The benefits of getting England cycling

Fiona Crawford[1] and Robin Lovelace[2]

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[1] University of Leeds, Institute for Transport Studies, ts12fc@leeds.ac.uk

[2] University of Leeds, School of Geography, R.Lovelace@leeds.ac.uk

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Introduction

There is a strong body of evidence highlighting the health and environmental benefits of increasing the number of people cycling (Cavill and Davis, 2007, Edwards and Magarey, 2007, Cavill et al., 2008, Oja et al., 2011). There is also evidence that exercising outdoors has benefits for mental wellbeing (Thompson Coon et al., 2011). This established evidence base has enabled the Department for Transport (DfT) to produce guidance specifically relating to the estimation of benefits from transport schemes focusing on walking and cycling (Department for Transport, 2014a). This methodology is usually applied to small schemes or city wide projects, but in this report it is used to estimate the benefit across all of England if two ambitions for cycling levels are achieved.

The UK is lagging behind many other European countries in key indicators of cycling levels and conditions for cyclists (European Cyclists' Federation, 2013). Whilst Scotland has an ambitious target of 10% of trips to be made by bicycle by 2020 (The Scottish Government, 2013), the Department for Transport has projected cycling levels will stagnate based on its National Transport Model (Pank, 2013).

The recently released draft Cycling Delivery Plan (CDP) (Department for Transport, 2014e) sets out a more optimistic vision of cycling for England. The CDP includes an ambition of doubling the number of cycle trips within 10 years, which is described as requiring a "step change" in mode choice. The vision presented is still being reviewed but even if the Government do commit to it, the report does not provide any details about how the increase in cycling will be achieved or how it will be funded.

Prior to the development of the CDP, the All Party Parliamentary Cycling Group (2013) produced a report called 'Get Britain Cycling' (GBC). This report included recommendations to Government in relation to cycling, including introducing an ambition to increase cycle use to 10% of all journeys by 2025 and 25% by 2050. The CDP ambition relates to doubling the *number* of trip stages made by bicycle by 2025. This ambition therefore relates to approximately 3% of journeys being made by bicycle by 2025 (subject to uncertainty due to population growth and overall travel patterns), far short of the levels recommended in the Get Britain Cycling report.

The purpose of this report is to compare the economic benefits of achieving the ambitions for cycling proposed in the CDP and GBC reports against a zero-growth baseline. Monetary estimates of the benefits to health, the environment, safety and congestion are presented for the period 2015 to 2050.

Future scenarios of cycling in England

The ambition presented in the Cycling Delivery Plan (CDP) report is "to double cycling, where cycling activity is measured as the estimated total number of bicycle stages made each year, from 0.8 billion stages in 2013 to 1.6 billion stages". As this target is based on the absolute number of stages, it is sensitive to assumptions about population growth and travel demand. This increases the uncertainty surrounding any benefits estimated based on this ambition. The CDP ambition uses 2013 National Travel Survey data as a baseline. These levels of cycling, 15.3 stages per person per year or 1.5% of stages (Department for Transport, 2014b), are the lowest reported by the NTS in recent years (using comparable data from 1995/97 onwards).

For the purposes of this report, the growth in the number of cycle stages per year in the CDP scenario has been considered to be linear due to the relative short time period of 10 years and the lack of intermediate targets. This linear trend has also been extended to 2050 to allow a comparison of the benefits with those achieved by the Get Britain Cycling (GBC) ambition to 2050.

The ambition presented in the GBC report is to “increase cycle use from less than 2% of journeys in 2011, to 10% of all journeys in 2025, and 25% by 2050”. Although this could be assumed to relate to trips (“a one-way course of travel with a single main purpose” (Department for Transport, 2013)), in this report it has been treated as an ambition relating to ‘stages’ (part of a trip made by a single mode). The DfT usually refer to cycle stages rather than trips as cycling is often not the main mode for the entire trip and thus cycling levels may be underestimated. The GBC report mentions the importance of cycle facilities at railway stations, which would impact on the number of cycle stages but not trips (as the main mode for the trip is likely to be train). This assumption allows this ambition to be compared directly with the CDP target which is expressed in stages.

The GBC report only includes targets for 2025 and 2050 and therefore assumptions had to be made in terms of how cycling levels may change in the interim years. Due to the ambitious nature of the target, a logistic growth pattern was assumed (Lovelace et al., 2011).

Using ONS population projections and assuming that the number of trip stages per person remains constant (at the 2013 level), the total number of stages by all modes for each year between 2015 and 2050 were estimated. This allowed the GBC targets to be converted into an absolute increase in the number of cycle trip stages in 2025 and 2050 and also for the CDP target to be converted into a mode share for cycle stages. The CDP ambition is very sensitive to assumptions relating to the overall number of stages per person per year and therefore alternative assumptions will be explored in the discussion section.

Estimations of the mode share for cycling under each scenario is represented in Figure 1. The baseline ‘zero growth’ scenario, whereby the mode share for cycle trips remains constant at the 2013 level, is also represented.

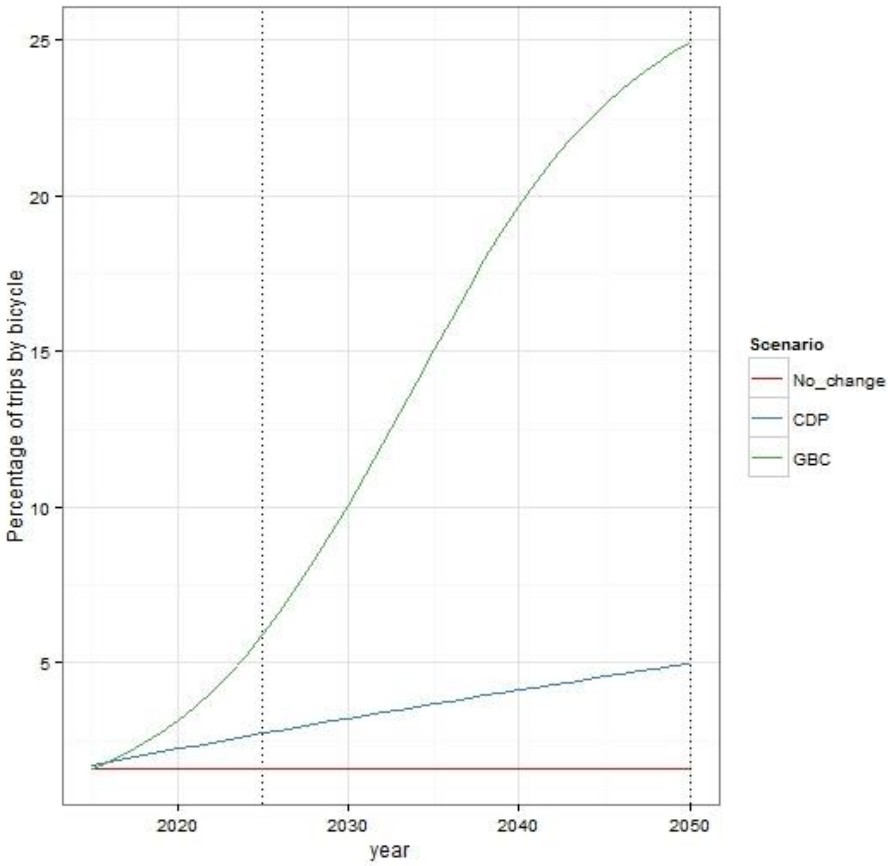

Figure 1: Mode share for cycling under each scenario

Methodology

The process undertaken in this analysis consisted of two stages:

1. The generation of a simulated population of cycle stages representing the achievement of the Cycling Delivery Plan and Get Britain Cycling ambitions in each year from 2015 to 2050.
2. The calculation of economic benefits associated with each scenario, compared with a baseline of zero growth in the mode share for cycling.

Modelling the increase in cycle trip stages

The method used in this research operates at the stage level. Matching variables between household, individual, trip and stage-level data allows individual-level attributes to be taken into account when modelling a modal shift. As detailed above, a stage is a single leg of a journey made by a single mode, whereas a trip is a journey for a single purpose which is made up of one or more stages. A typical example would be cycling to catch the train to work: a single trip composed of two stages. Although trips and stages are often used interchangeably (and 96% of trips in the National Travel Survey comprise of a single stage (Lovelace and Woodcock, 2014)), there is a distinction.

The richest single source of multi-level transport data in the UK is the 2002-2012 National Travel Survey (NTS), which provides one week of travel information for 236,249 individuals, 86% of whom reside in England. To ensure that the data is up-to-date, only records from 2008-2012 were used in this research, reducing the number of individuals to 105,070 and the number of stages to 1.5 million.

The model implicitly assumes that the NTS data is reasonably representative of the trip stages being undertaken in any given year. The characteristics of cycle stages under the baseline scenario for each year are estimated using the characteristics of trip stages currently cycled in the NTS data. The projections of mode share for cycling under each scenario in each year between 2015 and 2050 presented in the previous section are then used to estimate the number of trips made by bicycle each year, based on the population projection for each year (Office for National Statistics, 2014). The characteristics of the trip stages and the people making them, however, are determined stochastically using the probability of any given trip stage switching to bike. Due to the stochastic nature of the process, three model runs were performed and the average was used to produce the results below. As the outputs were relatively stable, three runs was considered to be sufficient. The main factors affecting the probability of switching trip stages to cycling are described below.

Distance

In many cases, distance is one of the most important determinants of whether a journey can be made by bicycle. In this model, the probability of a stage in the current transport system being replaced by bicycle is distance dependent. Rather than using a threshold for defining cycleable distances, it has been represented by a distance decay function to account for a more nuanced likelihood to cycle a trip stage as the distance increases.

Based on household survey data, Iacono et al. (2010) found that the distance decay for cycling follows the functional form:

$$p = \alpha \times e^{-\beta \times d}$$

where p is the probability of cycling a given trip, d is the distance of the given trip, α is the rate of cycling for the shortest distance and β represents the rate of decay. An exponential decay function was considered reasonable in this case as walking trip stages are 'protected' and thus given a zero probability of switching to bicycle, so very short trip stages which are too short to cycle are unlikely to require a distance decay function.

The parameters α and β were set to 0.4 and 0.2 respectively, following Iacono et al. (2010). In the current analysis the sampling uses *relative* probabilities of switching to cycling and thus α is not particularly relevant. An exploration of the distance decay rate for cycling in the NTS sample data identified that although the β parameter in Iacono et al. (2010) was estimated using data for journeys to work, it provided a satisfactory fit to the sample of NTS trips of all purposes.

Age

The probability of switching to cycling for a trip is not only determined by the trip distance, but also by factors relating to the individual making the trip. Intuitively, age is a significant factor in the propensity to cycle and therefore is likely to be a factor in the probability of switching to cycling. The relative likelihood of cycling by age group from the NTS is presented in Table 1. The adjustments in Table 1 have been applied as multiplying factors to the probabilities of switching to cycling. In the model, therefore, trip stages undertaken by people between 17 and 49 years old are more likely to be switched to cycling and stages by people outside this age band are less likely to be switched.

Table 1: Relative likelihood of cycling by age group

Age group	Relative probability of cycling
0-16	0.74
17-20	1.55
21-29	1.47
30-39	1.20
40-49	1.19
50-59	0.81
60-69	0.58
70+	0.43

Potentially cycleable trips

As detailed in Transport for London (2010), cycling may not be a viable mode for all trips, irrespective of the trip length. Parkin et al. (2008) examined Census 2001 data to explore the factors affecting the cycle mode share for commuting trips. Their model estimated that the overall saturation rate for cycling levels was 43% in England and Wales, using factors including socio-economic classification, local transport conditions and attributes such as hilliness and rainfall. In the current model this value was assumed to be applicable to trip stages as well as people. The research of Parkin et al. (2008) also focused on commuting trips, whereas this research considers all purposes. The factors affecting cycling used in Parkin et al. (2008), however, affect all types of trips and therefore the saturation rate has been applied here to narrow down the potentially cycleable trips. Note that this does not affect the eventual number of cycle trips sampled.

A sample of 43% of trip stages was selected from the NTS data. Trip stages undertaken by people reporting a disability affecting their choice of mode were automatically assigned to the 57% of trip stages not selected. The trip distance and the individual's age was also taken in to account when selecting the sample of trip stages which *could* be cycled. All trip stages which were not selected were given a zero probabilities of switching to be a cycling trip. This was done to represent trips which could not physically be undertaken by bicycle (for reasons other than distance), and trips made by individuals who would never cycle, no matter what cycle facilities are available.

Other factors

An increasing mode share for cycling is unlikely to replace all other modes of transport uniformly, as walking and bus journeys are more likely to be replaced. It is not clear, however, the extent to which this is due to the trip distances involved as car trips tend to be longer on average. Moreover, the mode of travel replaced by bicycle trips is highly policy dependent. To avoid double-counting the impact of distance, to maintain 'policy neutrality' and for simplicity, the probability of switching to cycling was not dependent on mode. The exception to this was cycling and walking. To prevent bicycle trips replacing existing bicycle trips, and to ensure the mode share for walking remains stable across all scenarios, the probability of switching to cycling was set to zero for these modes.

Additional variables that could affect cycling uptake include purpose, the location of the trip (urban areas, for example, may have better cycle path provision) and individual characteristics. However, there is little evidence about the precise impact of each of these variables on per-stage probabilities of modal switch, let alone for the specific case of England. Furthermore, there is no guarantee that currently observed relationships between these variables and cycling will continue. Women and older people, for example, may become more likely to cycle in the future if policies successfully promote cycling to these groups. For these reasons, and for parsimony in the model, these variables were omitted from the current analysis.

Calculating the economic benefits

The economic benefits of achieving the two cycling ambitions by 2025 and 2050 have been calculated. In each case the marginal economic benefit with respect to the baseline scenario where there is no change in mode share for cycle trip stages (from 2013 levels) have been presented.

The economic benefits have been calculated with respect to health, improved amenity for cyclists and the benefits of reduced car kilometres (reduced emissions, congestion, noise, accidents and improved air quality).

Health and absenteeism

The health benefits can be divided into two parts – the benefit of improved health for the individuals cycling the trip and the benefit to employers of reduced absenteeism as a result of improved health. As recommended in WebTAG (Department for Transport, 2014a), the benefits of improved health as a result of increases in cycling have been calculated using the World Health Organisation's Health Economic Assessment Tool (HEAT) for cycling (World Health Organisation). The HEAT tool estimates the value of reduced mortality as a result of increasing the number of cycle trips per year.

The number of cyclists was estimated using the total number of cycle trip stages in a year divided by the number of cycle trip stages per year per cyclist. The average number of cycle trip stages for someone who cycles at all in a year was estimated by multiplying the total trip stages per person per year by 25%, as this is the estimated percentage of trips undertaken by bicycle for someone who cycles at all (Department for Transport, 2014d). As most cycle trip stages are assumed to be paired up (an outbound and an inbound leg), the number of days cycled in a year per cyclist was estimated by dividing the number of cycle trips per year by two. The estimated number of days cycled per year was therefore 129, which is very close to the recommended value of 124 in HEAT (World Health Organisation).

HEAT is only intended as a way of measuring the health benefits of regular walking or cycling for people between 20 and 65. The majority of the simulated new cyclists in this analysis will be inside that age range, as they are assigned a higher probability of switching to cycling. Applying the standard methodology to older people is likely to overestimate benefits, but applying it to people under 20 is likely to underestimate the benefits. The HEAT methodology was applied to new cyclists of all ages in this analysis as any over or under estimate of benefits was considered to be small relative to the overall uncertainty surrounding the health benefit calculation.

The value of reduced absenteeism was also calculated using WegTAG (Department for Transport, 2014f), whereby 0.4 days gross salary costs are saved for each employee taking up physical exercise for 30 minutes on five days per week. In the calculations below the perceived costs of working time for cyclists (Department for Transport, 2014i) has been used in conjunction with an assumption that full time employees work on average 7.5 hours per day to estimate daily gross salary costs. Benefits have been pro-rated for individuals cycling less than 30 minutes per day and on fewer than five days per week.

Journey quality

As with journeys by car or public transport, people will attribute a value to a cycle journey based on the quality of the facilities available. Wardman et al. (1997) have estimated the value placed on different types of cycle route and on cycle facility availability (for example showers at work). In this report the methodology outlined in Department for Transport (2014f) for estimating the impacts on cyclists was followed, therefore existing users receive the full benefit of any improvement in facilities, whereas new users only receive half of the benefit.

Any change in the cycling journey quality will depend heavily on the interventions undertaken and the changes made to cycle infrastructure. The broad assumptions used in the calculation of Benefit-Cost Ratios for the Cycling Demonstration Towns (Department for Transport, 2010), where details of route specific improvements were not available, were used in the following calculations to represent policy neutral scenarios. As detailed in Department for Transport (2010) these estimates, therefore, include a large amount of uncertainty but are considered to be conservative. The assumptions made are that 20% of existing cyclists and 40% of new cyclists will utilize new infrastructure. This reflects the likelihood that some new cyclists may have been attracted to cycling by the new infrastructure. A benefit of 10p per trip for every trip using the new infrastructure was applied in Department for Transport (2010) and in this report.

Reduced car usage

Some of the benefits of increasing the mode share for cycling come from the corresponding decrease in the number of car journeys. These benefits include decreased greenhouse gas emissions, accident rates, congestion and noise, and improved air quality.

The WebTAG approach for calculating these benefits is based on marginal benefits where each scenario is compared to a baseline case. In this report, the baseline case is considered to be a future whereby the cycle mode share for trip stages remains constant. The number of trips which would have been made by car (as a driver) in the baseline scenario, but are made by bicycle under the scenario being evaluated are therefore of interest and were estimated using the modelling undertaken on NTS data. The average distance travelled by these replaced car trips was also estimated using the model outputs.

The monetary values attributable to each car kilometre replaced for each relevant benefit type were obtained from the TAG data book (Department for Transport, 2014i). Decongestion benefits were calculated assuming that none of the car kilometres replaced were from rural roads or motorways. The percentage of traffic on every other type of road was obtained from the TAG data book values for England. A more detailed estimate based on regional data is left for future research.

Cycle safety

The economic impact of possible increases in cyclist casualties due to the increased number of cycle trip stages has not been estimated in this report. As the types of cycle facilities provided, for example unsegregated, segregated or traffic free, are not known and the emphasis on cycle safety is not known, there is insufficient information to make a reasonable estimate.

Results

The methods described in the previous section were applied to two growth scenarios – the Cycling Delivery Plan (CDP) and Get Britain Cycling (GBC). The benefits for each of these scenarios were calculated relative to a baseline scenario where the percentage of trip stages undertaken by bicycle per year remains constant. The total number of stages per person per year of any mode was assumed to remain constant.

The two points in time named in the GBC report are 2025 and 2050. Figure 1 demonstrates the widening of the gap in cycling rates between the CDP and the GBC scenarios between 2015, 2025 and 2050. The amount of *additional* cycle trip stages per year in the CDP and GBC scenarios relative to the baseline (no-growth) scenario are given in Table 2. These should be considered in the context of the total number of trip stages undertaken per year, namely 60 billion in 2025 and 67.5 billion in 2050, assuming population projections in Office for National Statistics (2014) and a constant number of stages per person per year.

Table 2: Additional trip stages cycled per year, relative to the no-growth scenario

	by 2025	by 2050
Cycling Delivery Plan scenario (additional cycle stages per year)	688,692,000	2,285,576,000
Get Britain Cycling scenario (additional cycle stages per year)	2,603,340,000	15,752,408,000

The additional cycle stages in 2025 in the CDP scenario is 0.7 billion. This differs from the 0.8 billion stages specified in the draft report (Department for Transport, 2014e) as this is an increase *relative* to a 'do-nothing' scenario where the mode share for cycling is assumed to remain constant but due to population growth the number of cycle trip stages each year increases. The value in Table 2 therefore represents the part of the CDP ambition which would require a modal shift to cycling.

The benefits associated with the increases in cycle trip stages detailed in Table 2 are presented in Table 3. These are the benefits *per year* and the more ambitious nature of the GBC scenario is clearly visible when comparing the total economic benefit in 2025 and in 2050.

Table 3: Economic benefit of scenarios of increases in cycling levels (not discounted)

	Cycling Delivery Plan scenario		Get Britain Cycling scenario	
	by 2025	**by 2050**	**by 2025**	**by 2050**
Estimated economic benefits per year (£000s)	2,089,407	6,408,559	6,365,731	42,626,289
Estimated economic benefits per year per person (£)	36	98	109	649

Table 3 also includes the total economic benefit divided by the population of England. Although the benefits are unlikely to be evenly distributed across the population, this allows for a comparison with local schemes as demonstrated below.

Figure 1 demonstrated the scale of the difference between the CDP targets and those set out in the GBC report. Figure 2 demonstrates the resulting economic benefits achieved under the two scenarios. By 2050 achieving the extended-CDP ambition would result in an annual economic benefit of a similar level to those achieved in 2025 if the GBC ambition is achieved.

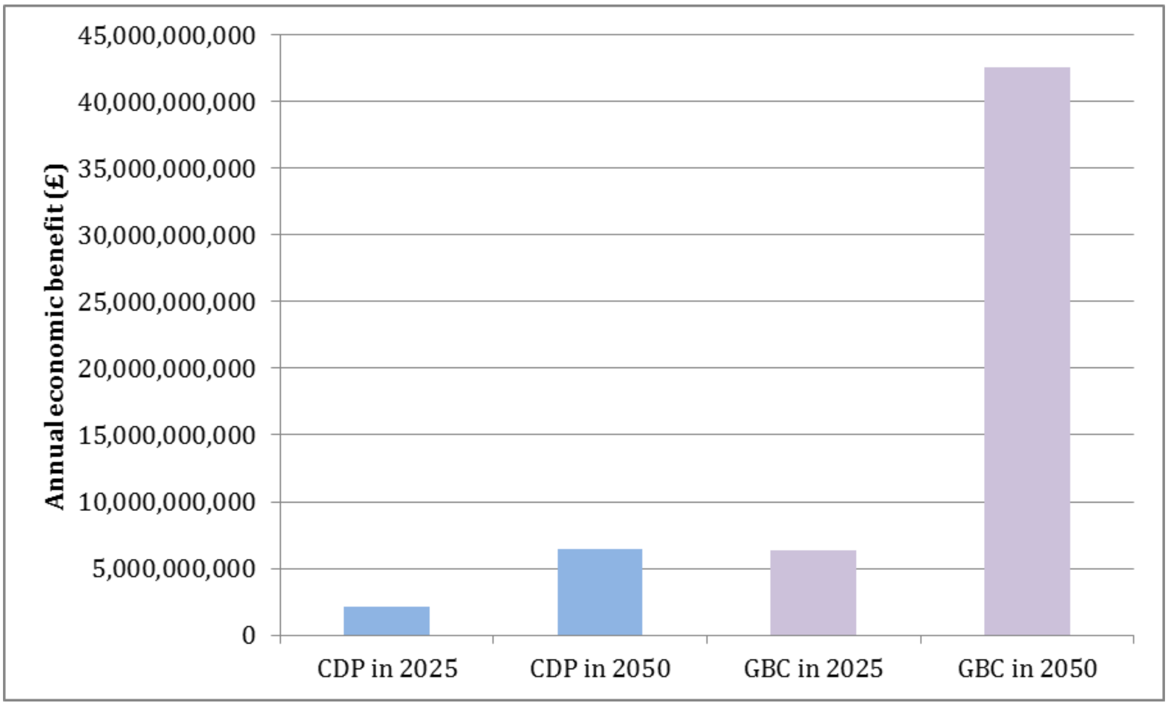

Figure 2: Economic benefit per annum under the two scenarios (undiscounted benefits)

Table 4 shows the benefit per year of increased cycling by 2025 under the two scenarios, broken down by benefit type. As expected, the largest component of the economic benefit is due to improved health as a result of physical activity (approximately 84% of total benefits), followed by decongestion benefits.

Table 4: Annual economic benefit in 2025 under both scenarios

	CDP in 2025 (£000s)	GBC in 2025 (£000s)
Increased physical fitness	1,807,052	5,295,653
Decongestion	283,534	1,086,239
Decreased casualties resulting from car usage	35,508	136,037
Reduced absenteeism	12,153	35,129
Reduced greenhouse gases	10,854	41,582
Decreased noise	2,367	9,069
Improved air quality	1,543	5,913
Improved journey quality	128	277
Reduction in indirect taxes (disbenefit)	- 63,734	- 244,169
Total economic benefits	2,089,407	6,365,731

A similar split between the different benefit categories are observed in the benefits estimated for 2050 (Table 5).

Table 5: Annual economic benefit in 2050 under both scenarios (undiscounted)

	CDP in 2050 (£000s)	GBC in 2050 (£000s)
Increased physical fitness	5,436,763	35,487,559
Decongestion	956,384	7,094,325
Decreased casualties resulting from car usage	119,775	888,471
Reduced absenteeism	60,553	379,887
Reduced greenhouse gases	36,611	271,576
Decreased noise	7,985	59,231
Improved air quality	5,206	38,619
Improved journey quality	261	1,308
Reduction in indirect taxes (disbenefit)	- 214,979	- 1,594,687
Total benefits	6,408,559	42,626,289

As described in the previous section, benefits were not just estimated for these two years of interest, but for every year from 2015 to 2050. The cumulative economic benefits of each scenario between 2015 and 2025 and also between 2015 and 2050 are shown in Table 6. All benefits in this table have been discounted to 2010 costs as per WebTAG.

Table 6: Cumulative economic benefits from 2015 to 2025 and from 2015 to 2050

		Cycling Delivery Plan scenario	Get Britain Cycling scenario
From 2015 to 2025	Estimated total economic benefit (£000)	7,640,496	18,563,787
	Estimated benefit per person per year	14	33
From 2015 to 2050	Estimated total economic benefit (£000)	46,358,675	248,261,542
	Estimated benefit per person per year	22	117

Estimated scenario costs

The CDP states that funding for cycling is currently around £5 per person and there is a hope that funding of £10 per person per year can be achieved by 2020/21. The GBC report indicates that a budget for cycling of £10 per person per year should be introduced and subsequently increased to £20.

The DfT have recently reported that the total benefit cost ratio for the successful Cycle City Ambition Grant bids was 5:1 (Department for Transport, 2014h). Based on this ratio, a very crude approximation of the predicted funding for the CDP and GBC to 2025 and 2050 have been included in Table 7 and Table 8 respectively.

Table 7: Estimated benefits and costs per person per year to 2025

	Cycling Delivery Plan (2015-2025)	**Get Britain Cycling (2015-2025)**
Estimated benefit per person per year (£)	14	33
Predicted cost per person per year (£)	3	6

Table 8: Estimated benefits and costs per person per year to 2050

	Cycling Delivery Plan (2015-2050)	Get Britain Cycling (2015-2050)
Estimated benefit per person per year (£)	22	117
Predicted cost per person per year (£)	4	23

Discussion

The results presented in the previous section are based on a number of key assumptions which cannot be verified at this time. In this section the impact of using alternative assumptions on the results are considered.

Trip rates per person

In the analysis undertaken, a constant number of trip stages per person per year was assumed. This is consistent with the trend currently assumed by DfT (Department for Transport, 2014g). Figure 3, however, shows that there has been a near continuous downward trend in the number of stages made per person each year in England, falling from 1217 in 1995/97 to 1029 in 2013. Whether the trend is driven by the recession, 'peak car' or changing habits due to the internet, and whether this trend will continue, is open to debate (Millard-Ball and Schipper, 2011).

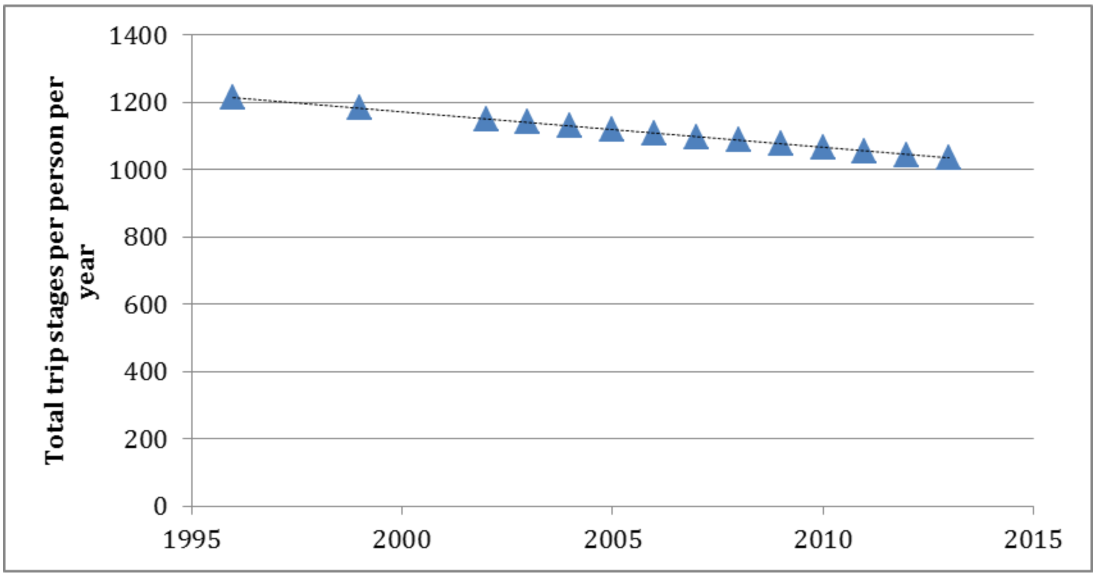

Figure 3: Trip stages per person per year (Department for Transport, 2014b)

As future trends are purely speculative, this research has been based on maintaining the 2013 level of trip stages per person. It is not clear what assumptions regarding trip rates have been made by the DfT whilst developing the CDP. Figure 4 shows the total number of trip stages in England each year under the constant trip rate per person assumption and an alternative assumption where trip rates continue to decline at the rate observed in Figure 3. Although the population of England is expected to grow from 53.8 million in 2013 to 58.4 million in 2025 and 65.6 million by 2050, if trip rates per person continue to decrease at the current rate, the overall number of trips by any mode per year in England will decrease.

Figure 4: Estimates of total trip stages per year in England under two scenarios of trip rates per person

As the CDP ambition is expressed in terms of an increase in the number of cycle trip stages and the GBC ambition is expressed in terms of cycle mode share, the two scenarios are affected differently by altering the trip rate assumption. Figure 5 shows how the total benefits per year would differ from those presented in the results section, if the assumption of trip rates per person is amended to reflect the declining trend. The CDP ambition benefits would be higher as the same number of cycle trips needs to be achieved each year, but the baseline number of cycle trips would decrease (as it is a fixed percentage of the total number of trips each year). This widening in the gap between the CDP and the 'no-growth' scenarios results in higher benefits attributed to the CDP, although the same number of cycle stages is achieved. In contrast, as the total number of trips per year decreases, the benefits attributed to the GBC ambitions will also decrease as they are expressed as achieving a certain cycle mode share.

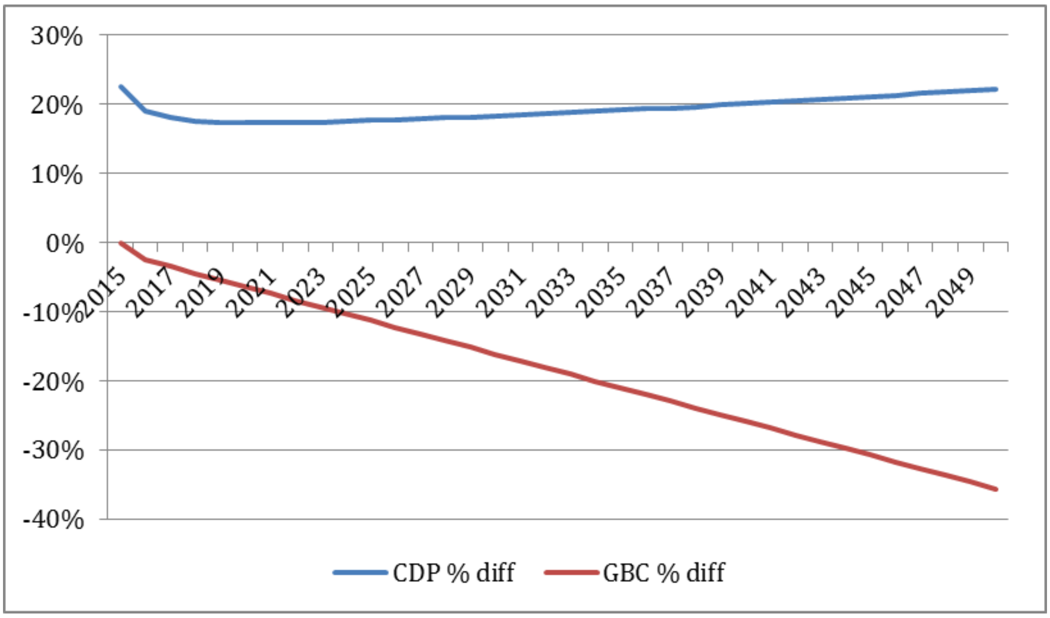

Figure 5: Comparing the annual economic benefit under assumptions of constant and decreasing trip stages per person per year

Even when using a decreasing trip rate per person per year, the GBC scenario still produces substantially higher economic benefits (Figure 6).

Table 9: Estimated economic benefits per year under two trip rate assumptions (not discounted)

Estimated economic benefits per year (£000s)	Cycling Delivery Plan scenario		Get Britain Cycling scenario	
	by 2025	by 2050	by 2025	by 2050
Constant trip rate per person per year	2,089,407	6,408,559	6,365,731	42,626,289
Linear decline in trip rate per person per year	2,458,081	7,841,084	5,627,794	27,324,648

It is likely that neither the assumption of a constant trip rate or a linear decline in the trip rate per person will actually occur, but the reality is likely to lie between the two proposals and is unlikely to be linear.

Additional sensitivity testing

Although most of the parameters in the analysis above are specified in the WebTAG documentation, some have been estimated using the modelling exercise described above. The simulated populations of future cycle trips were used to estimate the percentage of cycle trips which replace car trips. The model produced figures around 56-57% which is not far from the 50% figure used in Davis (2014), although it is not clear whether that was used purely for illustrative purposes. Sustrans (2014) also recently reported that 58% of new cycle trips on the National Cycle Network replace car trips, therefore our model appears to be producing sensible estimates.

In the analysis above the average cycle trip distances from the simulated populations of future cycle trips were used. Due to the use of the distance decay function in selecting trip stages to switch to cycling, the cycle trip distance decreased from the current average cycle trip distance of 5.3km (Department for Transport, 2014c). If, instead, the average cycle trip distance is assumed to stay relatively constant at 5.3km, the economic benefits in each year for both scenarios would more than double as a result of the increased physical activity undertaken.

Limitations

The analysis undertaken in this report was done in accordance with WebTAG, but the previous subsections have highlighted the sensitivity of the estimates to a large number of underlying assumptions. Although as few assumptions as possible have been made regarding the type of interventions which might be employed to reach the ambitions, this reduces the usefulness of the estimates as the type of intervention will have an impact on the type of benefits achieved. For example, interventions encouraging cycling for short trips in urban areas will have a large health benefit but a relatively low carbon benefit.

The assumptions within the current model are also fixed for the period up to 2050. It is unlikely that the characteristics of cyclists and cycle trips will remain the same if large increases in cycling are achieved. The impact of age, particularly, is likely to change, as the development of a stronger cycling culture and safer facilities encourage people to continue cycling until they are much older.

There are also implicit assumptions within the model that more fundamental aspects affecting travel patterns will remain unchanged, for example land use patterns or relative home and work locations. Such assumptions may not be valid over such a long time period and may even be affected by the cycle mode share achieved at that time. Consideration of an ageing population is also left for future work.

The analysis includes the main economic benefit types achieved through relatively localized projects but do not include other broader benefits. As reported in TAG Unit A2.1 (Department for Transport, 2014j), significant changes in the availability and or cost of transportation can have positive impacts on the wider economy.

Conclusions

The ambitions for cycling in the Cycling Delivery Plan (CDP) and the Get Britain Cycling (GBC) report, if achieved, could generate large economic benefits. If the CDP ambition is achieved by 2025, the doubling of cycle trip stages could result in an economic benefit of around £2 billion per year. The vast majority of the benefits would be due to increased levels of physical activity, but decongestion benefits would also be over £250 million per year. If the benefits are considered over the period 2015 to 2025, they would amount to around £14 per person per year for England.

The GBC report recommends a more ambitious aim of increasing the cycle mode share to 10% by 2025 and 25% by 2050. The annual benefits of achieving the 2025 ambition would be approximately three times those generated under the CDP. The cumulative benefits between 2015 and 2025 are estimated to be approximately £33. This is less than three times the CDP value as a slower starting growth rate was used for this scenario. If the rate of growth in the CDP is extended to 2050, the gap between the CDP and GBC ambitions widens and the benefits achieved by the GBC ambition are approximately seven times those of the CDP ambition.

The estimates of economic benefits in this report are based on many assumptions. These assumptions have been justified using supporting evidence where possible, but large amounts of uncertainty remain. Without details of specific interventions to be used to achieve the ambitions, it is not possible to model who will be affected and where, but the results do give an indication of the relative benefits under the two scenarios and the scale of benefits which could be realized through getting England cycling.

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