URBAN	7	2	30
13	A33	A35	A35	2-way	URBAN	11	1	40
14	A3035	A335	A33	2-way	URBAN	7	3	30
15	A335	A27/A35	M27	2-way	RURAL	2	1	40
16	A27	A33	A35	2-way	URBAN	7	2	30
17	A33	A35	A27	2-way	URBAN	7	0	40
18	A35	A33	A3057	2-way	URBAN	7	2	50
19	A3057	A35	Lower Brownhill Rd	2-way	URBAN	8	3	40
20	A334	A3024	A27	2-way	URBAN	7	2	30
21	A3025	A33	B3033 Botley Rd	2-way	URBAN	7	2	30
22	A33	B3039	A33 split	1-way	URBAN	7	1	30
23	A35	A3057	A35 split	2-way	URBAN	7	2	30
24	A3024	A33	A3035	2-way	URBAN	7	1	30
25	A335	A3035	A35	2-way	URBAN	7	1	60
26	A33	A3025	A33 Evans St	1-way	URBAN	8	3	30
27	A33	A33 Bernard St	A3025	1-way	URBAN	8	3	30
28	A33	A33 Evans St	A33 Terminus Terrace	1-way	URBAN	8	3	30
29	A3024	A35	West Quay Rd	2-way	URBAN	7	0	50
30	A33	A3035	A35	2-way	URBAN	7	1	40
31	A33	A33 West Quay Rd	A3024	2-way	URBAN	7	3	70
32	A33	Town Quay	Terminus Terrace	1-way	URBAN	8	1	30
33	A33	Town Quay	Queen's Terrace	1-way	URBAN	7	1	30

Southampton Permit Scheme – Cost Benefit Analysis
Table 18 DfT Traffic Flow Site Data 2012 (Sheet 3 of 4)

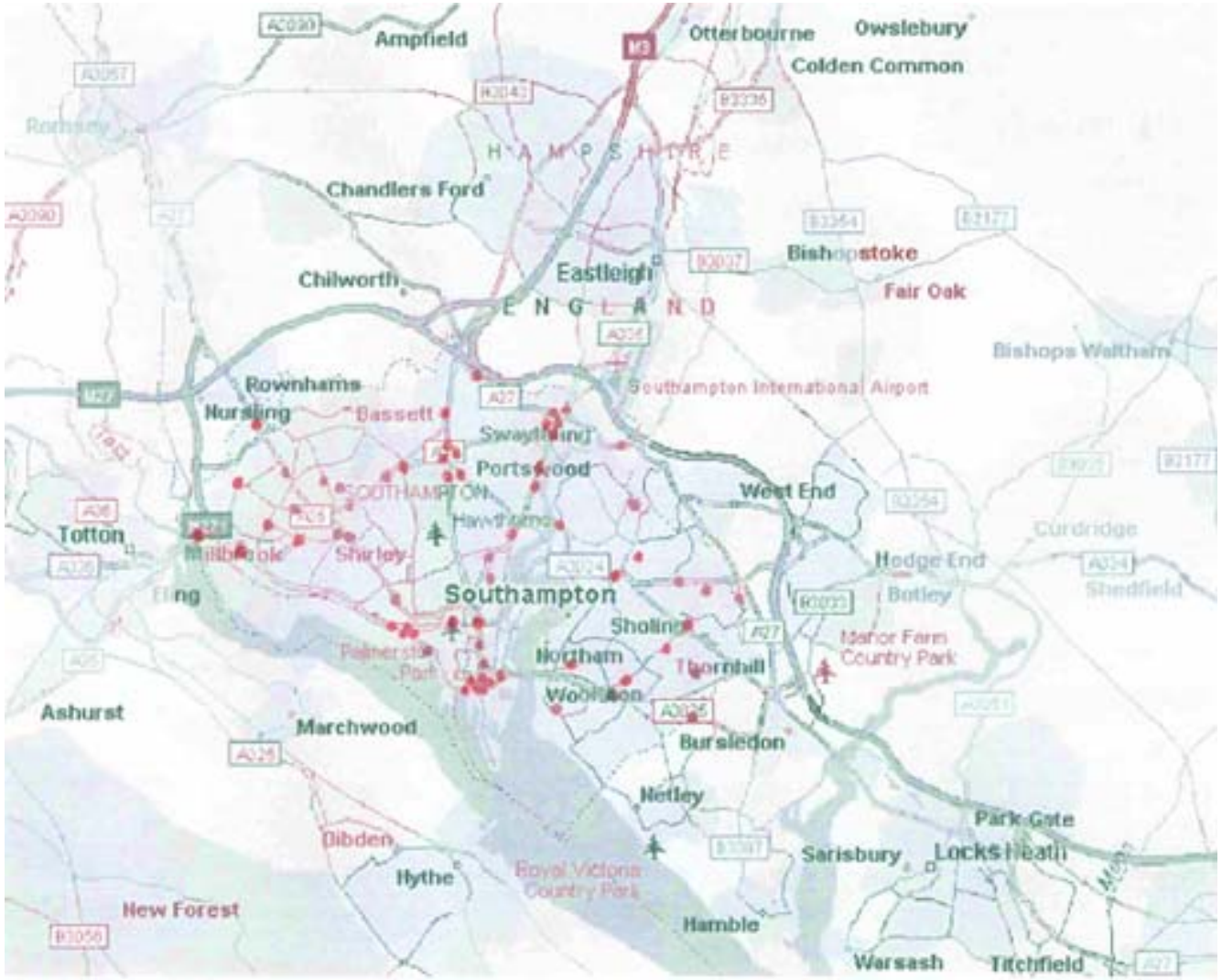
Southampton DfT Traffic Flow Site Data 2012 (Sheet 3 of 4)												
Ref No	**Road**	**Start Junction**	**End Junction**	**All Motor Vehicles**	**%Lights**	**%Heavy**	**% Car**	**% LGV**	**%OGV1**	**%OGV2**	**%PSV**	**Type**
34	A33	Queens Terrace	Bernard St	7982	0.945	0.055	0.808	0.133	0.023	0.033	0.004	S2AP
35	A27	A35	A35/A335	5896	0.981	0.019	0.840	0.140	0.015	0.004	0.001	S2AP
36	A35	Stoneham Way	A27	6931	0.984	0.016	0.868	0.091	0.015	0.002	0.025	S2AP
37	A3025	B3033 Botley Rd	Grange Road	11982	0.980	0.020	0.824	0.151	0.012	0.008	0.004	S2AP
38	A3057	Lower Brownhill Rd	Bakers Drove	10472	0.982	0.018	0.868	0.107	0.017	0.001	0.008	S2AP
39	A35	B3076	M271	62800	0.957	0.043	0.827	0.122	0.018	0.025	0.007	D2AP
40	A33	West Quay Rd	A3057	16656	0.983	0.017	0.846	0.134	0.012	0.004	0.004	S2AP
41	A33	Mountbatten Way	Southern Rd	25811	0.957	0.043	0.863	0.088	0.016	0.027	0.006	D2AP
42	A33	Southern Rd	B3039	28812	0.967	0.033	0.873	0.089	0.013	0.020	0.004	D2AP
43	A35	Stoneham Lane	Thomas Lewis Way	33114	0.974	0.026	0.844	0.124	0.019	0.006	0.006	D2AP
44	A3024	A3057	A33	17687	0.985	0.015	0.837	0.135	0.013	0.002	0.012	D2AP
45	A335	A33	A3035	17035	0.981	0.019	0.823	0.145	0.014	0.004	0.013	S2AP
46	St Monica Road	Spring Road	South East Road	3472	0.993	0.007	0.853	0.094	0.007	0.000	0.046	S2AP
47	Wimpson Lane	Kendal Avenue	Windermere Avenue	3769	0.992	0.008	0.855	0.103	0.008	0.000	0.034	S2AP
48	Portswood Road	Langhorn Road	Mayfield Road	7492	0.986	0.014	0.821	0.140	0.013	0.001	0.025	S2AP
49	Warren Avenue	Coxford Road	Winchester Road	4562	0.991	0.009	0.869	0.094	0.009	0.000	0.027	S2AP
50	Meggeson Avenue	Townhill Way	Wakefield Road	5556	0.988	0.012	0.870	0.101	0.012	0.000	0.018	S2AP
51	Redbridge Hill	Romsey Road	Walnut Grove	3708	0.990	0.010	0.816	0.118	0.010	0.000	0.056	S2AP
52	Belmont Road	St Denys Road	Osborne Road South	1444	0.988	0.012	0.855	0.130	0.012	0.000	0.003	S2AP
53	College Road	Weston Grove Road	Swift Road	248	1.000	0.000	0.891	0.109	0.000	0.000	0.000	S2AP
54	Foundry Road	Emsworth Road	English Road	1406	0.999	0.001	0.888	0.107	0.001	0.000	0.004	S2AP
55	Bishops Road	Peveril Road	Radstock Road	1013	0.988	0.012	0.896	0.085	0.012	0.000	0.007	S2AP
56	Sir George's Road	Shirley Road	Park Road	425	0.991	0.009	0.868	0.120	0.009	0.000	0.002	S2AP
57	Farringford Road	Solent Avenue	Byron Road	591	0.970	0.030	0.851	0.107	0.030	0.000	0.012	S2AP
58	Lordshill Centre West	Upper Brownhill Road	Lord's Hill Way	2977	0.995	0.005	0.879	0.068	0.004	0.000	0.048	S2AP
59	Seymour Road	A35	Malvern Road	1145	0.997	0.003	0.900	0.098	0.002	0.001	0.000	S2AP
60	Tennyson Road	Woodside Road	Portswood Avenue	551	0.987	0.013	0.855	0.132	0.013	0.000	0.000	S2AP
61	Thornhill Avenue	Thornhill Park Road	Bryon Road	3709	0.996	0.004	0.874	0.118	0.004	0.000	0.004	S2AP
62	Marne Road	Dean Road	Shales Road	620	0.998	0.002	0.916	0.079	0.002	0.000	0.003	S2AP
63	Maplin Road	Colne Avenue	Mansel Road West	173	0.988	0.012	0.798	0.191	0.012	0.000	0.000	S2AP
64	Elgar Road	Valentine Avenue	Sullivan Road	535	0.994	0.006	0.905	0.084	0.006	0.000	0.006	S2AP
65	Alfriston Gardens	Banbury Avenue	Kathleen Road	554	0.998	0.002	0.894	0.103	0.002	0.000	0.002	S2AP

Southampton Permit Scheme – Cost Benefit Analysis

Table 19 DfT Traffic Flow Site Data 2012 (Sheet 4 of 4)

Southampton DfT Traffic Flow Site Data 2012 (Sheet 4 of 4)								
Ref No	**Road**	**Start Junction**	**End Junction**	**2-way/1-way/bus lane**	**Data Type**	**Road Class**	**RC**	**Speed Limit (mph)**
34	A33	Queens Terrace	Bernard St	1-way	URBAN	8	3	30
35	A27	A35	A35/A335	2-way	URBAN	7	4	30
36	A35	Stoneham Way	A27	2-way	URBAN	7	3	30
37	A3025	B3033 Botley Rd	Grange Road	2-way	URBAN	7	3	40
38	A3057	Lower Brownhill Rd	Bakers Drove	2-way	URBAN	7	3	30
39	A35	B3076	M271	2-way	URBAN	7	0	70
40	A33	West Quay Rd	A3057	1-way	URBAN	7	2	60
41	A33	Mountbatten Way	Southern Rd	2-way	URBAN	7	1	30
42	A33	Southern Rd	B3039	2-way	URBAN	7	1	30
43	A35	Stoneham Lane	Thomas Lewis Way	2-way	URBAN	7	0	40
44	A3024	A3057	A33	2-way	URBAN	8	2	30
45	A335	A33	A3035	2-way	URBAN	7	2	30
46	St Monica Road	Spring Road	South East Road	2-way	URBAN	7	4	30
47	Wimpson Lane	Kendal Avenue	Windermere Avenue	2-way	URBAN	7	4	30
48	Portswood Road	Langhorn Road	Mayfield Road	2-way	URBAN	7	3	30
49	Warren Avenue	Coxford Road	Winchester Road	2-way	URBAN	7	4	30
50	Meggeson Avenue	Townhill Way	Wakefield Road	2-way	URBAN	7	4	30
51	Redbridge Hill	Romsey Road	Walnut Grove	2-way	URBAN	7	4	30
52	Belmont Road	St Denys Road	Osborne Road South	2-way	URBAN	7	4	30
53	College Road	Weston Grove Road	Swift Road	2-way	URBAN	7	4	30
54	Foundry Road	Emsworth Road	English Road	2-way	URBAN	7	4	30
55	Bishops Road	Peveril Road	Radstock Road	2-way	URBAN	7	4	30
56	Sir George's Road	Shirley Road	Park Road	2-way	URBAN	7	4	30
57	Farringford Road	Solent Avenue	Byron Road	2-way	URBAN	7	4	30
58	Lordshill Centre West	Upper Brownhill Road	Lord's Hill Way	2-way	URBAN	7	4	30
59	Seymour Road	A35	Malvern Road	2-way	URBAN	7	4	30
60	Tennyson Road	Woodside Road	Portswood Avenue	2-way	URBAN	7	4	30
61	Thornhill Avenue	Thornhill Park Road	Bryon Road	2-way	URBAN	7	4	30
62	Marne Road	Dean Road	Shales Road	2-way	URBAN	7	4	30
63	Maplin Road	Colne Avenue	Mansel Road West	2-way	URBAN	7	4	30
64	Elgar Road	Valentine Avenue	Sullivan Road	2-way	URBAN	7	4	30
65	Alfriston Gardens	Banbury Avenue	Kathleen Road	2-way	URBAN	7	4	30

Figure 1 DfT AADT Locations Southampton



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 CBA. 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 20 and 21 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 20 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 21 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 22 and 23 below.

Values for 2010 VOC are shown in Table 24 below.

Carbon emissions are considered in terms of the change in the equivalent tonnes of carbon Table 25 and estimated from fuel consumption Table 26 below.

Table 22 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 23 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 24 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 25 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 26 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 27 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 28 and 29 below. Accident values increase in line with GDP as shown in Table 30 below. Accident rates are calculated with and without works, combined link and junction rates are used in QUADRO,

Table 31 shows accident rates for 15 road types without works and Table 32 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 CBA these default values are used.

Table 33 shows the number of casualties per accident.

Table 28 WebTAG – Cost per Casualty

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

Table 29 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 30 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 31 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 32 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 33 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 CBA 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 34 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 34 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 35 below. Accident Rates were tabled earlier in Section 4.2.

Table 35 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 CBA 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 36 below to calculate a speed/flow relationship with default values shown on Table 37 and 38.

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 CBA, typical values have been applied as set out

in Table 39 below. The work site type is defined by the number of lanes open or shuttle working as shown on Table 40 below that selects a default capacity.

QUADRO contains values for average duration of incidents and are shown on Table 41 below.

Table 36 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 37 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 38 Speed/Flow

Default Speed/flow Parameters QUADRO									
CLASS	LIGHT-V (kph)	GRAD-A	GRAD-B	HEAVY-V	GRAD-A	GRAD-B	CHANGE	MINS	Qc
	kph	reduction (kph) per 1000 veh	reduction (kph) per 1000 veh	kph	reduction (kph) per 1000 veh	reduction (kph) per 1000 veh	Factor or vph per lane	kph	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
10	70	10	45	64	10	45	1200	25	1500
11	80	10	45	74	10	45	1200	35	1500

Table 39 Geometric Parameters

Default Geometric Parameters QUADRO													
CLASS	TYPE	DESCRIPTION	CWID	HILLS	DEVEL	INT	BEND	MAXS	SWID	VWID	JUNC	VIS	AXS
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							
10	URBAN	Suburban Single	10	15		0.8		64					30
11	URBAN	Suburban Dual	14.6	15		0.8		64					30

Table 40 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 41 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 CBA 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 42 below.

Table 42 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					Weekend	All Week	Weekday					Weekend	All Week
		7am – 10am	10am – 4pm	4pm – 7pm	7pm – 7am	Average	Average	Average	7am – 10am	10am – 4pm	4pm – 7pm	7pm – 7am	Average	Average	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 65 sites shown on Tables 16 and 19 showed a good spread of data over the Southampton 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 325 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 43 and 44 below.

The number of samples used for the CBA 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 45 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 CBA were selected by ranking the 65 sites by impact and making the average cost of sites selected equal the mean. For example, for RC 0-2 Major Works 6 samples were required and 32 sites available, the mean cost was £10,311 for 7 days with a 10 metre site length. Ranking sites 7th , 12th , 17th, 22nd, 27th and 32nd were used with an average cost of £11,584. 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. For example for RC 0-2 Major Works a High forecast was derived by applying a duration of 41and 40 days to 7th and 12th and 17th ranking site and a Low forecast 30, 26 and 23 days to 22nd , 27th and 32nd. The average of the two forecasts was used to obtain the Total Delay of Works. Summarised impacts are provided in Appendix B.

Table 43 Southampton Delay Modelling Daily Cost of Rural Works

Southampton							
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	No Data					
1	16,000	31,231	395	431	468	606	806
2	12,000	No Data					
3	8,000	No Data					
4	4,000	No Data					

Table 44 Southampton Delay Modelling Daily Cost of Urban Works

Southampton							
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	No Data					
1	24,000	24,790	755	819	884	1,136	666
2	16,000	16,805	2,453	2,481	4,343	9,065	16,419
3	10,000	8,587	21	33	53	102	202
4	6,000	1,301	26	26	43	85	165

Table 45 Southampton Work Samples

Southampton Street Work Samples				
Work Type	**RC 0-2**		**RC 3-4**	
	Sample Size	**%**	**Sample Size**	**%**
Major	6	2%	4	1%
Standard	36	11%	19	5%
Minor with Exc	268	79%	316	84%
Minor without Exc	0	0%	0	0%
Urgent	23	7%	27	7%
Emergency	7	2%	8	2%
Totals	**341**		**375**	

Table 46 Southampton Delay Modelling Percentage of Works by RC and Excavation Length

Southampton CBA Percentages of Works by RC and Excavation Length							
RC		**10m**	**30m**	**50m**	**100m**	**200m**	**Total Samples**
RC 0-2	Sample Nos	288	2	18	14	18	341
	Sample %	84.5%	0.6%	5.3%	4.1%	5.3%	
	Halcrow Study %	84.7%	0.7%	5.2%	4.2%	5.2%	
RC 3-4	Sample Nos	324	20	12	10	8	375
	Sample %	86.4%	5.3%	3.2%	2.7%	2.1%	
	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 47.

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 47 Southampton Monetized Costs and Benefits

Southampton Sample Sites QUADRO Results Summary			
Delay Modelling Totals			
	Total Impact	**Consumer Vehicle Operating Cost**	**Consumer Travel Time Cost**
High	£ 92,382,952	£ 3,721,917	£ 58,924,934
Low	£ 72,630,377	£ 2,916,219	£ 47,889,148
Average	£ 82,506,664	£ 3,319,068	£ 53,407,041
Cost Saving 5%	£ 4,125,333	£ 165,953	£ 2,670,352
Cost Saving 10%	£ 8,250,666	£ 331,907	£ 5,340,704
	Business Vehicle Operating Cost	**Business Travel Time Total**	**PSP Bus & Coach Operating Cost**
High	£ 1,518,827	£ 43,040,440	£ 586,647
Low	£ 1,188,642	£ 33,707,911	£ 461,139
Average	£ 1,353,734	£ 38,374,175	£ 523,893
Cost Saving 5%	£ 67,687	£ 1,918,709	£ 26,195
Cost Saving 10%	£ 135,373	£ 3,837,418	£ 52,389
	Total Business	**Accident Cost**	**Carbon**
High	£ 45,145,914	£ 1,157,159	£ 668,269
Low	£ 35,357,691	£ 1,058,051	£ 523,549
Average	£ 40,251,803	£ 1,107,605	£ 595,909
Cost Saving 5%	£ 2,012,590	£ 55,380	£ 29,795
Cost Saving 10%	£ 4,025,180	£ 110,761	£ 59,591

6 PERMIT SCHEME OPERATION

6.1 INTRODUCTION

This section assesses the process tasks required to establish and operate the Southampton 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 Southampton City Council and is shown on Table 48 below. The Fees Matrix is attached in Appendix C.

Table 48 Utility Permit Volume before Scheme opening

Southampton Notice Volumes						
Work Type	**RC 0-2**		**RC 3-4**		**Total Volume**	
	Number	**%**	**Number**	**%**	**Number**	**%**
Major	54	2%	189	1%	243	1%
Standard	318	11%	828	5%	1,146	6%
Minor with Exc	2,352	79%	13,582	84%	15,934	83%
Minor without Exc	-	0%	-	0%	-	0%
Urgent	204	7%	1,161	7%	1,365	7%
Special Urgent	-	0%	-	0%	-	0%
Emergency	65	2%	336	2%	401	2%
Totals	2,993	16%	16,096	84%	19,089	

The Utility Permit volumes by road categories are shown in Table 49 and Table 50 and with costings based upon statutory fee rates outlined in Table 8.

Table 49 Permit Volume on Category 0-2 roads

Category 0-2 and 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	65	151	N/A	N/A	9,794
Major	62	310	12	45	19,880
Standard	361	165	36	45	61,373
Minor	2,666	76	133	45	207,843
Immediate	305	58	15	45	18,414
Sub Total	3,460	N/A	197	45	317,305

Table 50 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	227	88	N/A	N/A	19,968
Major	218	157	44	35	35,793
Standard	959	71	96	35	71,816
Minor	15,727	33	786	35	543,643
Immediate	1,734	40	87	35	72,199
Sub Total	18,865	N/A	1,013	35	743,419

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 £107,600 by Southampton City Council. See Table 51 below.

Table 51 Scheme set up costs

Scheme Set-up Costs		
Start up Cost Centre	**Set-up (recovered from future fees)**	**Year 1 +**
Consultancy	£40,000	
KPI Production		£25,000
Invoicing		£70,000
IT system	£20,000	
IT support		£25,000
Unauthorised / Abandoned works		£60,000
Management Overhead		£50,000
Training	£20,000	
Staff	£20,000	
Set-up costs recovery (3 years)		£36,000
IT Capital Expenditure Adjustment	£7,600	
Totals	**£107,600**	**£266,000**

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 Southampton City Council and statutory rates and are outlined in Table 52.

Table 52 Staff Costing

Staff Costing			
Personnel Type	**Annual Salary**	**Final Hourly Rate**	**Total Annual Cost**
Street Works Officer	£ 24,793	£ 31.77	£ 48,633.95
Street Works Coordinator	£ 31,074	£ 39.81	£ 60,954.76
Traffic Manager	£ 44,610	£ 57.16	£ 87,506.98

National Insurance (%)	7.7
Pension (superannuation) (%)	14.9
Working hours/annum	1531
Employee Overhead Rate	1.6

Southampton Permit Scheme – Cost Benefit Analysis

The breakdown of costing per task for each of the three grades of Permit Scheme workers is shown in Table 53 below.

Table 53 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	0.63	1.91	1.21	0.64	0.47	4.86
Total Permits	65	62	361	2666	305	3460
Total Hours	41	119	437	1695	142	16802
No. of Posts Required	0.03	0.08	0.29	1.11	0.09	1.59
Employee Costs	£1,304	£3,791	£13,883	£53,856	£4,502	£77,336
Street Works Coordinators						
	PAA	**Major**	**Standard**	**Minor**	**Immediate**	**TOTAL**
Hours per Permit	1.44	2.79	1.35	0.58	0.58	6.75
Total Permits	65	62	361	2666	305	3460
Total Hours	93	174	487	1549	177	23341
No. of Posts Required	0.06	0.11	0.32	1.01	0.12	1.62
Employee Costs	£3,719	£6,942	£19,402	£61,661	£7,049	£98,772
Traffic Managers						
	PAA	**Major**	**Standard**	**Minor**	**Immediate**	**TOTAL**
Hours per Permit	0.69	1.19	0.63	0.19	0.13	2.83
Total Permits	65	62	361	2666	305	3460
Total Hours	45	74	228	512	38	9799
No. of Posts Required	0.03	0.05	0.15	0.33	0.03	0.59
Employee Costs	£2,569	£4,243	£13,030	£29,274	£2,192	£51,309
Category 3-4 Non-Traffic Sensitive Streets						
Street Works Officers						
	PAA	**Major**	**Standard**	**Minor**	**Immediate**	**TOTAL**
Hours per Permit	0.59	0.89	0.55	0.37	0.42	2.82
Total Permits	227	218	959	15727	1734	18865
Total Hours	135	195	524	5858	721	53231
No. of Posts Required	0.09	0.13	0.34	3.83	0.47	4.86
Employee Costs	£4,281	£6,192	£16,650	£186,098	£22,905	£236,126

Street Works Coordinators						
	PAA	**Major**	**Standard**	**Minor**	**Immediate**	**TOTAL**
Hours per Permit	0.72	1.51	0.64	0.27	0.37	3.51
Total Permits	227	218	959	15727	1734	18865
Total Hours	164	329	610	4312	637	66178
No. of Posts Required	0.11	0.22	0.40	2.82	0.42	3.95
Employee Costs	£6,532	£13,108	£24,272	£171,672	£25,342	£240,926

Southampton Permit Scheme – Cost Benefit Analysis

Traffic Managers						
	PAA	Major	Standard	Minor	Immediate	TOTAL
Hours per Permit	0.36	0.58	0.22	0.05	0.05	1.26
Total Permits	227	218	959	15727	1734	18865
Total Hours	82	127	213	740	94	23857
No. of Posts Required	0.05	0.08	0.14	0.48	0.06	0.82
Employee Costs	£4,667	£7,261	£12,148	£42,324	£5,368	£71,768

The overall costs associated with the operation of the Permit Scheme are summarised in Table 54 below.

Table 54 Staff costing summary

Total Number of Employees and Costs		
Personnel Type	**No.**	**Salaries**
Street Works Officers	3.90	£313,462
Street Works Coordinators	3.67	£339,698
Traffic Managers	1.28	£123,077
TOTAL	**8.86**	**£776,237**

With the addition of a provision for the cost of Permit variations, the final Permit Scheme cost is shown in Table 55.

Table 55 Permit Scheme costing summary

Permit Scheme Cost Breakdown	
Cost Type	**Cost**
Permit Application Employee Costs	£776,237
Permit Application Operational Factor Costs	£225,109
Total Permit Application Costs	£1,001,346

Permit Variation Employee Costs	£31,463
Permit Variation Operational Factor Costs	£12,851
Total Permit Variation Application Costs	£44,314

TOTAL PERMIT SCHEME COSTS	**£1,045,659**

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
- 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 56 and 62. 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 £86,957 (5%) and £86,775 (10%) in the first month are a pro-rata apportionment of the opening year total of £1,019,518 (5%) and £993,476 (10%) contained within Tables 57 and 63.

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 58 to 61 (5% saving) and 64 to 67 (10% saving).

Southampton Permit Scheme – Cost Benefit Analysis

Table 56 Financial Calculations 5% Reduction in Works Annual Cost

Southampton 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	1,045,659	1,019,518	1,019,518	1,019,518	1,019,518	1,019,518	1,019,518	1,019,518	1,019,518	1,019,518	1,019,518
Recovery of Set-up Costs	107,600	35,867	35,867	35,867							
Annual Cost For Recovery		1,070,146	1,055,385	1,055,385	1,019,518	1,019,518	1,019,518	1,019,518	1,019,518	1,019,518	1,019,518
Cost Recovery Price Permit fee income		1,139,455	1,015,369	1,019,518	1,019,518	1,019,518	1,019,518	1,019,518	1,019,518	1,019,518	1,019,518
Cost Recovery Price Permit fee income (prior year data)		53	45	50	50	48	48	48	48	48	48
(Over) / under-recovery £		-69,309	40,016	35,867	-	-	-	-	-	-	-
(Over) / under-recovery £ (prior year)	-	-69,309	40,016	35,867	-	-	-	-	-	-	-
Annual Cost Highway permits (non recoverable)	40,929	40,929	38,882	38,882	38,882	38,882	38,882	38,882	38,882	38,882	38,882
Annual Income Max Permit Fee	1,203,418	1,175,840	1,173,332	1,173,332	1,173,332	1,173,332	1,173,332	1,173,332	1,173,332	1,173,332	1,173,332
Overall Scheme Cost	1,045,659	950,209	1,059,534	1,055,385	1,019,518	1,019,518	1,019,518	1,019,518	1,019,518	1,019,518	1,019,518
Profit/Loss	-	225,630	113,798	117,948	153,814	153,814	153,814	153,814	153,814	153,814	153,814

Table 57 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	87,138	86,957	86,790	86,638	86,498	86,370	86,252	86,145	86,046	85,955	85,872	85,796	84,960
Permit Volumes	-	1,860	1,767	1,767	1,767	1,767	1,767	1,767	1,767	1,767	1,767	1,767	1,767
Cost Recovery Price Permit fee income	-	53.49	53.49	53.49	53.49	53.49	53.49	53.49	53.49	53.49	53.49	53.49	53.49
Multiplied by number of Permits	-	99,516	94,540	94,540	94,540	94,540	94,540	94,540	94,540	94,540	94,540	94,540	94,540
Income derived on Cost recovery basis	-	99,516	94,540	94,540	94,540	94,540	94,540	94,540	94,540	94,540	94,540	94,540	94,540
Cost Highway permits (non recoverable)	3,411	3,411	3,411	3,411	3,411	3,411	3,411	3,411	3,411	3,411	3,411	3,411	3,411
Income derived from Max Permit Fee	100,285	100,285	97,778	97,778	97,778	97,778	97,778	97,778	97,778	97,778	97,778	97,778	97,778
Permit Scheme - Operational Costs		-90,367	-90,201	-90,049	-89,909	-89,781	-89,663	-89,555	-89,457	-89,366	-89,283	-89,207	-88,371

Southampton Permit Scheme – Cost Benefit Analysis

Table 58 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	-	84,960	84,960	84,960	84,960	84,960	84,960	84,960	84,960	84,960	84,960	84,960	84,960
Permit Volumes	-	1,767	1,767	1,767	1,767	1,767	1,767	1,767	1,767	1,767	1,767	1,767	1,767
Cost Recovery Price Permit fee income	-	44.61	44.61	44.61	44.61	44.61	44.61	44.61	44.61	44.61	44.61	44.61	44.61
Multiplied by number of Permits	-	78,838	78,838	78,838	78,838	78,838	78,838	78,838	78,838	78,838	78,838	78,838	78,838
Income derived on Cost recovery basis	-	78,838	78,838	78,838	78,838	78,838	78,838	78,838	78,838	78,838	78,838	78,838	78,838
Cost Highway permits (non recoverable)	3,411	3,411	3,411	3,411	3,411	3,411	3,411	3,411	3,411	3,411	3,411	3,411	3,411
Income derived from Max Permit Fee	-	100,285	97,778	97,778	97,778	97,778	97,778	97,778	97,778	97,778	97,778	97,778	97,778
Permit Scheme - Operational Costs	-	-88,371	-88,371	-88,371	-88,371	-88,371	-88,371	-88,371	-88,371	-88,371	-88,371	-88,371	-88,371

Table 59 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	-	84,960	84,960	84,960	84,960	84,960	84,960	84,960	84,960	84,960	84,960	84,960	84,960
Permit Volumes	-	1,767	1,767	1,767	1,767	1,767	1,767	1,767	1,767	1,767	1,767	1,767	1,767
Cost Recovery Price Permit fee income	-	49.96	49.96	49.96	49.96	49.96	49.96	49.96	49.96	49.96	49.96	49.96	49.96
Multiplied by number of Permits	-	88,295	88,295	88,295	88,295	88,295	88,295	88,295	88,295	88,295	88,295	88,295	88,295
Income derived on Cost recovery basis	-	88,295	88,295	88,295	88,295	88,295	88,295	88,295	88,295	88,295	88,295	88,295	88,295
Cost Highway permits (non recoverable)	3,411	3,411	3,411	3,411	3,411	3,411	3,411	3,411	3,411	3,411	3,411	3,411	3,411
Income derived from Max Permit Fee	-	100,285	97,778	97,778	97,778	97,778	97,778	97,778	97,778	97,778	97,778	97,778	97,778
Permit Scheme - Operational Costs	-	-88,371	-88,371	-88,371	-88,371	-88,371	-88,371	-88,371	-88,371	-88,371	-88,371	-88,371	-88,371

Southampton Permit Scheme – Cost Benefit Analysis

Table 60 Financial Calculations 5% Reduction in Works 4-14 Year Cost

Financial Calculations 5% Reduction in Street Works Annual Cost of Permit Scheme - Closing Values	Year	Year-4	Year-5	Year-6	Year-7	Year-8	Year-9	Year-10	Year-11	Year-12	Year-13	Year-14
Permit Cost	-	1,019,518	1,019,518	1,019,518	1,019,518	1,019,518	1,019,518	1,019,518	1,019,518	1,019,518	1,019,518	1,019,518
Permit Volumes	-	21,209	21,209	21,209	21,209	21,209	21,209	21,209	21,209	21,209	21,209	21,209
Cost Recovery Price Permit fee income	-	49.76	48.07	48.07	48.07	48.07	48.07	48.07	48.07	48.07	48.07	48.07
Multiplied by number of Permits	-	1,055,385	1,019,518	1,019,518	1,019,518	1,019,518	1,019,518	1,019,518	1,019,518	1,019,518	1,019,518	1,019,518
Income derived on Cost recovery basis	-	1,055,385	1,019,518	1,019,518	1,019,518	1,019,518	1,019,518	1,019,518	1,019,518	1,019,518	1,019,518	1,019,518
Cost Highway permits (non recoverable)	-	38,882	38,882	38,882	38,882	38,882	38,882	38,882	38,882	38,882	38,882	38,882
Income derived from Max Permit Fee	-	1,173,332	1,173,332	1,173,332	1,173,332	1,173,332	1,173,332	1,173,332	1,173,332	1,173,332	1,173,332	1,173,332
Permit Scheme - Operational Costs		-1,058,400	-1,058,400	-1,058,400	-1,058,400	-1,058,400	-1,058,400	-1,058,400	-1,058,400	-1,058,400	-1,058,400	-1,058,400

Table 61 Financial Calculations 5% Reduction in Works 15-25 Year Cost

Financial Calculations 5% Reduction in Street Works Annual Cost of Permit Scheme - Closing Values	Year	Year-15	Year-16	Year-17	Year-18	Year-19	Year-20	Year-21	Year-22	Year-23	Year-24	Year-25
Permit Cost	-	1,019,518	1,019,518	1,019,518	1,019,518	1,019,518	1,019,518	1,019,518	1,019,518	1,019,518	1,019,518	1,019,518
Permit Volumes		21,209	21,209	21,209	21,209	21,209	21,209	21,209	21,209	21,209	21,209	21,209
Cost Recovery Price Permit fee income		48.07	48.07	48.07	48.07	48.07	48.07	48.07	48.07	48.07	48.07	48.07
Multiplied by number of Permits		1,019,518	1,019,518	1,019,518	1,019,518	1,019,518	1,019,518	1,019,518	1,019,518	1,019,518	1,019,518	1,019,518
Income derived on Cost recovery basis		1,019,518	1,019,518	1,019,518	1,019,518	1,019,518	1,019,518	1,019,518	1,019,518	1,019,518	1,019,518	1,019,518
Cost Highway permits (non recoverable)		38,882	38,882	38,882	38,882	38,882	38,882	38,882	38,882	38,882	38,882	38,882
Income derived from Max Permit Fee		1,173,332	1,173,332	1,173,332	1,173,332	1,173,332	1,173,332	1,173,332	1,173,332	1,173,332	1,173,332	1,173,332
Permit Scheme - Operational Costs		-1,058,400	-1,058,400	-1,058,400	-1,058,400	-1,058,400	-1,058,400	-1,058,400	-1,058,400	-1,058,400	-1,058,400	-1,058,400

Southampton Permit Scheme – Cost Benefit Analysis

Table 62 Financial Calculations 10% Reduction in Works Annual Cost

Southampton 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	1,045,659	993,376	993,376	993,376	993,376	993,376	993,376	993,376	993,376	993,376	993,376
Recovery of Set-up Costs	107,600	35,867	35,867	35,867	-	-	-	-	-	-	-
Annual Cost For Recovery	-	1,058,766	1,029,243	1,029,243	993,376	993,376	993,376	993,376	993,376	993,376	993,376
Cost Recovery Price Permit fee income	-	986,984	1,059,695	993,376	993,376	993,376	993,376	993,376	993,376	993,376	993,376
Cost Recovery Price Permit fee income (prior year data)	-	49	56	48	51	49	49	49	49	49	49
(Over) / under-recovery £	-	71,781	-30,452	35,867	-	-	-	-	-	-	-
(Over) / under-recovery £ (prior year)	-	71,781	-30,452	35,867	-	-	-	-	-	-	-
Annual Cost Highway permits (non recoverable)	40,929	40,929	36,836	36,836	36,836	36,836	36,836	36,836	36,836	36,836	36,836
Annual Income Max Permit Fee	1,203,418	1,148,261	1,143,247	1,143,247	1,143,247	1,143,247	1,143,247	1,143,247	1,143,247	1,143,247	1,143,247
Overall Scheme Cost	1,086,588	1,141,953	962,924	1,029,243	993,376	993,376	993,376	993,376	993,376	993,376	993,376
Profit/Loss	116,830	6,308	180,323	114,004	149,871	149,871	149,871	149,871	149,871	149,871	149,871

Table 63 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	87,138	86,775	86,442	86,137	85,858	85,601	85,366	85,151	84,953	84,772	84,607	84,454	82,781
Permit Volumes	-	1,860	1,674	1,674	1,674	1,674	1,674	1,674	1,674	1,674	1,674	1,674	1,674
Cost Recovery Price Permit fee income	-	48.67	48.67	48.67	48.67	48.67	48.67	48.67	48.67	48.67	48.67	48.67	48.67
Multiplied by number of Permits	-	90,549	81,494	81,494	81,494	81,494	81,494	81,494	81,494	81,494	81,494	81,494	81,494
Income derived on Cost recovery basis	-	90,549	81,494	81,494	81,494	81,494	81,494	81,494	81,494	81,494	81,494	81,494	81,494
Cost Highway permits (non recoverable)	3,411	3,411	3,411	3,411	3,411	3,411	3,411	3,411	3,411	3,411	3,411	3,411	3,411
Income derived from Max Permit Fee	100,285	100,285	95,271	95,271	95,271	95,271	95,271	95,271	95,271	95,271	95,271	95,271	95,271
Permit Scheme - Operational Costs	-	-86,775	-86,442	-86,137	-85,858	-85,601	-85,366	-85,151	-84,953	-84,772	-84,607	-84,454	-82,781

Southampton Permit Scheme – Cost Benefit Analysis

Table 64 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	-	82,781	82,781	82,781	82,781	82,781	82,781	82,781	82,781	82,781	82,781	82,781	82,781
Permit Volumes	-	1,674	1,674	1,674	1,674	1,674	1,674	1,674	1,674	1,674	1,674	1,674	1,674
Cost Recovery Price Permit fee income	-	56.31	56.31	56.31	56.31	56.31	56.31	56.31	56.31	56.31	56.31	56.31	56.31
Multiplied by number of Permits	-	94,290	94,290	94,290	94,290	94,290	94,290	94,290	94,290	94,290	94,290	94,290	94,290
Income derived on Cost recovery basis	-	94,290	94,290	94,290	94,290	94,290	94,290	94,290	94,290	94,290	94,290	94,290	94,290
Cost Highway permits (non recoverable)	3,411	3,411	3,411	3,411	3,411	3,411	3,411	3,411	3,411	3,411	3,411	3,411	3,411
Income derived from Max Permit Fee	-	95,271	95,271	95,271	95,271	95,271	95,271	95,271	95,271	95,271	95,271	95,271	95,271
Permit Scheme - Operational Costs	-	-82,781	-82,781	-82,781	-82,781	-82,781	-82,781	-82,781	-82,781	-82,781	-82,781	-82,781	-82,781

Table 65 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	-	82,781	82,781	82,781	82,781	82,781	82,781	82,781	82,781	82,781	82,781	82,781	82,781
Permit Volumes	-	1,674	1,674	1,674	1,674	1,674	1,674	1,674	1,674	1,674	1,674	1,674	1,674
Cost Recovery Price Permit fee income	-	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92
Multiplied by number of Permits	-	80,244	80,244	80,244	80,244	80,244	80,244	80,244	80,244	80,244	80,244	80,244	80,244
Income derived on Cost recovery basis	-	80,244	80,244	80,244	80,244	80,244	80,244	80,244	80,244	80,244	80,244	80,244	80,244
Cost Highway permits (non recoverable)	3,411	3,411	3,411	3,411	3,411	3,411	3,411	3,411	3,411	3,411	3,411	3,411	3,411
Income derived from Max Permit Fee	-	95,271	95,271	95,271	95,271	95,271	95,271	95,271	95,271	95,271	95,271	95,271	95,271
Permit Scheme - Operational Costs	-	-82,781	-82,781	-82,781	-82,781	-82,781	-82,781	-82,781	-82,781	-82,781	-82,781	-82,781	-82,781

Southampton Permit Scheme – Cost Benefit Analysis

Table 66 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	-	993,376	993,376	993,376	993,376	993,376	993,376	993,376	993,376	993,376	993,376	993,376
Permit Volumes	-	20,092	20,092	20,092	20,092	20,092	20,092	20,092	20,092	20,092	20,092	20,092
Cost Recovery Price Permit fee income	-	51.23	49.44	49.44	49.44	49.44	49.44	49.44	49.44	49.44	49.44	49.44
Multiplied by number of Permits	-	1,029,243	993,376	993,376	993,376	993,376	993,376	993,376	993,376	993,376	993,376	993,376
Income derived on Cost recovery basis	-	1,029,243	993,376	993,376	993,376	993,376	993,376	993,376	993,376	993,376	993,376	993,376
Cost Highway permits (non recoverable)	-	36,836	36,836	36,836	36,836	36,836	36,836	36,836	36,836	36,836	36,836	36,836
Income derived from Max Permit Fee	-	1,143,247	1,143,247	1,143,247	1,143,247	1,143,247	1,143,247	1,143,247	1,143,247	1,143,247	1,143,247	1,143,247
Permit Scheme - Operational Costs	-	-993,376	-993,376	-993,376	-993,376	-993,376	-993,376	-993,376	-993,376	-993,376	-993,376	-993,376

Table 67 Financial Calculations 10% Reduction in Works 5-25 Year Cost

Financial Calculations 10% Reduction in Street Works Annual Cost of Permit Scheme - Closing Values	Year	Year-15	Year-16	Year-17	Year-18	Year-19	Year-20	Year-21	Year-22	Year-23	Year-24	Year-25
Permit Cost	-	993,376	993,376	993,376	993,376	993,376	993,376	993,376	993,376	993,376	993,376	993,376
Permit Volumes	-	20,092	20,092	20,092	20,092	20,092	20,092	20,092	20,092	20,092	20,092	20,092
Cost Recovery Price Permit fee income	-	49	49	49	49	49	49	49	49	49	49	49
Multiplied by number of Permits	-	993,376	993,376	993,376	993,376	993,376	993,376	993,376	993,376	993,376	993,376	993,376
Income derived on Cost recovery basis	-	993,376	993,376	993,376	993,376	993,376	993,376	993,376	993,376	993,376	993,376	993,376
Cost Highway permits (non recoverable)	-	36,836	36,836	36,836	36,836	36,836	36,836	36,836	36,836	36,836	36,836	36,836
Income derived from Max Permit Fee	-	1,143,247	1,143,247	1,143,247	1,143,247	1,143,247	1,143,247	1,143,247	1,143,247	1,143,247	1,143,247	1,143,247
Permit Scheme - Operational Costs	-	-993,376	-993,376	-993,376	-993,376	-993,376	-993,376	-993,376	-993,376	-993,376	-993,376	-993,376

7.2.3 Investment costs

The investment costs of £107,600 are incurred in the month before the Permit Scheme opening and recovered throughout 3 years through Permit Scheme income. The detailed breakdown of costs is presented in Table 51.

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 Southampton 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 68 to 71.

8.3 PUBLIC ACCOUNTS

The Public Accounts tables show the net impact to Local and Central Government and are below on Tables 72 to 75.

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 76 to 79 are below.

8.5 STATUTORY COST BENEFIT ANALYSIS

The study has addressed all aspects of the implementation of the Southampton 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.

Southampton Permit Scheme – Cost Benefit Analysis

Table 68 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	2,710,898		2,395,548	315,350	-	-
Vehicle operating costs	165,953		165,953			-
User charges	-		-	-	-	-
During Construction & Maintenance	-		-	-	-	-
NET CONSUMER BENEFITS	2,876,851	*-1*	2,561,501	315,350	-	-

Business								
User benefits			**Goods Vehicles**	**Business Cars & LGVs**	**Passengers**	**Freight**	**Passengers**	
Travel time	1,918,709		655,105	1,176,630	86,974	-	-	-
Vehicle operating costs	67,687		46,527	21,159				-
User charges	-		-	-	-	-	-	-
During Construction & Maintenance	-		-	-	-	-	-	-
Subtotal	1,986,395	*-2*	701,632	1,197,789	86,974	-	-	-
Private sector provider impacts						**Freight**	**Passengers**	
Revenue	-				-	-	-	-
Operating costs	26,195				26,195	-	-	-
Investment costs	-				-	-	-	-
Grant/subsidy	-				-	-	-	-
Subtotal	26,195	*-3*			26,195	-		-
Other business impacts								
Developer contributions	-	*-4*	-		-	-	-	-
NET BUSINESS IMPACT	2,012,590	*(5) = (2) + (3) + (4)*						

TOTAL		
Present Value of Transport Economic Efficiency Benefits	4,889,441	*(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.

Southampton Permit Scheme – Cost Benefit Analysis
Table 69 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	5,421,796		4,791,096	630,700	-	-
Vehicle operating costs	93,055		93,055			-
User charges	-		-	-	-	-
During Construction & Maintenance	-		-	-	-	-
NET CONSUMER BENEFITS	5,514,850	*-1*	4,884,150	630,700	-	-

Business								
User benefits			**Goods Vehicles**	**Business Cars & LGVs**	**Passengers**	**Freight**	**Passengers**	
Travel time	3,837,418		1,310,209	2,353,260	173,948	-	-	-
Vehicle operating costs	135,373		93,055	42,319				-
User charges	-		-	-	-	-	-	-
During Construction & Maintenance	-		-	-	-	-	-	-
Subtotal	3,972,791	*-2*	1,403,264	2,395,578	173,948	-	-	-
Private sector provider impacts						**Freight**	**Passengers**	
Revenue	-				-	-	-	-
Operating costs	52,389				52,389	-	-	-
Investment costs	-				-	-	-	-
Grant/subsidy	-				-	-	-	-
Subtotal	52,389	*-3*			52,389	-	-	-
Other business impacts								
Developer contributions	-	*-4*	-		-	-	-	-
NET BUSINESS IMPACT	4,025,180	*(5) = (2) + (3) + (4)*						

TOTAL		
Present Value of Transport Economic Efficiency Benefits	9,540,031	*(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.

Southampton Permit Scheme – Cost Benefit Analysis
Table 70 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	67,772,447		59,888,694	7,883,753	-	-
Vehicle operating costs	4,148,835		4,148,835			-
User charges	-		-	-	-	-
During Construction & Maintenance	-		-	-	-	-
NET CONSUMER BENEFITS	71,921,282	*-1*	64,037,529	7,883,753	-	-

Business								
User benefits			**Goods Vehicles**	**Business Cars & LGVs**	**Passengers**	**Freight**	**Passengers**	
Travel time	47,967,719		16,377,618	29,415,746	2,174,356	-	-	-
Vehicle operating costs	1,692,168		1,163,183	528,985				-
User charges	-		-	-	-	-	-	-
During Construction & Maintenance	-		-	-	-	-	-	-
Subtotal	49,659,887	*-2*	17,540,800	29,944,731	2,174,356	-	-	-
						Freight	**Passengers**	
Revenue	-				-	-	-	-
Operating costs	654,866				654,866	-	-	-
Investment costs	-				-	-	-	-
Grant/subsidy	-				-	-	-	-
Subtotal	654,866	*-3*			654,866	-	-	-

Developer contributions	-	*-4*	-		-	-	-	-
NET BUSINESS IMPACT	50,314,753	*(5) = (2) + (3) + (4)*						

TOTAL		
Present Value of Transport Economic Efficiency Benefits	122,236,035	*(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.

Southampton Permit Scheme – Cost Benefit Analysis
Table 71 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	135,544,894		119,777,389		15,767,505	-	-
Vehicle operating costs	2,326,365		2,326,365				-
User charges	-		-		-	-	-
During Construction & Maintenance	-		-		-	-	-
NET CONSUMER BENEFITS	137,871,259	*-1*	122,103,754		15,767,505	-	-

Business								
User benefits			**Goods Vehicles**	**Business Cars & LGVs**	**Passengers**	**Freight**	**Passengers**	
Travel time	95,935,438		32,755,236	58,831,491	4,348,712	-	-	-
Vehicle operating costs	3,384,336		2,326,365	1,057,970				-
User charges	-		-	-	-	-	-	-
During Construction & Maintenance	-		-	-	-	-	-	-
Subtotal	99,319,774	*-2*	35,081,601	59,889,462	4,348,712	-	-	-
Private sector provider impacts						**Freight**	**Passengers**	
Revenue	-				-	-	-	-
Operating costs	1,309,733				1,309,733	-	-	-
Investment costs	-				-	-	-	-
Grant/subsidy	-				-	-	-	-
Subtotal	1,309,733	*-3*			1,309,733	-	-	-
Other business impacts								
Developer contributions	-	*-4*	-		-	-	-	-
NET BUSINESS IMPACT	100,629,507	*(5) = (2) + (3) + (4)*						

TOTAL		
Present Value of Transport Economic Efficiency Benefits	238,500,766	*(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.

Southampton Permit Scheme – Cost Benefit Analysis
Table 72 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	-1,051,250		-			-1,051,250
Operating Costs	961,282		-			961,282
Investment Costs	1,083,317		-			1,083,317
Developer and Other Contributions	-		-	-	-	-
Grant/Subsidy Payments	-		-	-	-	-
NET IMPACT	993,348	*-7*	-	-	-	993,348
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	993,348	*(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 73 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	-1,026,594		-			-1,026,594
Operating Costs	914,515		-			914,515
Investment Costs	1,122,793		-			1,122,793
Developer and Other Contributions	-		-	-	-	-
Grant/Subsidy Payments	-		-	-	-	-
NET IMPACT	1,010,714	*-7*	-	-	-	1,010,714
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	1,010,714	*(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.

Southampton Permit Scheme – Cost Benefit Analysis

Table 74 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	-26,231,948		-			-26,231,948
Operating Costs	23,675,055		-			23,675,055
Investment Costs	26,328,147		-			26,328,147
Developer and Other Contributions	-		-	-	-	-
Grant/Subsidy Payments	-		-	-	-	-
NET IMPACT	23,771,254	*-7*	-	-	-	23,771,254
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	23,771,254	*(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.

Southampton Permit Scheme – Cost Benefit Analysis

Table 75 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	-25,557,265		-			-25,557,265
Operating Costs	22,229,412		-			22,229,412
Investment Costs	25,653,464		-			25,653,464
Developer and Other Contributions	-		-	-	-	-
Grant/Subsidy Payments	-		-	-	-	-
NET IMPACT	22,325,611	*-7*	-	-	-	22,325,611
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	22,325,611	*(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 76 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	29,795		*-14*
Journey Quality	-		*-15*
Physical Activity	-		*-16*
Accidents	55,380		*-17*
Economic Efficiency: Consumer Users (Commuting)	2,876,851	*(1a)*	
Economic Efficiency: Consumer Users (Other)	-	*(1b)*	
Economic Efficiency: Business Users and Providers	2,012,590		*-5*
Wider Public Finances (Indirect Taxation Revenues)	22,681	*- (11) - sign changed from PA table, as PA table represents costs, not benefits*	
Present Value of Benefits (see notes) (PVB)	4,951,936	*(PVB) = (12) + (13) + (14) + (15) + (16) + (17) + (1a) + (1b) + (5) - (11)*	
Broad Transport Budget	993,348		
Present Value of Costs (see notes) (PVC)	993,348		
OVERALL IMPACTS			
Net Present Value (NPV)	3,958,588		
Benefit to Cost Ratio (BCR)	4.99		

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 77 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	59,591	*-14*
Journey Quality	-	*-15*
Physical Activity	-	*-16*
Accidents	110,761	*-17*
Economic Efficiency: Consumer Users (Commuting)	5,514,850	*(1a)*
Economic Efficiency: Consumer Users (Other)	-	*(1b)*
Economic Efficiency: Business Users and Providers	4,025,180	*-5*
Wider Public Finances (Indirect Taxation Revenues)	45,362	*- (11) - sign changed from PA table, as PA table represents costs, not benefits*
Present Value of Benefits (see notes) (PVB)	9,755,744	*(PVB) = (12) + (13) + (14) + (15) + (16) + (17) + (1a) + (1b) + (5) - (11)*
Broad Transport Budget	1,010,714	*-10*
Present Value of Costs (see notes) (PVC)	1,010,714	*(PVC) = (10)*
OVERALL IMPACTS		
Net Present Value (NPV)	8,745,030	NPV=PVB-PVC
Benefit to Cost Ratio (BCR)	9.65	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 78 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	744,886	*-14*
Journey Quality	-	*-15*
Physical Activity	-	*-16*
Accidents	1,384,507	*-17*
Economic Efficiency: Consumer Users (Commuting)	71,921,282	*(1a)*
Economic Efficiency: Consumer Users (Other)	-	*(1b)*
Economic Efficiency: Business Users and Providers	50,314,753	*-5*
Wider Public Finances (Indirect Taxation Revenues)	567,030	*- (11) - sign changed from PA table, as PA table represents costs, not benefits*
Present Value of Benefits (see notes) (PVB)	123,798,398	*(PVB) = (12) + (13) + (14) + (15) + (16) + (17) + (1a) + (1b) + (5) - (11)*
Broad Transport Budget	23,771,254	*-10*
Present Value of Costs (see notes) (PVC)	23,771,254	*(PVC) = (10)*
OVERALL IMPACTS		
Net Present Value (NPV)	100,027,144	NPV=PVB-PVC
Benefit to Cost Ratio (BCR)	5.21	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 79 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	1,489,773		*-14*
Journey Quality	-		*-15*
Physical Activity	-		*-16*
Accidents	2,769,013		*-17*
Economic Efficiency: Consumer Users (Commuting)	137,871,259	*(1a)*	
Economic Efficiency: Consumer Users (Other)	-	*(1b)*	
Economic Efficiency: Business Users and Providers	100,629,507		*-5*
Wider Public Finances (Indirect Taxation Revenues)	1,134,060	*- (11) - sign changed from PA table, as PA table represents costs, not benefits*	
Present Value of Benefits (see notes) (PVB)	241,625,492	*(PVB) = (12) + (13) + (14) + (15) + (16) + (17) + (1a) + (1b) + (5) - (11)*	
Broad Transport Budget	22,325,611		*-10*
Present Value of Costs (see notes) (PVC)	22,325,611	*(PVC) = (10)*	
OVERALL IMPACTS			
Net Present Value (NPV)	219,299,881	NPV=PVB-PVC	
Benefit to Cost Ratio (BCR)	10.82	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 SOUTHAMPTON PERMIT SCHEME CBA RESULTS

9.1 INTRODUCTION

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

9.2 SOUTHAMPTON 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 80), which includes the cost recovery from Permit Fee income and includes the effect of indirect taxation. The summary of benefits is presented in Table 81.

Table 80 Highway Authority Southampton Cost Benefit results

Highway Authority Assessment **5% reduction in works impact**	**Opening Year**	**25 Year**
Net Present Value of Benefits	£4,951,936	£123,798,398
Net Present Value of Costs	£993,348	£23,771,254
Net Present Value of Permit Scheme	£3,958,588	£100,027,144
Benefit to Cost Ratio	**4.99**	**5.21**

Highway Authority Assessment **10% reduction in works impact**	**Opening Year**	**25 Year**
Net Present Value of Benefits	£9,755,744	£241,625,492
Net Present Value of Costs	£1,010,714	£22,325,611
Net Present Value of Permit Scheme	£8,745,030	£219,299,881
Benefit to Cost Ratio	**9.65**	**10.82**

Table 81 Benefits Summary Values and Percentage 5% reduction in works impact 25 Years

Benefits	**Value**	**Percentage of Total Benefit**
Consumer Travel Time	£67,772,447	55%
Consumer Vehicle Operating Costs	£4,148,835	3%
Business Travel Time	£47,967,719	39%
Business Vehicle Operating Costs	£1,692,168	1%
Private Sector Provider Operating Costs	£654,866	1%
Reduction in Fuel Revenue	£567,030	0%
Greenhouse Gases	£744,886	1%
Accidents	£1,384,507	1%
Net Present Value of Benefits	**£123,798,398**	

The Scheme has a Benefit Cost Ratio of 5.21 and Net Present Value of £100m 2010 prices and 5% reduction in works which suggest the Southampton Permit Scheme would be both viable and beneficial for the Highway Authority and the population of Southampton.

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 £4.9m includes a reliability adjustment of 20% for urban roads and has been assessed at a local level. This is a decrease in the estimated suggested benefit in the DfT report in Section 3.7. The average by type of works in The Halcrow Study for Major and Standard works was 24% of total works, in Southampton this is 13% and will have a factor on the duration of works and subsequent 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 5.21.

The results in Table 82 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 82 Standard Sensitivity

Standard Sensitivity		
BCR	1%	2%
Works Reduction	0.97%	1.93%

Table 83 below presents the BCR achieved based upon the level of works reduction achieved.

Table 83 Works Reduction Sensitivity

Works Reduction Sensitivity	
Works Reduction	**BCR**
1% Saving	1.03
2% Saving	2.07
3% Saving	3.12
4% Saving	4.18
5% Saving	5.26
6% Saving	6.34
7% Saving	7.43
8% Saving	8.54
9% Saving	9.66
10% Saving	10.79

Table 84 shows the level of roadwork reduction achieved at different BCR levels.

Table 84 BCR Sensitivity

BCR Sensitivity	
BCR	**Works Reduction**
1	0.97%
2	1.93%
3	2.89%
4	3.83%
5	4.76%
6	5.69%
7	6.61%
8	7.51%
9	8.41%
10	9.30%

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

END OF DOCUMENT