Department for Transport

Investing in Cycling and Walking

The Economic Case for Action

March 2015

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Department for Transport
Great Minster House
33 Horseferry Road
London SW1P 4DR
Telephone 0300 330 3000
Website www.gov.uk/dft
General enquiries https://forms.dft.gov.uk

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1. Introduction

1.1 On 12th August 2013, the Prime Minister announced his intention to "kickstart a cycling revolution which would remove the barriers for a new generation of cyclists". The draft Cycling Delivery Plan published by the Department on 16th October 2014 demonstrates the significant role walking and cycling can play as a sustainable transport mode and congestion reliever, the trigger for the creation of good quality public realm and liveable communities which bring significant economic returns, and - perhaps most significantly - a major driver to improving the nation's health through its physical activity benefits.

1.2 There is a strong business case for investing in cycling and walking, and a range of recognised, evidence-based benefits resulting from increased participation levels. In August 2013 the Government's ambition for cycling was set out in the document 'Briefing on the Government's Ambition for Cycling'[1] and eight cities were provided with investment to boost their ambitious plans to increase cycling over the next 10 years. Five of these cities were provided with further funding to generate a 'walking dividend' and to take forward walking initiatives alongside their cycling schemes.

1.3 However, this is only one step towards bringing a step change in cycling and walking levels across the country. Along with the strategic, commercial, management and financial case, a robust economic case is essential for both central and local government to make the case that funding should be targeted towards cycling and walking.

1.4 This paper aims to summarise recent changes in the evidence base as well as the key legacy studies that should help not only to quantify the impacts resulting from investment in cycling and walking, but also to make the case for investing in cycling and walking above other demands on budgets.

1.5 The evidence on sustainable travel, including cycling and walking, has developed significantly over the past decade. The central message confirmed by this is that sustainable and more specifically active travel interventions have the potential to deliver strong benefits and deserve a place in the modern toolkit of transport policy.

1.6 This paper does not attempt to summarise or even list the vast literature that exists on this topic. It rather aims to point towards a number of relevant studies for the UK context and cover the main issues for the practitioner - e.g. in a local authority.

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[1] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/229473/briefing-governments-ambition-cycling.pdf

1.7 The next chapter summarises the picture that has emerged and confirms that sustainable travel as well as cycling and walking can deliver very high benefits when compared to their costs.

1.8 The third chapter of this paper provides a brief overview of how to demonstrate the economic case for a new cycling and walking proposal and provides a step by step illustration based on a hypothetical example. A spreadsheet accompanying this report provides the benefit cost ratio calculations for the example and can be used to replicate those calculations for different schemes that practitioners might be working on.

2. The Evidence

Sustainable Travel and Cycling Demonstration Towns

Sustainable Travel Towns

2.1 In 2004, the Department for Transport published Smarter Choices: Changing the Way We Travel (Cairns et al., 2004), which reviewed the evidence available at that time on the effect and scale of implementation of smarter choice measures, previously called 'soft measures'. The review suggested that these measures had the potential to deliver substantial changes in travel behaviour and reductions in traffic, if implemented in a supportive policy context and on a large scale over a period of ten years.

2.2 The Department then launched the Sustainable Travel Towns (STTs) programme to provide a 'real life' test as to whether it was indeed the case that intensive, town wide Smarter Choice Programmes might have such an impact on travel behaviour and traffic. It ran from April 2004 to April 2009, with £10 million funding for the implementation of large-scale Smarter Choice Programmes in three towns: Darlington, Peterborough and Worcester. All three programmes aimed to encourage more use of non-car options – in particular, bus use, cycling and walking – and less single-occupancy car use.

2.3 The in depth evaluation[2] of the STTs showed a real impact on mode shift from car use to other, more sustainable modes of transport. Based on the decongestion benefits alone, the programme's benefit cost ratio (BCR) has been estimated as 4.5:1.

2.4 It is not possible to attribute the overall impacts to each of the individual activities that formed the package of interventions in the programme. The BCR is thus for the package as a whole and cannot automatically be assumed to apply to e.g. the cycling interventions alone.

Cycling Demonstration Towns

2.5 In 2005, Cycling England launched a Cycling Demonstration Town (CDT) programme to invest in measures to stimulate increased levels of cycling through combinations of physical infrastructure, promotion and other smart measures. The towns selected as Cycling Demonstration Towns were Aylesbury, Brighton and Hove, Darlington, Derby, Exeter and Lancaster with Morecambe.

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[2] http://webarchive.nationalarchives.gov.uk/20111005180138/http://assets.dft.gov.uk/publications/the-effects-of-smarter-choice-programmes-in-the-sustainable-travel-towns-summary-report/summaryreport.pdf

2.6 The 'Analysis and Synthesis of Evidence on the Effects of Investment in Six Cycling Demonstration Towns'[3] report draws on a range of monitoring and survey data to conclude that for each pound invested, the programme's impact in terms of reduced adult mortality alone was worth £2.59.[4]

2.7 The data from the evaluation has further been used to estimate a 30 year BCR range for the programme of between 4.7:1 and 6.1:1[5]. This approach provides an assessment of the impact of the CDTs on a range of objectives such as congestion relief and improved journey ambience or cycling casualties.

More recent investment programmes

Local Sustainable Transport Fund

2.8 Following the success of the Sustainable Travel Towns, the Government's white paper 'Creating Growth, Cutting Carbon' launched the Local Sustainable Transport Fund in 2011. £560m was made available initially and a further £40m added to the Fund in 2012, enabling the Department to award funding to 96 projects, to be delivered by 77 authorities and a number of supporting authorities, which will bring benefits to all regions across England (outside London). Together with local contributions more than £1bn is being invested in sustainable travel through the Local Sustainable Transport Fund.

2.9 Analysis of the business cases of the twelve large schemes (those in excess of £5m Departmental funding - jointly accounting for £225m or about 40% of Departmental funding) published in November[6] 2014 suggests that across these projects the average BCR is at least 5:1. While the majority of this consists of traditional transport decongestion benefits, around a fifth are arising from e.g. health, journey quality and safety.

2.10 At an individual scheme basis, the estimated benefit cost ratios vary between 2:1 and 8:1. With non-monetised impacts being positive as well, all the schemes are judged to provide high or very high value for money.

2.11 This ex ante appraisal of the business cases provides corroboration for the strong returns observed in the STTs and suggests they are achievable elsewhere by well-targeted investment in sustainable transport initiatives.

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[3] http://webarchive.nationalarchives.gov.uk/20120607215928/http://assets.dft.gov.uk/publications/analysis-and-synthesis-of-evidence-on-the-effects-of-investment-in-six-cycling-demonstration-towns/cyclingdemotowns.pdf

[4] While encouraging children to cycle was a main focus of the programme, any benefits to children are not included in these benefits.

[5] http://webarchive.nationalarchives.gov.uk/+/http:/www.dft.gov.uk/cyclingengland/site/wp-content/uploads/2010/02/091223-cdts-bcr-analysis-final-edit.pdf

[6] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/347894/vfm-assessment-of-lstf.pdf

Cycling Ambition Grants

2.12 In February 2013, the Department announced the Cycle City Ambition Grant and the Cycling in National Parks Grant as a single fund of £42 million (later increased to £94 million) for capital expenditure to kickstart ambitious 10 year programmes to increase cycling.

2.13 Following a competitive bidding process the Prime Minister announced the successful schemes on August 12th 2013[7]. Eight cities were awarded a total of £77m and four National Parks received £17m of funding. Including local contribution, these twelve schemes represent a total of just below £150m investment in cycling.

2.14 The submitted evidence from the bidding process has been used to derive benefit cost ratios. The assessment report[8] concludes that the average BCR across the funded schemes is between 5 and 6 to one. This is largely driven by the health benefits more active lifestyles bring with them (about 60% of total). The remainder is split fairly evenly between journey quality and decongestion.

2.15 As before, this analysis based on ex ante appraisal clearly supports the very high value for money seen in the CDT evidence discussed above.

Linking Communities fund

2.16 The Linking Communities grant 2012-13 was made available for the creation and upgrading of traffic calmed and traffic-free walking and cycling routes which link local communities to areas of economic activity, for instance industrial estates and enterprise zones. Building upon the 'Links to Schools programme' which linked residential areas with schools via the National Cycle Network, Linking Communities routes targeted mainly utility use to help, for example, those wishing to walk or cycle to work or school.

2.17 During the financial year 2012-13, the Linking Communities programme distributed £18 million (£7.5 million Department for Transport grant funding and £10.5 million match funding) to enable people in 35 communities to reach areas of economic activity through the creation and upgrading of traffic calmed and traffic-free walking and cycling routes.

2.18 Sustrans administers this programme on behalf of the Department and has recently analysed monitoring data from eight representative schemes in their 'Improving access for local journeys' report[9]. The average BCR across the programme was found to be in excess of 10:1 with individual schemes ranging from 3.7:1 to 32.8:1.

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[7] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/229473/briefing-governments-ambition-cycling.pdf

[8] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/348943/vfm-assessment-of-cycling-grants.pdf

[9] 'Improving access to local journeys -Linking Communities 2012-13 programme-wide impacts' - Sustrans - to be published.

Wider Evidence

Academic review of active mode literature

2.19 In 2012, the Department for Transport commissioned a literature review to assess the strength of the economic case for cycling and walking during a time of fiscal austerity and to support investment decision-makers at both national and local levels (particularly given the transfer of public health functions to local authorities). The report[10] by Dr. Adrian Davis compiles the latest available cost benefit evidence from the UK and abroad from studies that have calculated health benefits alongside other benefits such as savings in travel time, congestion and accidents.

2.20 The report focuses largely on the financial benefits accruing as a result of improvements in health when more of the population become physically active through choosing walking and cycling – for part or all of their travel choices. The direct costs of illness as an outcome of physical inactivity to the NHS are quoted as up to £1.0 billion per annum[11] while indirect costs are estimated as £8.2 billion per annum[12].

2.21 The report investigates walking and cycling as a key means by which people can build physical activity into their everyday lives. The mean BCR for all schemes identified in the report is 6.28:1, for studies from the UK alone the average is 5.62:1.

Transport for London Cycling Vision

2.22 In 2014 Transport for London published the business case for its cycling vision portfolio; under this ten year programme a total investment of £913m is planned. Based 'on a number of conservative assumptions' the report estimates the 15 year BCR as 2.9:1[13].

2.23 This suggests that cycling schemes not only represent high BCR due to their low costs but that even at high levels of investment strong returns can be realised.

Walking

2.24 The Department for Transport has not funded significant programmes exclusively aimed at encouraging walking but supports walking initiatives through programmes aimed at sustainable or active travel more generally. Many schemes funded under the Local Sustainable Transport Fund for example include activities that will benefit pedestrians.

2.25 This results in a lack of available case study or programme wide evidence held centrally by the Department. Academic reviews of the evidence also seldomly separate walking schemes out but mostly consider cycling and walking jointly.

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10 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/371096/claiming_the_health_dividend.pdf

11 Figure in 2006-07 prices.

12 In constant 2002 prices.

13 http://www.tfl.gov.uk/cdn/static/cms/documents/board-20140205-part-1-item06-cycling-vision-portfolio.pdf

2.26 The walking charity Living Streets has summarised the case for investing in the walking environment[14] and concludes that

- Investing in walking environments can support local economies by increasing footfall, improving accessibility and attracting new business and events;
- Investment in the walking environment is likely to be of equal or better value for money than other transport projects;
- Retailers and residents express a willingness to pay for improvements to the walking environment, while good quality public realm increases the value of both residential and commercial property;
- Residents of walking friendly neighbourhoods are less likely to be depressed or to have poor mental or physical health ;
- People walk more when they feel their neighbourhood is safe, well maintained and lively, while increased walking in a neighbourhood is associated with better perceptions of safety and greater social interaction.

2.27 In terms of value for money the report finds that investments in the walking environment are generally good value for money even when considering that BCRs are typically underestimated due to the small number of potential benefits being monetised. The BCRs found range between 0.1:1 and 37:1; suggesting that very high returns are possible for well-targeted schemes.

Impacts on the Local Economy

2.28 The evidence above focusses on the BCRs for cycling and walking schemes. While BCRs are an important indicator of the indirect economic benefits (improved health, reduced congestion), some attention has recently been given to the direct 'cycling economy' and the potential impact of cycling on the local high-street.

2.29 A study by the London School of Economics shows that the gross cycling contribution to the UK economy in 2010 was £2.9 billion[15].The study takes into account factors such as bicycle manufacturing, retail and cycle related employment. This equates to £230 per cyclist, per year.

2.30 The New York City Department of Transport finds evidence of a significant increase in retail sales as a result of installing segregated bicycle lanes on 8th and 9th Avenues in central Manhattan[16].

2.31 The evidence base for such direct economic impact is still developing. It should be noted, however, that the impacts summarised in the BCR are

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[14] Living Streets: Making the case for investment in the walking environment - available at: http://www.livingstreets.org.uk/professionals/making-the-case-for-investment-in-the-walking-environment

[15] [15] Grous, A., 2011 The British Cycling Economy, the Gross Cycling Product Report, London: LSE.

[16] http://www.nyc.gov/html/dot/downloads/pdf/2012-10-measuring-the-street.pdf

considered to provide a good representation of such potentially more 'visible' outcomes of transport schemes in most cases.[17]

Summary

Benefit Cost Ratios

2.32 Table 2.1 summarises the various BCRs discussed above and confirms that sustainable transport as well as cycling and walking schemes frequently offer high to very high BCRs.

Table 2.1: Summary of BCRs discussed

	BCR	Comment
Sustainable Travel Towns	4.5:1	Decongestion benefits only
Cycling Demonstration Towns	2.59:1	Adult health benefits only
Local Sustainable Transport Fund [ex ante appraisal]	5.1:1	Based on 12 large schemes business cases
Cycling Ambition Grants [ex ante appraisal]	5.5:1	Based on business cases for 12 funded schemes
Linking Communities Fund	10:1	Based on eight representative schemes
Literature Review	5.6:1	Average BCR for UK case studies, overall average 6.3:1
Transport for London Cycling Vision [ex ante appraisal]	2.9:1	Very large programme - conservative BCR
Living Streets	0.1-37:1	Only subset of benefits monetised

Value for Money

2.33 Value for money conclusions take into account 'wider well-being' (but non monetisable) impacts alongside the BCRs. Across the type of schemes discussed in this note, very few negative non-monetised impacts can be identified. On the other hand schemes frequently provide significant improvements to severance, security, accessibility or travel options available to residents. These benefits are in addition to those that can be monetised and summarised in the BCR.

2.34 Based on the BCRs reported and considering the typical non monetised benefits, one can confidently conclude that sustainable travel and cycling and walking in particular regularly offer high and very high value for money.

[17] The user benefits which the BCR is based on ultimately give rise to economic growth such as a revitalised high street or an increase in employment. Academic research concludes that measuring the initial user benefits provides a reliable prediction of the size of the growth impact that ultimately derives from them in most cases.

Areas for further research

2.35 Some further improvements to the evidence base are still required to better inform a number of assumptions used when estimating benefit cost ratios.

2.36 One of the key remaining questions is that of the longevity of impacts. Especially where the initial change was achieved through 'smarter choice' measures such as travel planning, advertising and similar revenue funded schemes, impacts are typically assumed to decay over time once funding has stopped. No firm evidence for the choice of such a decay rate exists.

2.37 Similarly there is no consensus around the impact of increased cycling and walking on the number of cars on the road. It is not clear if people taking up cycling are reducing their car use (replace a car driver trip by cycling) as a result or e.g. walk less or actually undertake more trips than before.

2.38 On both those assumptions it appears that the studies quoted above use conservative assumptions. The downside risk on the BCRs is thus limited. The economic case could, however, look even better if we had more robust evidence on these questions.

2.39 The Department is currently reviewing the evidence in both these areas through research projects and will make the conclusions available later in the year.

3. How to make the case

3.1 This chapter summarises the steps that practitioners should follow when putting together the economic case for investing in cycling or walking. It is important to remember that the economic case is only one of the five cases to consider before making a final decision.

3.2 Without a convincing strategic case, even the best economic case does not provide a sufficient base for spending public funds. Similarly only projects with good management and commercial cases will be delivered successfully. Finally the financial case needs to establish that funding is available over the lifetime of a project.

3.3 As part of building a convincing strategic case, practitioners will want to demonstrate a good understanding of the target population. Only by analysing the attitudes and behaviours present within the populations can the solutions be designed to overcome the barriers to using active travel options. The Department's behavioural insights toolkit might help with this task.[18]

3.4 The chapter begins with an overview of the methodology recommended by the Department's transport appraisal guidance, WebTAG, and then provides a worked example to demonstrate the steps involved.

3.5 As active mode appraisals typically do not require the use of sophisticated transport models, following these steps should not require transport modelling expertise.

WebTAG

3.6 The unit on active mode appraisal A5-1 provides detailed guidance on steps to follow when constructing the economic case to support an intervention. It does incorporate the use of The World Health Organisation's (WHO) Health Economic Assessment Tool (HEAT) for monetising health benefits from increased physical activity.

3.7 HEAT has recently been updated[19] to better reflect recent developments in the evidence base. The Department's appraisal guidance WebTAG has not yet been updated to take account of these changes. A project is currently undertaken to update WebTAG to ensure it continues to reflect the most up to date evidence of mortality and morbidity benefits of active travel.

3.8 In general the first step will be to estimate the demand or the likely number of users that will benefit from the scheme. This task starts by

[18] https://www.gov.uk/government/publications/behavioural-insights-toolkit
[19] http://www.euro.who.int/__data/assets/pdf_file/0010/256168/ECONOMIC-ASSESSMENT-OF-TRANSPORT-INFRASTRUCTURE-AND-POLICIES.pdf?ua=1

establishing a baseline user number. A number of data sources are frequently used for this including but not limited to:

- Local automatic or manual counts
- National travel survey
- Active people survey
- Census travel to work data (commuting only but can be used as base to estimate all-purpose trips)

3.9 The guidance sets out several approaches to estimating how this baseline might change as a result of the scheme. Most business cases refer to evidence on the user growth observed for similar interventions elsewhere.

3.10 Once the number of people benefitting from the scheme is determined, the guidance can be followed to estimate a range of benefits the users experience due to the changes proposed. These typically involve

- Physical activity
- Absenteeism
- Journey Quality
- Road Safety
- Environment
- Decongestion and indirect tax and
- Time saving impacts for active mode users.

3.11 In general not all benefits will be important drivers of the business case for all proposals. In general

- Physical activity benefits will tend to dominate where forecasts of new walk and cycle users are relatively large;
- Journey quality will be proportionately greater where there is a relatively large number of existing users;
- Decongestion benefits will be much more important in congested urban areas of a higher density.

3.12 The following worked out example of a hypothetical scheme improving an existing canal towpath summarises what might typically be involved in completing the economic case for cycling and walking scheme.

Example Walking and Cycling Case Study

Introduction

3.13 This example below is taken from WebTAG unit A5.1 - active mode appraisal and demonstrates the application of the guidance to a hypothetical case study for illustrative purposes. The text provides a fair amount of detail on the mathematical steps involved. However, by skipping the more detailed paragraphs, the less technically minded reader should still gain a good understanding the overall approach to estimating the benefits.

3.14 A spreadsheet replicating the calculations accompanies this report. This can be used to undertake a range of sensitivity tests around the case study or indeed to apply the same calculations to a different scheme for which the user might want to obtain an estimate of the BCR.

3.15 Section A describes the hypothetical scheme and its costs; section B describes the forecasting approach used; section C sets out how the costs and benefits are calculated; section D how the results should be reported. Further steps involving sensitivity testing can be found in the annex to WebTAG unit A5-1.

A. The Case Study and Scheme Costs

3.16 This appraisal case study considers improvements to a canal towpath in London, providing access to a major industrial business park area. The project consists of upgrades to an existing 6km route carrying relatively high levels of usage from modest to high quality. Improving levels of commuter use is a particular priority.

3.17 Construction of the hypothetical scheme takes place in 2010, with the scheme opening in 2011. The construction cost is estimated at £182,000 with maintenance costs incurred every year and estimated as £18,800 per annum, in 2010 prices.

B. Estimating demand for and impacts of cycling and walking schemes

3.18 The demand impact of the scheme is estimated with reference to a comparative study. The increase in demand is based on user counts and surveys before and after an actual completed scheme, which showed a considerable increase in usage following upgrade to the route surface quality and connectivity.

3.19 In this case study, background growth rates by mode were taken from data from the National Trip End Model (NTEM), specifically growth in trip productions per annum in London. In this case this was assumed to be 0.25% for cyclists and 0.52% for walkers.

3.20 Both the 'without scheme' and 'with scheme' scenarios are based on 2010 counts of walkers and cyclists using the route. The 'without scheme' scenario is then based on the annual NTEM growth rates above. The 'with scheme' scenario is based on counts from the comparative study, which showed a 51% increase in cyclists and 11% increase in pedestrians using a similar canal towpath two years after a similar upgrade (i.e. demand in 2012 in the 'with scheme' scenario is assumed to be 51%/11% greater than demand in 2010).

3.21 To calculate the number of cycling and walking users generated by the scheme, the number of users expected under the 'without scheme' scenario is subtracted from the forecast number of users under the 'with scheme' scenario. Table 3.1 below shows the usage in terms of numbers of cyclists and pedestrians based on the 2010 count data collected during the pre-implementation phase and the 'with' and 'without scheme' forecasts.

Table 3.1 Cyclists and pedestrians before and after intervention (based on observed counts)		
	Cyclists	Walkers
2010 (usage per day)		
Trips	1,085	517
Individuals	597	284
2012 (usage per day)		
'Without scheme' (trips)	1,090	522
'With scheme' (trips)	1,636	572
Usage difference (trips)	546	50
'Without scheme' (individuals)	600	287
'With scheme' (individuals)	900	315
Usage difference (individuals)	300	27

3.22 The number of individual users is based on the assumption that 90% of trips are part of a return journey using the same route, to avoid double counting in the calculation of the number of individuals affected (e.g. 1,085 trips * 90% / 2 + 1,085 trips * 10% = 597 individual users).

3.23 The number of new individual users is used in the calculation of health benefits and is calculated by subtracting the number of users in the previous year from the number of users during the current year. The proportion of users on commuting journeys (which is relevant to the calculation of absenteeism benefits) is 56.4%, taken from surveys as part of the comparative study.

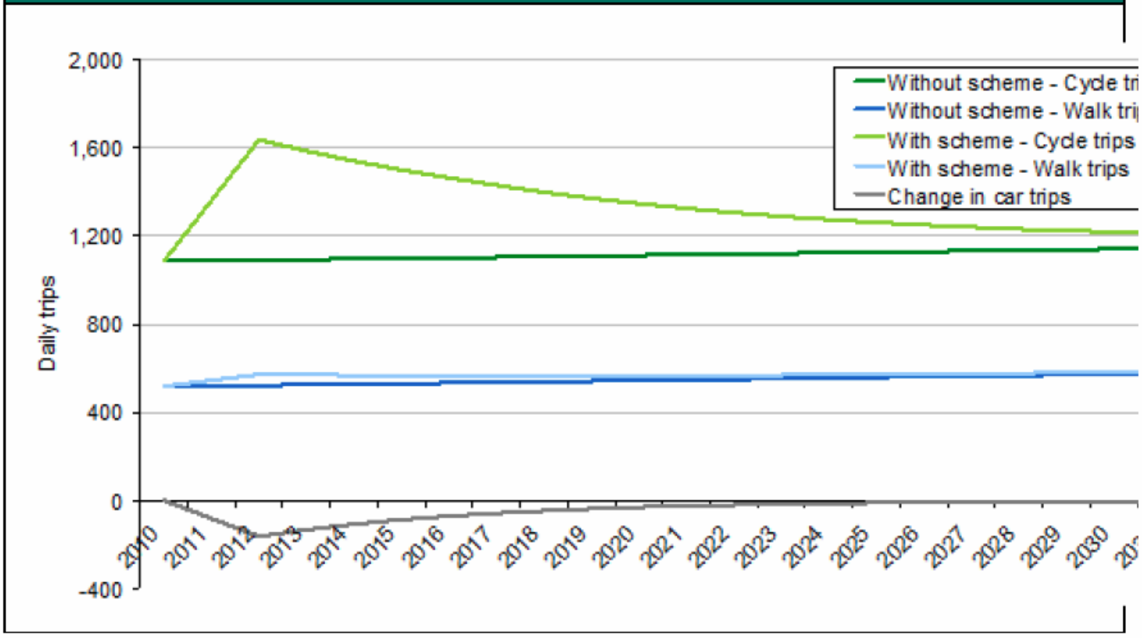
3.24 Levels of growth beyond 2012 have been estimated using the concept of a rate of decay in use (further explained above under further research and in WebTAG). In this case, it has been assumed that after the initial encouragement of active mode users to the intervention, rather than maintaining this increased level of use indefinitely, additional use reduces over time compared to the ‘without scheme’ case by 10% per annum. This is likely to be conservative in this case study, since the path is built and importantly maintained over time.

3.25 The number of car kilometres saved by the scheme is used in the calculation of decongestion, indirect tax and environmental impacts using the Marginal External Cost method. The total change in walking and cycling kilometres is calculated by multiplying the forecast ‘without scheme' and 'with scheme' trips by the average trip lengths, which are assumed to be 3.9kms for cyclists and 1.15kms for walkers (taken from the Department's National Travel Survey) and subtracting the former from the latter.

3.26 The proportion of users then reporting that they could have used a car but chose not to (27.3% in this example, based on surveys for the comparative study) is taken as the proportion of the total walking and cycling kilometres that can be described as car kilometres saved. Therefore, this example leads to 596 car kilometres being saved per day in 2012 (27.3%*(546 cycling trips * 3.9kms + 50 walking trips * 1.15kms)). Note that in this example it is assumed that average journey lengths by mode remain unchanged. As a result, even though the intervention is a 6km length of off-road cycle track, it is not assumed that users will traverse the whole length of that track.

3.27 Figure 3.1, below, shows the number of walking and cycling trips forecast to use the scheme daily with and without the scheme. This also shows net change in car trips (since total car trips are not known and in fact do not matter as the important element is the reduction in car kilometres). Another assumption in this case is that no account has been made for potential mode shift from public transport.

Figure 3.1: Daily usage forecasts of walking and cycling and net change in car mode



C. Calculating the costs and benefits

3.28 The combination of user numbers, growth rates and trip profiling form the basis for the calculation of total trips, numbers of new users, car kilometres saved, and numbers of commuter trips. Each of these is required for the generation of the monetised values for the items listed below. In each case the calculated value is the net present value over the appraisal period.

3.29 Unless a good case can be made to show that the lifetime of the intervention is as long, the sixty year appraisal period over which most large-scale infrastructure schemes for other modes are assessed is not generally recommended for schemes targeting active modes. In this case study a twenty year appraisal period is used. Sensitivity testing of this assumption is recommended and further discussed in in WebTAG.

3.30 This case study includes physical activity, absenteeism, journey quality and decongestion (calculated using the Marginal External Cost method) benefits of the upgraded towpath. As it is an upgrade to an existing route, time savings to users are not included.

Scheme costs

3.31 The scheme investment costs (design and construction) and operating costs (maintenance) are required for the appraisal. Construction will take place in 2010 and the construction cost is estimated at £182,000. Maintenance costs will be incurred every year and are estimated as £18,800 per annum, in 2010 prices. The estimated costs have been adjusted by +15% to account for optimism bias (in practice, this varies with the level of development of the scheme – see TAG Unit A1.2 – Scheme Costs), and a further 19.1% has been added to adjust total capital costs and operating costs to market prices. The maintenance costs presented in Table 3.2 have been summed and discounted over the twenty year appraisal period to form part of the Present Value of Costs (PVC) (see TAG Unit A1.1 – Cost Benefit Analysis).

Table 3.2 Present value costs of the case study after inclusion of optimism bias and adjustment to market prices (2010 prices)

	Capital costs	Maintenance costs
Scheme capital cost	£182,000	£276,545
+15% optimism bias	£209,300	£318,027
+19.1% market price adjustor	£249,276	£378,770

Physical Activity (this follows the HEAT methodology)

3.32 The reduction in the relative risk of premature death due to physical inactivity is calculated for potential new walkers and cyclists along the scheme route, based on the time spent active per day using estimated average length (from the National Travel Survey), speed (assumed to be 20kph for cyclists and 5kph for walkers) and frequency of new trips encouraged by active modes. The reduction in relative risk for cyclists is 0.28 (relative risk of 0.72) at 36 minutes per day[20] and for walkers is 0.22

[20] Andersen et al (2000) All-Cause Mortality Associated With Physical Activity During Leisure Time, Work, Sports, and Cycling to Work, Archives of Internal Medicine, Vol. 160, pp1621-1628

(a relative risk of 0.78) at 29 minutes per day for seven days a week[21] (compared to inactive individuals). As the reduction in relative risk is based on time spent travelling it is important to use realistic assumptions about average speeds.

3.33 Table 3.3 shows the calculation of the reduction of relative risk for walkers and cyclists. The average active time per day across individuals making return and single leg trips is based on the assumption that 90% of trips form part of a return journey. The reductions in relative risk are calculated by interpolating between 0 and the maximum reductions of 0.28 and 0.22 for cyclists and walkers, respectively, on the basis of the average active time per day (for example, for cyclists: 21.3mins / 36mins * 0.28 = 0.17).

Table 3.3 Calculation of reduction in relative risk of mortality for cyclists and walkers (following HEAT methodology)

	Cyclists		**Walkers**	
	Return	Single	Return	Single
Daily distance (km)	7.8	3.9	2.3	1.15
Average speed (kph)	20	20	5	5
Active time per day (mins)	23.4	11.7	16.6	8.3
Proportion of individuals	0.82	0.18	0.82	0.18
Average active time per day (mins)	21.3		15.1	
Reduction in relative risk	0.17		0.11	

3.34 As the evidence on reductions in relative risk for walkers is based on increased activity for 7 days a week, the active time per day is adjusted for the number of days per year (220) the new walkers are assumed to use the upgraded towpath (i.e. for return journeys, Active time per day = 2.3km / 5kph * 60 minutes per hour * 220/365 days = 16.6 minutes per day).

3.35 The calculated reduction in relative risk of death and the number of new walkers and cyclists are used to calculate a figure for the potential number of lives saved based on average mortality rates. For this case study an average mortality rate of 0.0024 is used[22], the mean proportion of the population of England and Wales aged 15-64 who die each year. It is also assumed that the benefit of using active modes accrues over a five year period, after which new cyclists or pedestrians achieve the full health benefit of their activities.

3.36 The number of potentially prevented deaths is then multiplied by the value of a prevented fatality used in accident analysis (see TAG Data Book) to give a monetary benefit for each year. Table 3.4 shows the calculation of the physical activity benefits for new cyclists in 2012 when there are 300 new cyclists as a result of the scheme, 150 receiving 20%

[21] World Health Organisation (2011), Health economic assessment tools, (HEAT) for walking and for cycling, Economic Assessment of Transport Infrastructure and Policies, Methodology and User Guide, Copenhagen.
[22] Source: ONS 2007

of the full benefit (as they have been more active for one year) and 150 receiving 40% (as they have been more active for two years).

Table 3.4: Calculation of the monetised physical activity cycling benefit in 2012

% of total benefit	New cyclists	Average mortality	Expected deaths	Reduction in RR / potential lives saved	Value of a prevented fatality (2010 prices)
Total / average	300	0.0024	0.7	0.17	£1,643,572
100%	0	0.0024	0.0	0.00	£0
80%	0	0.0024	0.0	0.00	£0
60%	0	0.0024	0.0	0.00	£0
40%	150	0.0024	0.4	0.02	£38,500
20%	150	0.0024	0.4	0.01	£19,179
Total				**0.04**	**£57,679**

3.37 These calculations are repeated for both cyclists and walkers for each year of the appraisal period, including real growth in the value of a prevented fatality in line with forecast GDP/capita, then summed and discounted to give a total benefit of £1.3m, in 2010 present values. This may also be converted into a unit saving per additional cyclist or pedestrian for ease of calculation across the appraisal period.

Absenteeism

3.38 Absenteeism from work is expected to decrease where more people walk or cycle to work. Moderate physical activity is seen to lead to a reduction in sick days taken from work and hence provides a benefit to the employer. This is not the same as the benefit of better health for the individual.

3.39 Average annual absenteeism rates per person (7.2 days per year, based on London-specific data) are multiplied by the expected reduction in absenteeism from increased cycling and walking (6% based on 30mins activity per day), based on data from a US study (WHO, 2003), resulting in a reduction in sick days of 0.43 days per affected individual (7.2 * 6%). The employer cost saving of the reduction is then calculated, based on a daily employment cost of £300, resulting in a benefit of £129 per affected individual (£300 * 0.43).

3.40 The number of new cyclists and walkers is factored by the proportion of commuting trips on the route (56.4%) to give the number of individuals affected. This results in a value for the reduction in absenteeism per new user of £52 per annum per new cyclist (£129 * 56.4% * 21.3mins / 30mins) and £37 per annum per new walker (£129 * 56.4% * 15.1mins / 30mins), based on the average time spent active relative to the 30 minutes per day in the US study.

3.41 As with the physical activity benefits, the absenteeism benefits are assumed to build up over a five year period. They are estimated for each year, including real growth in the employment cost in line with forecast GDP per capita, and then summed and discounted to give a total benefit of £77,500, in 2010 present values.

Journey Quality

3.42 Journey quality is calculated on the basis of a 'safety-insecurity' value, as derived from the research studies cited in the relevant section of TAG Unit A4.1.The approach is based on assigning a 'quality value' to each trip made by existing and new users. Separate journey quality values are used for cyclists and pedestrians. In each case the 'rule of a half' is used whereby current users experience the full benefit of quality improvements but the benefits for new users are divided by 2.

3.43 For cycling trips, the journey quality value is derived from the willingness to pay value of an off-road cycle track (7.03 pence per minute in 2010 prices). The assumption is also made that the average cyclist will use the upgraded towpath for approximately half their journey and that the upgrade from previous conditions represents only half of the full value. Effectively this means that one quarter of this value is used, which converts to a unit benefit of 21 pence per cycle trip (7.03p / 2 / 2 * 11.7mins/trip).

3.44 For walkers it has been assumed that the improvements to the towpath will include level kerbs (1.9p/km), information panels (0.9p/km), pavement evenness (0.9p/km), directional signage (0.6p/km) and bench provision (06.p/km). Again it is assumed that walkers use the route for half their journey and so that full benefits are halved. This gives an approximate unit benefit of 3 pence per walking trip ((1.9+0.9+0.9+0.6+0.6) / 2 * 1.15).

3.45 The benefit per trip is applied to the forecast number of trips in the 'without scheme' case and, following the rule of a half, half the benefit per trip is applied to new trips in the 'with scheme' case. In these calculations an annualisation factor of 220 is used, based on the number of working days in a year. Weekend use is therefore not included and this may represent a conservative view. Quality benefits are calculated for each year, including real growth in the values in line with forecast GDP/capita, summed and discounted to give a total quality benefit of £1.0m, in 2010 present values.

Benefits estimated with the Marginal External Cost method

3.46 Decongestion, accident, greenhouse gas, air quality, noise and indirect tax benefits have been estimated using the marginal external cost method using forecasts of reduced car kilometres as a result of the scheme. Reduced highway maintenance costs (which are netted off the construction and maintenance costs in the PVC) are also calculated in the same way. Detail on this method, including a worked example based on this case study, in given in TAG Unit A5.4 – Marginal External Costs.

3.47 Table 3.5 shows the 2010 present value of the impacts estimated with the marginal external cost method.

Table 3.5 Impacts estimated with the marginal external cost method (2010 prices and present values)	
Impacts	Present value
Decongestion	£1,125,217
Accidents	£49,490
Greenhouse gases	£2,117
Air quality	£3,322
Noise	£15,183
Indirect tax	-£89,079
Infrastructure	£1,537

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Transport Economic Efficiency

3.48 The only Transport Economic Efficiency (TEE) impacts monetised in this case study are the road decongestion benefits, derived from the estimated reduction in car kilometres. The £1.2m benefit represents both time and vehicle operating cost savings and is not disaggregated by journey purpose.

Public Accounts

3.49 Table 3.6 shows a simplified Public Accounts (PA) table, recording the construction and maintenance costs of the scheme (from Table 3.2) and the reduced highway infrastructure costs and indirect tax impact estimated with the marginal external cost method (from Table 3.5).

Table 3.6 Public Accounts (PA) table		
Funding	Walk / cycle	Road
Revenue		
Operating costs	£378,770	-£1,537
Investment Costs	£249,276	
Developer and Other Contributions		

Grant/Subsidy Payments		
Indirect Tax Revenues		£89,079
Broad Transport Budget		£626,509
Wider Public Finances		£89,079

Analysis of Monetised Costs and Benefits

3.50 Values from the TEE and PA tables should be carried forward in to the Analysis of Monetised Costs and Benefits (AMCB) table. In addition, values for 'Physical activity' (including absenteeism), 'Journey quality', 'Accidents', 'Greenhouse gases', 'Noise' and 'Local air quality' should also be included in the AMCB table. The scheme 'Present Value of Costs' (PVC) is the impact on the 'Broad Transport Budget' from the PA table. The 'Present Value of Benefits' (PVB) is the sum of all other impacts (including the indirect tax impact). The 'Net Present Value' and the 'Benefit Cost Ratio' are then calculated from the PVC and PVB. Table 3.7 shows the AMCB table for this example and Figure 3.2 shows the breakdown of the benefits.

Table 3.7 Analysis of Monetised Costs and Benefits	
Noise	£3,322
Local Air Quality	£2,117
Greenhouse Gases	£15,183
Journey Quality	£1,034,576
Physical Activity (including absenteeism)	£1,331,358
Accidents	£49,490
Economic Efficiency (Decongestion)	£1,125,217
Wider Public Finances (Indirect Tax Revenues)	-£89,079
Present Value of Benefits (PVB)	£3,472,183
Broad Transport Budget	£626,509
Present Value of Costs (PVC)	£626,509
OVERALL IMPACTS	
Net Present Value (NPV)	£2,845,674
Benefit to Cost Ratio (BCR)	**5.5**

Sensitivity testing

3.51 For this case study, assumptions around the decay rate, appraisal period and journey quality benefits have been made and their impact on the scheme appraisal should be tested. For further detail on sensitivity testing please refer to appendix B of WebTAG unit A5.1.

Figure 3.2: Proportion of benefits attributable to each main impact