Nottingham Cycle City Ambition Programme

BUSINESS CASE – ECONOMIC CASE

April 2013

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1 INTRODUCTION

1.1 The economic case is one of five documents required to fulfil DfT's requirements for a WebTAG compliant Transport Business Case and provides the financial appraisal of the investment programme requested. This economic case relates to the Nottingham Cycle City Ambition Programme (NCCAP) bid.

Scheme Overview

1.2 The *strategic case s*ets out a package of measures aimed at radically increasing the number of people cycling across Nottingham. Within the strategic case, the measures are described in detail, with the following providing a summary:

1. Two high quality cross city cycle routes (North-South and East-West)
2. City centre improvements
3. Neighbourhood level cycle improvements
4. A "Greenway" package including the River Leen cycleway and improvements to parks.

1.3 In order to make the economic appraisal more robust the packages have been slightly reconfigured (as reported throughout this economic case document) in order to avoid double counting and to interpret the demand data available into a suitable format that could be used for this appraisal. The following provides a summary of how the above measures are packaged together and described within this report.

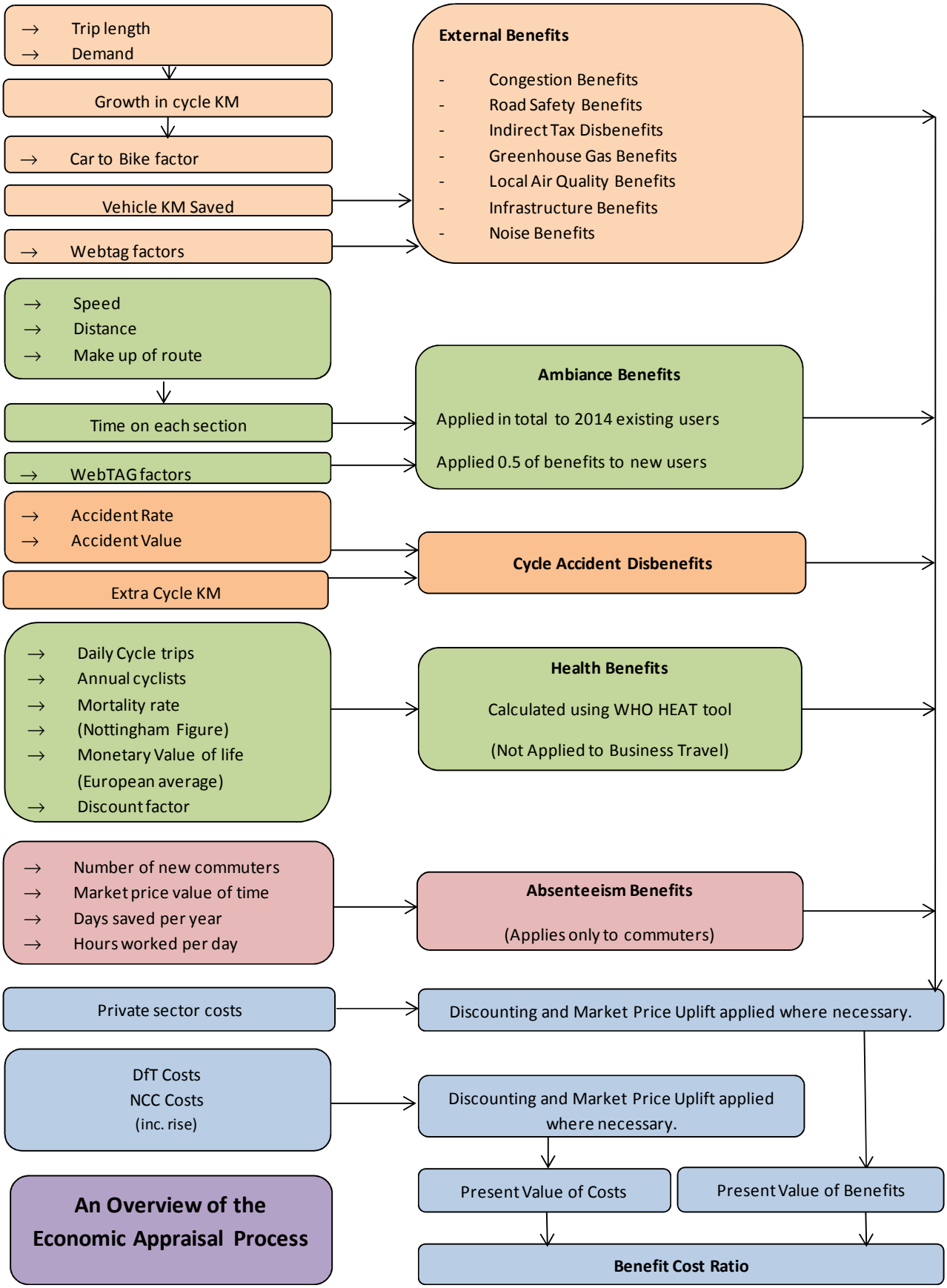
- Package 1 & 2 includes both the cross city routes and the city centre improvements, these have been appraised together in order to avoid overestimating demand on these routes.
- Package 3 – The upgrade to neighbourhood facilities in the wards of Bulwell, Lenton and St. Anns.
- Package 4a – Improvements to off street cycling facilities in six parks across the city.
- Package 4b – Improvements along the Leen corridor in order to improve commuter facilities between neighbourhoods in the North West of the city and major employers within the South West.

1.4 Package 4 has been separated as the demand has come from two separate sources. This is detailed further within Chapter 2.

Methodology

1.5 The methodology followed in this assessment has been taken from TAG unit 3.14.1. This was updated in August 2012 and therefore contains best estimates for factors, and determines that the appraisal undertaken for the Nottingham City schemes is both robust and logical. Figure 1.1 shows the process which has been applied, including the derivation of local data to inform the appraisal.

Figure 1.1 overall process flow diagram



Assumptions

1.6 A number of assumptions have been made in order to calculate the benefits for the above cycling packages. These include trip length which has been derived from the demand matrices, and average speed which we have assumed remains constant at 14km/h. Where possible these have been taken from previous experience, local evidence and TAG guidance. Where this is not possible a best estimate has been provided and noted within the text (adopting conservative estimates throughout).

2 DEMAND

Demand Calculation Overview

2.1 In order to calculate the benefits for each of the schemes, demand must first be established. For the purpose of this appraisal, demand has been calculated by two different methods.

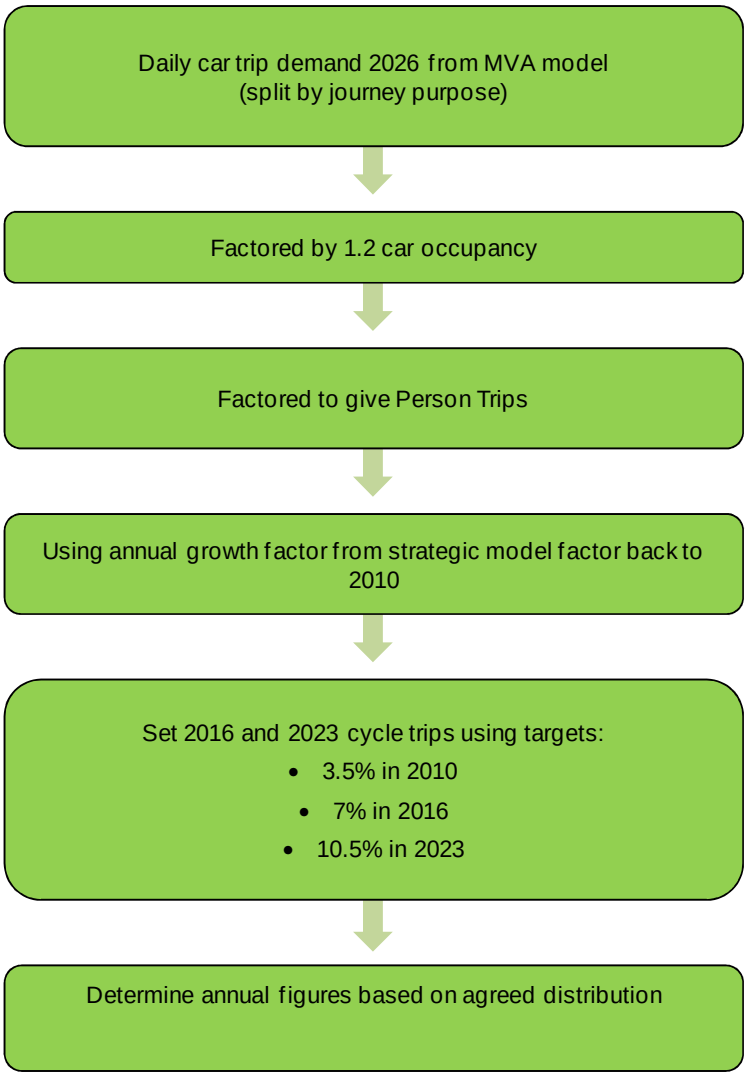
- For those packages along corridors (1, 2 and 4b) we have based the demand on the zones from the validated 'Nottingham model' developed by MVA Consultancy (as used for the LSTF major scheme funding bid).
- For Packages 3 and 4a, demand has been based on the levels of cycling in the wards where the improvements will take place. These have been taken from 2011 Census journey to work data.

2.2 These data sources are described below.

Demand for package 1, 2 and 4b

2.3 Figure 2.1 summarises the calculation process for package 1, 2 and 4b, with further details provided below.

Figure 2.1 demand calculation process for package 1, 2 and 4b



2.4 Demand for package 1 and 2 is based on car trip levels from the zones shown in pink in Figure 1. All trips under 8 miles were included that both originated and terminated within the zones indicated on the map.

2.5 Demand for package 4b (Leen Corridor) has also been based on car trip levels from the Nottingham model demand matrices. All trips under 8 miles were included that both originated and terminated within the zones indicated on the map.

2.6 Once the trip levels had been determined for each year of appraisal, the vehicle trip rates were then converted to person trip rates, using firstly a car occupancy factor and then a factor which incorporates other modes (as the original demand was based on car trips), in order to get total person trips.

2.7 Demand was then assumed for the trips at the following levels. These targets build on those developed for the LSTF programme, and are considered challenging yet achievable.

- In 2010 – 3.5% of trips were made by cycle
- In 2016 – 7% of trips will be made on bike (interim NCCAP target)
- In 2023 – 10.5% of trips will be made by cycle.(full NCCAP target)

This equates to the figures shown in Table 2-1. Using the same matrices, the journey purpose splits are included within

2.8 Table 2-2.

Table 2-1: Total Daily Cycle Demand (Trips) – Packages 1 & 2, and 4b

	Package 1 & 2	Package 4b
2010	7,954	3,074
2016	16,591	6,411
2023	26,135	10,100

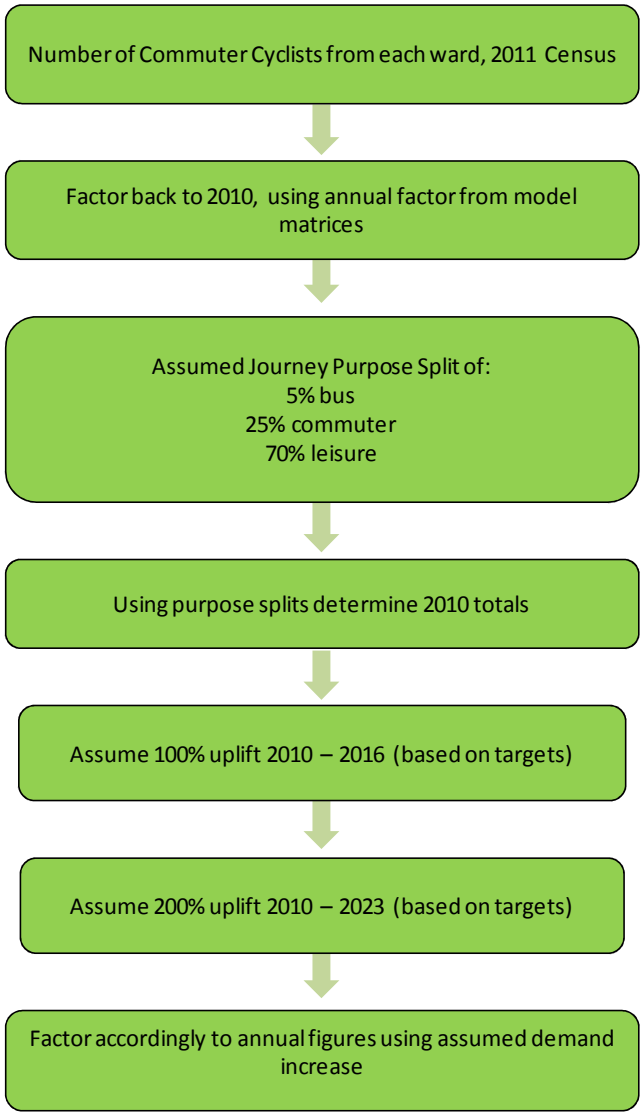
Table 2-2: Journey Purpose (% Split) – Based on Trip Matrices

	Package 1 & 2	Package 4b
Business	13.4%	4.8%
Commuters	23.4%	15.0%
Leisure	63.2%	80.2%

Demand from Wards (Packages 3 and 4a)

2.9 Figure 2.2 summarises the calculation process for package 3 and 4a, with further details provided below.

Figure 2.2 demand calculation process for package 3 and 4a



Using the ward populations, and the proportion of cycling commuters, the demand has been calculated as shown in Table 2-3. From Census data we know the number of commuting cyclists in each ward. Using assumed journey purposes (given in

Table 2-4), total daily demand was then calculated.

Table 2-3: Total Daily Cycle Demand (Trips) – Packages 3 and 4a

	Package 3	Package 4a
2010	2,039	5,530
2016	4,077	11,059
2023	6,116	16,589

Table 2-4: Journey Purpose (% splits) – Packages 3 and 4a

	Package 3 & 4a
Business	5%
Commuters	25%
Leisure	70%

New Users

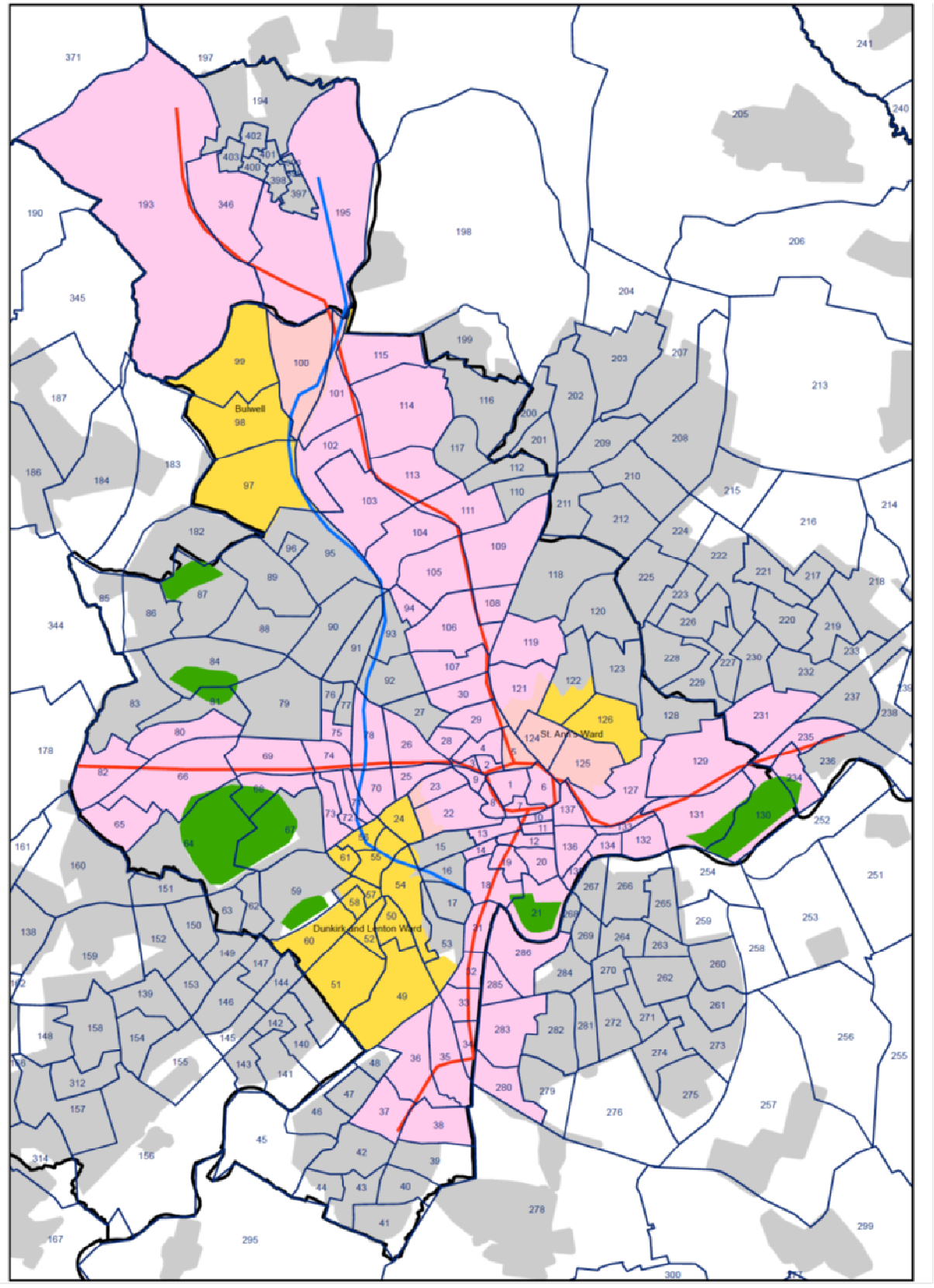
2.10 The distribution of increased users over the 10 year appraisal period is shown in Table 2-5. These figures are based upon when infrastructure is implemented and the profile of how the demand is expected to rise at a faster rate when the infrastructure is first introduced and then gradually the rate will decay.

Table 2-5: Distribution of New Users 2010 – 2016, and 2016 - 2023

Year	Cumulative Distribution of New Users 2010 - 2016
2010	10%
2011	20%
2012	30%
2013	40%
2014	70%
2015	100%

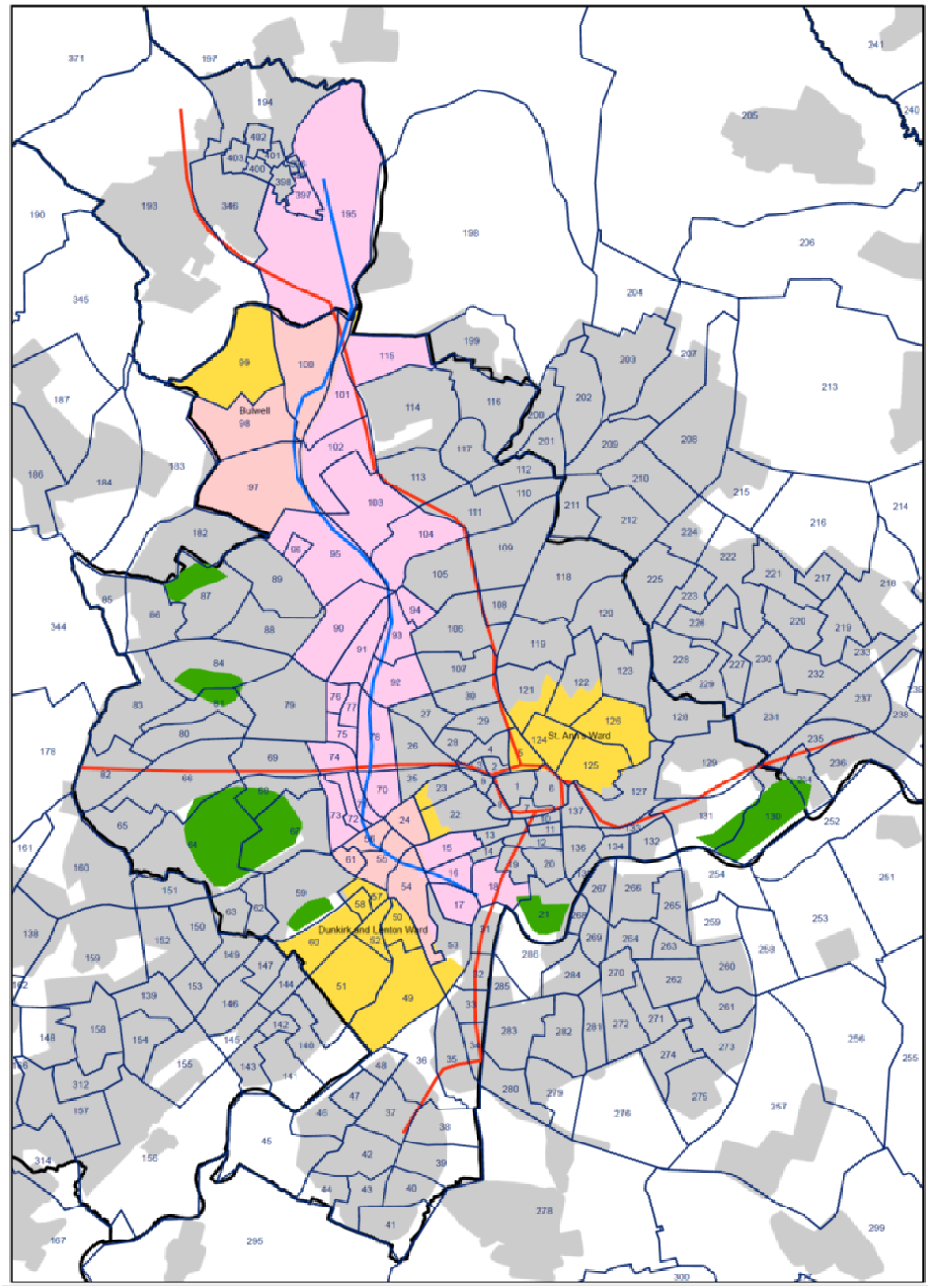
Year	Distribution of New Users 2016 - 2023
2016	20%
2017	40%
2018	60%
2019	70%
2020	80%
2021	90%
2022	100%

Figure 2-1: Zone Plan for Package 1 & 2



Note:
Red lines show the extent of package 1&2, blue line shows the extent of package 4b.
Pink cells represent those identified as 'within catchment' for NCCAP improvements for package 1&2.
Yellow areas are the wards with neighbourhood improvements in package 3
Green areas show the Park areas with improvements in package 4a.

Figure 2-2: Zone Plan for Package 4b



Note:
Red lines show the extent of package 1&2, blue line shows the extent of package 4b.
Pink cells represent those identified as 'within catchment' for NCCAP improvements for package 4b.
Yellow areas are the wards with neighbourhood improvements in package 3
Green areas show the Park areas with improvements in package 4a.

3 BENEFITS

3.1 Benefits from a cycle infrastructure scheme can be accrued through a number of different sources, as listed below:

- External Benefits
- Decongestion
- Environmental
  - Noise
  - Greenhouse gases
  - Local Air Quality
  - Infrastructure
- Road Safety – Accident reduction due to a reduction in the number of vehicle km
- Impact to Government in indirect tax charges
- Cycle Safety – A change in cycle accident levels due to increased cycling
- Health Benefits – Calculated by the World Health Organisation HEAT tool
- Journey Ambiance Benefits
- Absenteeism Benefits

3.2 In this section of the report each of these will be discussed, details reported of any assumptions made in the analysis, and a table presented giving the annual benefits for each of the packages appraised.

3.3 Since there are no fees or fares to be gained from the scheme all of the benefits can be classified as non-monetised. This indicated that the benefits have an assumed value which has been taken from guidance developed by the DfT, WebTAG unit 3.14.1.

3.4 It should be noted that to adopt a conservative approach we have not assessed any time saving benefits associated with the schemes. However, in reality the schemes would additionally bring some level of time savings for existing cyclists.

External Benefits (Overview)

3.5 External benefits are those which are calculated from a reduction in vehicle (car) kilometres. The figures for each car kilometre saved are detailed within Table 3.1.

Table 3-1: External Benefits per Vehicle km saved

	Benefit in pence of each vehicle kilometre saved (2015 values in 2010 prices)
Congestion	16.7973
Infrastructure	0.1
Accident	3.2
Local Air Quality	0.1
Noise	0.2
Greenhouse Gases	0.850476
Indirect Taxation	-5.00286

Source WebTag 3.14.1

A description of each of the benefits is given below with the total benefits accrued for each package detailed within

Table 3-2 to Table 3-5, which do not include market price uplift for business benefits, nor are they discounted as these adjustments are made further along in the appraisal process.

3.6 The car kilometres saved is calculated by determining the additional cycle trips and using an average journey length for each package and journey purpose. This figure is cumulative and therefore each year the benefits increase by the total new users.

3.7 Once the additional cycle kilometres has been determined this is then factored by the vehicle occupancy and the proportion of trips determined by TAG which have converted from car to cycle, and therefore the number of cars removed from the road.

Congestion Benefits

3.8 A reduction in car kilometres will improve the journey for other road users. This benefit takes into consideration the type of road which the vehicles are likely to be removed from, and how congested it is. These assumptions are calculated from guidance in TAG 3.14.1, and used with the worksheet provided within TAG in order to determine the most likely road type within Nottingham and therefore the appropriate benefits to apply.

Environmental Benefits

3.9 Environmental benefits are gained in four main areas, a reduction in noise, Greenhouse gases (carbon), local air quality (nitrous oxide and particulates), and infrastructure improvements. In order to achieve the benefits detailed in.

Road Safety Benefits

3.10 Included within these benefit are those accrued from a reduction in vehicle kilometres. Changes in accidents involving cyclists are included within the Accidents section.

Table 3-2: External Benefits – Package 1 & 2 (£ in 2010 prices)

	Congestion	Infrastructure	Road Safety	LAQ	Noise	Green-house Gasses
2014	17,139	102	3,265	102	204	868
2015	68,554	408	13,060	408	816	3,471
2016	119,970	714	22,855	714	1,428	6,074
2017	157,850	940	30,071	940	1,879	7,992
2018	195,730	1,165	37,288	1,165	2,330	9,910
2019	233,610	1,391	44,504	1,391	2,782	11,828
2020	252,550	1,504	48,113	1,504	3,007	12,787
2021	271,490	1,616	51,721	1,616	3,233	13,746
2022	290,430	1,729	55,329	1,729	3,458	14,705
2023	309,370	1,842	58,937	1,842	3,684	15,664

Table 3-3: External Benefits – Package 3 (£ in 2010 prices)

	Congestion	Infrastructure	Road Safety	LAQ	Noise	Green-house Gasses
2014	4,045	24	771	24	48	205
2015	16,182	96	3,083	96	193	819
2016	28,318	169	5,395	169	337	1,434
2017	36,409	217	6,936	217	434	1,843
2018	44,499	265	8,477	265	530	2,253
2019	52,590	313	10,019	313	626	2,663
2020	56,636	337	10,789	337	674	2,868
2021	60,681	361	11,560	361	723	3,072
2022	64,726	385	12,331	385	771	3,277
2023	68,772	409	13,101	409	819	3,482

Table 3-4: External Benefits – Package 4a (£ in 2010 prices)

	Congestion	Infrastructure	Road Safety	LAQ	Noise	Green-house Gasses
2014	10,974	65	2,091	65	131	556
2015	43,895	261	8,362	261	523	2,222
2016	76,816	457	14,634	457	915	3,889
2017	98,763	588	18,815	588	1,176	5,001
2018	120,710	719	22,996	719	1,437	6,112
2019	142,658	849	27,177	849	1,699	7,223
2020	153,631	915	29,268	915	1,829	7,779
2021	164,605	980	31,358	980	1,960	8,334
2022	175,579	1,045	33,449	1,045	2,091	8,890
2023	186,552	1,111	35,540	1,111	2,221	9,445

Table 3-5: External Benefits – Package 4b (£ in 2010 prices)

	Congestion	Infrastructure	Road Safety	LAQ	Noise	Green-house Gasses
2014	6,623	39	1,262	39	79	335
2015	26,492	158	5,047	158	315	1,341
2016	46,361	276	8,832	276	552	2,347
2017	61,000	363	11,621	363	726	3,089
2018	75,638	450	14,410	450	901	3,830
2019	90,277	537	17,198	537	1,075	4,571
2020	97,596	581	18,593	581	1,162	4,941
2021	104,915	625	19,987	625	1,249	5,312
2022	112,234	668	21,381	668	1,336	5,683
2023	119,554	712	22,776	712	1,423	6,053

Health Benefits

3.11 These are benefits which are attributed to a scheme which improve the health of a population due to increased cycling levels.

3.12 In order to calculate health benefits we have used the World Health Organisation's HEAT tool (Health Economic Assessment Tool). This uses assumptions from both the change in the number of cyclists and their journey habits in order to determine the health benefits to a population.

3.13 There are a number of assumptions which must be made in order to use this appraisal methodology and these are included within Table 3-6.

Table 3-6: Assumptions for using the WHO HEAT tool

Assumption	Figures Used
Number of days cycled – (based on the Journey purpose splits and calculations which determine the number of cycle trips per week for each journey purpose)	Package 1&2 – 106
	Package 3 - 55
	Package 4a - 55
	Package 4b - 94
Journey length - Based on trip matrices	Package 1&2 – 3.28km
	Package 3 – 4.54km
	Package 4a – 4.54km
	Package 4b – 2.59km
Mortality Rate (Nottingham <75 figure)	340 per 100,000 pop (Nottingham figure for those <75))
Value of Life (European Average from WHO)	£1,342,150
Percentage of Benefits accrued to scheme*	100%

* Alternatives have been tested within the sensitivity tests undertaken

3.14 The health benefits accrued to the packages are given within Table 3-7. These figures are totals from the appraisal period which have been calculated using the WHO's HEAT tool. They have already been discounted. It should be noted that to avoid double counting, business trips have been excluded from this analysis as those who cycle for business purposes have generally also commuted to work.

Table 3-7: Health Benefits (£)

	Package			
	1 & 2	3	4a	4b
Health Benefits	27,608,645	1,913,327	5,189,382	8,575,557

Accidents

3.15 An increase in cycling mileage within the UK will likely lead to an increase in the number of road traffic accidents including a cyclist. However the increase is not proportional and it is assumed that for a 100% increase in cycling there will be only a 32% increase in accidents involving a cyclist. This figure is included within TAG 3.14.1 and originates from work undertaken by Jacobsen in 2003.

3.16 The accident rates and monetary values for accidents involving cyclists are shown in Table 3-8.

Table 3-8: Cycling Accident rates and Cost Impacts

Type of Accident	Frequency per billion cycle miles	Cost Associations (£) (2010 prices)
Fatal	35	22,233.70
Serious	1005	207,771.08
Slight	5218	1,804,357.26

3.17 Using these figures (in 2010 prices) and the increase in cycling kilometres over the appraisal period, the monetary impact is given in Table 3.9. It should be noted that these figures do not include discounting and market price uplift where appropriate.

Table 3-9: Accident Impacts (£)

	Package			
	1 & 2	3	4a	4b
Increase in Cycling km (2016 -2023)	5,151,159	1,035,026	2,822,071	1,640,621
Change in accident value (2016 – 2023)	- 397,387	- 79,847	- 217,709	- 126,566

Journey Ambiance Benefits

3.18 By improving the environment for existing cyclists they experience a more pleasant journey. A monetary value can be attributed to this based on the type of infrastructure included within the scheme as detailed within TAG 3.14.1 and shown within

3.19 Table 3-10. Existing cyclists experience this benefit in full in the first year of operation.

3.20 Following the introduction of the schemes in Nottingham any new cyclists each year will accrue half the benefit as determined in the TAG Guidance. It should be noted that to avoid double counting, business trips have been excluded from this analysis as those who cycle for business purposes have generally also commuted to work.

Table 3-10: Improvement Type and Ambiance Benefits

Type of Route	Value in pence per minute (2010 prices)
Off Road Segregated cycle track	7.03
On road segregated cycle lane	2.99
On road non segregated cycle lane	2.97
Wider Lane	1.81
Shared bus Lane	0.77

3.21 Estimates have been made based on the known route journey lengths proposed within the NCCAP package, and the proportion of each type of intervention along each route. Benefits for existing users for each package are included within Table 3-11. These figures have not been discounted or subject to market price uplift where appropriate.

Table 3-11: Journey Ambiance Benefits to Existing Users (£ in 2010 prices)

	Package			
	1 & 2	3	4a	4b
2014	486,566	261,297	764,226	402,392

3.22 New users also accrue journey ambiance benefits at 0.5 the rate of existing users. Using the growth pattern given in Table 2-5, Table 3-12 shows the benefits for new users. These figures have not been discounted or subject to market price uplift where appropriate.

Table 3-12: Journey Ambiance Benefits to Existing Users (£ in 2010 prices)

	Package			
	1 & 2	3	4a	4b
2014	19,924	10,050	29,393	16,477
2015	59,772	30,150	88,180	49,432
2016	59,772	30,150	88,180	49,432
2017	44,037	20,100	58,787	36,419
2018	44,037	20,100	58,787	36,419
2019	44,037	20,100	58,787	36,419
2020	22,019	10,050	29,393	18,209
2021	22,019	10,050	29,393	18,209
2022	22,019	10,050	29,393	18,209

2023	22,019	10,050	29,393	18,209

Absenteeism Benefits

3.23 Reductions in short-term absence from work can be achieved by an increase in the health of those who take up cycling. Research from TfL (2004) assumes that there is a reduction of 0.4 days in sick leave by those who regularly cycle. It has also been assumed that the average working day is 7.5 hours. The market price for the value of time (for business users) has been extracted from TAG unit 3.5.6.

3.24 To avoid overestimating these benefits we have removed from the demand those who were counted as existing cyclists in 2014. Since the benefit is applied per person we converted the number of commuter trips to the number of cyclists based on factors determined by journey purpose. Table 3-13 gives these benefits.

Table 3-13: Absenteeism Benefits* (£ in 2010 prices)

	Package			
	1 & 2	3	4a	4b
2014	28,550	15,568	43,650	9,802
2015	114,198	62,273	174,601	39,208
2016	199,847	108,978	305,551	68,614
2017	262,948	140,115	392,851	90,279
2018	326,049	171,251	480,152	111,944
2019	389,151	202,388	567,452	133,609
2020	420,701	217,956	611,102	144,442
2021	452,252	233,524	654,752	155,274
2022	483,803	249,092	698,402	166,106
2023	515,353	264,661	742,052	176,939

*Figures in this table are taken before they have been discounted.

4 COSTS

Capital Costs

4.1 Costs for the schemes and packages have been put together by Nottingham City Council and are shown within Table 4-1. Additional funding where available has been included within the table with its origin shown. These costs are shown in Table 4-1 in 2013 prices although have been calculated to 2010 for appraisal purposes.

Table 4-1: Scheme Costs

	Package Cost (£, 2013 prices)			
Funding Source	1 & 2	3	4a	4b
DfT	3,025,000	1,025,000	1,425,000	625,000
Nottingham City Council	1,517,000	827,000	364,000	352,000
Private Sector	50,000	-	170,000	-

4.2 It is assumed that these costs occur in Year 1 of the appraisal. Management, monitoring and evaluation costs have been split equally between the packages assessed.

Optimism Bias

4.3 For the purpose of this appraisal a 20% level of optimism bias has been included within the appraisal. This increases the costs in line with the level of uncertainty. No risk has been included as this has already been covered within the base costs.

Maintenance Costs

4.4 For the purpose of this appraisal there are no additional maintenance costs included within the 10 year appraisal period. Where additional on-road highway infrastructure will be provided this will reduce the maintenance impact on the highway incurred from much heavier motorised traffic. Off road routes will require vegetation cut back but this is a minimal cost which the Council will incorporate into its maintenance regimes.

Indirect Tax Changes

Although strictly this is considered to be a disbenefit, there will be a reduction in income to the Government based on a reduction in fuel duty, based on the number of car kilometres saved. The factors used are included within

Table 3-1 and the impact of this to the Government is contained within

Table 4-2. These figures are shown before discounting and before market price uplift has been applied.

Table 4-2: Indirect Impact on Government (£ in 2010 prices)

	Package			
	1 & 2	3	4a	4b
2014	- 5,104	- 1,205	- 3,268	- 1,973
2015	- 20,418	- 4,819	- 13,073	- 7,890
2016	- 35,731	- 8,434	- 22,879	- 13,808
2017	- 47,013	- 10,844	- 29,415	- 18,168
2018	- 58,296	- 13,254	- 35,952	- 22,528
2019	- 69,578	- 15,663	- 42,489	- 26,888
2020	- 75,219	- 16,868	- 45,757	- 29,068
2021	- 80,860	- 18,073	- 49,025	- 31,248
2022	- 86,501	- 19,278	- 52,294	- 33,428
2023	- 92,142	- 20,483	- 55,562	- 35,607

5 REPORTING TABLES

The following tables summarise the findings of the economic appraisal. Table 5-1 to Table 5-5 show these results for each of the individual packages.

Consumers	Journey Ambiance	1,743,976
	Health Benefits	14,600,294
	Accidents	-244,693
	Decongestion	1,481,045
	Infrastructure	8,817
	Traffic Accidents	282,149
	LAQ	8,817.2
	Noise	17,634
	Greenhouse Gasses	74,988
Net Consumer Benefits		**17,973,028**
Business	Journey Ambiance	146,513
	Health Benefits	0
	Accidents	-59,646
	Decongestion	94,512
	Infrastructure	563
	Traffic Accidents	18,005
	LAQ	562.7
	Noise	1,125
	Greenhouse Gasses	4,785
	Absenteeism Benefits	4,700,859
	Private Sector Contributions	-219,382
Net Business Impacts		**4,687,897**
Central Government Funding	Indirect tax Revenues	-524,921
	Investment Cost	2,645,491
Local Government Funding	Investment Cost	**923,986**
Net Impact on Government		3,569,478

Present Value of TEE Benefits	PVB	**22,136,004**
Present Value of TEE Costs	PVC	3,569,478
Net Present Value	NPV = PVB - PVC	18,566,526

Benefit Cost Ratio	BCR = PVB / PVC	**6.20**

5.1 Table 5-6 shows the combined results for the NCCAP scheme as a whole. Benefits are in total pounds for the 10 year appraisal period.

Table 5-1: Package 1&2 Results

Consumers	Journey Ambiance	662,940
	Health Benefits	26,659,834
	Accidents	-225,595
	Decongestion	1,351,103
	Infrastructure	8,044
	Traffic Accidents	257,394
	LAQ	8,043.6
	Noise	16,087
	Greenhouse Gasses	68,409
Net Consumer Benefits		**28,806,260**
Business	Journey Ambiance	165,386
	Health Benefits	0
	Accidents	-136,496
	Decongestion	249,186
	Infrastructure	1,483
	Traffic Accidents	47,472
	LAQ	1,483.5
	Noise	2,967
	Greenhouse Gasses	12,617
	Absenteeism Benefits	2,599,507
	Private Sector Contributions	-64,524
Net Business Impacts		**2,879,082**
Central Government Funding	Indirect tax Revenues	-478,866
	Investment Cost	3,903,713
Local Government Funding	Investment Cost	**1,957,664**
Net Impact on Government		5,861,377

Present Value of TEE Benefits	PVB	**31,206,476**
Present Value of TEE Costs	PVC	5,861,377
Net Present Value	NPV = PVB - PVC	25,345,099
Benefit Cost Ratio	BCR = PVB / PVC	**5.32**

Table 5-2: Package 3 Results

Consumers	Journey Ambiance	385,777
	Health Benefits	2,026,783
	Accidents	-54,968
	Decongestion	334,953
	Infrastructure	1,994
	Traffic Accidents	63,811
	LAQ	1,994.1
	Noise	3,988
	Greenhouse Gasses	16,959
Net Consumer Benefits		**2,781,291**
Business	Journey Ambiance	30,763
	Health Benefits	0
	Accidents	-15,956
	Decongestion	21,416
	Infrastructure	127
	Traffic Accidents	4,080
	LAQ	127.5
	Noise	255
	Greenhouse Gasses	1,084
	Absenteeism Benefits	1,358,291
	Private Sector Contributions	0
Net Business Impacts		**1,400,188**
Central Government Funding	Indirect tax Revenues	-118,716
	Investment Cost	1,322,746
Local Government Funding	Investment Cost	**1,067,230**
Net Impact on Government		2,389,976

Present Value of TEE Benefits	PVB	**4,062,763**
Present Value of TEE Costs	PVC	2,389,976
Net Present Value	NPV = PVB - PVC	1,672,787
Benefit Cost Ratio	BCR = PVB / PVC	**1.70**

Table 5-3: Package 4a Results

Consumers	Journey Ambiance	1,126,043
	Health Benefits	5,497,101
	Accidents	-148,838
	Decongestion	906,964
	Infrastructure	5,399
	Traffic Accidents	172,783
	LAQ	5,399.5
	Noise	10,799
	Greenhouse Gasses	45,921
Net Consumer Benefits		**7,621,572**
Business	Journey Ambiance	92,656
	Health Benefits	0
	Accidents	-44,737
	Decongestion	60,047
	Infrastructure	357
	Traffic Accidents	11,439
	LAQ	357.5
	Noise	715
	Greenhouse Gasses	3,040
	Absenteeism Benefits	3,808,357
	Private Sector Contributions	-219,382
Net Business Impacts		**3,712,850**
Central Government Funding	Indirect tax Revenues	-321,452
	Investment Cost	1,838,939
Local Governement Funding	Investment Cost	**469,736**
Net Impact on Government		2,308,675

Present Value of TEE Benefits	PVB	**11,012,970**
Present Value of TEE Costs	PVC	2,308,675
Net Present Value	NPV = PVB - PVC	8,704,295
Benefit Cost Ratio	BCR = PVB / PVC	**4.77**

Table 5-4: Package 4b Results

Consumers	Journey Ambiance	617,933
	Health Benefits	9,103,193
	Accidents	-95,855
	Decongestion	574,081
	Infrastructure	3,418
	Traffic Accidents	109,366
	LAQ	3,417.7
	Noise	6,835
	Greenhouse Gasses	29,067
Net Consumer Benefits		**10,351,456**
Business	Journey Ambiance	53,857
	Health Benefits	0
	Accidents	-14,909
	Decongestion	34,465
	Infrastructure	205
	Traffic Accidents	6,566
	LAQ	205.2
	Noise	410
	Greenhouse Gasses	1,745
	Absenteeism Benefits	892,502
	Private Sector Contributions	0
Net Business Impacts		**975,047**
Central Government Funding	Indirect tax Revenues	-203,469
	Investment Cost	806,552
Local Government Funding	Investment Cost	**454,250**
Net Impact on Government		1,260,802

Present Value of TEE Benefits	PVB	**11,123,034**
Present Value of TEE Costs	PVC	1,260,802
Net Present Value	NPV = PVB - PVC	9,862,232
Benefit Cost Ratio	BCR = PVB / PVC	**8.82**

Table 5-5: Package 4 Results (combined 4a & 4b)

Consumers	Journey Ambiance	1,743,976
	Health Benefits	14,600,294
	Accidents	-244,693
	Decongestion	1,481,045
	Infrastructure	8,817
	Traffic Accidents	282,149
	LAQ	8,817.2
	Noise	17,634
	Greenhouse Gasses	74,988
Net Consumer Benefits		**17,973,028**
Business	Journey Ambiance	146,513
	Health Benefits	0
	Accidents	-59,646
	Decongestion	94,512
	Infrastructure	563
	Traffic Accidents	18,005
	LAQ	562.7
	Noise	1,125
	Greenhouse Gasses	4,785
	Absenteeism Benefits	4,700,859
	Private Sector Contributions	-219,382
Net Business Impacts		**4,687,897**
Central Government Funding	Indirect tax Revenues	-524,921
	Investment Cost	2,645,491
Local Government Funding	Investment Cost	**923,986**
Net Impact on Government		3,569,478

Present Value of TEE Benefits	PVB	**22,136,004**
Present Value of TEE Costs	PVC	3,569,478
Net Present Value	NPV = PVB - PVC	18,566,526
Benefit Cost Ratio	BCR = PVB / PVC	**6.20**

Table 5-6: Total Overall Results

Consumers	Journey Ambiance	2,792,693
	Health Benefits	43,286,911
	Accidents	-525,256
	Decongestion	3,167,101
	Infrastructure	18,855
	Traffic Accidents	603,354
	LAQ	18,854.8
	Noise	37,710
	Greenhouse Gasses	160,356
Net Consumer Benefits		**49,560,579**
Business	Journey Ambiance	342,662
	Health Benefits	0
	Accidents	-212,098
	Decongestion	365,114
	Infrastructure	2,174
	Traffic Accidents	69,557
	LAQ	2,173.6
	Noise	4,347
	Greenhouse Gasses	18,486
	Absenteeism Benefits	8,658,657
	Private Sector Contributions	-283,906
Net Business Impacts		**8,967,166**
Central Government Funding	Indirect tax Revenues	-1,122,503
	Investment Cost	7,871,950
Local Government Funding	Investment Cost	**3,948,880**
Net Impact on Government		11,820,830

Present Value of TEE Benefits	PVB	**57,405,242**
Present Value of TEE Costs	PVC	11,820,830
Net Present Value	NPV = PVB - PVC	45,584,412
Benefit Cost Ratio	BCR = PVB / PVC	**4.86**

6 SENSITIVITY TESTS

6.1 A series of sensitivity tests have been included within this appraisal with the overall change in BCR given in Table 6-1.

Table 6-1: Sensitivity Test Results

	Package					
	1 & 2	3	4a	4b	4	All
Base Appraisal	5.32	1.70	4.77	8.82	6.20	4.86
75% of Health Benefits are attributed in scheme	4.19	1.49	4.17	7.02	5.18	3.94
Costs are 20% higher	4.43	1.42	3.96	7.35	5.16	4.04
Costs are 20% lower	6.66	2.12	5.99	11.03	7.77	6.08
Demand is 20% higher	7.23	2.33	6.58	11.78	8.42	6.60
Demand is 20% lower	3.48	1.06	4.63	5.86	5.06	3.47
Journey Length is 20% longer	6.27	1.93	5.42	10.42	7.19	5.67