Newcastle Cycle City Ambition

Appendix 9: Economic Appraisal Report

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1 Introduction

This report presents the methodologies used to estimate the potential economic value of the interventions proposed through the Newcastle City Council bid to the Cycle City Ambition fund.

The report covers programme expenditure for the 2013 – 2015 financial years only.

Using the Department for Transport WebTAG guidance for the appraisal of walking and cycling schemes, we estimate the economic value of the health, decongestion, carbon, accident and amenity benefits. The forecast impact of the various interventions is based on evidence for changes in cycling levels collected from other similar interventions. Non-monetised benefits, including those to the community, are not included in these calculations.

The first section of the report details the assumptions and methodologies used to calculate impacts on cycling for each of the interventions included in the proposal. We then go on to describe the calculations for each intervention. An appraisal summary table is appended to this report. This includes these monetised values and other, qualitative, impacts.

All calculations reported herein can be made available to bid assessors upon request.

2 Methods and assumptions

In order to model the interventions put forward by Newcastle City Council, a number of assumptions are required, particularly in relation to the population and current cycling mode share. A number of parameters are also required in order to calculate the economic benefits of the different scenarios. The most recent values for these parameters have been obtained through consultation of the WebTAG guidance.

2.1 Population

The population data used within this modelling exercise are taken from the estimates of ‘all usual residents’ in the 2011 Census[11]. Data from wards within the Newcastle City Council area have been used for city wide interventions. For modelling around the impact of route improvements, the populations in the wards surrounding the routes are taken (including some wards in the Gateshead area for the most central route developments). For other elements of the programme, the population used in calculations is that corresponding to a specific area as stipulated in the proposals.

2.2 Current cycling mode share and cycle trips per person

The current mode share for cycling trips has been taken from Newcastle City Council area data from a Tyne and Wear-wide household travel survey. The overall Council area mode share is 1.01%. Where interventions are focused upon a specific part of the city, the cycling mode share from the wards impacted are used. This has been combined with the National Travel Survey (NTS) estimate of the average number of trips under 5 miles per person residing in the North East of England[12] to estimate the average number of cycle trips per person per year.

2.3 Evidence for change following interventions

Potential changes in levels of cycling following interventions have been estimated using evidence on the impact of interventions

In the following scenarios we draw on a range of data sources relevant to the interventions planned by Newcastle City Council, details of which are presented in section 3.

The precedents for transferability are not well-established. The areas for which data are available may not be directly comparable to the city area, and translating empirical observations into an expression of value for money often presents a further challenge. We have dealt with these by applying conservative assumptions when comparing different types of area, and applying established frameworks and conventions for economic appraisal, largely based on Webtag. Although we acknowledge the difficulties in translating available evidence to Newcastle, we have sought to make clear in the report the evidence basis for the modelling, the nature of the assumptions made, and the relative applicability of the results. The conclusions from each stage of the modelling exercise are considered to be indicative.

Details of the specific data sources relied upon are provided in sections detailing the modelling of individual interventions.

2.4 Assumptions around car km replaced and valuation of carbon and decongestion benefits

Where the percentage of cycle trips which are replacing car journeys is not available for an intervention, the average value for cyclists on the National Cycle Network in 2012 has been used (28.4%).

A decongestion rate of 35.9p km^{-1} has been used, taken from Department for Transport guidance. This is based on a 2013 scheme opening year, calculated at 2010 prices and then increased by inflation to 2013 prices (2.5% per year).

[11] Available via http://www.nomisweb.co.uk/default.asp
[12] Table NTS9911, accessible here: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/35743/nts2011-index.xls

Carbon savings have been calculated using a value of 0.194kg CO_2 per km. This is based on an average car of unknown fuel type in 2012[13]. This has then been converted to a monetary amount by applying a value of £53 per tonne[14].

2.5 Assumptions around calculation of health benefits

Health benefits are calculated using the World Health Organisation's Health Economic Assessment Tool (HEAT). Within the HEAT calculation, a Value of a Statistical Life of €1,574,000 has been used. This is the standard value used across Europe. The mortality rate for the United Kingdom in the WHO's European Detailed Mortality Database has been used (456.73 deaths per 100,000 persons per year). Within the HEAT tools it is assumed that there is a build up of uptake in cycling over three years, and a build up of benefits over five years, after which benefits remain constant for the remainder of the appraisal period.

2.6 Assumptions around ambience

An amenity benefit of 7.02p/minute[15] has been applied for existing cyclists. As per WebTAG guidance unit 3.14.1, the amenity benefit is halved for new cyclists. Cyclists are assumed to cycle 14km/hour on average.

2.7 Assumptions around trip length

Unless more specific data are available, cycle trip distances are assumed to be 4.8km, based on NTS 2011 data[16]. Where a car trip is replaced, the car km replaced is assumed to be equal to the distance of the cycle trip replacing the car journey.

2.8 Appraisal periods adopted

Calculations are reported using two appraisal periods – ten years and 30 years. Benefit to cost ratios are calculated assuming the situation where 100% or 50% of the calculated benefits are achieved.

2.9 Optimism bias

Benefit to cost ratios are calculated using un adjusted total costs and cost adjusted to include a +10% optimism bias.

[13] using: https://www.gov.uk/government/publications/2012-greenhouse-gas-conversion-factors-for-company-reporting
[14] Based on 2012 prices obtained from:
https://www.decc.gov.uk/assets/decc/what%20we%20do/a%20low%20carbon%20uk/carbon%20valuation/1_20090715105804_e_@@_carbonvaluationinukpolicyappraisal.pdf
[15] Valuation for off-road segregated cycle track taken from the following report and then inflated to 2012 prices:
Hopkinson, P and Wardman, M (1996) Evaluating the demand for cycling facilities, Transport Policy Vol. 3 No. 4 pp. 241-249
[16] Table NTS0306 converted to kms, accessible here:
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/35743/nts2011-index.xls

3 Modelling individual interventions

3.1 Route development

The development of strategic routes linking to Newcastle City Centre is a key part of the Cycle City Ambition bid. Elements included in the proposal are:

- The Central Gateway and Great North Cycleway developments, enhancing provision in the city centre
- The Gosforth and Great Park routes to the north of the city centre
- The Newburn route to the west of the city centre
- The Walker route to the east of the city centre

This section of the report describes modelling undertaken to estimate the potential impacts of these developments.

3.1.1 Evidence

In order to model the impact of the development of these routes into the centre of Newcastle, three sources of data have been used. The estimated additional cycle trips generated is the average of the figures modelled using each of the following evidence sources:

- Conversion of 100% major road with no cycling facilities and minor roads with no cycling facilities to non-segregated on road cycle lane
- Conversion of 100% major road with no cycling facilities and minor roads with no cycling facilities and non segregated on road cycle lane to segregated on road cycle lane
- Barclays Cycle Super-Highways pilot scheme

In the first two cases, change in cycling has been modelled using the findings of Wardman et al.[17] which estimate the growth in cycling levels expected when cycle facilities are introduced or improved. Modelling has been undertaken around the creation of segregated and non-segregated on road cycle lanes.

The third case models the percentage growth in cycling observed on the two pilot superhighway routes in London[18]. The routes are wide cycle lanes with blue surfacing and additional interventions at junctions, including mirrors at signal control junctions. The evaluation was undertaken one year after the routes were launched and although some continued growth is likely, in this scenario only the initial growth has been modelled as there is no evidence available of longer term impacts. A 46% growth in cycling was observed along the routes and Transport for London research has found that cycle numbers on parallel routes have also increased, which suggests that the growth is not due to displacement from other routes. The growth factors used in each of three radial route scenarios are reported in Table 3-1.

Table 3-1 Growth in cycling levels associated with infrastructure interventions

	Increase from base level
Conversion of 100% major road with no cycling facilities and minor roads with no cycling facilities to non-segregated on road cycle lane	33%
Conversion of 100% major road with no cycling facilities and minor roads with no cycling facilities and non segregated on road cycle lane to segregated on road cycle lane	52%
Implementation of Barclays Cycle Superhighway type routes	46%

[17] Wardman, Tight and Page (2007) Factors Influencing propensity to cycle to work *Transportation Research Part A* **41:**339-350

[18] http://www.tfl.gov.uk/assets/downloads/roadusers/BCS-pilot-evaluation-report.pdf

3.1.2 Population impacted by the routes

The population anticipated to benefit from the routes is based on the population of the key wards through which the routes pass. Existing levels of cycling are based on cycle mode share recorded in the household travel survey.

- For the Central Gateway and Great North Cycleway developments, the population within Wards in the centre of Newcastle and those connected to the centre along the Strategic Cycle Routes (including Wards in the Gateshead local authority area): 203,341 people
- For the Gosforth and Great Park routes, the population of East Gosforth, Fawdon, North Jesmond, Parklands, South Jesmond, West Gosforth, West Gosforth and Wingrove Wards are assumed to benefit: 75,544 people
- For the Newburn route, the population of Benwell and Scotwood, Elswick and Westgate Wards are assumed to benefit: 35,951 people
- For the Walker route, the population of Byker, Ouseburn, South Heaton, Walker and Walkergate are assumed to benefit: 54,686 people

Table 3-2 Population impacted by the routes and assumed base levels of cycling

Route	Population benefiting	Number of trips per person per year (NTS)	% cycling mode share in population benefiting[19]	Existing cycle trips per year
Central Gateway/Great North Cycle Way	203,341	596	1.13	1,367,255
Gosforth and Great Park route	75,544	596	0.91	407,614
Newburn route	35,951	596	0.94	201,590
Walker route	54,686	596	1.14	370,342

3.1.3 Decongestion and carbon benefits

Decongestion benefits are calculated from the number of car km replaced. Car km replaced is estimated by applying the expected growth in cycling trips based on the available evidence (Table 3-1) and assuming that 28.4% of the new cycling trips generated would have been made previously by car. Each car trip replaced is assumed to be the same distance as the cycle trip replacing it (ie, the average cycling trip distance). Car km replaced are multiplied by a standard decongestion value.

Average emissions values are used with car km to estimate carbon dioxide saved. This is valued using a standard value per tonne.

[19] Using data from the Newcastle household survey

Table 3-3 Estimated annual value of decongestion benefit with infrastructure interventions

Route	Estimated km per year abstracted from the road network	Estimated annual value of decongestion benefits (£)[20]
Central Gateway/Great North Cycle Way	810,664	£291,028
Gosforth and Great Park route	241,680	£86,763
Newburn route	119,525	£42,910
Walker route	219,581	£78,830

Table 3-4 Estimated annual value of carbon emissions savings with infrastructure interventions

Intervention type	Estimated km per year abstracted from the road network	Tonnes of CO_2 saved per year[21]	Estimated annual value of carbon emissions savings (£)[22]
Central Gateway/Great North Cycle Way	810,664	157	£8,335
Gosforth and Great Park route	241,680	47	£2,485
Newburn route	119,525	23	£1,229
Walker route	219,581	43	£2,258

3.1.4 Health benefits

The forecast cycle trips before and after the development of the route were used to estimate the total number of trips per day. This is used with the average cycling trip length to estimate the total health benefit.

Table 3-5 Estimated annual mortality benefit with infrastructure interventions

Intervention type	Mean annual net present value of mortality benefit (£)	10 year value of mortality benefit (£)	30 year value of mortality benefit (£)
Central Gateway/Great North Cycle Way	£1,060,461	£10,604,611	£31,668,180
Gosforth and Great Park route	£316,009	£3,162,644	£9,444,492
Newburn route	£156,727	£1,571,527	£4,691,582
Walker route	£287,049	£2,870,485	£8,572,274

[20] Assuming a decongestion rate of 35.9p km^{-1} based on a 2013 scheme opening year calculated at 2010 prices, then increased by inflation to 2013 prices (2.5% per year)
[21] Assuming 0.194kg CO_2 per km. This is based on an average car of unknown fuel type in 2012 (using: https://www.gov.uk/government/publications/2012-greenhouse-gas-conversion-factors-for-company-reporting)
[22] Assuming £53 per tonne in 2012 (using https://www.decc.gov.uk/assets/decc/what%20we%20do/a%20low%20carbon%20uk/carbon%20valuation/1_20090715105804_e_@@_carbonvaluationinukpolicyappraisal.pdf)

3.1.5 Overall benefits

The combined costs and benefits of the route developments described above have been calculated. Benefit Cost Ratios have been provided for projected costs and also projected costs increased by an optimism bias of 10%.

Table 3-6 Costs and benefits of all route developments

		Benefits over 10 years		Benefits over 30 years	
	Total costs	NPV of all benefits	Benefit Cost Ratio	NPV of all benefits	Benefit Cost Ratio
Unadjusted costs	£6,447,540	£12,815,790	2.0:1	£36,905,190	5.7:1
Costs increased by 10%	£7,092,294	£12,815,790	1.8:1	£36,905,190	5.2:1

Benefit Cost Ratios have also been calculated based on a scenario where only half of the benefits produced within the modelling work described above are achieved.

Table 3-7 Costs and benefits of all route developments – benefits halved

		Benefits over 10 years		Benefits over 30 years	
	Total costs	NPV of all benefits	Benefit Cost Ratio	NPV of all benefits	Benefit Cost Ratio
Unadjusted costs	£6,447,540	£6,407,895	1.0:1	£18,452,595	2.9:1
Costs increased by 10%	£7,092,294	£6,407,895	0.9:1	£18,452,595	2.6:1

3.2 Allowing bicycles on the Tyne and Wear Metro

This scenario models the impact of a proposed trial to allow bicycles on the Tyne and Wear Metro system on overground sections during off-peak hours.

3.2.1 Potential impact of the proposed trial

In 2012 Nexus undertook a survey of Metro users in order to explore perceptions relating to their bicycle policies. Nexus estimate, using findings from this survey, that 500,000 Metro journeys per year could be generated if bicycles were allowed on the Metro. This could replace 7,000 car trips per year. Nexus also estimate that these journeys could be made by 26,000 individuals. These data are used here to model the potential impact on levels of cycling in a scenario under which bicycles could be transported on the Metro system. A more detailed analysis of the data and further investigations will be undertaken by Nexus prior to any potential changes to allow the carriage of bicycles by Metro.

The following calculations assume that all of the estimated impacts will be generated under a scenario where bicycles are allowed on overground sections of the Metro at off-peak hours only. The assumption has been made that each additional Metro journey generated will generate two cycle trips (one from the trip origin to the boarding Metro station and one from the alighting Metro station to the destination). It has also been assumed that the sum of each pair of trips will be equal to the average cycle trip length[23]. Each car trip that has been replaced is assumed to be the same distance as the average trip length on the Tyne and Wear Metro system[24].

This model is based on a survey of current Metro users and therefore is likely to underestimate the impact of the policy change as it does not include new Metro users, for example due to the expansion of the catchment areas around stations.

[23] Using NTS 2011, Table NTS0306
[24] DfT Light Rail Statistics 2011/12, Table LRT0107

3.2.2 Results of improved Bike/Metro integration

The following tables include the number of new cycle trips generated, decongestion benefit and carbon benefit which could be achieved in Newcastle under the assumptions presented above.

Table 3-8 Additional trips per year

	Additional cycle trips
Bike/Metro integration	500,000[1]

[1] Each of these trips consists of two cycling stages and one Metro stage

An estimated value for reduced decongestion as a result of the displacement of journeys from the road network was obtained by multiplying the estimated km replaced by a standard decongestion value.

Table 3-9 Estimated annual value of decongestion benefit

Intervention type	Estimated km per year abstracted from the road network	Estimated annual value of decongestion benefits (£)[25]
Bike/Metro integration	56,000	£20,104

Table 3-10 includes the tonnes of CO_2 saved under this scenario and the estimated value of the saving.

Table 3-10 Estimated annual value of carbon emissions savings following Bike/Metro integration in Newcastle

Intervention type	Estimated km per year abstracted from the road network	Tonnes of CO_2 saved per year[26]	Estimated annual value of carbon emissions savings (£)[27]
Bike/Metro integration	56,000	11	£576

The WHO HEAT tool for cycling is used with estimates of the number of cycle trips generated, number of people cycling and average distance cycled to estimate potential health benefits under the proposed trial. It is assumed that there is a build up of uptake in cycling over three years, and a build up of benefits over five years, after which benefits remain constant for the remainder of the period. The mean annual NPV of the estimated mortality benefits, the total benefits accumulated over 10 years and the total benefits accumulated over 30 years are presented in the following table.

Table 3-11 Estimated annual mortality benefit following Bike/Metro integration in Newcastle

Intervention type	Mean annual net present value of mortality benefit (£)	Total benefits accumulated over 10 years (£)	Total benefits accumulated over 30 years (£)
Bike/Metro integration	£890,931	£8,905,046	£26,587,376

3.2.3 Overall benefits

The combined benefits of the Bike/Metro integration described above have been calculated over 10 years and over 30 years. The Net Present Value of benefits have also been calculated based on a scenario where only half of the benefits produced within the modelling work described above are achieved.

[25] Assuming a decongestion rate of 35.9p km^{-1} based on a 2013 scheme opening year calculated at 2010 prices, then increased by inflation to 2013 prices (2.5% per year)
[26] Assuming 0.194kg CO_2 per km. This is based on an average car of unknown fuel type in 2012 (using: https://www.gov.uk/government/publications/2012-greenhouse-gas-conversion-factors-for-company-reporting)
[27] Assuming £53 per tonne in 2012 (using https://www.decc.gov.uk/assets/decc/what%20we%20do/a%20low%20carbon%20uk/carbon%20valuation/1_20090715105804_e_@@_carbonvaluationinukpolicyappraisal.pdf)

Table 3-12 Total benefits following Bike/Metro integration in Newcastle

	NPV of benefits over 10 years	NPV of benefits over 30 years
Impact described above	£9,057,276	£26,947,964
50% impact described above	£4,528,638	£13,473,982

3.3 Cycle Friendly Areas

This scenario models the impact of the proposed Cycle Friendly Areas in Newcastle which would incorporate DIY Streets-type interventions.

3.3.1 Impact of the proposed intervention

DIY Streets are projects with a strong community engagement focus in which streets are made safer and more attractive for residents using simple interventions, usually with a low capital cost. DfT have stated that "the main benefit for people is a change in the perceptions of how the street environment can be used"[28] in relation to Home Zones. Although this may result in residents selecting active travel modes for more journeys, the primary outputs relate to the quality of life of residents and community cohesion.

Development of a 'home zone' in The Dings, Bristol improved residents' perceptions of the attractiveness and safety of their street and reduced concerns relating to noise, access for delivery and emergency vehicles, anti social behaviour and the safety of children playing in the street[29]. Research undertaken at the Southville Home Zone[30] indicated that after the intervention residents reported that they spend more of their time in the street and take part in more street activities (both informal and formal events). The pilot home zone evaluation also found that mean traffic speeds within the home zones were reduced, on average, by 5mph[31]. This is likely to be a factor in half of residents in the TRL evaluation of nine pilot home zones reporting that walking in the home zones is "more pleasant" as a result of the intervention.

DIY Streets interventions generally have a greater impact on walking trips than on cycle trips. TRL report that this is likely to be because trips within the home zone are likely to be too short to be cycled and longer trips depend on cycle facilities in areas beyond the home zone. Repeating the modelling exercise below for the number of walking trips expected to generated in this scenario produces decongestion and carbon benefits which are almost two times the values generated for cycling and HEAT values more than three times those for cycling.

3.3.2 Results of DIY Streets interventions

In order to model the impact of this intervention the impact of a similar DIY Streets programme in Haringey has been applied to the population within the designated Cycle Friendly Areas in Newcastle (29,676). Haringey was selected due to the size of the project and thus the sample sizes for pre and post surveys.

In Haringey there was a 10%-point increase in cyclists reporting everyday cycling and a 17%-point decrease in cyclists reporting cycling frequently (2-5 days per week). Over half of the decrease in frequent cyclists is likely to be due to people moving into the everyday cyclist category. This is relatively consistent with the evaluation of the pilot Home Zones in England and Wales which reported that 10% of people with access to a bicycle reported cycling more[32].

The following tables include the number of new cycle trips generated, decongestion benefit and carbon benefit which could be achieved in Newcastle under the assumptions presented above. The lower bound reflects the fact that some DIY streets interventions have not resulted in any change in cycling levels. The upper bound has been calculated using the Haringey data described above.

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[28] DfT (2001) Home Zones – Planning and Design, Traffic Advisory Leaflet 10/01. Available at: http://assets.dft.gov.uk/publications/tal-10-01/tal-10-01.pdf (accessed 12 April 2013)
[29] Sustrans (2006)The Dings Home Zone, Information sheet LN01, Sustrans.
[30] Sherwin, H., Parkhurst, G. and Chatterjee, K. (2006) *Southville Home Zone: An Independent Evaluation.* Project Report. Centre for Transport and Society, University of the West of England, Bristol.
[31] TRL (2006) Pilot home zone schemes: summary of the schemes, TRL.
[32] TRL (2006) Pilot home zone schemes: summary of the schemes, TRL.

Table 3-13 Additional trips per year

	Additional cycle trips per year
Lower bound	0
Midpoint	19,327
Upper bound	38,653

An estimated value for reduced decongestion as a result of the displacement of journeys from the road network was obtained by multiplying the estimated km replaced by a standard decongestion value.

Table 3-14 Estimated annual value of decongestion benefit

Intervention type	Estimated km per year abstracted from the road network	Estimated annual value of decongestion benefits (£)[33]
Lower bound	0	£0
Midpoint	26,346	£9,458
Upper bound	52,692	£18,916

Table 3-15 includes the tonnes of CO_2 saved under this scenario and the estimated value of the saving.

[33] Assuming a decongestion rate of 35.9p km^{-1} based on a 2013 scheme opening year calculated at 2010 prices, then increased by inflation to 2013 prices (2.5% per year)

Table 3-15 Estimated annual value of carbon emissions savings following DIY Streets interventions in Newcastle

Intervention type	Estimated km per year abstracted from the road network	Tonnes of CO_2 saved per year[34]	Estimated annual value of carbon emissions savings (£)[35]
Lower bound	0	0	£0
Midpoint	26,346	5	£271
Upper bound	52,692	10	£542

The WHO HEAT tool for cycling is used with estimates of the number of cycle trips generated, number of people cycling and average distance cycled to estimate potential health benefits under the proposed trial. It is assumed that there is a build up of uptake in cycling over three years, and a build up of benefits over five years, after which benefits remain constant for the remainder of the period. The mean annual NPV of the estimated mortality benefits, the total benefits accumulated over 10 years and the total benefits accumulated over 30 years are presented in the following table.

Table 3-16 Estimated annual mortality benefit following DIY Streets interventions in Newcastle

Intervention type	Mean annual net present value of mortality benefit (£)	Total benefits accumulated over 10 years (£)	Total benefits accumulated over 30 years (£)
Lower bound	£0	£0	£0
Midpoint	£34,922	£344,959	£1,031,469
Upper bound	£68,992	£689,918	£2,059,532

3.3.3 Overall benefits (cycling)

The combined costs and benefits of the intervention described above have been calculated. Benefit Cost Ratios have been provided for projected costs and also projected costs increased by an optimism bias of 10%. The benefits reported relate to the midpoint values reported above.

Table 3-17 Costs and benefits of DIY Streets interventions in Newcastle

		Benefits over 10 years		Benefits over 30 years	
	Total costs	NPV of all benefits	Benefit Cost Ratio	NPV of all benefits	Benefit Cost Ratio
Unadjusted costs	£1,660,000	£416,577	0.3:1	£1,201,113	0.7:1
Costs increased by 10%	£1,826,000	£416,577	0.2:1	£1,201,113	0.7:1

Benefit Cost Ratios have also been calculated based on a scenario where only half of the benefits produced within the modelling work described above are achieved.

[34] Assuming 0.194kg CO_2 per km. This is based on an average car of unknown fuel type in 2012 (using: https://www.gov.uk/government/publications/2012-greenhouse-gas-conversion-factors-for-company-reporting)
[35] Assuming £53 per tonne in 2012 (using https://www.decc.gov.uk/assets/decc/what%20we%20do/a%20low%20carbon%20uk/carbon%20valuation/1_20090715105804_e_@@_carbonvaluationinukpolicyappraisal.pdf)

Table 3-18 Costs and benefits of DIY Streets interventions in Newcastle – benefits halved

		Benefits over 10 years		Benefits over 30 years	
	Total costs	NPV of all benefits	Benefit Cost Ratio	NPV of all benefits	Benefit Cost Ratio
Unadjusted costs	£1,660,000	£208,289	0.1:1	£600,556	0.4:1
Costs increased by 10%	£1,826,000	£208,289	0.1:1	£600,556	0.3:1

3.3.4 Overall benefits (cycling and walking)

In the previous section the benefits from an increase in cycling in the Cycle Friendly Areas were presented. As this intervention is also likely to have an impact on walking trips in these areas, the benefits from the increase in both cycle and walking trips are presented below. Benefit Cost Ratios have been provided for projected costs and also projected costs increased by an optimism bias of 10%. The benefits reported relate to the midpoint values for both walking and cycling trips. In addition to the benefits estimated here, we anticipate a scheme of this type to bring substantial benefits to community and society, which are not monetised.

Table 3-19 Costs and benefits of DIY Streets interventions in Newcastle[1]

		Benefits over 10 years		Benefits over 30 years	
	Total costs	NPV of all benefits	Benefit Cost Ratio	NPV of all benefits	Benefit Cost Ratio
Unadjusted costs	£1,660,000	£1,813,150	1.1:1	£5,283,334	3.2:1
Costs increased by 10%	£1,826,000	£1,813,150	1.0:1	£5,283,334	2.9:1

[1] Benefits relate to both walking and cycling trips

Benefit Cost Ratios have also been calculated based on a scenario where only half of the benefits produced within the modelling work described above are achieved.

Table 3-20 Costs and benefits of DIY Streets interventions in Newcastle – benefits halved[1]

		Benefits over 10 years		Benefits over 30 years	
	Total costs	NPV of all benefits	Benefit Cost Ratio	NPV of all benefits	Benefit Cost Ratio
Unadjusted costs	£1,660,000	£906,575	0.5:1	£2,641,667	1.6:1
Costs increased by 10%	£1,826,000	£906,575	0.5:1	£2,641,667	1.4:1

[1] Benefits relate to both walking and cycling trips

3.4 Retail vitality

An estimated 54 million shopping trips are made by the residents of Newcastle City Council each year[36]. Nationally only 24% of shopping trips are made by bicycle or on foot[37] and therefore there is significant potential for increasing the active travel mode share for these trips.

The District Centre Vitality Program seeks to make cycling a more attractive option both for trips to local shops and services, but also to attract cyclists travelling to the city centre into local shops. There are approximately 365 businesses[38] within the targeted areas which could benefit from this programme.

[36] Calculated by multiplying the population of Newcastle (280,177, Census 2011) by the average number of shopping trips per year in the North East (194, NTS 2011).
[37] National Travel Survey 2011

Table 3-21 Number of Businesses within the Shared Space Retail Areas

Area	Number of businesses
Benwell	115
Heaton Road	34
Jesmond	52
Shields Road	120
Stanhope Street	44

There is a body of evidence which supports the impact that pedestrians and cyclists have on retail vitality. Research by TfL[39] has shown there is a definite differentiation in the spending levels on high streets according to travel mode. Car users do spend more money on a single trip than visitors travelling by other modes however when looking at spend by mode over a longer period of time pedestrians and public transport users spend more than car users. This is due to shoppers not travelling by car visiting the shopping area more often than car drivers. People who walk to shop, spend an average of 65% more per head per month than those who travel by car to do their shopping.

According to a Sustrans report on “Shoppers and How They Travel”, measures such as widening pavements, restraining traffic and accommodating for cyclists would result in “attracting more regular, dedicated custom to the area and have a positive impact on retailers and customers alike”[40]. This is supported by evidence from New York where the introduction of protected bicycle lanes in Manhattan has resulted in an increase in retail sales of up to 49%[41] on one of the streets where the lanes were installed. Given that pedestrianisation of streets can result in an increase in retail footfall of between 20% and 40%[42], it is likely that an intervention such as this which also makes the area more attractive to pedestrians and cyclists will result in an increase in the number of shopping trips.

3.5 Active Travel Centre

3.5.1 Impact of Active Travel Centre – type interventions

This scenario looks at the potential for increasing cycling levels through the implementation of a city centre hub. Calculations use the Ucycle Nottingham programme as the source of information on potential impacts. The Ucycle Nottingham project has delivered infrastructure improvements, a cycle hire scheme and a variety of soft measures aimed at increasing cycling amongst staff and students at the University of Nottingham, Nottingham Trent University and Nottingham University Hospitals since September 2009. In October 2011, the monitoring and evaluation report[43] included the following findings:

- an increase in levels of cycling trips made to work/study, from 5% to 8% for students and 8% to 13% for staff
- a reduction in car use across all three sites - for staff, from 53% to 52% of trips, and for students from 17% to 15% of trips

[38] Calculated using http://www.2010.voa.gov.uk/rli/en/basic
[39] TfL (2011) Town centre study 2011 [online] Available from http://www.tfl.gov.uk/assets/downloads/customer-research/town-centre-study-2011-report.pdf [Accessed 10 April 2013]
[40] Sustrans(2006) Shoppers and how they travel [online] Available from http://www.sustrans.org.uk/assets/files/liveable%20neighbourhoods/Shoppers%20info%20sheet%20-%20LN02.pdf [Accessed 15 March 2012]
[41] New York City Department of Transportation (2012) Measuring the Street: New Metrics for 21st Century Streets [online] Available from http://www.americabikes.org/nyc_study_finds_protected_bicycle_lanes_boost_local_business [Accessed 9 April 2013]
[42] Adrian Davis (2011) Spend on high streets according to travel mode**,** Essential Evidence on a page: No 68 [online] Available from http://travelwest.info/sites/default/files/Essential-Evidence-68-spend-on-high-streets.pdf [Accessed 12 April 2013]
[43] Sustrans (2011) Ucycle Nottingham phase one: Monitoring and evaluation report

3.5.2 Results of Active Travel Centre-type interventions

The following tables include the number of new cyclists[44], decongestion benefit and carbon benefits which could be achieved under the assumption that the Active Travel Centre could achieve a quarter of the impact and benefits described above. A quarter of the overall benefit is assumed on the basis that the Active Travel Centre as planned for Newcastle will not deliver the same package of interventions as delivered in the Nottingham project.

Table 3-22 Estimated numbers of new cyclists

	New cyclists
Active Travel Centre	93

An estimated value for reduced decongestion as a result of the displacement of journeys from the road network was obtained for each scenario by multiplying the estimated km replaced by a standard decongestion value.

Table 3-23 Estimated annual value of decongestion benefit of the Active Travel Centre

Intervention type	Estimated km per year abstracted from the road network	Estimated annual value of decongestion benefits (£)[45]
Active Travel Centre	133,921	£48,078

Table 3-24 includes the tonnes of CO_2 saved under each of the scenarios and the estimated value of the saving.

Table 3-24 Estimated annual value of carbon emissions

Intervention type	Estimated km per year abstracted from the road network	Tonnes of CO_2 saved per year[46]	Estimated annual value of carbon emissions savings (£)[47]
Active Travel Centre	133,921	26	£1,377

The WHO HEAT tool for cycling is used with estimates of numbers of new cyclists, average distance cycled and number of days cycled per year to estimate potential health benefits. It is assumed that there is a build up of uptake in cycling over three years, and a build up of benefits over five years, after which benefits remain constant for the remainder of the period. The mean annual NPV of the estimated mortality benefits, the total benefits accumulated over 10 years and the total benefits accumulated over 30 years are presented in the following table.

Table 3-25 Estimated annual mortality benefit

Intervention type	Mean annual net present value of mortality benefit (£)	Total benefits accumulated over 10 years (£)	Total benefits accumulated over 30 years (£)
Active Travel Centre	£49,189	£492,099	£1,469,482

[44] The data which can be provided differs between scenarios due to the way in which impact has been measured and therefore modelled.
[45] Assuming a decongestion rate of 35.9p km^{-1} based on a 2013 scheme opening year calculated at 2010 prices, then increased by inflation to 2013 prices (2.5% per year)
[46] Assuming 0.194kg CO_2 per km. This is based on an average car of unknown fuel type in 2012 (using: https://www.gov.uk/government/publications/2012-greenhouse-gas-conversion-factors-for-company-reporting)
[47] Assuming £53 per tonne in 2012 (using https://www.decc.gov.uk/assets/decc/what%20we%20do/a%20low%20carbon%20uk/carbon%20valuation/1_20090715105804_e_@@_carbonvaluationinukpolicyappraisal.pdf)

3.5.3 Overall benefits

The combined costs and benefits of the interventions described above have been calculated. Benefit Cost Ratios have been provided for projected costs and also projected costs increased by an optimism bias of 10%.

Table 3-26 Costs and benefits of the Active Travel Centre

		Benefits over 10 years		Benefits over 30 years	
	Total costs	NPV of all benefits	Benefit Cost Ratio	NPV of all benefits	Benefit Cost Ratio
Unadjusted costs	£220,000	£856,149	3.9:1	£2,331,809	10.6:1
Costs increased by 10%	£242,000	£856,149	3.5:1	£2,331,809	9.6:1

Benefit Cost Ratios have also been calculated based on a scenario where only half of the benefits produced within the modelling work described above are achieved.

Table 3-27 Costs and benefits of the Active Travel Centre – benefits halved

		Benefits over 10 years		Benefits over 30 years	
	Total costs	NPV of all benefits	Benefit Cost Ratio	NPV of all benefits	Benefit Cost Ratio
Unadjusted costs	£220,000	£428,074	1.9:1	£1,165,905	5.3:1
Costs increased by 10%	£242,000	£428,074	1.8:1	£1,165,905	4.8:1

3.6 Community Outreach Areas (East and West)

This scenario models the impact of Community Outreach Areas in the East and West Ends of Newcastle. The intervention will include soft measures in order to raise the profile of cycling and promote the health benefits.

3.6.1 Impact of the Community Outreach Areas (East and West)

This scenario is based on increases in cycling levels and reductions in car trips observed in Travel Actively projects[48]. The increase in cycling equates to 1.28 additional trips per day for people who are engaged with the project. This has been calculated based on the change in cycle trip frequency between the pre and post surveys for Travel Actively projects.

The reduction in car kilometres as a result of the intervention has been calculated using the following information sources:

- the percentage of households with a car, based on ward level Census 2011 car ownership data;
- the percentage of people who are estimated to reduce their car usage as a result of the project, using Travel Actively data;
- the percentage of car trips in which the surveyed person is likely to be the driver, based on NTS data;
- the average reduction in car kilometres for people within all three of the categories above, based on Travel Actively data.

3.6.2 Results of the Community Outreach Areas (East and West)

The following tables include the number of new cycle trips generated, decongestion benefit and carbon benefit which could be achieved in Newcastle under the assumptions presented above. The population used in the calculation is the number of people living within the boundaries of the Community Outreach Areas (East and West)(50,458).

[48] Sustrans (2012) Travel Actively funded Sustrans' Active Travel projects, Sustrans, Bristol.

Table 3-28 Additional trips per year

	Additional cycle trips
Community Outreach Areas (East and West)	101,460

An estimated value for reduced decongestion as a result of the displacement of journeys from the road network was obtained by multiplying the estimated km replaced by a standard decongestion value.

Table 3-29 Estimated annual value of decongestion benefit

Intervention type	Estimated km per year abstracted from the road network	Estimated annual value of decongestion benefits (£)[49]
Community Outreach Areas (East and West)	592,694	£212,777

Table 3-30 includes the tonnes of CO_2 saved under this scenario and the estimated value of the saving.

Table 3-30 Estimated annual value of carbon emissions savings

Intervention type	Estimated km per year abstracted from the road network	Tonnes of CO_2 saved per year[50]	Estimated annual value of carbon emissions savings (£)[51]
Community Outreach Areas (East and West)	592,694	115	£6,094

The WHO HEAT tool for cycling is used with estimates of the number of cycle trips generated, number of people cycling and average distance cycled to estimate potential health benefits under the proposed trial. It is assumed that there is a build up of uptake in cycling over three years, and a build up of benefits over five years, after which benefits remain constant for the remainder of the period. The mean annual NPV of the estimated mortality benefits, the total benefits accumulated over 10 years and the total benefits accumulated over 30 years are presented in the following table.

Table 3-31 Estimated annual mortality benefit

Intervention type	Mean annual net present value of mortality benefit (£)	Total benefits accumulated over 10 years (£)	Total benefits accumulated over 30 years (£)
Community Outreach Areas (East and West)	£115,838	£1,154,973	£3,449,588

3.6.3 Overall benefits

The combined costs and benefits of the intervention described above have been calculated. Benefit Cost Ratios have been provided for projected costs and also projected costs increased by an optimism bias of 10%. Due to the nature of this intervention benefits have only been calculated over a ten year period.

[49] Assuming a decongestion rate of 35.9p km^{-1} based on a 2013 scheme opening year calculated at 2010 prices, then increased by inflation to 2013 prices (2.5% per year)
[50] Assuming 0.194kg CO_2 per km. This is based on an average car of unknown fuel type in 2012 (using: https://www.gov.uk/government/publications/2012-greenhouse-gas-conversion-factors-for-company-reporting)
[51] Assuming £53 per tonne in 2012 (using https://www.decc.gov.uk/assets/decc/what%20we%20do/a%20low%20carbon%20uk/carbon%20valuation/1_20090715105804_e_@@_carbonvaluationinukpolicyappraisal.pdf)

Table 3-32 Costs and benefits of the Community Outreach (East and West) project

		Benefits over 10 years	
	Total costs	NPV of all benefits	Benefit Cost Ratio
Unadjusted costs	£775,000	£2,766,149	3.6:1
Costs increased by 10%	£852,500	£2,766,149	3.2:1

Benefit Cost Ratios have also been calculated based on a scenario where only half of the benefits produced within the modelling work described above are achieved.

Table 3-33 Costs and benefits of the Community Outreach (East and West) project – benefits halved

		Benefits over 10 years	
	Total costs	NPV of all benefits	Benefit Cost Ratio
Unadjusted costs	£775,000	£1,383,074	1.8:1
Costs increased by 10%	£852,500	£1,383,074	1.6:1

3.7 Transport poverty and affordability

The following statistics are taken from the data set supporting the recent Sustrans publication 'Locked Out: Transport Poverty in England'[52]. This combines data on income, access to essential services and access to public transport.

No Lower Super Output Areas (LSOA) in the Newcastle City Council are rated to be at high risk of transport poverty; 108 LSOA (60.8% of the population) are at medium risk of transport poverty. We have used our estimates of car kilometres replaced through the proposed interventions to calculate the potential savings in car running costs. We estimate that almost £500,000 per year could be saved through the replacement of car trips with cycling trips following the interventions.

3.8 Job creation

Investment in cycling generates jobs, both in the construction of infrastructure and through the delivery of soft measure interventions. Sustrans estimate that 11.0 jobs are created for every £1 million of investment in sustainable transport infrastructure[53]. The design of soft measure interventions will require an estimation of the number of staff required.

The package of interventions discussed in this document is estimated to create 61 jobs - 54 jobs through the infrastructure investment and a further seven jobs through the Community Outreach project and at the Active Travel Centre.

[52] http://www.sustrans.org.uk/sites/default/files/images/files/migrated-pdfs/Transport%20Poverty%20England%20FINAL%20web.pdf
[53] Sustrans (2012) Sustrans' job creation study: interim report, Sustrans.

4 Overall impacts

The combined costs and benefits of package of interventions described above have been calculated. Benefit Cost Ratios have been provided for projected costs and also projected costs increased by an optimism bias of 10%.

Table 4-1 Costs and benefits of all interventions

		Benefits over 10 years		Benefits over 30 years	
	Total costs	NPV of all benefits	Benefit Cost Ratio	NPV of all benefits	Benefit Cost Ratio
Unadjusted costs	£1,932,540	£27,308,514	3.0:1	£74,234,448	8.1:1
Costs increased by 10%	£10,045,794	£27,308,514	2.7:1	£74,234,448	7.4:1

Benefit Cost Ratios have also been calculated based on a scenario where only half of the benefits produced within the modelling work described above are achieved.

Table 4-2 Costs and benefits of all interventions – benefits halved

		Benefits over 10 years		Benefits over 30 years	
	Total costs	NPV of all benefits	Benefit Cost Ratio	NPV of all benefits	Benefit Cost Ratio
Unadjusted costs	£1,932,540	£13,654,257	1.5:1	£37,117,224	4.1:1
Costs increased by 10%	£10,045,794	£13,654,257	1.4:1	£37,117,224	3.7:1

Table 4-3 Summary of benefits

	Route development	Community Outreach Areas (East and West)	Cycle Friendly Areas[a]	Metro/bicycle integration	Active Travel Centre	Total
HEAT – 10 years	£10,604,611	£1,154,973	£1,599,587	£8,905,046	£492,099	£22,756,316
Decongestion – 10 years	£2,142,374	£1,566,315	£207,617	£147,991	£353,914	£4,418,211
Carbon – 10 years	£61,358	£44,860	£5,946	£4,238	£10,136	£126,538
Amenity – 10 years	£6,287	-	-	-	-	£6,287
TOTAL 10 years	**£12,814,630**	**£2,766,148**	**£1,813,150**	**£9,057,275**	**£856,149**	**£27,308,514**
HEAT – 30 years	£31,668,180	£1,154,973	£4,777,466	£26,587,346	£1,469,482	£64,502,473
Decongestion – 30 years	£5,074,586	£1,566,315	£491,783	£350,548	£858,318	£6,755,235
Carbon – 30 years	£145,339	£44,860	£14,085	£10,039	£24,009	£193,472
Amenity – 30 years	£14,373	-	-	-	-	£14,373
TOTAL 30 years	**£36,902,478**	**£2,766,178**[b]	**£5,283,334**	**£26,947,933**	**£2,331,809**	**£74,234,448**

[a] Includes benefits from cycling and walking

[b]Due to the nature of the intervention, benefits are not included beyond 10 years. The value for the Community Outreach Areas (East and West) after 30 years is therefore the same as at 10 years.

5 Calculation of inputs to scheme proforma

5.1 Route length

Where applicable, the proposed route length is entered into the pro forma.

5.2 Average trip length

Cycle trip distances are assumed to be 4.8km, based on NTS 2011 data[54].

5.3 Average cycling speed

In the absence of measured values, the average speed to be achieved by strategic cycling routes as set out by the Newcastle Cycling Forum Working Group is assumed (12mph).[55]

5.4 Users per day

Users per day before and after the programme are calculated from forecast additional trips per year, assuming cycling on 220 days a year for two trips a day.

5.5 % of additional cyclists who would have driven a car

We assume 28.4% of additional cycle trips would have been made by car. This is based on the proportion of route users in survey of the National Cycle Network who had not used a car for any part of their journey, but for whom a car was an available option.

5.6 Car traffic km (per average day)

In the absence of detailed information concerning car traffic on and surrounding the planned interventions, we report the estimated reduction in car kilometres per day based on the additional cycle trips forecast to result from the interventions, assuming that 28.4% of these additional trips are replacing car journeys (section 5.5).

[54] Table NTS0306 converted to kms, accessible here: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/35743/nts2011-index.xls
[55] http://www.newcastle.gov.uk/sites/drupalncc.newcastle.gov.uk/files/wwwfileroot/parking-roads-and-transport/cycling/strategic_cycling_routes_criteria.doc