

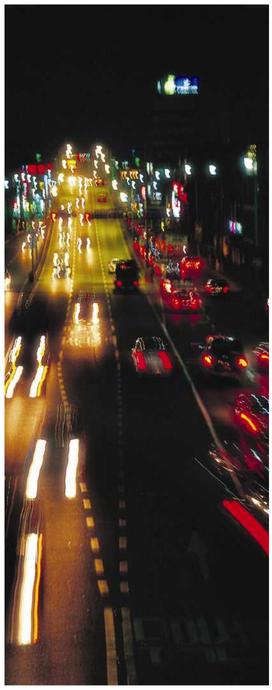

Birmingham Cycle Revolution: Phase 2

Economic Case

February 2014

Mott MacDonald

Birmingham Cycle Revolution: Phase 2

Economic Case

February 2014

Mott MacDonald, 35 Newhall Street, Birmingham, B3 3PU, United Kingdom
T +44 (0)121 234 1500 F +44 (0)121 200 3295 W www.mottmac.com

Mott MacDonald

Issue and revision record

Revision	Date	Originator	Checker	Approver	Description	Standard
A	February 2014	A Gordon	C Hardwick	P Shingadia	First issue	

This document is issued for the party which commissioned it and for specific purposes connected with the above-captioned project only. It should not be relied upon by any other party or used for any other purpose.

We accept no responsibility for the consequences of this document being relied upon by any other party, or being used for any other purpose, or containing any error or omission which is due to an error or omission in data supplied to us by other parties.

This document contains confidential information and proprietary intellectual property. It should not be shown to other parties without consent from us and from the party which commissioned it.

Contents

1 Introduction

This document sets out the economic case for Birmingham City Council's bid for funding for Birmingham Cycle Revolution Phase 2. It provides the detailed justification for the headline figures included in the main funding bid proforma.

The approach to economic appraisal that we have adopted is essentially the same as that used in the successful Cycle City Ambition Grant (CCAG) bid to DfT in 2013 for the delivery of Phase 1[1]. It incorporates the various route improvements that are included in the Phase 2 package and updates various economic parameters in accordance with the latest version of DfT's WebTAG guidance[2].

Section 2 sets out the detailed methodology used for the calculation of the following impacts:

- Scheme costs
- Journey quality
- Mortality
- Absenteeism
- Road accidents
- Environmental impacts
- Indirect tax revenues

Section 3 provides a summary of the results.

[1] http://www.birmingham.gov.uk/cs/Satellite?c=Page&childpagename=Sustainable-Travel%2FPageLayout&cid=1223415457481&pagename=BCC%2FCommon%2FWrapper%2FInlineWrapper

[2] https://www.gov.uk/transport-analysis-guidance-webtag#guidance-for-the-appraisal-practitioner

2 Detailed methodology

2.1 Assumptions

The following subsections set out some of the general assumptions made in our appraisal methodology. Assumptions that are specific to particular impacts (for example, journey quality) are set out in the sections dealing with each impact.

2.1.1 Economic base year and discounting

WebTAG requires that the results of an economic appraisal are presented in 2010 prices discounted to 2010.

Where required we have adjusted the price base of all values to 2010 using the GDP deflator measure of inflation, as required by WebTAG Unit A1.2.

Discounting to 2010 has been done using a discount rate of 3.5%, as set out in Table A1.1.1 of the WebTAG data book[3].

2.1.2 Appraisal period

We have assumed that all Phase 2 schemes will be completed by 2020 (though some routes will be completed before then). In line with WebTAG guidance for cycling schemes we have assumed a 20 year appraisal period, from 2020 to 2039 inclusive.

2.1.3 Annualisation

Benefits have initially been calculated for a single weekday. These are factored up to a full year using an annualisation factor of 253 (the number of normal working weekdays in a year, i.e. excluding holidays). Weekends and bank holidays have not been explicitly included, thus giving a conservative estimate of benefits.

2.1.4 Cycle trip characteristics

Analysis of household travel diary surveys carried out in the West Midlands between 2009 and 2012 showed that the average length of a cycle trip is 3.7km[4].

An average cycling speed of 20km/h is used in the calculations, the figure obtained from Cycle England for the Phase 1 CCAG bid.

[3] The discount rate drops to 3.0% after 30 years, but since we are only concerned with costs and benefits up to 2039 that does not apply here.

[4] Cycle and Walk Trips Analysis using PRISM Household Survey Data, Mott MacDonald, 2013.

2.1.5 Demand forecasts

Analysis carried out for the Phase 1 CCAG bid estimated that, on average, 5,393 trips were made on an average weekday in Birmingham in 2012 and that this would increase by 11% a year (based on recent trends) up to 2016, giving 7,896 trips a day. Thereafter there would be no further increase unless cycling infrastructure was improved.

For consistency, we have used the same basic assumption. However, in recognition of the fact that Phase 2 is less extensive than Phase 1 (99.5 route kilometres compared with 212.4) we have reduced the number of cycle trips affected proportionally. This gives 3,699 trips a day that benefit from the Phase 2 schemes. As a conservative assumption we have not increased this figure further to take account of any boost to cycling from Phase 1.

These trips have been split between the individual route corridors in proportion to the length of each corridor, as was done for the Phase 1 bid.

Also in line with Phase 1 we have assumed that completion of Phase 2 will increase cycling levels along the affected routes by 27%. That figure was taken from the Cycling Demonstration Towns report for DfT[5].

2.1.6 Impact on car traffic

A number of the benefit calculations depend on the reduction in car traffic (measured in vehicle kms) following a transfer from car to cycle.

To calculate this reduction we have made the conservative assumption that only 50% of new cycle trips transfer from car (the remainder being from public transport or walking, or are completely new trips) and that the average length of the car trip was 3.7km (i.e. the same as the average cycle trip length).

[5] Analysis and synthesis of evidence on the effects of investment in six Cycling Demonstration Towns (2009). http://webarchive.nationalarchives.gov.uk/20120607215928/http://www.dft.gov.uk/publications/analysis-synthesis-of-evidence-on-investment-effects-in-six-cycling-demonstration-towns

2.1.7 Summary of assumptions

Table 2.1: Summary of key assumptions

Item	Assumption
Appraisal period	2020-2039 inclusive
Average cycle trip length	3.7km
Average cycle speed	20km/h
Annualisation factor (single weekday to whole year)	253
Cycle trips per day over affected network	3,699
Increase in cycling due to Phase 2 schemes	27%
Discount rate	3.5% p.a.
Proportion of new cycle trips that transfer from car	50%

2.2 Scheme costs

The total cost of the Phase 2 routes is £8M (2014 prices). The predicted spend profile is:

Table 2.2: Spend profile

Year	£M
2015/16	1
2016/17	2
2017/18	2
2018/19	2
2019/20	1

The following adjustments were applied to these costs for the purposes of the economic appraisal, in line with the requirements of WebTAG Unit A1.2:

- Optimism bias of 15% was added
- Converted from factor costs to market prices by multiplying by the indirect tax correction factor of 1.19
- Adjusted to 2010 prices using the GDP deflator[6]
- Discounted to 2010

Together, these adjustments resulted in a present value of costs (PVC) of £7.86M (2010 prices, discounted to 2010).

2.3 Journey quality

Journey quality (previously referred to as journey ambiance in WebTAG) is defined as "*a measure of the real and perceived physical and social environment experienced while travelling*"[7]. In the context of cycling

[6] https://www.gov.uk/government/publications/gdp-deflators-at-market-prices-and-money-gdp-march-2013

schemes it includes impacts relating to the fear of accidents[8], quality of the infrastructure being used and environmental conditions on the route (such as levels of noise and air pollution).

The WebTAG data book contains values for journey quality of various measures as follows:

Table 2.3: Value of journey quality benefit of cycle facilities, relative to no facilities (2010 prices & 2010 values)

Type of facility	Value (pence/minute)
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

Source: WebTAG data book Table 4.1.6

These values have been increased in real terms in future years by applying the real growth in GDP per capita set out in the WebTAG data book.

Each route improved was allocated to one of the five categories of cycle facility listed in the table above. The average time spent on the route by each cyclist was calculated using the length of the route[9] and the assumed average cycle speed. Multiplying this time by the appropriate value from the table above gives the journey quality benefit in monetary terms for each cyclist on the route.

Following WebTAG guidance, the rule of a half was used to calculate total benefits, i.e. new cyclists on the route are assumed to receive half the benefit of existing cyclists.

Daily benefits were then annualised, extended to the full 20 year appraisal period and discounted. This resulted in a present value of benefits (PVB) for journey quality of £9.09M (2010 prices, discounted to 2010).

2.4 Mortality and absenteeism (physical activity)

Mortality and absenteeism benefits both arise from the increase in physical activity that comes from more people using cycles to get around rather than motorised modes. This decreases their risk of a premature death (mortality) and results in their taking fewer sick days off work (absenteeism). The calculation of both impacts follows the guidance in WebTAG Unit A5.1, which in turn makes use of the Health Economic Assessment Tool (HEAT) developed by the World Health Organisation[10]. This is based on evidence from a reference study in Copenhagen.

---

[7] WebTAG Unit A4.1 https://www.gov.uk/government/publications/webtag-tag-unit-a4-1-social-impact-appraisal

[8] i.e. the *perceived* risk. The actual impact on accident numbers is appraised separately.

[9] For routes longer than 3.7km the distance travelled per user was capped at 3.7km, i.e. the average cycle trip length in Birmingham.

[10] http://www.heatwalkingcycling.org/index.php

We have adopted a conservative approach of only including benefits for new users.

2.4.1 Mortality calculations

Based on the average cycle trip length (including the return journey) and the annualisation factor we estimate that each cyclist in Birmingham cycles 1781km a year. This compares to 1620km in the HEAT reference study in Copenhagen.

In the HEAT study cycling 1620km a year reduces the annual mortality risk in the 15-64 age group by 28%. Following WebTAG guidance we extrapolated this based on the distances travelled to estimate a 31% reduction in mortality risk in this age group.

Based on the average all-causes mortality rate in England and Wales in this age group[11], a reduction in this rate of 31% for new cyclists, and 999 new cyclists we estimated an average reduction of 0.72 deaths per year. Multiplied by the WebTAG value for a life saved of £1.65M (2010 values and prices), extending to the 20 year appraisal period and discounting resulted in a PVB for mortality benefits of £16.69M (2010 prices, discounted to 2010).

2.4.2 Absenteeism calculations

Following WebTAG, we assumed that each new cyclist has 0.4 fewer sick days per year. With an average wage of £26,500 per year[12] this gives an annual benefit per new cyclist of £588. Over the full appraisal period and discounted this resulted in a PVB for absenteeism benefits of £0.59M (2010 prices, discounted to 2010).

2.5 Car decongestion benefits

Any transfer of trips from car to cycle reduces congestion and provides a benefit to road users. Based on the assumptions set out in section 2.1.6 we estimated that the Phase 2 schemes will reduce car traffic by 467,931km a year.

To this figure we applied a decongestion benefit value of 32.4p per car km, obtained from Table A.5.4.2 of the WebTAG data book[13].

Over a full appraisal period and discounted this resulted in a PVB for car decongestion benefits of £2.13M (2010 prices, discounted to 2010).

---

[11] 0.00235 (or 2.35 per 1000 population) according to WebTAG

[12] Figure from ONS, as used in the Phase 1 bid

[13] Specifically, this is the figure for 'Other roads' for the area type 'Inner and Outer Conurbations'

2.6 Accident benefits

The appraisal of accident benefits was split into two parts:

- Accidents involving cyclists
- General road traffic accidents

The starting point for accidents involving cyclists was the Sustrans report ‘Cycling Trends in Birmingham: Technical Report’ (2011). This showed that between 2008 and 2010 there were an average of 236 cyclists a year injured in traffic accidents in Birmingham. In line with assumptions made elsewhere, we estimated that 111 of these were on routes that would benefit from the Phase 2 schemes.

20% of the new infrastructure from Phase 2 is off-road. We assumed a casualty rate of zero for cyclists on off-road routes, which reduced the annual casualty total to 88.5.

On the other hand, increased levels of cycling tend to lead to more cyclists involved in accidents. On the remaining on-road routes cycling levels were predicted to increase by 27%. Using an elasticity of casualties with respect to amount of cycling of 0.4 (WebTAG A4.1) gave an estimated increase in casualties of 10%.

The net result is a predicted 97.4 cyclist casualties a year, 13.2 fewer than without the Phase 2 schemes in place. Using the WebTAG value of £53,149 per cycling casualty (data book Table A4.1.2, 2010 values and prices) this resulted in an annual benefit of £700,871 (2010 values and prices). In practice this is likely to be an underestimate, as supporting measures such as the introduction of 20mph zones around the cycle routes should help to reduce accident rates further. Also, it does not take account of the positive impact on on-road accidents resulting from clearly signed cycle lanes, compared to having no special provision for cyclists.

For general road accidents we took the predicted reduction in car vehicle kilometres from section 2.5 and applied an accident benefit of 3.5p per car km (Table A.5.4.2 of the WebTAG data book), giving an annual benefit of £16,378.

Over the full appraisal period, and after discounting, this resulted in a PVB for accident benefits of £10.07M (2010 prices, discounted to 2010).

2.7 Environmental benefits

Environmental benefits were also calculated using the predicted reduction in car vehicle kilometres, and the values per km in Table A.5.4.2 of the WebTAG data book. For ‘Other Roads’ in the area type ‘Inner and Outer Conurbation’ this gives the following values per km:

Table 2.4: Environmental benefits per car vehicle km reduced

Impact	p/km
Air quality	0.00
Noise	0.20
Greenhouse gases	0.80

Applied to the predicted reduction in car vehicle kilometres, and over the full appraisal period this gave the following PVBs:

Table 2.5: Environmental benefits per car vehicle km reduced

Impact	PVB (£)
Air quality	0
Noise	£9,759
Greenhouse gases	£39,037
Total	**£48,796**

2010 prices discounted to 2010

2.8 Indirect tax revenues

Any transfer of trips from car to cycling leads to a reduction in government indirect tax revenues, mainly due to the loss of duty and VAT from petrol and diesel sales.

Table A.5.4.2 of the WebTAG data book gives a loss of 5.1p of revenue per car vehicle kilometre. Over the full appraisal period the loss of revenue had a present value of -£248,861 (2010 prices discounted to 2010).

3 Summary of results

The following table summarises the results of the appraisal, using the WebTAG standard Analysis of Monetised Costs and Benefits (AMCB) table.

Table 3.1: Analysis of monetised costs and benefits[14]

Noise	£	9,759
Local Air Quality	£	0
Greenhouse Gases	£	39,037
Journey Quality	£	9,089,771
Physical Activity	£	17,280,598
Accidents	£	10,072,681
Economic Efficiency	£	2,129,129
Wider Public Finances (Indirect Taxation Revenues)	-£	248,861
Present Value of Benefits (PVB)	**£**	**38,372,115**
Present Value of Costs (PVC)	**£**	**7,863,780**
OVERALL IMPACTS		
Net Present Value (NPV)	£	30,508,336
Benefit to Cost Ratio (BCR)		4.9

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.

With the exception of the loss of government indirect tax revenues, and the cost of the scheme itself, the impacts are positive.

A BCR of 4.9 puts Phase 2 firmly in DfT's 'very high' value for money category (defined as a BCR greater than 4.0). This is broadly in line with the cycling case study included in WebTAG Unit A5.1, which shows a BCR of 5.5.

[14] Individual rows may not sum exactly to the total due to rounding.