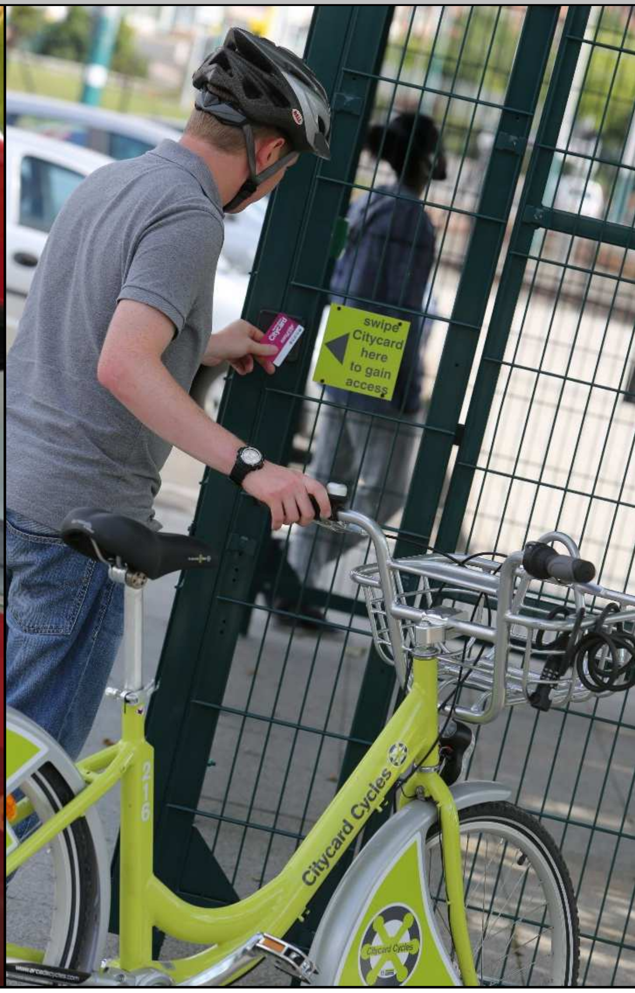
Finding the Optimum:

Revenue / Capital Investment Balance for Sustainable Travel



Final Report to the Department for Transport, December 2014

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Project name:	Finding the Optimum: Revenue / Capital Investment Balance for Sustainable Travel
Client Reference:	DfT247 PPRO 04/91/38 T-TEAR Lot 2
Client:	Department for Transport
Date:	December 2014
Version:	141216 / FINAL

Citation

The preferred citation for this report is: -
Sloman L, Taylor I, Wilson A, King N, Goodwin P, Anable J, Davison S, Crawford M, Cope A and Adcock S (2014) - *Finding the Optimum: Revenue / Capital Investment Balance for Sustainable Travel* Report to Department for - Transport -

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Acknowledgements

The research team are grateful for the assistance of the following individuals in providing information for case studies and illustrative examples, and as expert interviewees.

Troels Andersen, Odense Municipality
Paul Baker, North Somerset Council
Manuel Calvo Salazar, Estudio MC
Ali Clabburn, Liftshare
Paul Conolly, North Somerset Council
Jeremy Cooper, Stagecoach
Graham Dean, CH2M Hill
Louise Fannon, South Yorkshire PTE
Giles Fearnley, First Bus
Sue Flack, Nottingham City Council
Ruth Goudie, Kent County Council
Verity Heal, South Gloucestershire Council
Mark Holroyd, New Forest National Park Authority
Rebecca Lovell, South Gloucestershire Council
Jackie Lower, North Somerset Council
Lilli Matson, Transport for London
Martin Ohrland, Stuart Michael Associates Ltd
Dave Roberts, Buckinghamshire County Council
David Rowe, Transport for London
Ann Rowland, Central Bedfordshire Council
Zsolt Schuller, Devon County Council
Lesley Smith, Devon County Council
Ben Still, South Yorkshire PTE
Nat Taplin, New Forest National Park Authority
Andrew Whitehead, Bristol City Council

We also gratefully acknowledge the advice and help of the DfT Steering Group.

Front cover images: Chris Parker Photography; Nottingham City Council

This report was delivered through the T-TEAR Framework by the WSP Parsons Brinckerhoff supplier group.

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Executive Summary

Demand for revenue funding

National funding programmes to stimulate cycling and sustainable modes of transport have variously offered capital funding alone; revenue funding alone; or a mixture of capital and revenue. Review of the funding allocations made via five recent programmes (the Local Sustainable Transport Fund, Better Bus Areas Fund, Cycling Demonstration Towns / Cycling City and Towns, Sustainable Travel Towns, and Scottish Smarter Choices, Smarter Places) shows that the bids to these programmes by local authorities have a range of revenue-to-capital proportions, probably reflecting local priorities and circumstances.

There is clear demand for revenue funding as well as capital. At the programme level, the overall proportions within the government grant element (i.e. not including local contributions) are typically 30-50% revenue and 50-70% capital. Local contributions tend to be biased towards capital, reflecting the difficulties encountered by local authorities in securing funding for transport projects from council revenue budgets. Nevertheless, local contributions still include up to about 10-20% revenue funding.

Outputs from revenue and capital investment

Analysis of activities undertaken by local authorities with the support of the Local Sustainable Transport Fund identified 51 types of activity (or output) to encourage increased cycling or sustainable travel. A typology of outputs was developed, with outputs categorised into one of eight groups according to the nature of the activity and the obstacle to behaviour change that it addressed. Revenue-funded activities featured in seven of the eight groups; capital-funded activities featured in three. Activities to solve deficiencies in transport infrastructure and services required both capital and revenue funding. Interventions to overcome obstacles stemming from habit, social norm and perceptions mainly required revenue funding. Illustrative examples of local cycling and sustainable transport programmes showed that these programmes had required a mixture of capital and revenue activities.

Interviews with UK and international experts in cycling and sustainable transport and review of professional literature identified examples of synergy between revenue and capital investment. These included:

- Bus priority measures (capital), which must be accompanied by enforcement (revenue) in order for the capital expenditure to be effective.
- City-wide action to reduce congestion pinch-points for buses, involving junction redesign (capital) and reprogramming of traffic lights plus on-street management of late-running buses (revenue).

- Workplace travel planning (revenue) at traffic-generating developments close to the strategic highway network (capital) to reduce peak-hour delays and increase the operational effectiveness of the network.
- Cycle training and cycle parking (revenue) offered to employees at workplaces close to Transport for London's Cycle Superhighways (capital), to increase use of cycle routes and hence ease demand for public transport and car travel in inner London at peak times.

Expert interviewees also cited examples of outputs that helped meet key policy objectives and that could <u>only</u> be achieved by revenue funding. Examples included pump-priming of new bus services to hard-to-reach employment sites for low-paid workers; workplace travel planning support including grants for cycle parking and discounted bus travel for staff, which was helping businesses to gain access to labour markets; and eco-driver training and advice on fleet composition and maintenance, which was helping fleet operators to reduce carbon emissions.

Outcomes from revenue and capital investment

Seven in-depth case studies were undertaken in order to compare outcomes associated with a <u>combination</u> of revenue and capital expenditure with outcomes of related projects where there had been <u>only</u> capital expenditure in the absence of revenue. Four focussed on buses and three on cycling. It was not always possible to attribute outcomes, and so findings should be considered indicative. Key findings from the case studies were that:

In **East Kent**, two bus routes benefitting from a combination of revenue investment and capital investment showed large patronage increases, which outpaced those on comparator routes. The revenue investment on the targeted routes included short-term 'kick-start' funding for service frequency upgrades and marketing; the capital investment included bus priority measures, upgraded bus stops and new buses. Some comparator routes had benefitted from capital improvements, but not from revenue investment. Over a nine-year period, patronage on the targeted routes increased by a factor of 2.3-2.4, while patronage on the comparator routes increased by a factor of 1.4-1.7.

In **Buckinghamshire**, two bus routes that received a combination of revenue and capital investment showed significant patronage increases, outpacing those on a comparator route. Another targeted bus route was not successful and the service was subsequently discontinued. The revenue investment on the targeted routes included short-term 'kick-start' funding for service frequency upgrades, Real Time Passenger Information (RTPI) and marketing; the capital investment included RTPI plus bus station enhancements and new buses. The comparator route benefitted from RTPI, marketing and bus station enhancements but did not receive revenue funding for a service frequency upgrade. Over a ten year period, patronage on the two successful routes increased by a factor of 1.5-2.2, while patronage on the comparator route increased by a factor of 1.3.

In **Greater Bristol**, investment in service frequency upgrades on two commuter bus routes resulted in sharp increases in patronage immediately afterwards. The revenue investment in increasing the service frequency was accompanied by re-branding of buses, marketing, and new / newer vehicles. Both routes had previously benefitted from substantial capital investment in bus priority measures (as part of the Greater Bristol Bus Network project) and RTPI. The patronage uplift can be compared with changes in patronage on the rest of the Greater Bristol Bus Network, which has received comparable capital investment. Since the service frequency upgrades took place, one route has seen an increase in patronage of 30% (compared to no increase over the previous two years), while the other has seen an increase of 29% (compared to much smaller increases in previous years). Over the same period, patronage on the rest of the Greater Bristol Bus Network has remained fairly stable, increasing by 5% at most. Although the revenue investment has proved highly effective, it would not have been possible to increase service frequencies on one of the express routes without prior capital investment in bus priority measures to alleviate congestion.

In the **New Forest National Park**, capital and revenue funding has turned around a bus service aimed at visitors that was previously struggling. The capital funding paid for newer buses; revenue funding supported operating costs and helped market the service. There was a rapid build-up of patronage. This resulted in the operator making a commercial decision to launch a second route, and the local authority initiating a third route. Passenger journeys increased from about 5,000 during the summer season in 2005 to over 40,000 in 2013.

In the 18 **Cycling Demonstration Towns / Cycling City and Towns** (CDTs/CCTs), different combinations of revenue and capital investment (in the range 8-43% revenue) are not strongly associated with the magnitude of uplift in cycling. This suggests that either type of investment may be equally appropriate, depending upon local needs and circumstances – there is no rule that either capital or revenue investment is better, within the range of proportions observed. Cycling increased by differing amounts (varying from +6% to +62%, or +4 to +104 average daily counts per cycle counter), with the absolute variation mainly correlated with baseline cycling levels: that is, it appeared easier to increase cycling in those towns where there was a stronger pre-existing cycling culture.

Cycling to work in **Exeter** (one of the CDTs) increased from 3.6% to 5.0% between 2001 and 2011. In the comparator town of Barnstaple, cycling to work also increased over this period, but by a smaller amount (4.5% to 4.8%). Exeter invested substantial sums in a mixture of capital schemes and revenue activity to encourage cycling to work over this period. Detailed investigation of cycle count data close to two industrial estates in Exeter suggests that cycling grew more rapidly close to the industrial estate where there had been more revenue-funded activity. At both industrial estates, growth in counts was concentrated during peak commuting hours; counts at other times of day tended to decline. This tends to suggest that the role of the revenue-funded activities (which particularly benefitted commuters) was important.

Comparison of **schools** which received investment in cycle infrastructure (Links to School) with schools that received investment in both infrastructure and cycle promotion (Bike It) suggests that the combination of capital and revenue investment is more effective than capital investment on its own. Although sample sizes are small, five schools that had received both capital and revenue investment showed an uplift in cycling mode share as measured in the School Census of +1.8 %-points compared to the trend at schools with no intervention. Schools that received capital investment alone showed a smaller uplift of +0.4 %-points compared to the trend at schools with no intervention.

Value for money of revenue and capital investment

Economic analysis based on WebTAG methodology and assumptions was undertaken to evaluate the capital and revenue investments reported in the case studies.

Sustainable transport schemes that were 100% capital did not, in general, show the highest value (although particular sustainable transport capital projects can show good BCRs and will be very worthwhile).

Some 100% revenue projects showed exceptionally high value. This is most likely to occur where prior capital funding has laid the ground, or where limited project size and / or a short project timescale offer ‘windows’ of high-value opportunity. There is likely to be only a limited pool of projects in this category, but these are worth identifying and picking as cheaply available ‘low-hanging fruit’.

It is hypothesised that at the programme level, there should be an inverted-U relationship between the proportion of revenue expenditure and the maximum achievable benefit-cost ratio (BCR). That is, the highest benefits are likely to come from a mixed deployment of capital and revenue.

When a longer programme timescale is considered, the overall distribution of benefit-cost ratios (BCRs) for sustainable transport (bus) schemes examined in the case studies is consistent with the inverted-U hypothesis. The data are too limited to provide certainty as to precisely where the peak of the inverted-U might lie, but the highest two long-run BCRs are for projects in the range 40-70% revenue.

Evidence from the cycling schemes in the case studies is insufficient to fully test the inverted-U hypothesis, because of the lack of long-run town-wide cycling investment programmes with proportions of revenue funding above 50%. However, significant proportions of revenue funding, in the range 20-40%, seem capable of delivering high BCRs.

Evidence from expert interviewees identified a number of factors that might be expected to influence the optimal ratio of revenue to capital at the level of an individual local authority. These included the size of the urban area, overall budget, cultural starting point, programme duration and programme stage. For example, over a timeframe of several decades, investment in cycling might need to be largely revenue in the initial stages in order to stimulate interest; followed by a period of high capital investment to build a high quality cycle network; which would in turn be succeeded by a period of greater focus on revenue projects to promote use of the network through services such as cycle training and bike loan. The first two stages in this three-stage pattern are evident in London.

Thus there is no single 'right answer' as to the optimum proportion of revenue and capital at local authority level – the priorities will be different in different locations, and will also vary over time. However, at the level of a national investment programme, variation between different local authorities may tend to average out. This means that best overall value for money would be obtained from a programme offering both revenue and capital, with flexibility for local authorities to choose what is right for their particular circumstances.

PART I: OUTPUTS FROM REVENUE AND CAPITAL FUNDING

1. Introduction

1.1 Background to the research

In recent years there has been significant policy interest in the potential for non-infrastructure measures to stimulate greater use of sustainable modes of transport, including cycling, walking, public transport and car-sharing.

These non-infrastructure measures include:

- Improvements to existing sustainable transport services (e.g. more frequent bus services).
- More efficient management of services (e.g. enforcement of bus lanes).
- New types of service (e.g. car clubs, car-sharing databases or cycle training schemes).
- Provision of information about alternatives (e.g. via personal travel planning).
- Campaigns designed to change the social norm (e.g. workplace cycle challenges).
- Interventions designed to encourage a change in habitual behaviour (e.g. through the offer of - free bus passes for a limited period). -

Such measures generally require funding from revenue budgets rather than capital budgets, because they do not result in the creation of a physical asset. This creates a difficulty for local authorities and others who are interested in delivering packages of interventions to increase use of cycling and other sustainable transport modes. Revenue funding is less readily available than capital funding, so it may not be possible to design the optimum programme using a combination of revenue and capital measures.

This is a matter of policy interest for a number of reasons. First, there is a body of opinion that holds that revenue measures may sometimes be more effective, and offer greater value for money, than capital schemes.

Second, some transport services may be amenable to significant long-term improvement through short-term funding. Examples include pump-priming of new car club services to the point of commercial viability or boosting already-viable bus services to commercial viability at a higher service level. Even though no physical asset is created (and hence the funding must come from revenue budgets), the nature of this type of support is distinct from the continuing revenue subsidy that is required for certain other transport services.

Third, growing interest in behavioural economics and theories of behaviour change has led to the view that capital schemes (e.g. bus lanes, cycle paths) on their own will not result in the degree of modal shift towards sustainable travel that might be expected in a fully rational world, because they do not address all the obstacles to change, some of which are psychological or social. In this view, individuals do not always make choices which follow the logical predictions of classical economic theory. We all base our travel decisions on approximate rules of thumb (heuristics), which may be out-of-date or incorrect, and we are influenced by many factors that do not fit classical economic theory, including habit (past behaviour) and social norm (peer group behaviour). To achieve the maximum modal shift, capital investment in sustainable transport infrastructure must therefore be combined with revenue investment in better information, marketing campaigns and so on.

Fourth, there is the view expressed by transport practitioners – not always fully appreciated by policy-makers – that the full benefit of sustainable transport capital assets will only be realised if accompanied by investment in maintenance, network management, staff training and enforcement. Some elements of this require revenue funding, without which capital assets such as real-time information systems may have to be turned off, or bus lanes will become ineffective because of illegal parking. The requirement for revenue support to maximise the benefits of capital assets is widely recognised in commercial contexts, where the constraints are rather different.

Finally, there is the possibility that, having once created a new capital asset, such as a cycle track, the marginal cost of attracting an extra user through a revenue measure (e.g. offering cycle training to people who live or work nearby) may be very modest. If this were the case, revenue measures would have the effect of increasing the value of capital schemes.

1.2 Focus of the research

This report sets out the findings of research commissioned by the Department for Transport to consider these possibilities and to understand the extent to which revenue measures have a role to play – alongside capital investment – in order to achieve a shift in travel behaviour towards cycling, public transport and other sustainable modes.

It explores the following questions:

- To what extent is there a demand for revenue funding from local authorities?
- What are the outputs that can be delivered as a result of revenue investment?
- What are the outcomes that can be delivered as a result of revenue investment?
- How much value does revenue investment add to capital-based projects?
- Is there an optimal ratio of revenue to capital investment for a project to be effective?
- What are the policy benefits of an investment programme that includes revenue as well as - capital funding? -

The overall intention of the research has been to inform the ways in which national time-limited funding programmes can achieve the most change with a balance of capital and revenue funding. The main focus has therefore been on the interaction of capital and revenue funding, not one in isolation of the other. The report does not deal with the issue that sustainable modes of transport may require ongoing revenue support under particular demographic and geographic circumstances (for example regional rail services or rural bus networks), and does not attempt to discuss the many social and environmental justifications for such revenue expenditure[1].

1.3 Methodology

A variety of approaches have been used to gather evidence to answer these questions. These include:

- Analysis of expenditure data from current and previous investment programmes for cycling and sustainable travel.
- Search of the published literature.
- Development of a typology for revenue and capital investment based upon a review of outputs from the Local Sustainable Transport Fund.
- Gathering illustrative examples of investment programmes that included revenue funding.

[1] However, we have undertaken a purely economic assessment of the effect of bus fare subsidies for young people and pensioners in the local context of one of the case studies.

- Structured discussion with expert interviewees.
- Seven in-depth case studies of projects to increase bus use and cycling.
- Economic modelling based on WebTAG to understand how incorporation of revenue measures may influence the value-for-money of capital investment, drawing on data from the seven in-depth case studies.

Further details on our approach to the analysis of expenditure data, development of a typology for revenue and capital investment, and economic analysis, are provided in the relevant sections of this report (Chapters 2, 3 and 13 respectively).

We summarise below the method adopted for the literature review, preparation of illustrative examples, discussions with expert interviewees, and case study selection.

1.3.1 Literature review

To avoid being overwhelmed by a large volume of data of marginal utility to this project, the literature review was mainly focussed on seeking examples where the added value of revenue investment had been explicitly evaluated, with a preference for studies that reported outcomes and were able to assess whether these were attributable to the revenue investment in question. Thus, the primary question for the literature review was 'what are the outcomes of capital investment in cycling / sustainable transport when it is, compared to when it is not, accompanied by revenue investment?'

The search strategy involved the following elements:

- Web / database search using a number of stratified search terms (level 1: 'mobility management'; 'soft measures'; 'smarter choices'; 'walking and/or cycling programmes / initiatives / measures'; sustainable transport programmes / initiatives / measures'; 'packages'; in conjunction with level 2: 'capital'; 'revenue'; 'expenditure'; 'evaluation'; 'effectiveness'; cost-benefit (ratio)'; 'value for money'). Academic journals were searched using the Scopus abstract and citation database of peer-reviewed literature. A web search was also undertaken for grey literature, using the same search terms.
- Search of five databases that have developed through European projects focussed on mobility management, and that record project-level data on sustainable transport initiatives (MaxEva, Eltis, Astute, Civitas and Itrace). The search aimed to assess whether project-level data on expenditure, revenue / capital split and outcomes were recorded in sufficient detail to enable a degree of meta-analysis of outcomes and value for money.
- 'Snowballing' for grey literature through our contacts, and following up suggestions made by - expert interviewees. -

The literature review found no previous studies which had explicitly set out to examine whether revenue investment had the effect of adding value to capital investment. Academic literature was generally focussed on behavioural outcomes with little or no data on expenditure. The information contained in European project databases was generally too broad-brush to allow conclusions to be drawn as to effectiveness or value for money of interventions classified into revenue or capital expenditure. However, web searches for grey literature combined with snowballing and targeted requests for information revealed some useful references. These included some evaluations of expenditure and outcomes from public transport and cycling projects using case study evidence. The findings from these evaluations are reported in Chapter 4.

1.3.2 Preparation of illustrative examples

In order to show how revenue funding is combined with capital funding to encourage mode shift towards cycling and sustainable transport, a number of illustrative examples or mini-case studies were produced.

Potential examples were initially identified in three ways: by reviewing data contained in the Local Sustainable Transport Fund (LSTF) annual outputs database for 2012/13, initially searching at scheme element level for schemes that involved a mixture of revenue and capital funding, or that were principally revenue schemes; through 'leads' from presentations at the 2013 LSTF national conference; and from the pre-existing knowledge of the research team.

For suitable examples, further detail was obtained from the LSTF Large Project business cases and LSTF funding bids; through telephone and email contact with the relevant local authorities; and by reference to relevant documentation on local authority websites.

1.3.3 Structured discussions with expert interviewees

A long-list of 18 potential expert interviewees (including individuals from the UK and abroad) was drawn up by the research team and discussed with the steering group. This was reduced to eight individuals from six organisations. Criteria for selection were that the interviewees should offer a balance between cycling experts and sustainable travel experts; that all interviewees should bring a high level of strategic analysis of the role of revenue and capital investment, coupled with experience of delivery of cycling or sustainable travel programmes; and that all interviewees should be individuals whose views and knowledge would carry weight with senior opinion formers and policy makers within government.

The interviewees were:

- Managing director of a major bus operator in the UK.
- Local authority Director of Planning and Transport.
- Director General and LSTF Programme Manager at a Passenger Transport Executive.
- Two senior staff at Transport for London with responsibility for delivery planning and borough - programmes. -
- Consultant who played a lead role in the design of the cycle infrastructure network in Seville.
- Senior traffic planner in Odense, Denmark, a city with high levels of cycling.

A structured discussion guide was drawn up, based upon a set of questions agreed with the steering group and covering the effectiveness of revenue interventions; evidence as to their value for money; and evidence as to the ideal balance between revenue and capital investment under different circumstances. Interviews were carried out either face-to-face or by telephone.

1.3.4 Case study selection

The original purpose of the case studies was to examine what additional outcomes could be achieved as a result of revenue investment, which would not be achieved in its absence.

It emerged that the most productive source of relevant data was likely to be from instances where local authorities had undertaken area-wide improvements in cycling or sustainable travel infrastructure but only applied revenue measures over part of the geographical area. Our reasoning was that this would enable comparison of the outcomes deriving from *a combination of revenue and capital expenditure* with outcomes as a result of *capital expenditure in the absence of revenue investment*.

The process for identifying case studies included the following activities:

- Two alerts about the research were included in the LSTF Bulletin that is sent to all local - authorities by DfT. -
- A flyer about the research was distributed at the 2013 LSTF national conference.
- All Better Bus Areas (BBA) successful application forms were reviewed, and five local authorities with schemes that appeared relevant were approached directly.
- The DfT Better Bus Areas team alerted all BBA local authorities to the research.
- Expert interviewees' views on potential case studies were sought.
- The research team reviewed local authority initiatives that they were already aware of from previous work (including from the Cycling Demonstration Town / Cycling City and Towns programmes; Connect 2; various school travel programmes; the Sustainable Travel Town programme; and case study work carried out on previous projects for DfT).

A long-list of 24 possible case studies was drawn up, and the 12 most-promising were prioritised for follow-up. A case study screening questionnaire was developed, to check whether data of sufficient quality (covering expenditure, outputs and outcomes) would be available for each potential case study. Research team members contacted local authority officers or bus operators in each case study area to check data availability, and completed the screening questionnaire. Following this exercise, the research team reviewed the results of the screening questionnaires, and identified six case studies that were felt to offer most potential. These were agreed with the steering group. In addition, four 'reserve' case studies were identified, in case insufficient data were available for any of the six. One of these was subsequently taken forward, giving a total of seven in-depth case studies for analysis.

Five of the selected case studies drew upon data from single geographical areas, while two drew upon data from multiple areas, potentially offering the opportunity to compare a number of different schemes with differing proportions of revenue and capital investment. There were four 'bus' case studies and three 'cycling' case studies.

For the four 'bus' case studies, face-to-face interviews and/or contact by telephone / email took place with local authority officers or bus operators. These used a structured discussion guide to gather details of the timing of revenue and capital expenditure; the resulting outputs; outcomes (mainly in terms of changes in patronage); any analysis of wider impacts; and conflating factors. Local authority officers and bus operators then supplied data for analysis.

For the three 'cycling' case studies, most input, output and outcome data were already held by the research team, or were readily available from sources such as the CCT / CDT end-of-programme reports. Face-to-face interviews were not therefore carried out, but additional details were obtained where necessary through phone contact with relevant local authority officers.

1.4 Definitions of revenue and capital

At the start of the project, it became clear that the distinction between 'revenue' and 'capital' is not always clear-cut. The meaning of the concept depends upon the country (Britain is particularly attuned to the distinction), the legal context (e.g. HMRC rules) and the professional situation (e.g. commercial and public sectors may treat the division differently). Furthermore, the day-to-day terminology of transport professionals, dealing with 'operational versus infrastructure' expenditure or 'soft versus hard' measures, does not exactly map to the revenue-capital distinction. It is also evident that certain items of expenditure may be categorised as either revenue or capital under different circumstances, and HMRC guidance recognises this grey area. These issues and their implications are dealt with in Chapter 15.

1.5 Structure of this report

The report is structured as follows:

Part I: Outputs from revenue and capital funding

Following this introduction, there is an analysis of the level of demand for revenue funding, using expenditure data from current and previous programmes for cycling and sustainable travel (Chapter 2). This is followed by an exploration of the types of output that revenue funding can buy, using evidence from expert interviewees and some illustrative examples, and presentation of a proposed typology for revenue and capital investment (Chapter 3).

Part II: Outcomes and value for money of revenue and capital interventions

This section reviews evidence from the literature on the outcomes of programmes that involve a combination of capital and revenue investment (Chapter 4). It reports on the four in-depth case studies showing the effects of revenue and capital investment in buses, and three in-depth case studies, of somewhat different character, reviewing the effects of revenue and capital investment in cycling at the programme level, the town level, and the scheme level (Chapters 5-12). It then reports on an economic analysis of the value added by revenue and capital investment, using data drawn from the seven in-depth bus and cycling case studies (Chapter 13).

Part III: Policy considerations for revenue and capital investment

This section considers whether there is an optimum proportion of revenue and capital funding at the programme level, and how this might vary according to local circumstances (Chapter 14). It then looks in more detail at the definitions of revenue and capital (Chapter 15). It concludes by summarising the policy benefits of an investment programme that combines revenue and capital (Chapter 16).

2. Demand for revenue funding

In order to understand the role of revenue funding in supporting capital investment in cycling and sustainable travel schemes, we need first to establish the extent to which there is a demand from local authorities for revenue funding for these purposes.

Although the availability of government grants for 'revenue-type' cycling and sustainable travel schemes is a relatively recent phenomenon, we are able to draw upon evidence from several such national programmes: the Local Sustainable Transport Fund; Better Bus Areas Fund; Cycling Demonstration Towns / Cycling City and Towns; Sustainable Travel Towns; and (in Scotland) Smarter Choices Smarter Places. These programmes are summarised below, and our conclusions from analysis of the evidence are summarised in Section 2.6 and Figure 2.9.

2.1 Local Sustainable Transport Fund

The Local Sustainable Transport Fund (LSTF) is a competitive grants programme, open to all local transport authorities in England outside London. For the period between July 2011 and March 2015, local authorities were able to bid for a mixture of capital and revenue funding under the LSTF. The guidance to bidders suggested that the total grant available would be £560 million over four years, made up of £350 million revenue and £210 million capital (63% revenue; 37% capital).

Of this sum, £60 million was directly allocated to other sustainable travel initiatives (Bikeability cycle training, Links to Schools, Bike Club, walking to school initiatives, Transport Direct cycle journey planner and business to business initiatives on alternatives to travel). With these initiatives excluded, the initially planned ratio at the programme level was 60% revenue to 40% capital.

The fund was over-subscribed, with 130 local authority bids totalling £791 million. The Department for Transport identified modest additional funding which enabled it to increase the funds available for local authorities to £540 million (whilst maintaining funding for the other sustainable travel initiatives). This enabled grants to be awarded to 96 bidders[2].

Looking just at the successful bids, the overall ratio at the programme level was 52% revenue funding to 48% capital. Looking at all bids (unsuccessful as well as successful), the ratio was similar at 54% revenue to 46% capital. There was thus only a very slight tendency to favour bids with a higher allocation to capital.

Local authorities were expected to demonstrate that a local contribution would be made to the cost of the project. In total, the successful local authorities committed £535 million to their LSTF projects. Figures are not available for what proportion of the aggregate local contributions will be revenue and what proportion will be capital for the entire programme period, but for the first two years (July 2011 to March 2013) the ratio in the matched contribution is 21% revenue to 79% capital.

Looking at the individual project level, the projects supported by the LSTF show a very wide range of revenue: capital ratios. Figure 2.1 plots the proportion of revenue funding in the **Department for Transport awards** against the size of the DfT grants, for all successful LSTF projects. From this it is

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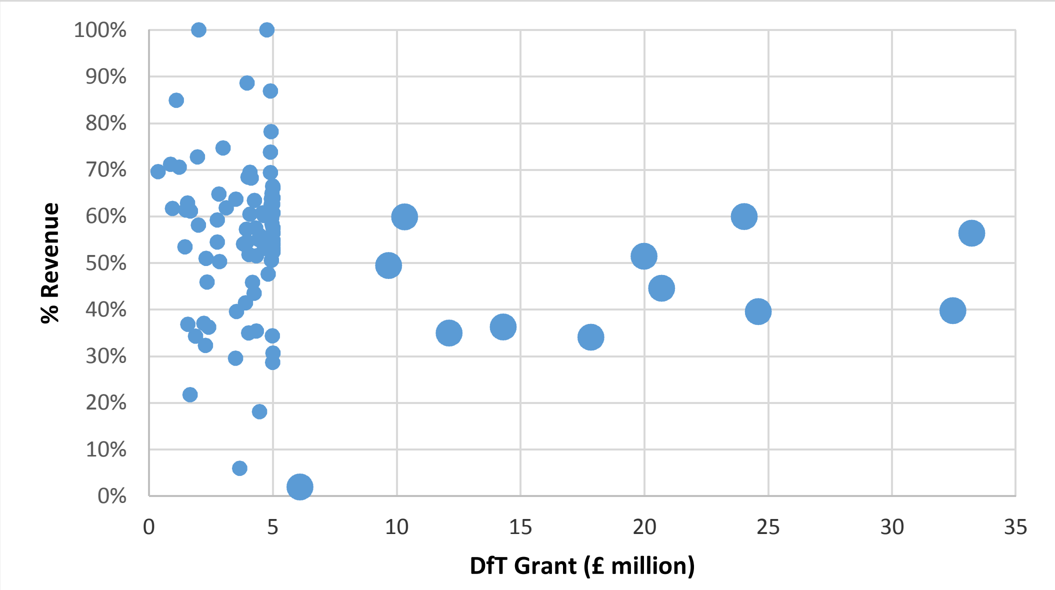
2 Local authorities could either bid for a Small Project (capped at £5 million), or for a Large Project (£5 - 50 million). The first tranche of awards was made in July 2011, for activity in the 3.5 year period to March 2015. This was for Small Projects and 'Key Components' of Large Projects, both with a £5 million threshold. A second tranche of awards was made in May / June 2012, covering the 2.5 year period to March 2015. This was for Small Projects under the £5 million threshold and Large Projects. A total of 84 bids for Small Projects and Key Components, and 12 bids for Large Projects, were awarded funding.

clear that Small Projects and Key Components (under £5 million) vary between almost 100% capital schemes and almost 100% revenue schemes, but with two-thirds of Small Project / Key Component grants involving between 40% and 70% revenue. The Large Projects (with one exception) lie in the range between 30% and 60% revenue[3]. The average (mean) proportion of revenue is 56% for Small Projects /Key Components and 46% for Large Projects; medians are similar.

Figure 2.1: LSTF: proportion of revenue funding in DfT grant, according to size of DfT grant



Small Projects and Key Components:
Mean = 56% Revenue; Standard deviation = 16% Revenue; Median = 58% Revenue
Large Projects (excluding Telford and Wrekin):
Mean = 46% Revenue; Standard deviation = 10% Revenue; Median = 45% Revenue

Base: all local authority LSTF grants for the period July 2011 to March 2015. Figures are for DfT grant only. Large Project grants shown as larger dots.

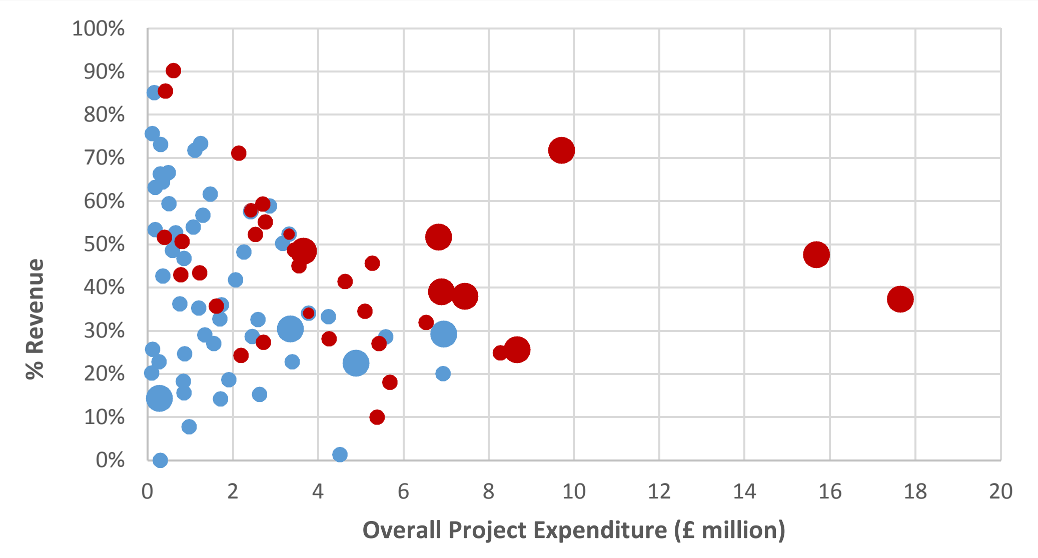
Figure 2.2 shows the variation in revenue: capital ratios **including local contribution to project costs as well as DfT grant**. These figures are for the period from July 2011 to March 2013, because centrally-recorded data for the ratio of revenue: capital in local contributions is not available for the entire period of July 2011 to March 2015. Each data point is for the entire period for which each project had been active (from July 2011 for Tranche 1 projects and Key Component / Large Projects, and from May / June 2012 for Tranche 2 projects and Large Projects without an associated Key Component grant).

Figure 2.2 should be interpreted with caution, because the ratio of revenue: capital for the initial stages of a project will not necessarily reflect the final revenue: capital proportion once the project is completed. It might be expected that revenue expenditure would be higher in the early stages of a project, with capital expenditure back-end loaded, because of the time required for design and approval of capital schemes. However, in practice the average (mean) proportion of revenue is about the same for projects which have been active for a longer period (two financial years) as for those that have only been active for one financial year, at 41-45%.

[3] The exception is a £6.1 million Large Project at Telford and Wrekin Council for a town centre transformation scheme, which was predominantly capital (2% revenue). This scheme was undertaken alongside a £3.5 million Key Component project which was 40% revenue. If the two projects are combined, the overall proportion of revenue in the DfT award was 16%.

Again, Figure 2.2 shows a very wide range in the proportion of revenue funding, particularly in the Small Projects. Two-thirds of projects with outturn expenditure under £2 million lie in the range between 20% and 70% revenue; while two-thirds of projects with outturn expenditure above £2 million lie in the range between 25% and 50% revenue[4].

Figure 2.2: LSTF: proportion of revenue funding according to outturn project expenditure (including DfT grant and local contribution) for 2011-12 and 2012-13



Projects active for one year: Mean = 41%; Standard deviation = 23%; Median = 35%
Projects active for two years: Mean = 45%; Standard deviation = 17%; Median = 44%
Small Projects and Key Components without ongoing Large Project:
Mean = 42%; Standard deviation = 20%; Median = 43%
Large Projects (excluding Telford and Wrekin):
Mean = 40%; Standard deviation = 14%; Median = 38%

Base: local authority LSTF project outturn expenditure for the period July 2011 to March 2013. Project funding period varies: projects active for one year = blue; projects active for two years = red. Large Project grants shown as larger dots.

2.2 Better Bus Areas Fund

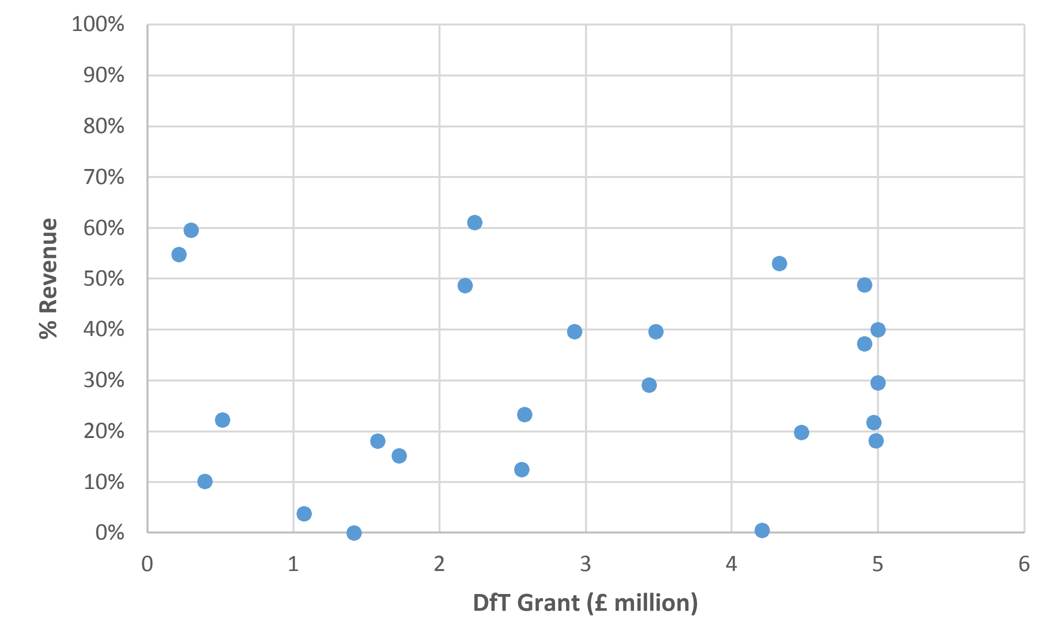
The Better Bus Areas Fund (BBA) was also a competitive grants programme open to all local transport authorities in England outside London. Bids were invited in early 2012, for funding during the two year period between March 2012 and March 2014. Local authorities were able to bid for a mixture of capital and revenue funding, and the guidance to bidders suggested that the aggregate split between capital and revenue across all grants was expected to be of the order of 50:50.

Grants were for up to £5 million. It was initially anticipated in the guidance to bidders that a total of £50 million would be available to fund a minimum of 10 local authorities. The Fund was over-subscribed, with applications received from 50 local authorities and a total bid value (if all bidders had been successful) of £114 million. The Department for Transport awarded grants to 24 local authorities, with a total value of £70 million. Looking just at the successful bids, the overall ratio at the programme level was 30% revenue to 70% capital, suggesting that there was somewhat less demand for revenue funding than anticipated. If all bids (unsuccessful as well as successful) are considered, the ratio is the same (30:70).

[4] This does not necessarily mean that the Small Projects are less well-balanced or beneficial, as discussed later.

As with LSTF, local authorities were expected to demonstrate that a local contribution would be made to the cost of their project. In total, the successful local authorities committed £73 million to their BBA projects, with a ratio of 19% revenue to 81% capital.

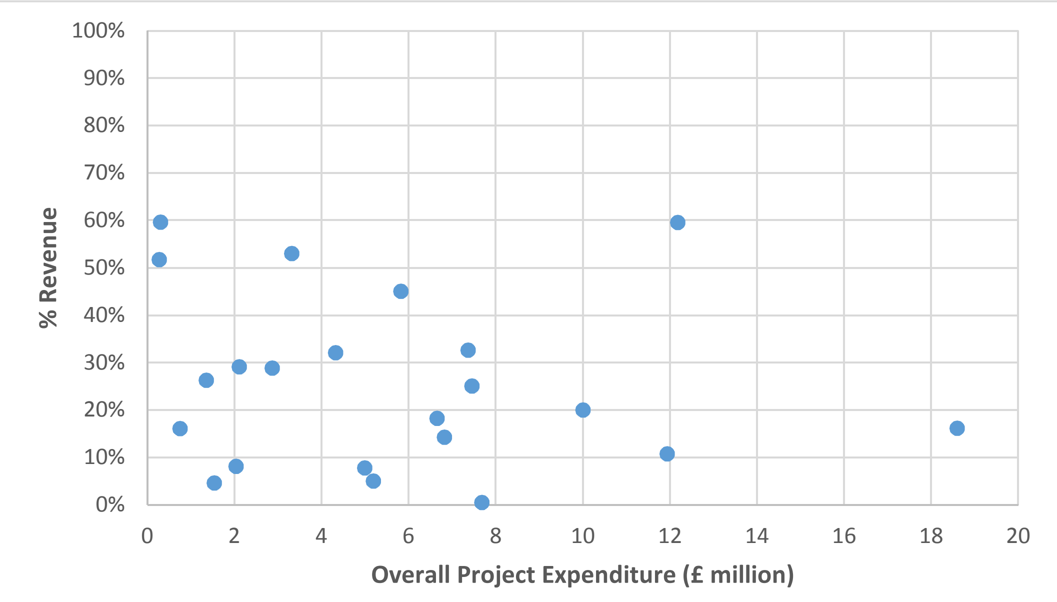
Figure 2.3: BBA: proportion of revenue funding in DfT grant, according to size of DfT grant



Mean = 30%; Standard deviation = 19%; Median = 26%

Base: all local authority BBA grants for the period March 2012 to March 2014. Figures are for DfT grant only.

Figure 2.4: BBA: proportion of revenue funding according to outturn project expenditure (including DfT grant and local contribution) for entire grant period



Mean = 26%; Standard deviation = 18%; Median = 23%

Base: local authority BBA project outturn expenditure for the period March 2012 to March 2014. Data from two local authorities (West Yorkshire and York) not included because reporting of local contribution does not disaggregate revenue and capital.

Also as with LSTF, individual BBA projects show a large range in revenue: capital ratios. Figure 2.3 plots the proportion of revenue funding in the **Department for Transport awards** against the size of the DfT grants, for all successful BBA projects. The revenue: capital ratio varies between zero and just over 60%, with no particular tendency for larger projects to require a lower (or higher) proportion of revenue. The average (mean) proportion of revenue is 30%; the median is 26%. Figure 2.4 shows the variation in revenue: capital ratios **including local contribution to project costs as well as DfT grant.** The average (mean) proportion of revenue is 26%; the median is 23%[5].

2.3 Cycling Demonstration Towns / Cycling City and Towns

The Cycling Demonstration Towns / Cycling City and Towns (CDT / CCT) programme funded a comprehensive package of measures to increase cycling in 18 towns and cities between 2005 and 2011 (six Cycling Demonstration Towns over a 5.5 year period between 2005 and 2011; and 12 additional Cycling City and Towns over a 2.5 year period between 2008 and 2011). It was a competitive programme. Local authorities were able to bid for a mixture of capital and revenue funding. The programme was significantly over-subscribed, with 67 local authorities making unsuccessful bids to become a CDT and / or CCT.

Grant size varied according to the population of the town, but was approximately £1.5 million per town for the CDTs between 2005 and 2008 (somewhat less for Aylesbury, which was smaller); and between £1 million and £4 million per town for the CDTs and CCTs between 2008 and 2011. Greater Bristol, the single 'Cycling City', received substantially more funding (£11.6 million) because of its larger population.

Looking at the six CDTs for the period 2005 – 2008, the overall revenue: capital ratio in the DfT grant at programme level was 35% revenue to 65% capital[6]. For the 18 CDTs and CCTs between 2008 and 2011, the overall ratio in the DfT grant was similar (36% revenue to 64% capital)[7].

Individual CDT/CCT projects show a somewhat smaller range of revenue: capital ratios than seen in the LSTF and BBA projects. Figure 2.5 plots the proportion of revenue funding in the **DfT awards** against the size of the DfT grants, for the 18 CDTs and CCTs in the period 2008 – 2011. The revenue: capital ratio varies between 25% and 70%, although for the larger projects (over £3 million grant), the proportion of revenue does not exceed 50%. The average (mean) proportion of revenue is 38%; the median is 34%.

Figure 2.6 shows the variation in revenue: capital ratios **including local contribution to project costs as well as DfT grant.** Here, data are available for the six CDTs in the period 2005 – 2008, as well as for the 18 CDTs and CCTs in the period 2008 – 2011. For both time periods, the proportion of revenue for most towns is between 10% and 35%. The average (mean) proportion of revenue is 24% for both time periods; the median is 22% for the period between 2005 and 2008, and 24% for the period between 2008 and 2011.

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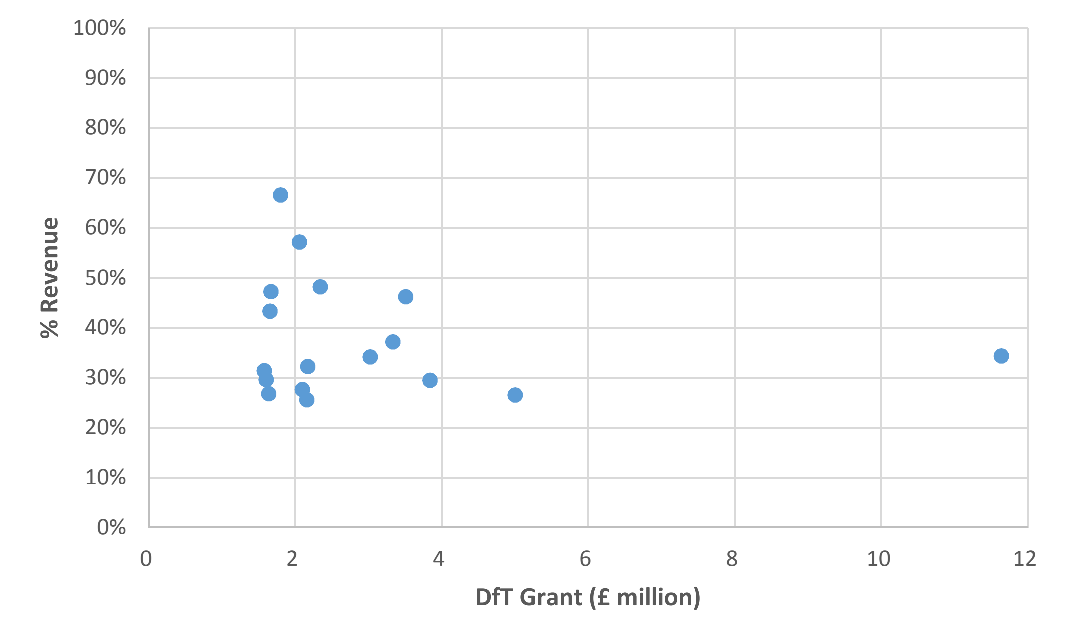
[5] These figures exclude data from two local authorities whose reporting did not break down their local - contribution into capital and revenue. -

[6] Figure supplied by Department for Transport in specification for this research project. -

[7] Analysis of data in CCT end of programme reports, available at - https://www.gov.uk/government/publications/cycling-england-cycling-city-and-towns-end-of-programme-reports, accessed 13 December 2013. -

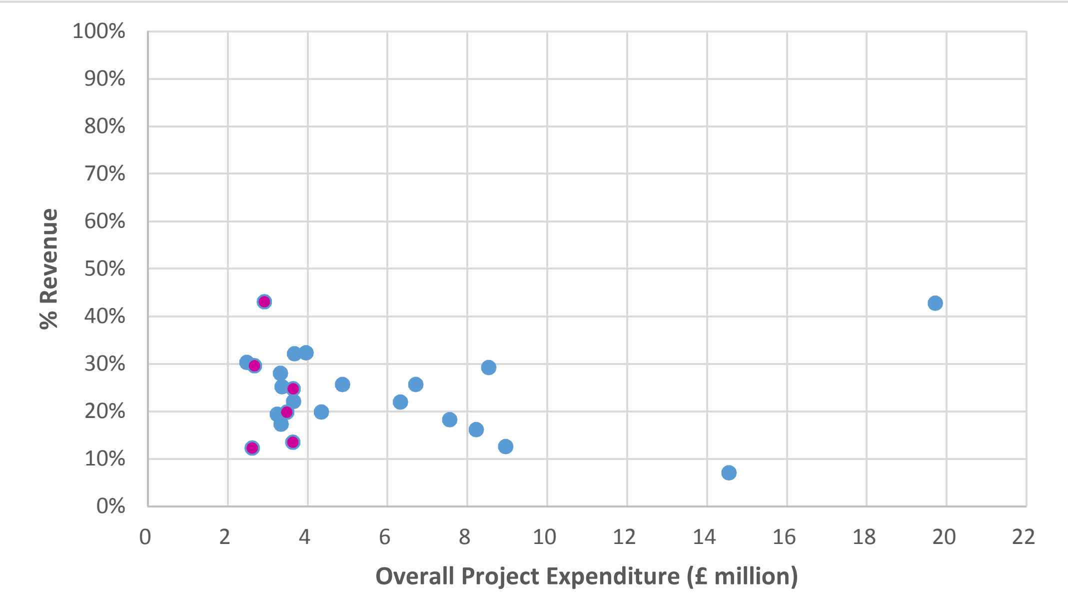
Figure 2.5: CDT / CCTs: proportion of revenue funding in DfT grant, according to size of DfT grant



Mean = 38%; Standard deviation = 11%; Median = 34%

Base: 18 local authority CDT / CCT grants for the period 2008 to 2011. Figures are for DfT grant only.

Figure 2.6: CDT / CCTs: proportion of revenue funding according to outturn project expenditure (including DfT grant and local contribution) for entire grant period



CDTs, 2005 - 2008:
Mean = 24%; Standard deviation = 12%; Median = 22%
CDTs and CCTs, 2008 - 2011:
Mean = 24%; Standard deviation = 8%; Median = 24%

Base: local authority outturn expenditure for the period 2005 to 2008 (CDTs, in purple), and for the period 2008 – 2011 (CDTs and CCTs, in blue).

2.4 Sustainable Travel Towns

The Sustainable Travel Towns programme funded three towns between 2004 and 2009 to develop large-scale 'smarter choice' or behaviour change programmes. The towns, Darlington, Peterborough and Worcester, were awarded 100% revenue grants by DfT, which they supplemented with capital expenditure on a range of supporting measures. Across all three towns, total outturn revenue expenditure accounted for 44% of the total investment[8].

Looking at the three towns individually, revenue accounted for 60% of outturn expenditure in Darlington (in a programme of £4.4 million), 39% in Peterborough (in a programme of £6.8 million), and 35% in Worcester (in a programme of £4.4 million).

2.5 Smarter Choices, Smarter Places

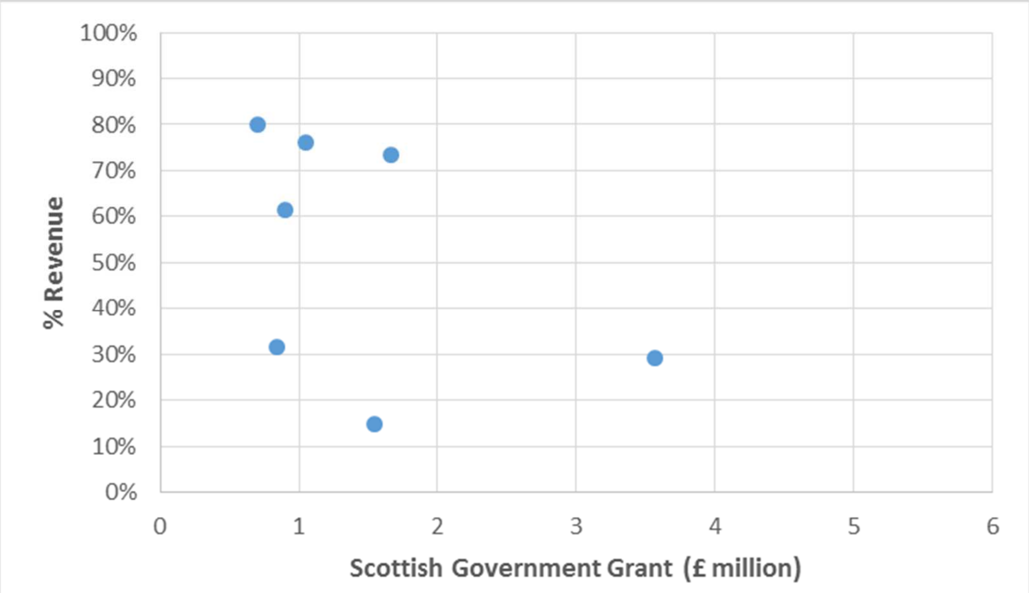
The Smarter Choices, Smarter Places programme was established by the Scottish Government and CoSLA, and supported seven pilot areas to implement behaviour change programmes between 2009 and 2012.

Grant size was around £1 – 2 million for most towns, except for Dundee which received £3.6 million. At the programme level, the overall ratio for the Scottish Government grant was 46% revenue to 54% capital.

At the level of individual projects, the proportion of revenue funding in the **Scottish Government grant** varied from 15% to 80%, as shown in Figure 2.7.

Looking at **local contribution to project costs as well as Scottish Government grant**, the proportion of revenue funding for individual projects ranged from 20% to 76%, as shown in Figure 2.8[9].

Figure 2.7: Smarter Choices Smarter Places: proportion of revenue funding in Scottish Government grant, according to size of Scottish Government grant

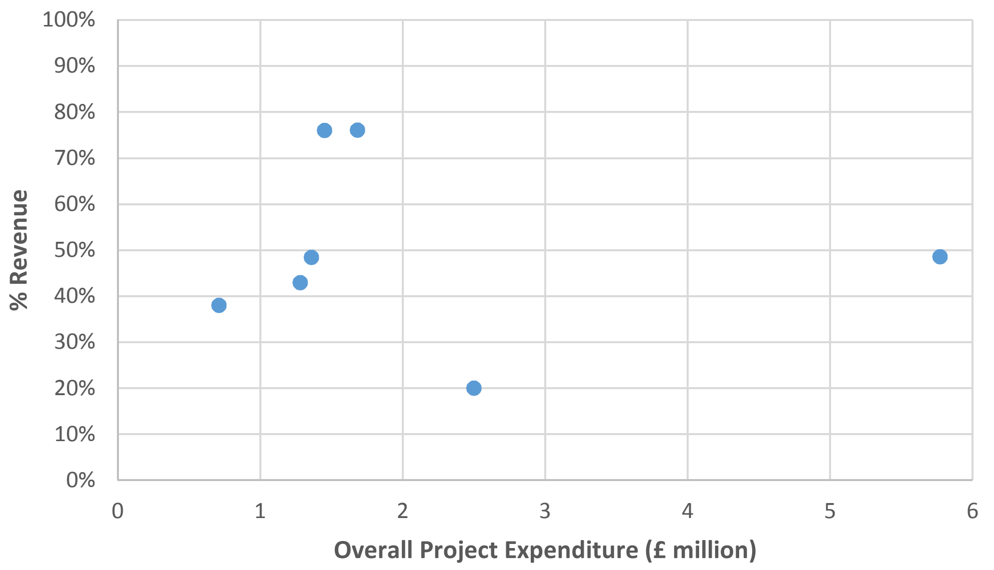


Mean = 52%; Standard deviation = 27%; Median = 62%

Base: local authority grants for the period 2008/09 to 2011/12.

[8] Unpublished analysis prepared for Sloman et al. (2010)
[9] DHC, ITP and University of Aberdeen (2013)

Figure 2.8: Smarter Choices Smarter Places: proportion of revenue funding according to outturn project expenditure for entire grant period



Mean = 50%; Standard deviation = 20%; Median = 49%

Base: local authority SCSP project outturn expenditure for the period 2009 to 2012. Note that reported outturn expenditure does not fully align with grant claims for some towns. Unpublished data provided by evaluation team for Smarter Choices Smarter Places.

2.6 Conclusions

From the analysis of these five funding programmes in support of cycling and sustainable transport, we are able to make the following observations (key figures are summarised in Figure 2.9):

- Government grant programmes for cycling and sustainable transport that offer revenue funding as well as capital funding are popular with local authorities, and always over-subscribed. That is, there is more demand than can be met from the available funds.
- Local authority bids for such grant programmes show a very wide range of revenue: capital proportions, depending upon local priorities and circumstances. Local authorities do not appear to tailor their bids to match the proportions of revenue and capital on offer at the programme level. (In contrast, local authorities clearly do tailor their bids to match the maximum grant available, as is evident from Figure 2.1 and to some extent Figure 2.3.)
- Where data are available for all bids (unsuccessful as well as successful), there is no evidence of any selection bias towards either more revenue-intensive or more capital-intensive projects. This means that the revenue: capital ratio of successful bids is a fair representation of the overall demand from local authorities.
- For the **government grant** element, the overall revenue proportion at the programme level is - approximately **30-50%** (LSTF 52% revenue; BBA 30% revenue; CDT / CCT 35-36% revenue). -
- Where grant programmes require local authorities to identify an element of matched funding (the 'local contribution'), this tends to be biased towards capital, reflecting the general difficulty of local transport authorities in securing funding for transport projects from council revenue budgets. However, local authorities still secure some revenue funding from local sources. The revenue proportion in the **local contribution** for all successful bids is typically **10-20%** (LSTF 21% revenue; BBA 19% revenue; CCT 13% revenue).

- The mean proportion of revenue for all projects in a particular programme, including **both government grant and local contribution**, is typically **25-50%**, depending upon the programme (LSTF 41-45% revenue; BBA 26% revenue; CDT/CCT 24% revenue; STT 44% revenue; SCSP 50% revenue).
- There are indications that Small Projects may sometimes involve higher proportions of revenue funding than Large Projects. This means that the optimum revenue: capital ratio for a government funding programme is unlikely to be fixed and may depend upon the size of grants being awarded. That is, a programme with fewer, larger grants (e.g. ten grants of £30 million) would require a lower proportion of revenue than a grants programme with more, smaller grants (e.g. 60 grants of £5 million).
- Mode-specific programmes (BBA and CDT/CCT) appear to have less overall demand for revenue than programmes which are not mode-specific (LSTF and SCSP), although the reason for this is not entirely clear.

Figure 2.9: Summary of revenue proportions in cycling and sustainable transport investment programmes

			Programme level (Government grant)			Government grant: variation between projects			Overall expenditure: variation between projects		
Progr-amme	**Time period**		**Amount £ million**	**% revenue**		**Mean % revenue +**	**Median % revenue**	**Typical % revenue ~**	**Mean % revenue +**	**Median % revenue**	**Typical % revenue ~**
LSTF	2011-2015	Pre-bid allocation	500	60%							
		All bids (130)	791	54%							
		Successful bids (96)	540	52%	*Small Projects and Key Component bids (<£5 million) (84)*	56%	58%	40 - 70%	42% #	43% #	20 - 60% #
					*Large Projects (>£5 million) (11)**	46%	45%	30 - 60%	40% #	38% #	20 - 50% #
BBA	2012-2014	Pre-bid allocation	50	50%							
		All bids (50)	114	30%							
		Successful bids (24)	70	30%		30%	26%	0 - 60%	26%	23%	0 - 60%
CDT	2005-2008	Successful bids (6)	8.5	35%		n/a	n/a	n/a	24%	22%	10 - 35%
CDT & CCT	2008-2011	Successful bids (18)		36%		38%	34%	25 - 70%	24%	24%	10 - 35%
STT	2004-2009	Successful bids (3)	10	100%		100%	100%	100%	45%	n/a	35 - 60%
SCSP	2009-2012	Successful bids (7)	10	46%		52%	62%	15 – 80%	50%	49%	20 - 76%

+ Mean % revenue is not weighted by project size
~ 'Typical % revenue' means at least two-thirds of all projects have a revenue proportion within this range
# Figures are for first half of LSTF programme period only (July 2011-March 2013)
* Excluding Telford project, which was atypical

3. What outputs does revenue funding buy?

3.1 A typology of deliverables from revenue and capital funding

In order to understand the range of outputs that requires revenue funding, either on its own or in combination with capital funding, a review was undertaken of the 2012/13 Local Sustainable Transport Fund (LSTF) annual outputs database.

This database contains information at the 'scheme element' level for up to seven schemes in each of 96 local authority LSTF projects. In all, there are descriptions for 411 scheme elements. Each scheme element groups together several different activities, which may be aimed at a particular target audience (e.g. 'business and schools engagement'), or focussed on a particular mode, or grouped in some other way.

The review identified 51 different types of output that were intended to encourage increased cycling or sustainable travel. We categorised these outputs in three ways:

- According to the obstacle to behaviour change that they aimed to overcome. We adopted a simplified threefold distinction between outputs that were aimed at influencing *habitual behaviour or social norms* (H); outputs that aimed to address the *perception* (P) that sustainable travel options were absent or difficult; and outputs that were designed to resolve the *reality* (R) of inadequacies in the transport system, including the fact that alternative options may actually be absent, difficult, slow, expensive, unpleasant or unsafe[10].
- According to the nature of the intervention, distinguishing between *marketing* (M), *information* (I), *transport services* (T) and *civil engineering* (C).
- According to whether they required capital funding, revenue funding, or a combination.

Figure 3.1 maps the different types of output. Each output is coded according to the obstacle it seeks to overcome (H / P / R) and the nature of the activity (M / I / T / C), and coloured to indicate whether it requires capital funding (red), revenue funding (dark green) or both (orange). So far as possible, each output is a single 'building block' that could be applied to a variety of target audiences. So, for example, 'school travel planning' does not appear as an output, but would be expected to be made up of multiple output building blocks (e.g. cycle / walk to school days + school champions + classroom active travel sessions + safe cycle routes + secure cycle parking + 20mph zones). It is worth noting that although a very wide range of outputs was identified from the database, this does not necessarily represent the full range of activities that could be undertaken in order to stimulate behaviour change. In particular, there is more focus on 'pull' factors as opposed to 'push' factors such as parking charges. Equally, some barriers to behaviour change may not be tackled by the outputs listed in Figure 3.1: for example, chained journeys or high public transport fares.

Examination of Figure 3.1 shows that it results in an eight group typology (i.e. only eight of the 12 - possible fields are populated: HM, HI, PM, PI, PT, RI, RT and RC). This is because while civil -

[10] Appendix A of DfT's *Behavioural Insights Toolkit* (DfT 2011) summarises the different types of economic, psychological and social models that have been used to explain behaviour change. Our inclusion of habitual behaviour as one determinant of behaviour is consistent with Triandis' Theory of Interpersonal Behaviour. The three-fold distinction between habitual behaviour and social norms (H); perception (P); and reality (R) also to some extent accords with the three main elements recognised in social practice theory of 'images and meaning'; 'skills'; and 'things' (although not mapping exactly onto these elements).

engineering schemes can address the *reality* of inadequacies in the transport system, they cannot resolve obstacles related to *perception* or *habit /social norm*. Similarly, marketing schemes may influence *perception* and *habit / social norm*, but cannot tackle the *reality* of an inadequate transport system.

Revenue schemes predominate in the top-left of the chart, but they also feature towards the bottom (fields RI and RT). If only capital funding were available to a local authority, they would be severely restricted in terms of the type of outputs they could deliver. (Equally, in the unlikely event that only revenue funding were available, there would be severe limitations to the outputs that could be delivered.)

Figure 3.1: Typology of outputs from revenue and capital investment

Obstacle overcome	Nature of activity: Marketing (M)	Information (I)	Transport services (T)	Civil engineering (C)
Habit & social norm of driving (H)	HM1 cycling or walking fun days or festivals HM2 competitions or challenges to cycle or walk or to not drive HM3 free try it out bus tickets HM4 community engagement for local street improvements HM5 guided cycle rides HM6 guided walks HM7 car sharers workplace breakfasts HM8 cycle/walk to work/school days or walk once a week schemes HM9 workplace and school champions HM10 classroom active travel sessions HM11 reward schemes for non car modes HM12 social media initiatives HM	HI1 information to job changers/house movers HI		
Perception that other options are absent or difficult (P)	PM1 area wide bus marketing campaigns PM2 area wide cycle route publicity PM3 awareness raising of real time bus information apps PM4 promotion of online journey planners and information PM	PI1 personal travel plan information PI	PT1 cycle buddy schemes to show quiet safe routes PT	
Reality that other options are absent (or difficult, slow, expensive, unpleasant, unsafe) (R)		RI1 real time information at stations & bus stops RI2 real time train & bus information via phone app/text RI3 travel information enquiry services by phone or website RI4 cycle route signage RI5 pedestrian route signage RI	RT1 new public transport services RT2 more frequent public transport services RT3 rural & out of hours demand responsive services RT4 new smart & comfy buses or trains RT5 easy to use smart tickets valid for all buses/trains RT6 cycle repair schemes RT7 cycle maintenance training RT8 cycling training RT9 free or affordable loan of bikes, e bikes, scooters RT10 bicycle recycling schemes to provide cheap bikes RT11 provision of free or affordable tickets RT12 help to learn to use public transport confidently RT13 partner finding database for car sharing RT14 car clubs RT	RC1 new rail lines and stations RC2 bus priority measures to speed buses past jams RC3 better bus rail interchange facilities RC4 park & ride facilities for bus or rail RC5 secure cycle parking at interchanges RC6 disability access to trains and buses RC7 well lit safe feeling stations & bus stops RC8 safe cycle routes for everyday trips RC9 secure cycle parking at destinations RC10 walking & cycling cuts through obstructions RC11 well lit safe feeling walking & cycling routes RC12 local street environment improvements RC13 20 mph zones; traffic taming measures RC

Colour Key	
	Capital item
	Revenue item
	Capital and revenue item

3.2 Illustrative examples of programmes combining revenue and capital funding

Having broken LSTF projects into their constituent building blocks to produce our eight-fold typology, we now look at some illustrative examples to see how local authorities are creating packages of outputs (requiring both revenue and capital funds) with the aim of supporting local economic development and reducing carbon emissions.

Most LSTF projects are at a relatively early stage of implementation, and so the focus of most of the illustrative examples is on inputs and outputs. There is some limited information about predicted outcomes, impacts and value-for-money, but this is generally based on pre-scheme appraisal rather than post-scheme evaluation.

The illustrative examples described in sections 3.2.1 – 3.2.3 are focussed on enhancing local economic competitiveness. Examples 3.2.4 and 3.2.5 demonstrate how packages of revenue and capital investment have been designed with the aim of reducing carbon emissions. Example 3.2.5 also highlights the benefits that may arise when revenue investment is sustained. Finally, example 3.2.6 shows how the addition of revenue schemes to an investment programme may increase its overall value-for-money.

3.2.1 Reducing congestion to enhance business competitiveness in Stafford

Summary
Economic inefficiencies resulting from congestion on Stafford's radial road corridors are being tackled using a combination of revenue and capital funds so that the town centre and peripheral business sites can thrive and grow.
Context
Stafford's LSTF plan concentrates on the eastern part of the town and the town centre. This zone contains destinations for 70% of peak hour trips, a reflection of the distribution of jobs in the town, 43% of which are in the city centre and 23% in peripheral areas. Big employers include Alstom Grid (1500 employees), Perkins Engines (850), MoD (3500), Staffordshire Hospital (3500), Staffordshire University (600 staff plus 5000 students). In addition this zone contains the expanding Beacon Business Park (600 jobs planned for the present site with 2000 to follow on new land) and Stafford Technology Park. Congestion on the A34 and A518 poses a threat to the competitiveness of these businesses. Planned housing and retail development will make this worse. Stafford Technology Park reports difficulties letting units, attributed to the congestion and the resulting unreliability of bus services; Alstom finds congestion impacts on recruitment; and Perkins Engines reports it cannot reliably schedule its HGV movements, with lorries that miss their time slot backing up onto the main road (worsening the congestion problem that delayed them).
Inputs
The whole project represents £2.4 million capital and £1.8 million revenue[11].
Outputs
Capital: RI1, RT4, RC2
Revenue: HM1, HM3, HM7, HM8, PM1, RI2, RC8, RC10
The LSTF plan combines improved non-car access to key destinations with promotion of the new options. - Physical changes to the A518 will reduce bus delays at the hospital, where queues of cars - presently block buses. Works to the A34 will reduce congestion and bus journey times to the - Alstom Grid site. -

[11] Staffordshire County Council, *Local Sustainable Transport Application Form*, LSTF tranche 2 bid, table at A7. These figures are for DfT spend only.

Wi-Fi has been installed on 35 buses, so the bus journey can be promoted as a chance to use time more productively. Installation of real-time information equipment will enable bus users to see - when their buses will arrive. There will be screens at all big employment sites as well as at bus - stops and on-line for smart phone and computer access. -

A campaign to boost bus use will target all households close to the key corridors with promotional - material backed by free taster tickets from the bus operator. -

The River Sow, presently a major barrier to walking and cycling, will be bridged to give 11,500 - residents in Baswich a choice of walking and cycling to the business and technology parks, - hospital, university and Perkins sites on the other side. Cycling and walking improvements - elsewhere include segregated routes within the town centre and parallel to the key A-road - corridors. -

Cycling and walking will be promoted to residents with a large programme of community - engagement and activities with schools. Active travel and car-sharing will also be promoted to - commuters through activities that engage significant employers in the target zone. -

Outcomes, impacts, value-for-money

Modelling of the effects of the programme suggests that it will deliver significant congestion relief on main radial corridors, as illustrated here.

Modelled pattern of congestion relief

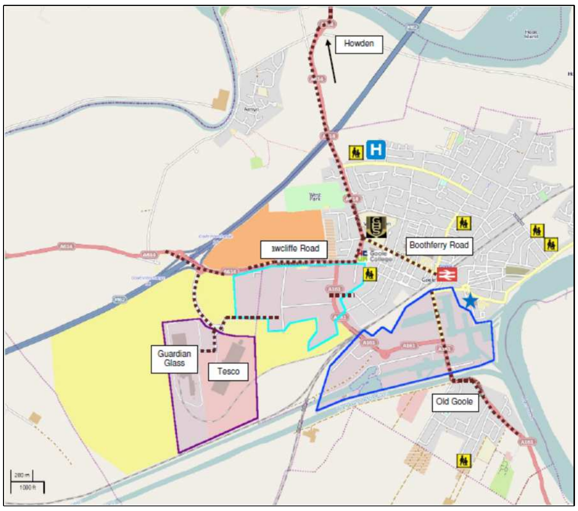
3.2.2 Unlocking development of new employment sites in Goole -

Summary

Revenue and capital funding are being used together to enable business development to take place at sites that would otherwise generate excessive traffic, with adverse consequences for the port, the town centre and the sites themselves.

Context

The town of Goole, located where the River Ouse flows into the Humber estuary, is a significant port and at the convergence of several strategic land transport routes. These transport considerations have contributed to the East Riding Council's designation of land at Goole for business development, expected to provide 5000 new jobs.



Key business development sites (coloured) west of Goole alongside the motorway

The key sites lie outside the previously-developed area of Goole, adjacent to junction 36 of the M62. This raises the question of how the new employment sites can be developed without generating large volumes of commuter car traffic that would lead to increased CO_2 emissions and congestion that could affect access to these sites. This is a serious consideration because some businesses, for example a Tesco distribution centre, are fundamentally concerned with logistics. The continued success of the port also requires uncongested road access to connect with ships.

Inputs

Cycle-specific measures: £151,000 capital and £82,000 revenue[12]
Promotional campaign: £27,000 capital and £305,000 revenue
Work with employers: £163,000 capital and £163,000 revenue

Outputs

Capital: RC9, RC10

Capital + revenue: RT9

Revenue: HM5, PM2, PI1, RT6, RT7

Goole is using its LSTF monies to enable development to go ahead in a sustainable way. Several factors led Goole to make cycling prominent in the strategy. Most people that work in the town also live there. The town is flat and small, so cycling from one side to the other only takes around 10 minutes. There is receptiveness to cycling, with 15% of commuter journeys already being made by bike. And in the most deprived areas, for which access to employment is most vital, car ownership is presently low.

There had already been investment in cycling routes but an audit showed problematic gaps that would stop people cycling to the key employment sites. Capital spend was used to build five new cycle routes to fill these gaps within the first year of the LSTF project. Other capital spend was used to improve cycle parking at destinations and to purchase bikes for loan to those who cannot afford one.

The infrastructure investment is backed up by revenue spending on provision of cycling maps; a programme of promotional rides that includes some specifically to encourage women to cycle

[12] East Riding of Yorkshire Council, *Get Moving Goole*, LSTF tranche 2 bid, table at C2. DfT spend only given. First year LSTF reporting indicates the local funding revenue: capital split was similar to DfT money in the first year for the cycle-specific measures.

more; and sessions to repair bikes and teach maintenance.

The other major elements of the overall Goole bid are a promotional campaign including provision of personalised travel information to all Goole households and work with employers to develop workplace travel plans. Both these elements provide further promotion of cycling whilst also promoting other sustainable modes of travel.

Outcomes, impacts, value-for-money

The council estimates that without this programme, new business and residential development in Goole would have generated over a million new car trips over the LSTF period (2012/13 to 2014/15). The LSTF project is forecast to completely offset this increase and result in a net fall in car trips of 280,000.

3.2.3 Helping deprived communities to access jobs in Middlesbrough -

Summary

Middlesbrough is deploying £1.15 revenue spend for each £1.00 of capital spend in a balanced programme to address multiple obstacles that prevent people getting to employment by bicycle. -

Context

Since 2011, Middlesbrough has been part of a designated Enterprise Zone intended to stimulate regeneration, but the city is aware that such regeneration will not automatically overcome the transport barriers faced by the disadvantaged communities that are most in need of the new jobs. ‘Cycling to Employment’ is a central strand of its LSTF project. For this relatively compact town, it offers a way to avoid congestion from renewed economic activity, whilst giving deprived communities with high levels of ill health an affordable and healthy way to access employment.

Inputs

The project outputs represent £303,000 capital and £353,000 revenue spend.[13]

Outputs

Capital: RC8, RC9, RC11

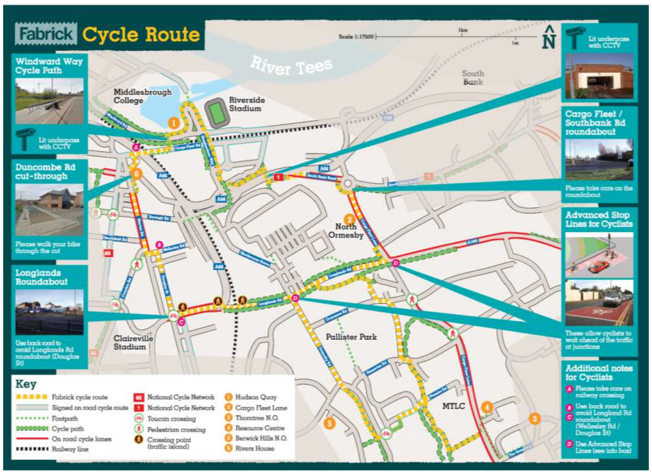
Capital + revenue: RT9

Revenue: HM1, PM2, RI4, RT6, RT7, RT8, RT10

The project recognises that a single insurmountable obstacle is enough to deter a potential cyclist. Middlesbrough’s cycling to employment strategy has to address a range of types of obstacle, some requiring capital expenditure, some requiring revenue, and some requiring both.

Capital spend will create safe, well-signed cycle routes on key arterial routes to the town centre and other major employment sites (such as Fabrick, illustrated). This will be backed up by new cycle parking and shelters at those destinations.

Further capital is being used to purchase bicycles for a pool bike scheme, in which businesses buy bikes at a subsidy so that their employees can cycle to work. This has proved popular: 60 bikes are in use across more than 20 employers after less than one year. Some revenue funding is being deployed to support a service



Cycle routes to work for Fabrick’s 6 town-centre sites

13 Middlesbrough Council February 2012, *Sustainable Middlesbrough – A Place for Business*, LSTF tranche 2 bid, table at C2, DfT spend only, for the Cycling to Employment and Travel Behaviour Change scheme elements. It is evident that over the whole LSTF project local funding is also balanced, at 47% revenue: 53% capital. (Table at C2 mislabels Travel Behaviour Change as capital, but the Annual Report shows the correct categorisation).

organisation to maintain these bikes until sufficient employers are on board for it to be a self-sustaining operation. -

Revenue funding is also being used to provide cycle training for those who cannot cycle or are not - confident, and to run ‘Dr Bike’ bicycle maintenance sessions so that those with unroadworthy - bikes can have them made safe and learn how to keep them that way. -

Revenue funds also support a project where unemployed people are trained to recycle bikes - donated by the police and public, gaining a job skill and a free bike to get to work interviews and - to future employment. -

Further revenue funding supports a broader campaign to encourage increased use of all - sustainable modes of transport, promoting cycling through events and distribution via employers - and other outlets of 10,000 packs with cycling maps and information. -

Outcomes, impacts, value-for-money

Middlesbrough Council’s 2013-14 LSTF Annual Report to DfT reports a 20% increase in the recorded levels of cycling since the start of the project.

3.2.4 Reducing carbon emissions from residential development in Central Bedfordshire -

Summary

A high level of revenue spend is enabling large-scale housing growth to go ahead without generating unacceptable levels of traffic and congestion.

Context

A large urban extension has been under development to the south of Leighton Buzzard since 2007. Building these 1500 homes threatened to generate large volumes of traffic and congestion with severe impacts on the town. The council therefore struck a ground-breaking Section 106 planning agreement before the first phase of development, using a ‘roof tax’ approach that stipulated a developer contribution per housing unit. This combined developers’ money with public funds for measures to create sustainable travel patterns amongst new residents from the start.

Inputs

The basic developer contribution was £800,000 for the first phase of 720 dwellings, largely capital spending directed at transport infrastructure. -

The council also set up an ‘Exemplar Transport Scheme Obligation’ to cover all phases, which was - largely revenue spending. The council primed this fund with £400,000 (from the Government’s - Growth Area Fund) in order to gain from developers a further £600,000. -

For the entire development the roof tax is expected to provide £3.3 million (a mix of capital and - revenue) to fund work required to make the development sustainable with regard to transport. -

Outputs

Capital: RI1, RC2, RC8

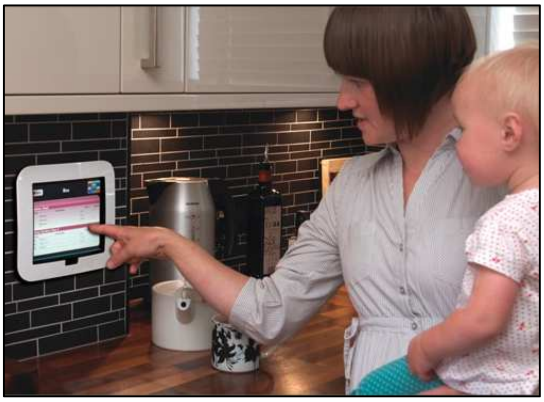
Revenue: HM1, HM2, HM5, HM8, HM9, HM10, HI1, PM1, PI1, RI2, RT1

The agreement focusses on travel between the new homes, the town centre and the edge-of-town station. Capital spend has improved the primary road corridor into the town to give buses priority and improve the route for cyclists and pedestrians. Revenue spending on a new ‘Dash Direct’ bus service provides residents with a direct service to both the town centre and the station, priced at less than half of the parking fee at the station.

Additional capital funding provides real-time information about bus and train services, including an innovative scheme that is now fitting real time information screens into new homes as they are built and retrofitting them to the earlier homes. And further revenue funding backs all this with a programme of personalised travel planning to inform residents of their sustainable travel options and encourage them to use them.

Funds from the Exemplar Transport Scheme Obligation were directed towards revenue measures, principally the 'Dash Direct' bus service to the new estate, marketing for it and the programme of residential travel planning. The obligation also committed the developer to spend further monies to fit each home with real time information screens[14].

Martin Ohrland, who has been running the residential travel plan since it started in 2007, estimates that it now requires staff time of 0.1 - 0.2 full-time equivalents, but initially required several days per week. He set up and updates a website that gives residents comprehensive information about travel and local destinations; oversees the 'Dash Direct' bus service run by Arriva; works with the local lower school to encourage sustainable travel habits amongst the youngest residents; and goes door-to-door offering personalised travel planning information to the 500 households now resident.



Real-time bus and rail information to new homes

This has not all happened in isolation. Leighton Buzzard was also a cycling town from 2008-2011, and put in several new cycle routes serving the new development area and promoted a cycling culture. Since then, LSTF monies have also improved and promoted sustainable travel options for residents in South Leighton Buzzard.

Outcomes, impacts, value-for-money

Levels of car use in Southern Leighton Buzzard exemplar development are estimated to be 20% below the business-as-normal scenario[15].

3.2.5 Consistent support to deliver long-term growth in car-sharing in Devon

Summary

Continuous support with modest amounts of revenue funding over a decade has steadily built up Carshare Devon to be the UK's largest regional car-share scheme.

Context

Lift-share schemes need to achieve critical mass to work, with enough people on the database for users to stand a good chance of finding someone else wanting to make similar trips to themselves. This means that a long-term approach is essential.

Since Carshare Devon began in 2003, its funding has come from a variety of external sources and different parts of Devon County Council's budget. It might be expected that this type of expenditure would be entirely categorised as revenue, including the initial set-up costs for Liftshare to establish the necessary database and systems. However, the council has been able to designate at least some items as capital and this has been key to preventing the scheme collapsing during years when revenue funding has been lean.

Devon Council's long-term approach has, after ten years of consistent promotion, achieved a situation where a large proportion of the people registered on carsharedevon.com – 55% – have been able to find a partner to share their journey.

Inputs

2012-13: £30,000 (LSTF) + £10,000 (local contribution)

Estimated average, prior to the present tranche of LSTF funding, of £10-15,000 per year (varying with funding availability and activities undertaken).

[14] Gosschalks, 2007, Section 106 agreement for Pratt's Quarry site.

[15] Central Bedfordshire Council , Feb 2012, *Smarter Routes to Employment*, Local Sustainable Transport Fund Tranche 2 Application, p.9

Lesley Smith, the coordinator of the scheme since its inception, says it has succeeded because Devon County Council has consistently 'put its money where its mouth is'. The scheme runs with an average council staffing level of 0.2 full-time equivalents, rising higher at times of peak promotional activity.

Outputs

Revenue: HM2, HM7, HM12, RT13

Over the years Carshare Devon has been promoted by almost every conceivable means, including competitions, 'roadshows' and events. During 2012-13, promotional activities included adverts on the backs of buses, billboards, the radio, and social media. This resulted in a further 1,500 people registering with the scheme.

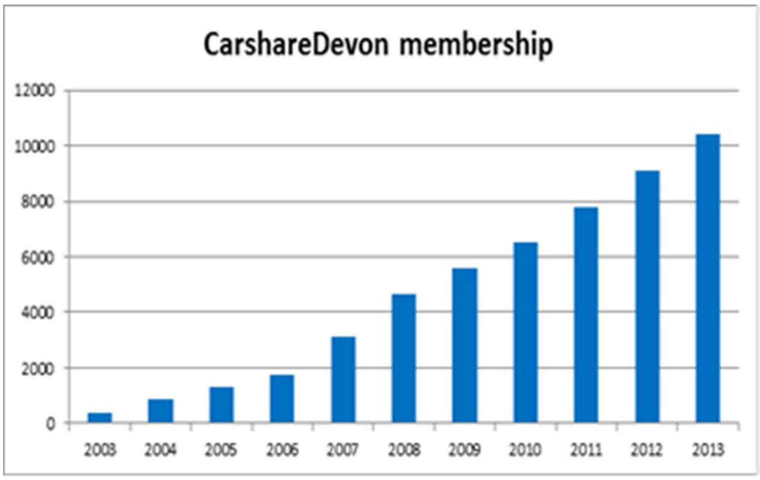
The Carshare Devon website allows employees to choose to be part of their employer's private company scheme instead of, or as well as, the scheme for the general public. These big employers, including two universities and a hospital, contribute revenue funding by covering the additional costs of their discrete portions of Liftshare's database.

The majority of expenditure has been on promotional activity, with a small proportion covering a fee to Liftshare for database administration and a phone enquiry service. The continuity of the scheme has been a critical factor in enabling the scheme coordinator to negotiate good-value long-term rates from Liftshare.

Outcomes, impacts, value-for-money

The scheme now has 10,745 registrations, and is able to promote itself as the UK's most successful car share scheme. This growth is after allowing for 'churn': over 4,000 members have been deleted from the database (e.g. because they have moved) to ensure high quality.

It is estimated that 4.6 million car km are now being saved every year [16].



Consistent promotion has resulted in steady growth

3.2.6 Increasing benefit from capital schemes through revenue projects in South Hampshire -

Summary

Revenue funding for behaviour change measures will add 17% to the capital costs of bus priority measures and smart ticketing technology, but is predicted to add 64% to the value of benefits of the project.

Context

The Southampton-Portsmouth conurbation is the largest urban area in southern England after London, but with its two cities and surrounding towns spread along a complexly indented coastline it faces a particular challenge to make its public transport system more attractive than the car, which presently accounts for 70% of all trips.

[16] Liftshare, 2014, Email communication from Ali Clabburn 06.03.2014. Calculation based on members who have confirmed they are sharing a regular journey. Considered by Liftshare to be conservative because 50% are known to share yet not provide feedback that they are doing this.

Transport for South Hampshire's Local Sustainable Transport Fund (LSTF) project reflects a realisation that the future economic growth of the area is threatened by increasing traffic congestion, but that building ever-more highway capacity is unsustainable.

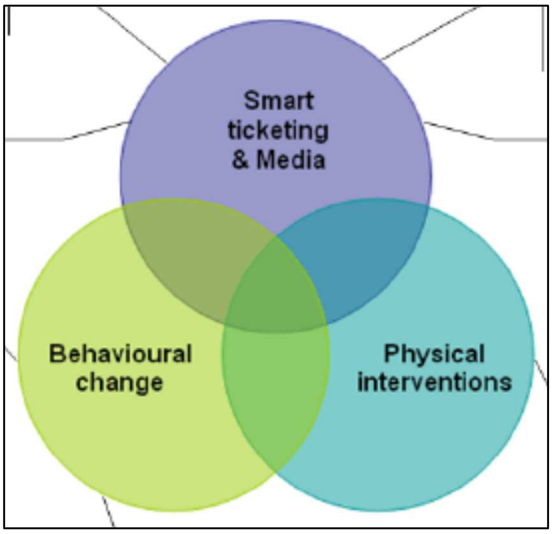
Inputs

Total project cost will be £29 million capital-dominated expenditure for physical interventions and smart ticketing and £5 million revenue-dominated expenditure for behaviour change initiatives.

Outputs

Capital: RI1, RT5, RC2

Revenue: HM2, PM1, PI1



The 3 elements of South Hampshire LSTF strategy

The project aims to transfer local car trips, most of which are short, to other modes of travel. It is targeting the key transport corridors that radiate from the city centres with three complementary measures: physical highway engineering to cut bus journey times by giving buses priority through pinch points; real-time information technology and 'smart' card tickets valid on all operators' buses (and ferries) that will make buses easier to use; and a range of initiatives to make the public aware of these improvements and encourage them to use them.

The marketing uses multiple channels to raise awareness and prompt behaviour change, including traditional media and face-to-face advice services and engagement. Southampton and Portsmouth city councils are running linked LSTF projects, building recognition of a 'My Journey' brand. Activities to date include visits by personal journey planning advisors to 1200 households in Southampton, one quarter of whom have taken up a 'challenge' to try a sustainable mode of travel for one of their regular journeys; and engagement of 85 businesses in a Hampshire-wide 'commuter challenge', taken up by 1629 of their employees for 36,116 journeys.

Outcomes, impacts, value-for-money

The pre-implementation project appraisal shows the behaviour change revenue-funded activities add a relatively small amount to project spend (an increase of 17%) but add disproportionately to the benefits the whole project is predicted to bring (increasing their value by 64%).[17]

3.3 Synergies between revenue and capital investment

Our discussions with expert interviewees enabled us to identify a variety of ways in which revenue schemes are being used by local authorities to increase the effectiveness of capital schemes.

In some cases, the revenue and capital elements of a programme were simply complementary: that is, the capital investment might still have been worthwhile in the absence of the revenue element, but it would have been less effective. In a few cases, lack of revenue funding would have meant that the capital investment was either pointless or wasted. The examples identified by the expert interviewees are summarised in Figure 3.2.

[17] Transport for South Hampshire Dec 2011 *A Better Connected South Hampshire Volume One: The Five Business Cases* LSTF Large Project bid, for figures see Table 3.1 p.200. Percentages represent additional costs and benefits from adding behaviour change measures i.e. (additional cost of behaviour change measures) / (costs of bus priority + RTPI + smart card measures). The cost-benefit analysis is based on total project cost i.e. combined DfT & local spend.

Expert interviewees also identified a wide range of outputs that were important in order to achieve key policy objectives, and that could only be delivered through revenue investment. These are summarised in Figure 3.3.

Figure 3.2: Synergies between revenue and capital investment

Enforcement of bus priority measures	One interviewee cited a major city where *"the capital expenditure has gone in in huge style, but unless it's enforced, it is an absolute waste"*. He felt that after a number of years of substantial capital investment in bus 'Showcase' routes, enforcement of bus lanes was now becoming a high priority. The city council had already recognised this and started to take action, but BBA2 revenue funding was enabling it to be properly resourced.
Real-time bus network management	An interviewee cited York as an example of a congested small city with limited road space, where most of the physical reallocation of road space to provide dedicated bus lanes that could be done *had* been done. To keep buses running reliably, and to take full advantage of the capital measures that have already gone in, it is important that the whole road network functions efficiently. Funding from LSTF and BBA1 has enabled the council to tackle this issue by setting up a traffic control centre, involving all bus operators and the council; and by employing a bus manager who is responsible for maintaining the punctuality of the network. Under BBA2, this person will be supported by on-street supervisors. The interviewee explained that this small team of people "*will be absolutely focussed on supporting the bus drivers, sorting out punctuality issues, making decisions about whether a particular bus should turn short, or turn back, or run empty, and all the operators have accepted they will take instructions from the supervisor."*
City-wide approach to tackling pinch points for buses	In Sheffield, the bus operator interviewee commented that the PTE, city council and operators were working closely together under BBA2 to identify and tackle pinch points on the network that caused delays to buses. Some solutions required revenue – for example, for changes such as new programming of traffic lights; others involved capital – for example to redesign a junction. A combination of lots of small interventions, revenue as well as capital, spread right across the city, offered much better value than expensive construction of one major bus lane that would only benefit services on a single corridor.
Maintaining or enhancing real time information systems	The bus operator interviewee was aware of instances where local authorities had been forced to turn off real time information systems because they did not have the revenue funding to maintain them. This meant that the original capital investment was wasted.
Marketing new public transport products	The SYPTE interviewee cited the example of the PTE's strategy of moving towards 'self-service' for public transport ticketing. The aim is to get passengers to buy tickets on-line, and to use smart cards. In order to get people to adopt these new products, they have to know about them, and how to use them – and this requires revenue-funded promotional activity. Without promotion, the capital investment in IT systems would be pointless.

Figure 3.3: Outputs that can only be achieved through revenue funding

Providing access to major employment sites for low-paid workers	'Kickstart' short-term support can play an important role in funding frequent high quality bus services for a few years until they achieve commercial viability. For example, First Group has received funding from BAA for several bus routes that enable airport workers to access Heathrow from locations such as Slough and Maidenhead. A decade ago, the network had six buses; now there are 26, and there have been increases in both service frequency and the places served. Some services run 24 hours per day, and all of them run 20 hours a day, seven days a week. The services have greatly increased the number of workers who can gain access to employment at Heathrow. At several stages over the last decade, Heathrow has put in money for about two years to enable a new route to be introduced or a night-time service provided on an existing route. On each occasion, the service expansion has become a commercial proposition.
Helping businesses to get better access to labour markets	One interviewee cited the workplace travel planning support that Nottingham City Council provides to businesses. One of the businesses benefitting from this is Asda, who have a 'dark store' for internet shopping in north Nottingham employing about 600 people, in an area of high unemployment. Nottingham's workplace travel planning officers provided Asda with a range of practical support including grants for cycling parking; review of local bus services; and discounted bus travel for their employees. This was valuable to the business, because a high proportion of their workers do not drive.
Getting business buy-in for demand management measures	Nottingham's approach to workplace travel planning (described above), has been to "*help businesses out*". Our interviewee suggested that this is one of the reasons that the workplace parking levy is accepted. The levy in turn provides a revenue stream which is paying for lines 2 and 3 of the city's tram system, the new station hub and the electric 'Linkbus' fleet. The interviewee commented that "*Revenue support for travel planning and parking management initiatives is vital to make the workplace parking levy work, which in turn makes other projects possible and gives us lines 2 and 3 of the tram, the station hub and the electric 'Linkbus' fleet. So sitting right at the bottom of the 'inverted triangle' we have our business support programme of around £200k per annum – and that is supporting hundreds of millions of pounds of investment by enabling the workplace parking levy to continue*."
Helping fleet operators to reduce carbon emissions	One interviewee cited the example of the Ecostars project. This is a fleet accreditation scheme that awards operators 'ecostars' based on the environmental impact of their fleet, and offers help and advice on how to reduce their impact. The scheme was originally established by Barnsley Council; across South Yorkshire PTE area more than 6000 vehicles at 60 organisations are now covered by it, and the programme is now being extended to other local authorities in Britain (e.g. Nottingham) and internationally. Member companies receive tailored support to make their vehicle fleets run efficiently, including advice on fleet composition, fuel management and maintenance of vehicles for optimum efficiency, and training for staff in eco-driving techniques.
Provision of new bus services for major housing developments	The bus operator interviewee cited the example of Ipswich, where 15,000 new homes will be built on the edge of the town over the next 10 years. First Bus is in discussion with the county council to ensure that a good bus service is introduced from the outset. This will be funded by a combination of payments from the developers, payment from the local authority, and First running services at a loss for an initial period. Subsidy will be required for about five years, but the expectation is that ultimately it will be possible to provide commercially viable services.

Enabling young people with special needs to travel independently	One interviewee cited the example of independent travel training, which is provided by a number of local authorities. In the medium-term (if enough young people can be trained), travel training may reduce the cost of providing taxis for school transport. In the longer term, it enables the young people concerned to lead independent lives, with benefits such as being able to go to college, get a job etc. which in turn will reduce the revenue requirement from social services budgets. In effect, this type of revenue investment represents a ‘spend to save’ strategy.
Tackling intractable safety issues	A TfL interviewee made the point that not all collisions can be ‘engineered out’. For example, the hazard posed to cyclists by HGVs can partly be tackled through vehicle design (sideguards etc), but it also requires both cyclists and HGV drivers to be aware of the risks. TfL runs ‘swap’ training, where cyclists have the chance to be in the cab of an HGV and experience what it is like in terms of visibility. Some boroughs run training programmes in which HGV drivers experience what it is like to ride a bike on busy roads.

PART II: OUTCOMES AND VALUE FOR MONEY OF REVENUE AND CAPITAL INTERVENTIONS

4. - Evidence from the literature on the effects of revenue and capital interventions

In the last decade, there has been an extensive effort to document the effects of interventions to encourage cycling and sustainable travel. The literature includes large amounts of academic and practitioner comparative case study research into workplace travel initiatives, school travel initiatives, personal travel planning, residential travel planning, car-sharing, car clubs and rural and out-of-hours demand responsive bus services, much of the UK research having been commissioned by the Department for Transport; and many evaluations by project delivery bodies or those commissioning them of the outcomes of cycle training programmes, workplace cycle challenges, school cycle promotion schemes, free bus ticket promotions, independent travel training, and so on.

Despite this extensive literature, we found that very little material has specifically addressed our core research questions. At an early stage of the work, we hoped that a literature review would uncover a reasonable number of case studies and analyses where suitable measures of benefit had been calculated separately for projects funded by revenue or capital accounts, and indeed possibly had addressed the question of optimising the balance between these. However, it quickly became clear that using a classification into revenue and capital funded projects has simply not been a dimension of main – or sometimes any – concern in research and studies. There has been much attention to the benefits and costs of sustainable transport policies and projects as a whole, usually in packages of many different elements, and sometimes divided into changes in infrastructure versus operations (which is related to capital versus revenue, but not identical to it) or specific activities such as marketing, training, and information which may be classified as either. But almost none of these studies explicitly recorded the actual class of funding separately for different elements of the intervention, in a way that allowed comparability between projects. And while outcomes (e.g. percentage increase in cycling or bus patronage) were commonly reported, it was rarely the case that these were presented in a way that enabled any comparison of effectiveness between projects on an equivalent basis such as cost per car km saved, cost per new cyclist, or benefit-cost ratio.

We report below a few key reports that offer evidence on the effects and value for money of cycling and sustainable travel interventions in a form enabling us to distinguish between revenue, capital and combined interventions, and then some important documents that illustrate a theoretical framework for optimum allocation of funds between revenue and capital.

4.1 - Evidence on effects of public transport interventions

The main pre-smarter choices literature reviews on factors affecting the demand for public transport are contained in two substantial collaborative studies coordinated by the Transport Research Laboratory (formerly the Transport and Road Research Laboratory), in 1980 and 2004, each compiled by large expert teams of the leading research specialists of the time (Webster et al. 1980, Balcombe et al. 2004). The focus of these and subsequent studies does not map precisely onto our own research focus, in that a distinction is rarely made between factors requiring revenue, those requiring capital, and those requiring a mixture of the two. Nevertheless, it is instructive to review the approach that these and subsequent studies have adopted. This section first briefly reviews how thinking on the factors affecting demand for public transport has developed, and then reports one

US study which did distinguish between the benefits of public transport capital investment and public transport operational (revenue) spending.

Webster et al. (1980) cited over 350 research studies on the then state of the art of research on factors affecting public transport demand. There was already some evidence that the quality of service offered, fares, and travel times (which will be affected in different measures by revenue and capital spending) had distinct effects on demand. The report commented:

"In general, much less information is known about the effect of the various service factors than about the effect of fares... (but) A sizeable body of data is available concerning the effects of changes in vehicle kms operated, service frequencies, and passenger walking and waiting time.... there can be no doubt that passengers regard service reliability as being of great importance (though) available information must rely largely on attitudinal studies and theoretical considerations.... The 'comfort and convenience' factors associated with public transport are many and varied, but several ad hoc studies have been made of particular aspects. Being able to find a seat appears to be of considerable importance (particularly, of course, for longer journeys), and so is protection from the weather... Interchange is generally disliked" (Extracts from Executive Summary pp xix-xxi; based on chapter 8).

By 2004, knowledge had advanced significantly. A study designed explicitly to update the earlier results was published by Balcombe et al. (2004). About 600 references are cited, with special attention to those which had been published since the 1980 Report. The authors report a number of important developments in knowledge, including a much more detailed breakdown of quality of service factors, and their associated values. But in particular they drew attention to the time scale over which demand responses to changes in fares, service levels or other factors built up, with an important relevance now (not seen so clearly at the time) of whether there can be lasting effects from revenue spending.

"The most widely estimated parameters have been price elasticities of demand and, in particular, public transport fare elasticities. Evidence collected during the study suggests that short-term elasticities, relating to changes in demand measured soon after changes in fare, may be substantially different from long-term elasticities, based on measurements made several years after fare changes. Broadly speaking: bus fare elasticity averages around -0.4 in the short run, -0.56 in the medium run and -1.0 in the long run; metro fare elasticities average around -0.3 in the short run and -0.6 in the long run, and local suburban rail around -0.6 in the short run. These results appear to indicate a significant change from those reported in the 1980 study….

"Fare elasticities are dynamic, varying over time for a considerable period following fare changes. Therefore it is increasingly common for analysts to distinguish between short-run, long-run and sometimes medium-run elasticity values. There are various definitions of short-, medium- and long-run, but most authors take short-run to be 1 or 2 years, and long-run to be around 12 to 15 (although sometimes as many as 20) years, while medium run is usually around 5 to 7 years." (Exec. Summary p 1).

Concerning quality of service factors, there were reports of work which started to enable the monetisation of benefits associated with spending on quality improvement. The summary of the summary says:

"The examination of quality of service identifies seven categories of attributes of transport services that collectively determine quality, and examines evidence as to how these components of quality affect demand. The findings are presented either in the form of elasticities, or as weights to be given to the various quality components when incorporating them in generalised costs for purposes of

modelling. There is limited evidence on elasticities with respect to in-vehicle time (IVT). The available evidence suggests that IVT elasticities for urban buses appear to be roughly in the range -0.4 to -0.6, while those for urban or regional rail range between -0.4 and -0.9....Attribute values have been derived for various aspects of bus shelters, seats, lighting, staff presence, closed-circuit TV and bus service information. Estimates for individual attributes of the waiting environment range up to 6p per trip (subject to a limiting cap of around 26p on the total), or up to 2 minutes of in-vehicle time per trip." (section 3.1.1)

AECOM (2009) reviewed evidence on the effect of 'soft measures' on patronage growth, with results from case studies, statistical analysis and demand modelling[18]. Measures included infrastructure, management, operating improvements, comfort factors and information, though not directly distinguishing between capital and revenue budgets. Elasticity-based demand models were used to convert various factors into equivalent 'value in minutes', as measured by their effect on demand, which in principle then allows values of time used in appraisal to be applied to the user benefits obtained from the improvements.

The values in minutes found for bus soft measures, distinguishing here (but not in their report) the measures likely to require a proportion of revenue expenditure (italics) were as follows: *Audio Announcements 1.22;* New Bus Shelters 1.08; CCTV at Bus Stops 2.91; New Bus with Low Floor 1.78; CCTV on Buses 2.54; New Interchange Facilities 1.27; Climate Control 1.24 (2.5); *On-Screen Displays 1.29; Customer Charter 0.88; Real Time Passenger Information 1.69 (Separate stated preference analysis gave some substantially higher figures ranging up to 5.05 minutes for real time information at bus stops); In-Vehicle Seating Plan 2.21; Simplified Ticketing 1.43;* Leather Seats 1.08; *Trained Drivers 2.63.*

It is notable that the values of probably revenue funded factors are in the same range, and if anything slightly higher, than the values for capital factors, in the methodology used.

This approach is adopted in WebTAG (DfT 2014a, section M3.2.1), where different soft bus interventions are ascribed values for modelling purposes in generalised minutes.

While we have not identified published research from Britain which seeks to differentiate between the outcomes or benefits of public transport capital investment and public transport revenue spending, there is some evidence from the USA (Weisbrod (2009) for the American Public Transportation Association, summarised in PTEG (2014)). This research looked at the benefits to the economy in terms of jobs created per billion dollars of expenditure. It found that capital investment in public transport (including purchase of vehicles and equipment and development of infrastructure and supporting facilities) supported nearly 24,000 jobs for a year, per billion dollars of spending. Meanwhile, public transport operations supported over 41,000 jobs for a year per billion dollars of spending. These job impacts in turn resulted in added business output which contributed to GDP, and again in turn contributed to federal, state and local tax revenues. Each $1 billion of capital spending contributed $1.5 billion to GDP and hence $350 million to tax revenues; each $1 billion of revenue spending contributed $2.0 billion to GDP and hence $530 million to tax revenues. The relevant summary table from Weisbrod (2009) is reproduced here as Figure 4.1. Commenting on the US evidence, PTEG (2014) pointed out that for each unit of government revenue and capital spending, respectively 3 and 3.8 times as much overall economic output was generated, comparing well with a recent UK Contractors Group study which had estimated that each £1 spent in construction generated £2.84 in total economic activity.

[18] Note that in this context, the term 'soft' may but does not necessarily imply 'revenue-funded'.

Figure 4.1: Summary of the short-term economic impact per billion dollars of national investment in public transportation (includes indirect and induced effects) [A] (reproduced from APTA 2009)

Economic impact	Per $ billion of capital spending	Per $ billion of operations spending	Per $ billion of average spending [B]
Jobs (thousands)	23.8	41.1	36.1
Output (business sales, $bn)	$3.0	$3.8	$3.6
GDP (value added, $ bn)	$1.5	$2.0	$1.8
Labor income ($bn)	$1.1	$1.8	$1.6
Tax revenue ($m, rounded)	$350	$530	$490

A indirect and induced effects include impacts on additional industries; they provide multiplier impacts on job creation only to the extent that there is sufficient unemployment to absorb additional jobs without displacement of other existing jobs.
B The US average impact reflects a mix of 29% capital and 71% operations spending. The study finds that the FTA federal aid impact is 30,000 jobs per billion of spending, due to a mix of 69% capital and 31% maintenance (operations).

In summary, the now rather well-established approach to modelling of demand for public transport recognises that there are a very wide range of factors that will influence levels of public transport use. The nature of the funding required for these factors is generally implicit rather than explicit, and the use of the term ‘soft factors’ is confusing because in other contexts this term is more often taken to imply schemes that are largely revenue-funded. Nevertheless, factors such as fares, vehicle kilometres operated, service frequencies, passenger waiting time, service reliability, staff presence, information, and customer care / driver training are all repeatedly recognised as important determinants of patronage growth, and all of these require either entirely revenue funding or a combination of capital and revenue. Meanwhile, evidence from the USA suggests that at the macroeconomic level, each unit of revenue investment in public transport operations delivers somewhat larger economic benefit than each unit of capital investment.

4.2 Evidence on effects of cycling interventions

The body of evidence on the effects of revenue and capital investment on cycling is far less developed than for public transport. It includes a limited number of studies that estimate the value for money of revenue and capital schemes on a comparable basis; some evidence of the costs and benefits of town-scale investment programmes that combine revenue and capital; and an example of a revenue programme being ‘bolted on’ to a capital programme in order (by implication, although unstated) to increase its value.

Research for Cycling England (SQW 2007) estimated the value of a range of types of investment designed to encourage cycling, including both capital and revenue-funded initiatives. The benefit-cost ratio of two large-scale capital programmes (Links to School and the London Cycle Network LCN+) was estimated at 2.2 and 3.9; the benefit-cost ratio of two revenue programmes (Bike It and cycle training) was estimated at 1.4 and 7.4.

Further research for Cycling England by the same consultancy (SQW 2008) reported the results of five case studies on improving cycling facilities:

- 18km cycleway (Swindon) cost £3.7 million, BCR 0.34
- Cycling and pedestrian bridge (Lancaster) cost £1.8 million, BCR 0.77
- Facilities in development site (Guildford) cost £158,000, BCR 1.07
- Facilities in university campus (Surrey) cost £300,000, BCR 5.56
- Reallocation of road space (Hull) cost £148,000, BCR 42

The method used was very sensitive to observed numbers of cyclists shortly after completion, and may significantly underestimate the longer-term BCR. The significant point about this comparison is that there are two schemes with very substantial infrastructure spending, but with BCRs less than one (albeit not taking into account long term growth which for such projects may be large); and three schemes with much lower costs, including in two cases (Guildford and Surrey) a proportion which would have been counted as revenue spending, all of which had positive BCRs, and one, a low cost reallocation of existing road capacity, one of the best BCRs of any transport project.

Several examples show that a large-scale programme combining both revenue and capital schemes at the city level can deliver value for money. A study by the Department for Transport (2010) assessed the value for money of the Cycling Demonstration Towns programme, which (as discussed in section 2.3) was roughly one-third revenue and two-thirds capital with a total cost of £18 million. Based on interim project outcome data on actual cycling uplift between 2005 and 2008, the benefit-cost ratio was estimated at 2.6-3.5 over ten years (a conservative assumption), with the range depending upon the assumptions made.

Odense in Denmark implemented a four year programme of cycling improvements from 1999 to 2003 including physical improvements, changes in regulations, and campaigns (Andersen, undated, probably 2004). Post-scheme evaluation reported effects including a 20% increase in cycling, as a result of combined capital and revenue measures, but did not distinguish the separate effects of each. Health-related benefits from the project were estimated to be worth DKK 33 million (£3.5 million), as against a project cost of DKK 20 million (£2.1 million).

Gotschi (2010, 2011) assessed the costs and benefits of investment in cycling in Portland, Oregon, including both costs of infrastructure and costs of a ‘SmartTrips’ programme. Most of the expenditure was on infrastructure improvements, which under the UK convention would have been classified as capital expenditure, and about 10% on ‘encouragement programs’. Calculations were carried out for a fifty year period (1991 to 2040). Including both historic investment and planned investment as set out in the city’s bicycle master plan, total expenditure on cycling was forecast to be $138m from 1991 to 2040; growth in cycling was assumed to continue at a similar rate to that observed between 1991 and 2008. The predicted benefit-cost ratio over the fifty-year period (composed mostly of health care savings and fuel savings) was calculated at 4.8 (Gotschi 2010, 2011).

In London, various documents from Transport for London give insights into the effect of revenue-funded promotional schemes when these take place in the context of recent capital investment in cycle infrastructure. Around 12-20% of the funding for the Cycle Superhighways Programme is for promotional work (TfL 2011, 2013), including engaging with businesses located close to new Cycle Superhighways to help their staff to start cycling; leaflet drops to people living close to the new routes; free cycle training; and advertising on buses that run along the route and at bus stops. TfL (undated, probably 2012) reports that a programme of cycle parking, cycle training and cycle safety checks aimed at employees of workplaces within 1.5km of two Cycle Superhighways in London resulted in an increase in cycling mode share from 11% to 14% at the 84 targeted workplaces. The average cost per head for the supporting measures was £6; average cost per new cyclist was just over £500. The measured uplift in cycling was broadly consistent with an earlier ex-ante demand analysis based on cyclists’ intentions (Tfl 2010), which reported that the number of people saying they would use a planned Cycle Superhighway increased by between 19% and 26% when four specific smart measures were mentioned, namely cycle safety checks, cycle training, cycle buddy scheme, and led rides.

In overview, these documents suggest that revenue schemes and capital schemes can both deliver worthwhile benefit-cost ratios; that whole-town cycling programmes comprising a mixture of revenue and capital schemes in aggregate representing a total cost equivalent to a major highways scheme (i.e. £2-3 million) can also offer good value for money (so high BCRs are not simply a function of small scale); and that revenue schemes may add value to a capital scheme by increasing uptake.

4.3 Evidence on effects of smarter choice interventions

In the period between about the mid-1990s and mid-2000s, there was a major expansion of new types of initiative designed to change people's travel patterns towards more sustainable modes using a combination of infrastructure, targeted information, new services, marketing and promotion. This included development of workplace travel planning programmes, school travel planning, personalised travel planning, travel awareness advertising campaigns, public transport marketing schemes, car sharing services, car clubs, and, subsequently, many other variations on the same themes, such as station travel plans, residential travel planning, and so on.

The largest assessment to date of the effectiveness of these types of interventions remains Cairns et al. (2004), the 'Smarter Choices report'. This included an extensive literature review citing about 300 sources and also reported on 21 in-depth case studies of smarter choice interventions, including workplace, school and personal travel planning, public transport information and marketing, car clubs, car sharing and travel awareness campaigns. The case studies examined were estimated to have cost in the order of 0.1 – 10 pence per car kilometre saved, with an average of 1.5 pence, giving an indicative 'congestion only' benefit-cost ratio of about 10. No distinction was made between revenue and capital elements of the case study projects, but in general those case studies which involved a larger amount of infrastructure (hence capital) tended to have somewhat higher costs per car kilometre saved than those that did not involve significant new infrastructure and hence were mostly revenue. The key summary table from Cairns et al. is reproduced here as Figure 4.2.

Subsequently, the Department for Transport supported a large-scale programme implementing smarter choice measures at the whole town level, in Darlington, Peterborough and Worcester. The effects of this programme were evaluated and reported in Sloman et al. (2010). The Sustainable Travel Towns programme is commonly (mis-)described as though it was an entirely revenue-funded programme having principally focussed on personalised travel planning. In reality, slightly less than half (44%) of the total programme expenditure was revenue, and personalised travel planning accounted for somewhat under half (33-46%) of the revenue expenditure in each town. At the programme level, the cost (not distinguishing between revenue and capital elements) was estimated to have been about 3.6 pence per car kilometre saved. This gave an indicative 'congestion only' benefit-cost ratio of about 4.5.

The Scottish Government undertook a similar programme in seven towns, called Smarter Choices Smarter Places. This was evaluated by DHC et al. (2013). Their report found that the £14.7 million programme, with an overall proportion of 49% revenue (including both government grant and other sources of funding) had delivered benefits with a value totalling between £20.5 million and £55.9 million. Although not stated in the evaluation report, this suggests an indicative benefit-cost ratio somewhere in the region of 1.4 – 3.8.

Figure 4.2: Indicative public sector costs, in terms of pence/vehicle kilometre reduced, for soft factors (reproduced from Cairns et al. 2004)

Factor	Source	Indicative Cost* pence/vehicle km reduced
Workplace travel plans--	Birmingham case study	0.1 – 0.3
	Bristol case study	0.6 – 1.6
	Buckinghamshire case study	0.7 – 1.5
	Cambridgeshire case study	0.4 – 0.9
	Merseyside case study	0.4 – 0.7
	Nottingham case study	0.6 – 2.0
	York case study	0.4 – 0.6
School travel plans	Buckinghamshire case study	1.4 – 2.6
	Merseyside case study	2.0 – 3.8
	York case study	5.3 – 9.9¬
Personalised travel planning	Gloucester case study (pilot)	3.3
	Bristol case study (Vivaldi phase 1)	3.4
	London proposed large-scale	1.2
	Nottingham proposed large-scale	0.7
Public transport information and marketing +	Brighton case study	4.4
	Nottingham case study	4.1
Travel awareness	York case study	0.2 – 2.7
Car clubs#	Edinburgh case study	4.8
	Bristol case study	5.1
Car-sharing	Buckinghamshire case study	3.3
	Milton Keynes case study	0.7
Teleworking Tele-conferencing Home shopping	In all three cases, private sector investment is needed, but cost savings should outweigh investment costs. However, public sector intervention may be needed to stimulate developments and changes in business practice^.	

* Use of decimal places (eg in 0.2p) should not be read as greater precision than 1p, 5p etc.. Capital costs have been annualised at 3.5%. No allowance has been made for induced traffic.

¬ York's school travel figures are high because they include a substantial amount of safer routes work, as well as the 'softer' elements of school travel plans. Such engineering work is often essential to school travel plans, but, in many authorities, it is partly borne by the road safety budget, not simply by the school travel plans budget.

-- Excludes spending by the private sector. We assume that private employers will only invest in travel plans if they see offsetting benefits, such as reduced parking requirements, improved staff recruitment and retention, obtaining commercially valuable planning permissions, etc. In some cases, employers have managed entirely to fund travel plans from car parking charges.

+ Costs include public investment only. Investment by commercial operators is assumed to be motivated, and therefore at least offset, by revenue generated by additional passengers. (However, net costs would be even less where revenue from additional passengers exceeds investment by the public transport operator).

It is likely that car clubs will become cheaper, and eventually 'free', at the point when they become self-financing.

^ For telework, we estimated that the BT initiative had reduced travel at a cost of 1.2 pence per km, in terms of the costs to BT of facilitating teleworking. However, this calculation did not include offsetting savings. For example, BT estimate that telework has contributed to their office space savings worth £180 million per year.

For teleconferencing, one company reported that videoconferencing equipment paid for itself within the first week of each month in terms of reduced travel costs and staff time savings, and numerous other companies also reported financial savings from adopting teleconferencing. However, public sector promotion, advice and grants may be needed to encourage greater adoption of teleconferencing as mainstream practice, which are currently impossible to cost.

For home shopping, provision of services is largely occurring for commercial reasons anyway. However, public sector promotion of home shopping for groceries could help to increase take-up, and funding for local drop-off facilities could help to make freight operations more efficient. One 'back of the envelope' calculation suggested that, to achieve traffic reduction at a cost of 1.5 pence per kilometre, in a city of 200,000 people, it would be possible to justify spending at least £300,000 over 10 years.

One further interesting report demonstrates how revenue-funded smarter choice programmes can be used to increase the operational effectiveness of transport infrastructure. Emmerson and Gibson (2008) carried out economic assessment of three area travel plans sponsored by the Highways Agency intended to manage demand at traffic-generating employment centres near to congested sections of the Agency's strategic road network. The cost of each of the initiatives was about £100,000 per site. Details of the interventions are not given but they seem to have mainly been management activities by employers to reduce car use, the benefits being measured mainly using a simplified form of the same methods used to appraise highway capacity schemes, mostly reduction of delays compared with a 'without' base. Although it is not clear how the spending was classified in terms of revenue and capital, it seems likely that the projects would have been treated as revenue spending, but intended to reduce a greater amount of capital spending on infrastructure expansion.

The economic assessment assumed that reported change in travel behaviour (as measured by before and after employee travel surveys) would ramp up over the two years of scheme implementation, and then decay at 25% per year. The summary calculated benefit-cost ratios for three plans in Whitely, Cambridge, and at Northampton General Hospital are given as 4.05, 13.68, and 5.58 respectively. This suggests that even if the interventions had very short-lived effects, their benefits substantially outweighed costs.

4.4 Evidence on optimum allocation of funds between revenue and capital

We have not found a single previous assessment specifically identifying the optimal balance between capital and revenue spending, but the first systematic approach to a closely related problem seems to have been a system developed by London Transport, in consultation with the Greater London Council, in the mid-1970s (London Transport 1975)[19]. At that time LT's formal corporate objective was specified as maximising passenger miles subject to a break-even budget constraint[20], and the balancing was seen essentially as relating to the trade-off between setting fares levels, service levels (e.g. bus vehicle mileage operated), and expenditure on investment programmes including new buses, garages, etc. The fares levels would almost entirely impact on revenue budgets, as would much of the service levels affecting staffing and operating costs, while the investments would affect passenger miles through quality of service and capacity. Some investments, such as a major exercise in machine ticket control on the Underground, would also affect revenue budgets by changing staffing levels and by reducing fraud.

The trade-off was calculated by a system of converting fares elasticities into service elasticities through some mathematical identities in the relationship between fares, travel times, and the values of time, which later became standard practice, and was in turn the source of much research in expressing other service attributes such as comfort, security or information provision as 'equivalent minutes' of travel time, described in section 4.1 above. This then enables a structure of calculations of demand. In rough chronological order of research, the sequence was:

- Start with fares elasticities;
- Then those aspects of service measurable as travel times;

[19] London Transport Executive Business Planning Office (1975) *London Transport's Corporate Aim Explained* London, 1975. At the moment no web-accessible archive copy of this document has been found. There are summaries in Quarmby D A (1977) and in Glaister S and Collings J J (1978).

[20] During this period there was a substantial subsidy from the GLC to London Transport, as policy, and subject to its own constraints on GLC spending. This became a source of great tension between the GLC and the Government, with new legislation, court cases, and eventually the abolition of the GLC. Neither the existence of a subsidy nor the conflicts affected the principles or practice of the calculations described.

- Then separation into different 'types' of time such as for walking or waiting, subsequently - climbing stairs or standing in uncomfortable conditions; -
- Then other aspects of service not measurable as time but convertible into equivalent time.

Given the formal quantifiable objective of maximising passenger miles, and the budget constraint, the process becomes a relatively straightforward optimising problem, and produces simple rules of thumb notably the rule that it was worthwhile raising fares as long as the additional passenger miles generated by spending the revenue gained were greater than the passenger miles lost from the fares increases itself, and vice versa. This principle could have been applied to any trade-off including, if it had been an issue, changing the balance of capital and revenue spending.

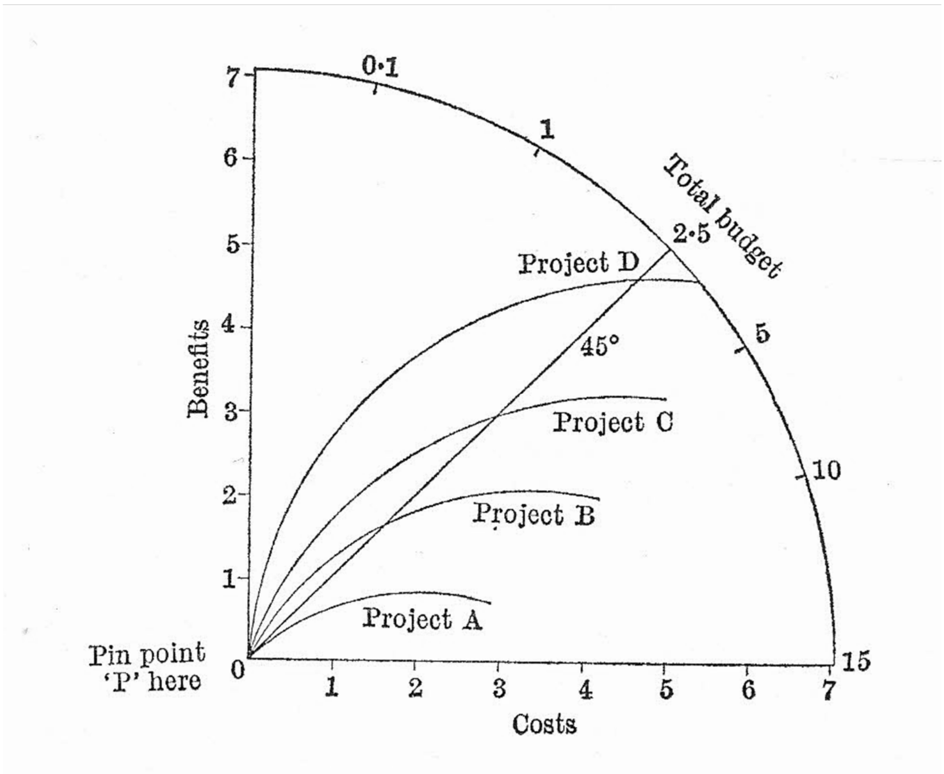
While the thinking and method is directly relevant to the problem in this report, it should be emphasised that in practice the system worked by assuming that revenue and capital funds were comparable and interchangeable. On occasion the outcome would be increasing fares in order to fund more investment, on others it would increase fares in order to fund better operating levels, on others it would suggest reducing fares even at the expense of reduced investment, where more demand would be produced by a basic cheap service than a gold-plated expensive one. The method would optimise the balance between fares and service levels, in the short term and the long term, but only accidentally optimise revenue and capital spending, in the process.

In parallel with the London Transport approach, some of the same thinking was forming part of the national government process, formally initiated by the Mathematical Advisory Unit of the Department of the Environment (notably in McIntosh and Quarmby 1970[21]), which eventually led to the rules and advice contained in Webtag, but was more oriented to investment project appraisal and had a more complex formal objective, to optimise the use of social resources to maximise economic welfare, and was much more rarely applied to current expenditure except for an adjustment in the case of 'transfer payments' (including taxes) which did not measure the consumption of real physical resources. It was not until more than 20 years later, by which time the system had become pervasive in public investment appraisal, that attempts started to apply the same methods to revenue spending, except for the special case of road pricing to which similar methods had been applied in many studies.

Also in the 1970s, a visually simple solution to optimise allocation of funds was explained by Goodwin (1972). This method, illustrated in Figure 4.3, is equally applicable to allocation of funds between classes of expenditure (e.g. capital versus revenue) or types of project (e.g. road construction versus public transport investment versus cycling schemes versus smarter choices).

[21] Interestingly, Quarmby was a key figure in both sets of discussions, moving from the Department of the Environment to head the Operations Research Department of London Transport.

Figure 4.3: A visual solution to optimise the allocation of funds between projects (reproduced from Goodwin 1972)



Goodwin (1972) suggests that over this graph may be placed a set of close parallel lines in a contrasting colour drawn on transparent paper, initially parallel to the x-axis. This is fixed by a drawing pin at the origin (point P) so that it can be rotated over the graph. At any particular angle of rotation, the points on the curves at which tangents are formed by the parallel lines give the optimum expenditure (on the x-axis) for each project so as to maximise the benefit from a given total budget. For example, a maximum benefit for a total budget of 10 units is given by spending 1.2 units on Project A, 2.2 units on Project B, 3.0 units on Project C and 3.6 units on Project D. If the total budget is greater than 10 units, the parallel lines are rotated clockwise; if less, they are rotated anticlockwise. If benefits are expressed as money on the same scale as on the cost axis, only investments to the left of the 45 degree line are worthwhile. This rule-of-thumb technique is a simple alternative to the use of Lagrange's undetermined multipliers (a mathematical solution to problems where some function has to be maximised subject to a constraint).

The method starts from the assumption that for any type of project, benefits are likely to increase with the level of expenditure, but with diminishing marginal returns, and at a different level for different project types. In Figure 4.3, we might (for the sake of example) take Projects D and C as representing two types of capital investment, and Projects B and A as representing two types of revenue scheme. In line with current expectations, the capital projects have a higher general level of benefit than the revenue projects, for any given expenditure, but the same argument would apply if it were the other way round.

The decision rule which maximises total benefits for a given total budget is to make the marginal return per £ spent equal for each type of expenditure, which will be where tangents to the curves are parallel to each other. This is because the best projects in the class with the lower average BCR – revenue, say – are still better than the worst projects with a higher average BCR – capital, say.

The result is that in general it is sensible to have some expenditure on capital and some on revenue projects, starting with the best ones of each, not to spend all the money on the one with the best average return.

The idea of optimising the balance of spending across several different types of intervention was further explored in a series of research papers for the Commission for Integrated Transport, summarised in CfIT (2010). This drew upon data from a variety of sources, including actual benefit-cost ratios for 93 Highways Agency road schemes and 48 local road schemes, ranked by expenditure and recalculated as mean BCRs for each expenditure quintile. Mean BCRs for each expenditure quintile for other types of scheme (local safety schemes, smarter choices, cycling schemes, local bus schemes, light rail schemes, intelligent speed adaptation, and rail schemes) were then theoretically derived, using overall mean BCRs and assumptions about the maximum expenditure 'scope' of projects with a BCR of at least 1, and assuming variance in BCR by expenditure quintile consistent with the pattern of variance seen in the road schemes. The method, with caveats and further details, is explained in Goodwin (2010).

This technique illustrated the scope for optimising the balance of spending on several different types of intervention, some of which have higher average BCRs than others, but all qualifying for some proportion of the spending. It suggested that BCRs from sustainable transport projects were, on average, as high as, or higher than, those from road infrastructure projects, but also that BCRs on small, widely spread initiatives were better than BCRs on bigger more expensive ones. The analysis did not distinguish between revenue and capital spending, but the examples included a higher proportion of revenue spending on smarter choices (that being a greater proportion of the spending than in other types of scheme) and almost none on roads as the sources were ex ante appraisals of road infrastructure projects.

Goodwin (2010) concluded that:

*"1. **The first £2billion.** It is very apparent that the very best value for money at present is coming from spending on a large number of small, relatively cheap projects aimed at **local safety schemes**, **smarter choices**, **cycle improvements** and some **quality improvements to bus services**…. It is worth spending about £2b on these as a first claim on funds before any other expenditures give such good value for money. The calculated economic benefits from this £2b will be in the order of £10b to £30 billion, as compared with benefits of £3b to £4b which would be available from average infrastructure schemes which pass current BCR tests.*

*2. **The next £2billion**. After this, the next best value for money according to the assumptions could be obtained from some remaining bus, cycle and smarter choices projects, one or two tram systems, the first tranche of spending on ISA, and the best of the Highways Agency schemes.*

3. Spending at greater levels than this brings in the next tranches of spending on ISA, some local roads schemes, and more tram schemes. With some caveats, the bank of data from past benefit-cost appraisals suggest, at face value, that there is closer competition among a mix of bus, tram, local road schemes, Highway Agency schemes and national rail schemes: under each head, there exist schemes which are better than the worst ones under other heads, and deserve higher priority."

An important conclusion is therefore that the optimum balance was different for different total budgets. The distinction between revenue and capital expenditure was not made, but there was a strong tendency for revenue-funded initiatives to be more apparent in the first (highest value) tranche, and traditional infrastructure projects to be more apparent in the later, lower value tranches. This did not reflect prevailing practice at the time, or since, so there is some indication that the proportion of revenue spending overall may have been under-optimised.

5. Introduction to the case studies

The following chapters (6 – 12) describe in detail our findings from the four in-depth bus case studies and three in-depth cycling case studies. In each case, we report *input* data (total expenditure, and how this was disaggregated between revenue and capital); *output* data, including what activities were undertaken and the timing of these; *outcomes* such as changes in bus patronage or level of cycling activity; any available evidence on wider *impacts;* and any relevant conflating factors.

Wherever possible, our approach has been to identify a control area, corridor, or sample against which changes in bus patronage or cycling activity can be compared. This enables us to estimate the value for money of the expenditure, comparing the 'with investment' case to the 'without investment' case, in the subsequent economic analysis (reported in Chapter 13).

The selected case studies were:

Case Study 1: East Kent: Bus service improvements including increased service frequencies, new buses, a bus lane and bus stop enhancements on two 'loop' bus services linking relatively deprived small satellite towns to the main urban centre (Canterbury).

Case Study 2: Buckinghamshire: Three interurban bus corridors radiating from Aylesbury where service frequencies were increased, in the context of area-wide capital investment in a new bus interchange and a real-time passenger information system.

Case Study 3: Greater Bristol: Three bus corridors with new / improved services aimed at commuter travel, in the context of area-wide capital investment in bus priority measures through the Greater Bristol Bus Network (GBBN).

Case Study 4: New Forest: Three circular bus routes aimed at visitors to the National Park, and designed to offer the opportunity to hop-on and hop-off at a number of tourist attractions; supported by intensive marketing by the National Park Authority.

Case Study 5: Cycling City and Towns: 18 towns and cities that received a combination of revenue and capital funding in varying proportions for between 2.5 and 5.5 years through the Cycling Demonstration Towns / Cycling City and Towns programme.

Case Study 6: Exeter workplace cycling: A programme of capital and revenue investment to support cycling to work (as part of the CCT / CDT programme), with comparison both of work locations with more / less revenue investment within Exeter, and of Exeter with a control town, Barnstaple.

Case Study 7: Links to Schools and Bike It: Schools in England that received investment in cycle infrastructure both with, and without, accompanying Bike It cycle promotion programmes.

6. Case Study 1: East Kent bus improvements

6.1 Background information

This case study considers two sets of bus routes in East Kent operated by Stagecoach, known as the 'Diamond' and the 'Triangle' due to the geographical shape made by the towns that they serve.

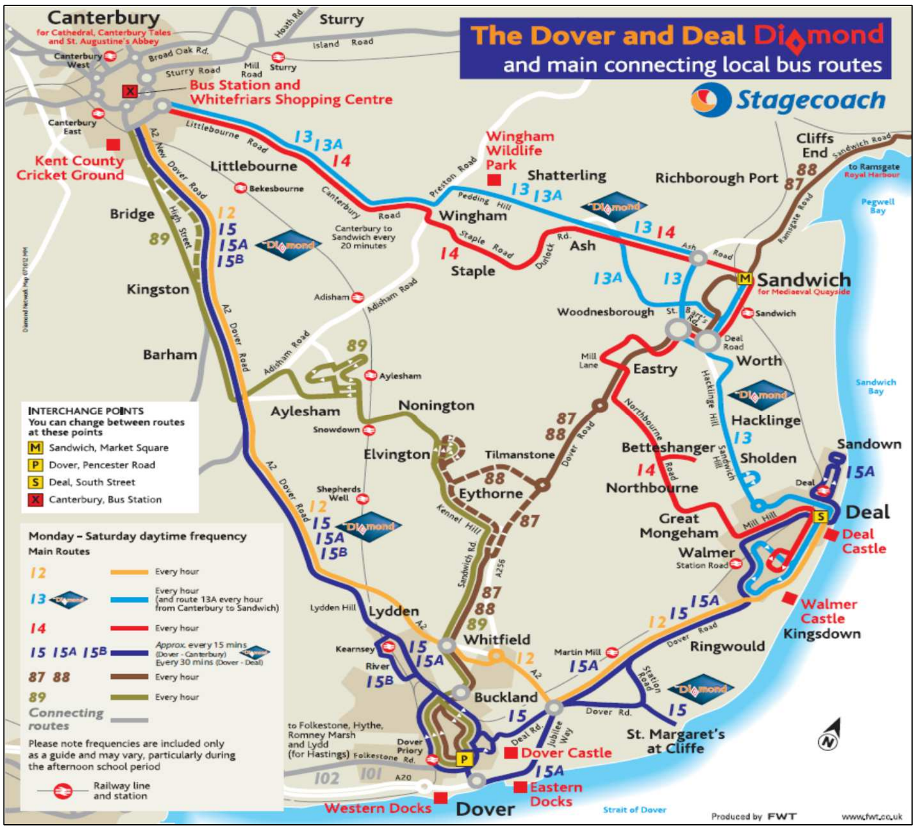
The Diamond

The 'Diamond' routes link Canterbury, East Kent's main town and transport hub, with the coastal towns of Dover, Deal and Sandwich to the east.

The northern side of the Diamond, defined by the corner towns of Canterbury, Sandwich and Deal, is served by routes 13, 13A and 14. The southern side of the Diamond is served by the Canterbury-Dover-Deal 15, 15A and 15B services. Since 2012, service 12 has provided a faster Canterbury-Deal connection by skirting Dover through Whitfield edge-of-town retail development. The southern side of the Diamond is also supplemented by service 89 between Canterbury and Dover, which runs by small villages rather than along the main A2. Figure 6.1 shows the geography of the Diamond.

This case study also considers two comparator routes to the Diamond: route 9/9X which runs from Canterbury to Ramsgate; and route 17 from Canterbury to Folkestone. Both of these routes have experienced relatively little change during the period under consideration.

Figure 6.1: Map of the Diamond bus routes



The Triangle

The 'Triangle' circuit is a set of bus routes running between Canterbury and the coastal towns of Whitstable and Herne Bay to the north.

In addition to serving these towns at the corners of the Triangle, the routes serve a string of settlements along the built-up coastal strip. They also serve University of Kent at Canterbury. The services are operated by Stagecoach as a set of clockwise routes (4, 4A, 4X) and a set of anticlockwise routes (6, 6A, 6X). The map in Figure 6.2 shows the geography.

Figure 6.2 also shows route 5 to Seasalter, a route which has seen minimal investment and provides a comparator route to the Triangle.

An annotated timeline showing key events in the development of bus routes in East Kent is provided in Figure 6.3.

Figure 6.2: Map of the Triangle circuit (pink) and comparator route 5 (pale blue)

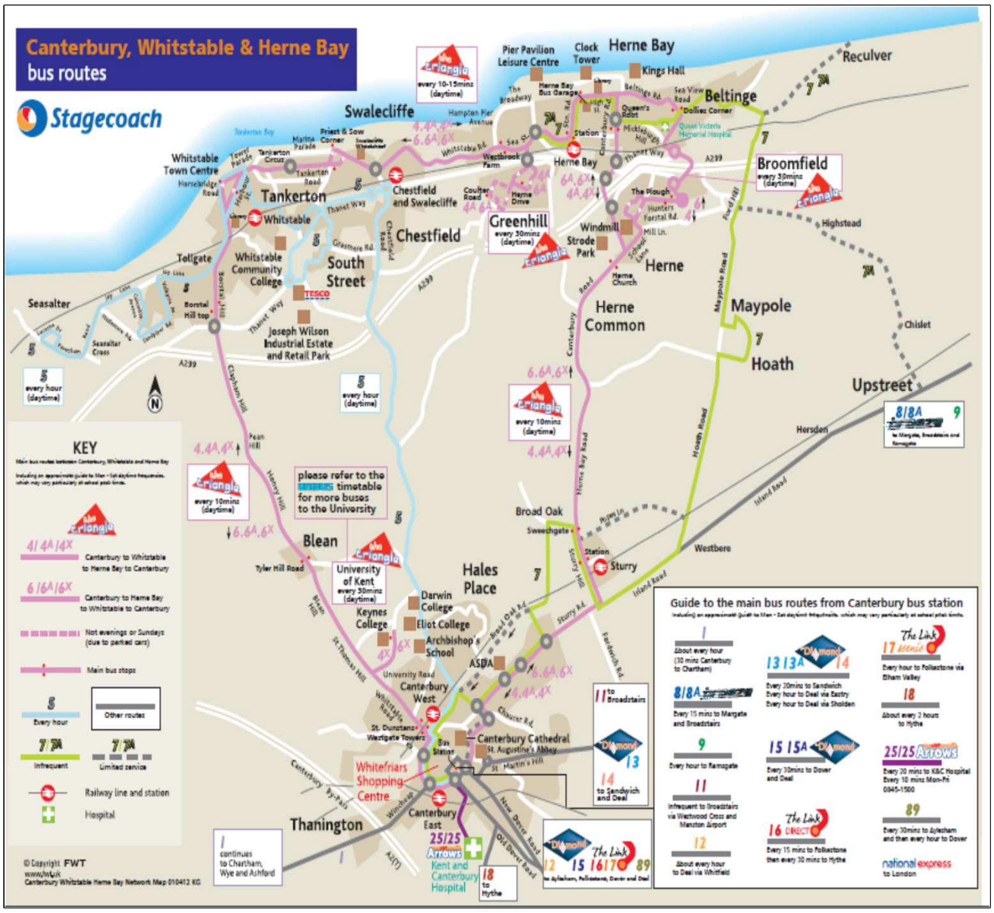
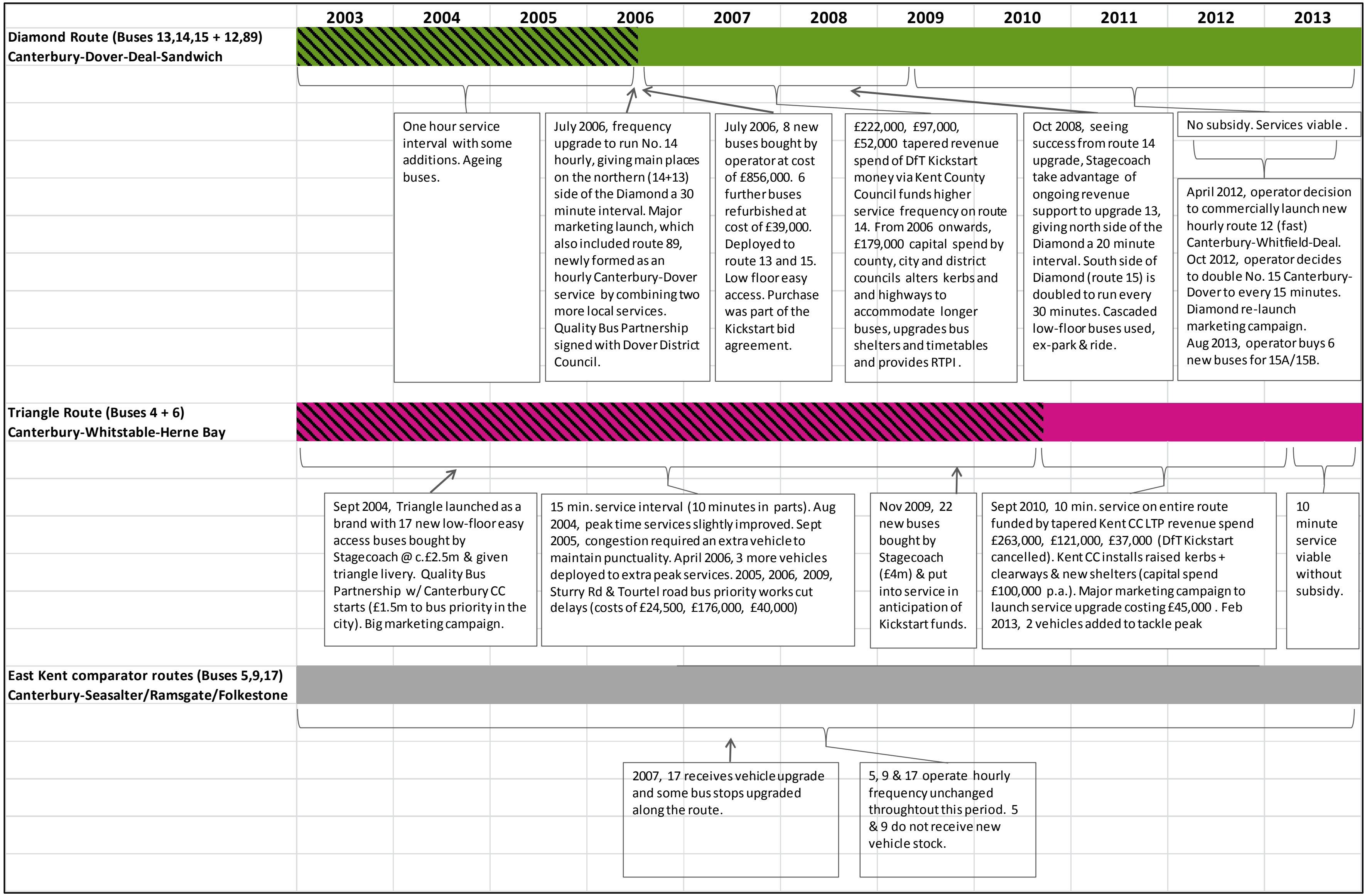


Figure 6.3: Schematic timeline showing key events in the development of East Kent bus routes



The following sections consider the financial inputs to the Triangle and the resulting outputs and outcomes. The data are drawn from the Stagecoach database of weekly patronage data, with further information provided by the Stagecoach Commercial Director for the area, who has been in post throughout the period under consideration.

6.2 Capital spending inputs and outputs

Figure 6.4 shows the annual breakdown of capital expenditure.

Diamond

In 2005 Kent County Council won a bid for Department for Transport Kickstart funds. The bid linked provision of revenue funding to 'kick-start' higher service frequencies with capital expenditure on highway and bus stop improvements by local authorities and capital expenditure by Stagecoach on new and refurbished buses.

Highway alterations were required to allow new longer buses to negotiate the route and to provide longer clearways so buses could pull up with their doors adjacent and flush to the bus stop kerbs. The bid shows a tapered capital spending programme across three financial years from 2006/7 to 2008/9 of £109,000, £35,000 and £35,000. Kent County Council Local Transport plan covered £105,000[22] of this expenditure, with additional contributions in the first year of £25,000, £15,000 and £5,000 from Dover District Council, Canterbury City Council and Deal District Council respectively.

In addition, the Kickstart bid included £29,000 capital funding for real time passenger information (RTPI) equipment on buses[23].

According to the bid, Stagecoach's purchase of eight new long single-deck buses would cost £856,000 with the refurbishment of six more costing a further £39,000. Although these were the only new buses purchased for the route during the period of Kickstart funding that is of most relevance to this case study, Stagecoach also cascaded used park and ride buses onto the route in October 2008 in order to further increase service frequencies, which probably carried capital spending implications. In August 2013, following four years of commercially successful unsubsidised operations, Stagecoach decided to buy six more new buses for route 15A/B.

The Kickstart initiative took place in the context of a (voluntary) Quality Bus Partnership between Canterbury City Council and Stagecoach that was signed in 2004. From the Council side this entailed commitment to a capital programme of £1.5 million (reiterated in the Kickstart bid) which introduced measures to help bus movements through the congested city centre and otherwise upgraded city centre bus facilities.

Triangle

The Triangle has received capital investment from two sources. Stagecoach has bought vehicles. Kent County Council has installed bus priority measures at pinch points and upgraded stops with boarder kerb build-ups and bus clearways to ensure easy low-floor access.

The Stagecoach investment in vehicles began in September 2004, at which point a fleet of 17 new vehicles was purchased and liveried with Triangle branding at a cost of about £2.5 million[24]. In

[22] A later public document *Welcome to New Routes 13 and 15* states Kent contribution was over £200,000. -
[23] This following expenditure table (Figure 6.4) assumes the RTPI spend was part of the three year tapered spending programme and therefore does not list it separately. -
[24] Stagecoach 2004 *On Stage* (in-house newspaper) Issue 56. Bus companies regard prices they obtain from manufacturers as commercially sensitive, so it can be assumed that this number is a significant over-estimate. -

November 2009, the whole fleet was replaced with new vehicles, with an expansion to 22 vehicles in readiness to improve the service interval from 15 minutes to 10 minutes. The Kickstart bid documentation indicates the anticipated cost of these vehicles was £160,000 each: *'Stagecoach is committed, if the bid is successful, to investing over £4 million in 25 new buses for the enhanced service'*. In the event, although the bid for Kickstart funds was successful, this final round of Kickstart funding was cancelled as part of a round of Government funding cuts[25], so the service frequency was not upgraded until September 2010, when Kent County Council stepped in to replace the Kickstart funding. In 2013 the fleet was further enlarged to 24 vehicles to improve punctuality. Two further buses were added to the Triangle fleet in February 2013 to counter peak congestion problems.

Kent County Council undertook work to upgrade bus stop clearways, kerbs, shelters, poles and timetable cases over a period following the service upgrade in 2009. The programme of work amounted to approximately £300,000 over three years. Some of this budget may also have covered works on other routes, so this figure should be treated as a maximal estimate.

Congestion problems along the Sturry Road approach to Canterbury had previously been significantly improved by a series of works from 2005 to 2009. If these capital costs were to be apportioned to the Triangle according to its share of the total number of timetabled buses passing through this junction they would amount to £24,500 in 2005 (bus lane), £176,000 in 2006 (bus lane extension) and £40,000 in 2009 (bus priority lights at Tourtel Road junction). The operator estimates that these changes created time savings of about 4 minutes at peak time and 1 minute off-peak, for the 50% of buses travelling into Canterbury.

The Kickstart bid documentation also mentions ongoing Kent County Council expenditure on real time passenger information, with an intention to 'eventually' cover the Triangle routes in their entirety, but it does not appear that this happened during the period covered by this case study.

6.3 Revenue spending inputs and outputs

Figure 6.4 shows the annual breakdown of revenue expenditure.

Diamond

The 2005 Kickstart bid lays out a tapered programme of revenue expenditure of £222,000, £97,000 and £52,000 over financial years 2006/7, 2007/8 and 2008/9. This paid for route 14 to run hourly from July 2006, which with the 13 provided the main settlements on the northern side of the Diamond with a half-hourly service.

At the same time, on the southern leg of the Diamond, although the main Canterbury-Dover-Deal service 15 remained hourly, the Kickstart money was used to start a complementary hourly through-route (89) running via the villages between Canterbury and Dover that were previously served only by shorter routes from either end[26].

In October 2008, during the last year of revenue support, Stagecoach decided that the increasing patronage merited further service upgrades. Service frequency on Route 13 was upgraded so that the northern side of the Diamond gained a 20 minute service interval. On the southern side of the Diamond, route 15 was doubled to become a half-hourly service.

Since revenue support ceased there have been two further service upgrades to the Diamond as a result of commercial decisions by the operator. In April 2012 a new fast hourly service (route 12) was

[25] House of Commons Library (2013) *Buses: grants and subsidies* p.14

[26] Route 89 is mentioned here for completeness but is excluded from the data and charts for the Diamond in the following section.

formed on a Canterbury-Whitfield-Deal route, missing Dover centre but serving an out-of-town retail development. In October 2012 Stagecoach doubled route 15 to become a 15 minute service interval.

The Kickstart bid documentation also states that the Diamond services will be 'vigorously marketed' with spend of £30,000 in 2006/7 and £15,000 in the following years to include branding, improved timetable displays and an 'extensive and intensive publicity drive by the operator'[27]. The marketing effort was significant, with the budget including vehicle branding (£8000), route-branded bus stop flags, roadside posters, in-bus branded posters, press ads, 'roadshows' with promotional give-aways, and door-drop postcards.

Triangle

Although the Triangle routes were already running on a commercial basis, from 2010 Kent County Council provided three years of temporary revenue funding in order to boost the service frequency. This was due to be funded by the last round of Government Kickstart funding, but when this round was cancelled, Kent funded the intervention from its Local Transport Plan budget. The revenue expenditure on service support was tapered over 2010/11, 2011/12 and 2012/13 at £263,000, £121,000 and £37,000.

Marketing spend by the operator at the time of this upgrade was planned to be £45,000 to include branding as well as publicity. It appears from Stagecoach information that most of this spend was when new buses were provided in 2009, preceding the service frequency upgrade. This figure should probably be regarded as a maximum estimate. The promotional effort included new brand-specific bus stop poles and flags, press work and advertising.

In 2004, the Triangle had already been one of the first examples of Stagecoach East Kent's marketing strategy to develop strong brands on its core routes. It is evident from Stagecoach records that there was significant marketing effort following its renewal of the vehicle stock in 2004, and again with vehicle repainting and rebranding in 2007, with some relevant marketing to university students in each year. The phase of marketing from 2010 onwards built on this foundation.

6.4 Relevant factors for the comparator routes

Route 5

Route 5 between Canterbury and Seasalter has operated at an unchanged hourly frequency throughout the period under consideration and has not received new vehicles. Most of the vehicles remained step-entrance during this time. Route 5 shares some stops with the Triangle buses in Whitstable but elsewhere it has not benefitted from any infrastructure improvements.

The centre of Whitstable is served by both route 5 and the Triangle, so there is a possibility of some users switching from route 5 to the Triangle as it improved. However, this is likely to be a small proportion of users. The highest proportion of route 5 users are older people, who are likely to favour the proximity of the 5 over a longer walk to catch a Triangle bus, and the change from a 15 to 10 minute interval on the Triangle that is the focus of this study is not likely to have greatly influenced this group.

Route 9

Route 9, between Canterbury and Ramsgate, serves a town of comparable size to Dover or Deal at a similar distance from Canterbury and therefore offers a suitable comparator to the Diamond. Route 9 also shares the Sturry Road approach to Canterbury with the Triangle. This congested road

[27] By implication this is expenditure by the operator, although that is not explicitly stated.

received bus priority measures from 2005 to 2009 so route 9 is also a relevant comparator to the Triangle.

Route 9 has retained an hourly frequency during the time period covered by this case study, with most vehicles remaining step-entrance rather than easy-access.

However, the route has experienced some changes. At various times since 2004 the route has had different extensions beyond Ramsgate, which have caused some variation in loadings. From 2008, an extra bus at 16:00 from Canterbury has increased patronage. From 2013, Canterbury (sixth form) College has generated noticeable extra peak time demand (although this is a factor that has also increased patronage on Diamond Route 15).

Route 17

Route 17 runs between Canterbury and Folkestone also serving a series of villages along the Elham valley. It has remained at an hourly frequency during the time considered in this case study. However, the fleet was upgraded to low-floor buses in 2007. Some bus stops were improved at this time too.

A cheap youth 'Freedom pass' was introduced by Folkestone's district council (Shepway) in 2008, but this is the same timing as Dover introduced its youth Freedom pass, so in this respect route 17 is a good control example against the Diamond. (However, the Canterbury area Freedom Pass was introduced in 2007, so some allowance is needed for any comparison with the Triangle services).

Although route 17 has not increased frequency, the faster Canterbury-Folkestone route 16 service running along the A2 then to Folkestone increased from 30 minutes to 20 minutes in 2009 and then increased to 15 minutes in 2011. This is likely to have taken some (end-to-end) patronage from route 17.

Figure 6.4: Inputs and outcomes for East Kent bus routes

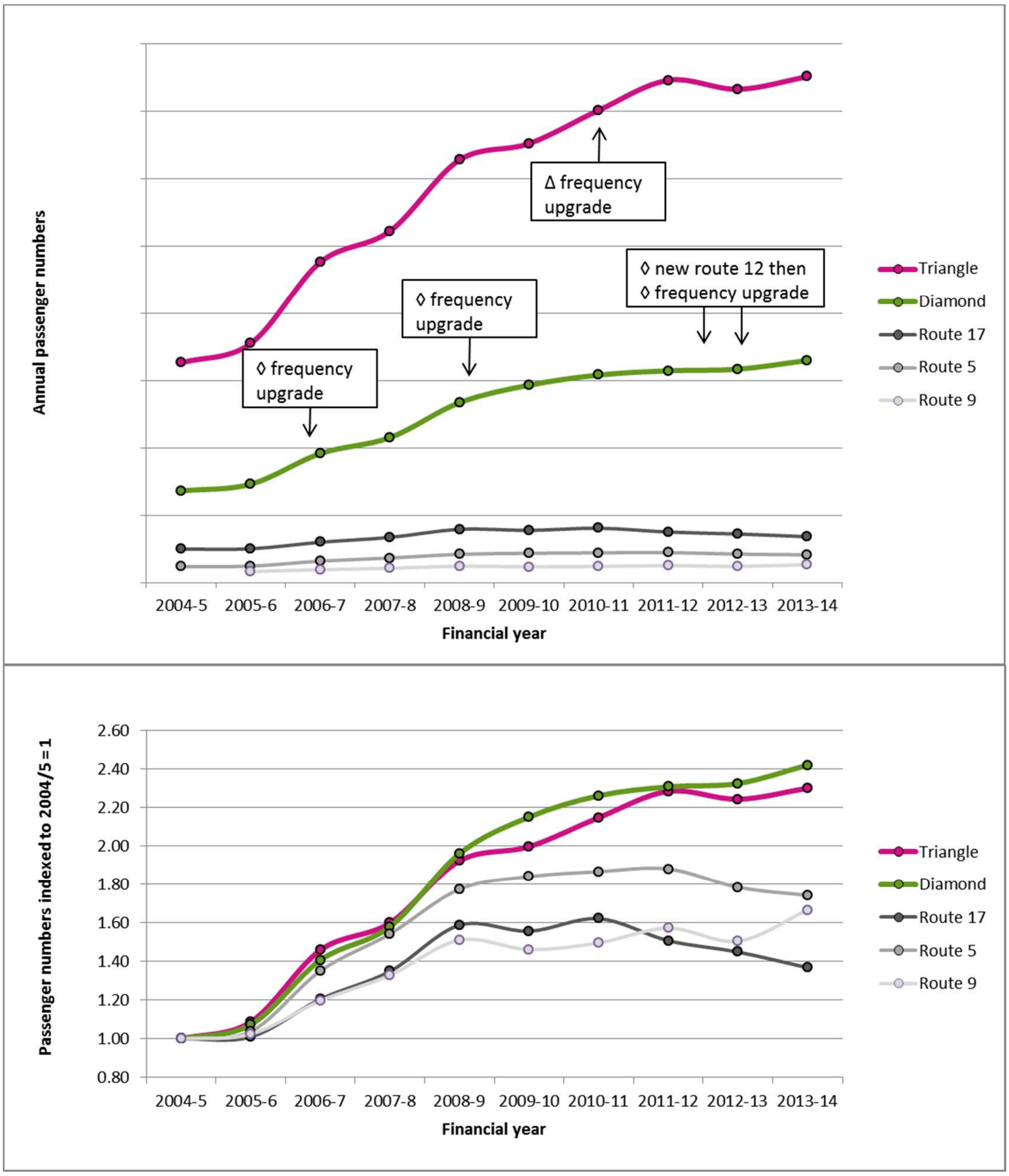
Financial year	2004/5	2005/6	2006/7	2007/8	2008/9	2009/10	2010/11	2011/12	2012/13	2013/14
Inputs										
Revenue, LA service subsidy Diamond[+]			222,000	97,000	52,000					
Revenue, LA service subsidy Triangle[~]							263,000	121,000	37,000	
Revenue, operator Diamond marketing			30,000	15,000	15,000					
Revenue, operator Triangle marketing[‡]	c.10,000	c.500	c.500	c.15,000	c.500	45,000	‡	‡	‡	‡
Capital spend, LA Diamond[#]			109,000	35,000	35,000					
Capital spend, LA Triangle[##]		24,500	176,000			40,000	100,000	100,000	100,000	
Capital spend, operator Diamond new buses[*]			895,000							*
Capital spend, operator Triangle new buses[**]	2,500,000					4,000,000			320,000	
Outcomes										
Indexed patronage Diamond	1.00	1.07	1.41	1.58	1.96	2.15	2.26	2.31	2.32	2.42
Indexed patronage Triangle	1.00	1.09	1.46	1.60	1.92	2.00	2.15	2.28	2.24	2.30
Indexed patronage route 5	1.00	1.04	1.35	1.54	1.77	1.84	1.87	1.88	1.78	1.74
Indexed patronage route 9	1.00	1.02	1.20	1.33	1.51	1.46	1.50	1.57	1.51	1.67
Indexed patronage route 17	1.00	1.01	1.21	1.35	1.59	1.56	1.62	1.51	1.45	1.37

+ LA is local authority; Kent County Council was the conduit for these DfT 'Kickstart' funds. -
~ The original Kickstart bid to DfT was for one year earlier but the Triangle service upgrade eventually started with LA substitute funding in Sept 2010. -
‡ £45,000 for 2009 marketing launch & branding 'as for all new vehicle launches in Kent'. Other figures estimated from unpriced list of marketing activity. No data 2010 onwards. -
# Mainly highways works for longer buses and better stops, shelters and timetable displays. Paid from Kent County Council LTP, except for first year £45,000 combined - contribution from Dover District Council, Canterbury City Council and Deal Town Council. Also includes £29,000 DfT Kickstart funds for RTPI on-bus units (from bid document). -
Kickstart bid appendix implies £300,000 was required for kerbs, clearways, etc. Sturry Road bus lane and Tourtel Road bus advance lights account for the other figures. -
* 2006 purchase of 8 new vehicles is costed in the Kickstart bid at £856,000, 6 more were refurbished at a cost of £39,000. Price of six new buses in 2013/14 is not known. -
** Feb 2013 purchase of 2 new vehicles is calculated at same unit price as the 2009 purchase. -

6.5 Outcomes from revenue and capital spending

Figure 6.5 compares trends on all routes in absolute terms and on an indexed basis.

Figure 6.5: Annual passenger numbers in absolute terms and indexed to 2004, all East Kent routes

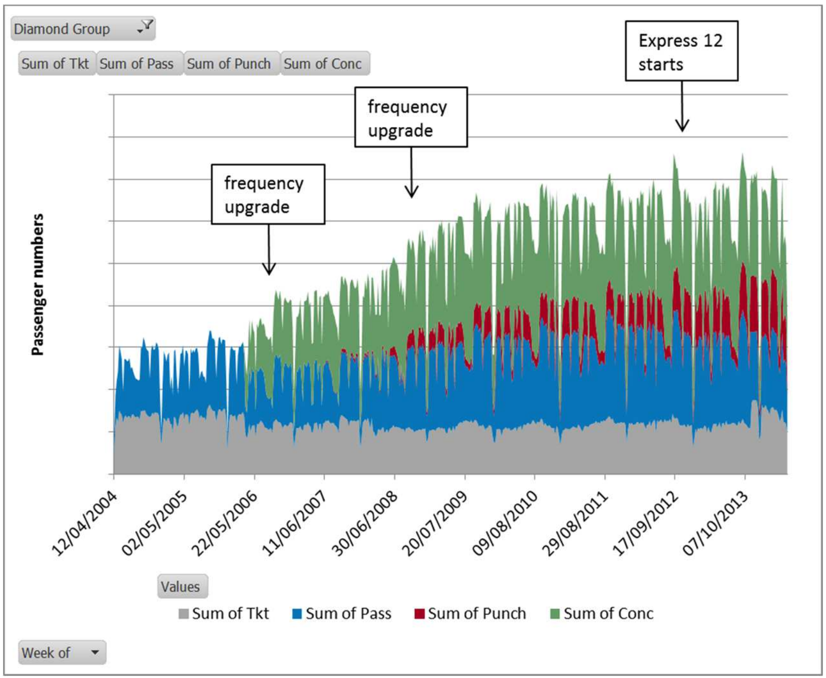


The plot of absolute passenger numbers highlights that both the Triangle and Diamond carry much higher numbers of passengers than the unimproved routes. This is in large part because the only unchanged routes suitable to form control examples are those that are of insufficient commercial value to have attracted service upgrades. Although it would be expected that the bigger routes would achieve greater rises in passenger numbers than the smaller comparator routes, the rises in absolute terms appear very large. After indexing, it is apparent that the Triangle and Diamond have also risen faster and further than the comparator routes in relative terms. The improved routes also maintained growth after 2008/9 when growth on the comparator routes levelled off. The various frequency upgrades do not result in sharp kinks in the curves. However, when the two improved routes are compared against each other, the indexed plot gives a subtle indication that these upgrades may change which route grows faster during the period immediately after an enhancement.

Detailed patronage data has been made available at a weekly level and by breakdown of ticket types so it is possible to look further at the growth trends and what types of passenger have increased most. For this level of analysis we consider the Diamond and Triangle separately.

Diamond
Figures 6.6 and 6.7 provide a breakdown of types of passenger using the Diamond services.

Figure 6.6: Diamond weekly passenger numbers showing contribution by ticket type



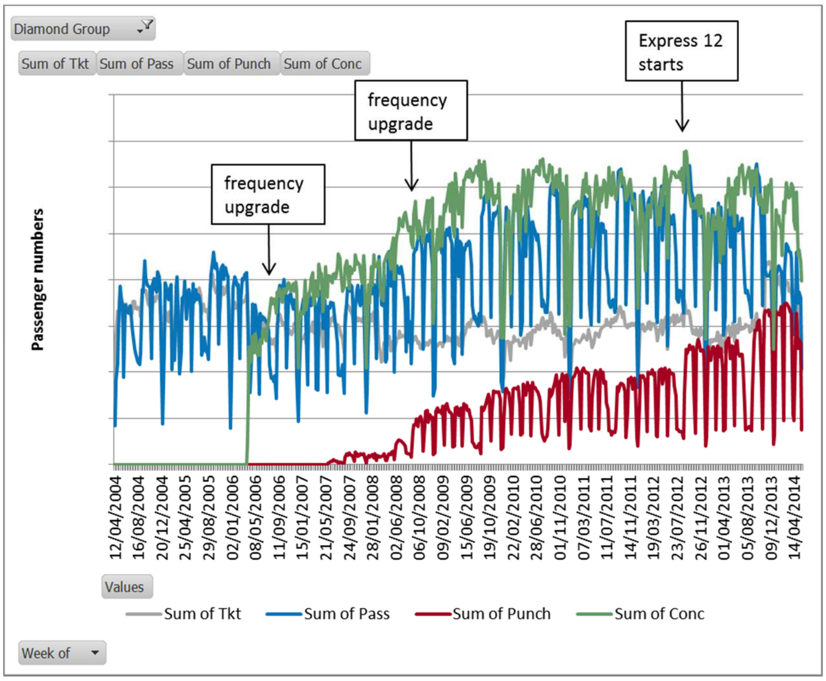
Tkt = single tickets & first use of return, daily & weekly tickets

Pass = all pre-issued tickets including return ticket portions, weekly, monthly, & longer seasons

Punch = youth 'Freedom pass'

Conc = free older person

Figure 6.7: Diamond weekly passenger numbers showing trends by ticket type



Tkt = single tickets & first use of return, daily & weekly tickets

Pass = all pre-issued tickets including return ticket portions, weekly, monthly, & longer seasons

Punch = youth 'Freedom pass'

Conc = free older person

The breakdown of patronage types for the Diamond shows growth in three types of tickets. The start of statutory free concessionary travel for older people in April 2006 has a big impact, which carries through until 2009. There is some corresponding decrease in paid-for single tickets ('Tkt' category) and also in day returns and seasons ('pass' category), but the net effect is a marked increase. This occurs at the same time as the first frequency upgrade to the Diamond, masking its effects.

From June 2007 in the Canterbury area, a cheap youth 'Kent Freedom pass' was available to 11-16 year olds (£50 initially, later rising to £100 and doubling again to £200 in 2014). In the Dover area this was introduced a year later. This ticket produces a net rise, more than compensating for the decrease its introduction causes in paid-for tickets and the 'pass' category of tickets. It indicates demand for bus travel to school from pupils whose journeys do not qualify under the statutory obligations on the local authority to meet travel-to-school costs[28].

The day returns, weeklies and longer period tickets that are lumped into a 'pass' category show a steady rise from 2007 up to late 2009. A further disaggregation of data for the northern and southern sides of the Diamond (not shown here graphically) indicates that the pass category has grown most strongly on the southern side of the diamond, whereas the Freedom pass has grown more strongly on the northern side of the Diamond (with the rise in older people's travel similar for both). Some of this growth probably represents growth in commuting trips to work, but this ticket category also represents some trips to education made by sixth formers and others older than the age limit for the Freedom pass.

Triangle

Figures 6.8, 6.9 and 6.10 compare the patronage trends for the Triangle and comparator route 5 and break the trends down by passenger type.

The overall patronage trends (Figure 6.8) show a sharp increase from early 2006 (above a slightly rising previous trend in the case of the Triangle). Although the Triangle shows a much faster rise in absolute passenger numbers it is less far ahead in terms of indexed percentages. The rise on both routes slows from the end of 2008. Thereafter, route 5 patronage remains level and shows a slight decline from mid-2012 onwards. From mid-2010 the Triangle departs from the route 5 trend with a further rise until the beginning of 2012, after which patronage holds level.

Figures 6.9 and 6.10 break down the patronage trends by ticket type to enable analysis of where the extra patronage has come from. From April 2006 there is a clear effect from the advent of free bus passes for older people. The increase in this category more than offsets the decrease it causes in paid-for tickets. Patronage within this group continues to rise until the end of 2008 on both routes. Thereafter the trend levels off on the Triangle but falls away on the Seasalter route.

[28] Either because these pupils have chosen to go to schools that are not the closest option or because they live within the 3 mile statutory walking distance for secondary school pupils but prefer to take the bus.

Figure 6.8: Triangle and route 5 weekly passenger numbers in absolute terms and indexed to 2004

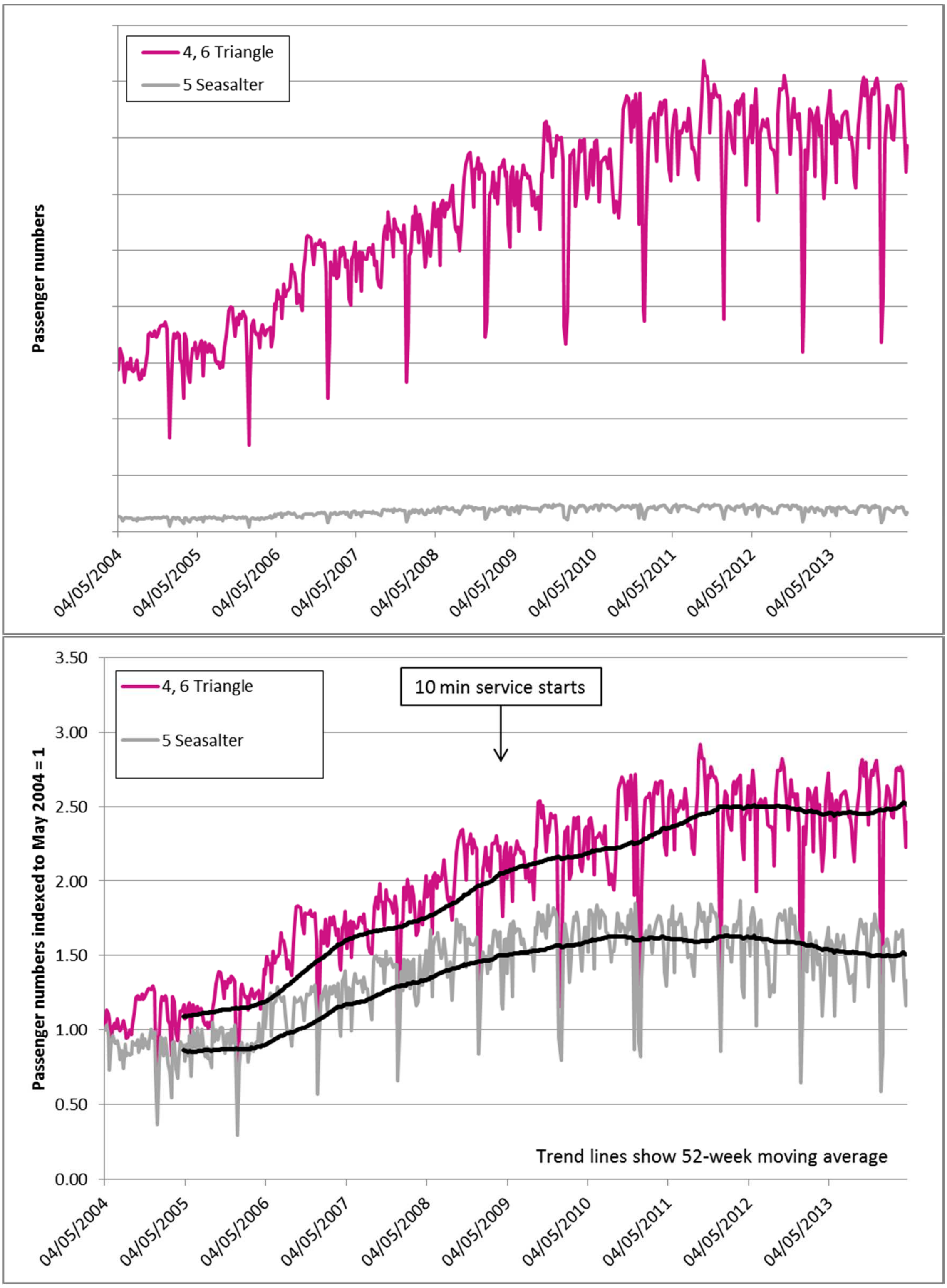


Figure 6.9: Triangle and route 5 weekly passenger numbers showing contribution by ticket type

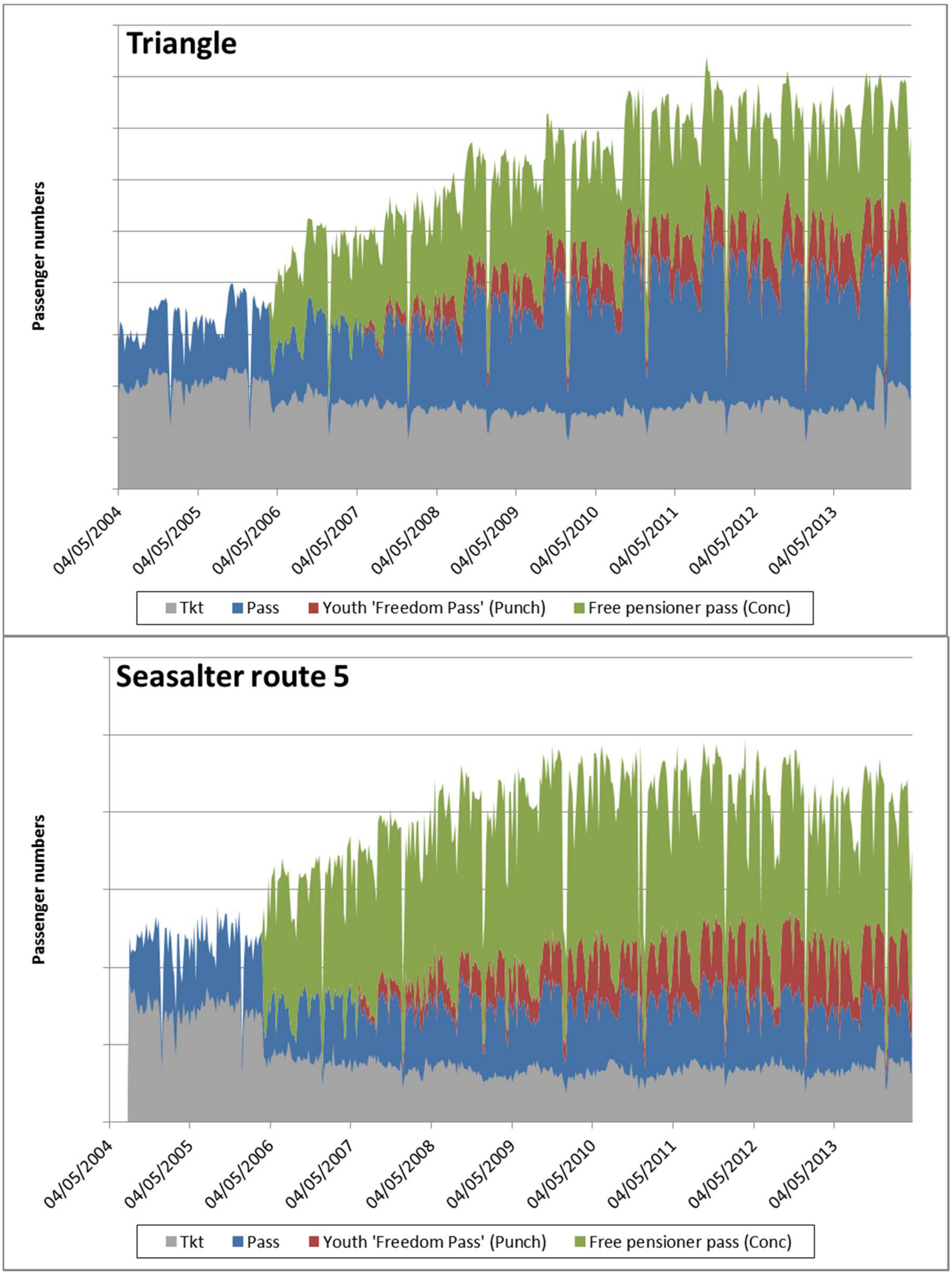
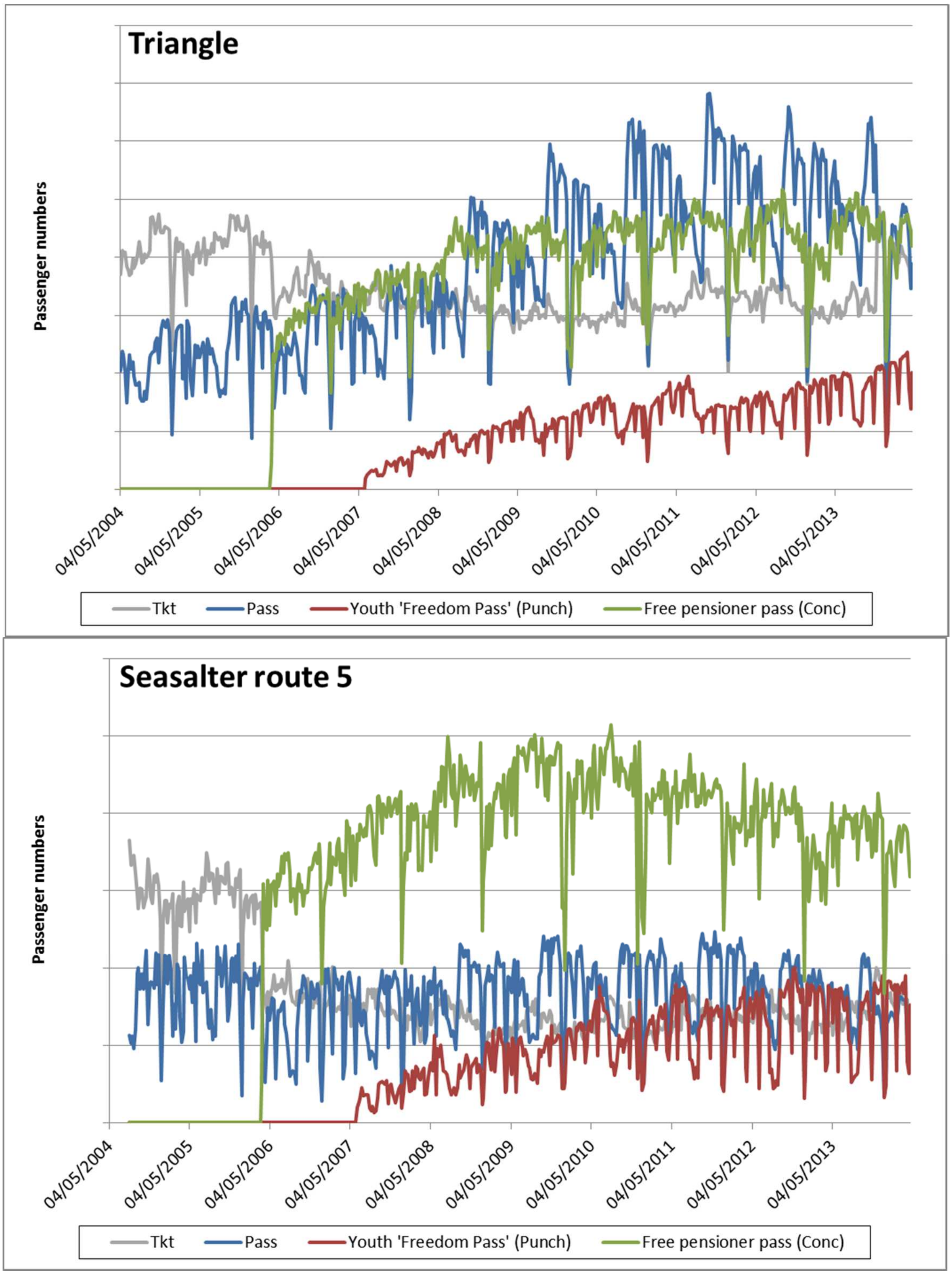


Figure 6.10: Triangle and route 5 weekly passenger numbers showing trends by ticket type



From June 2007 the impact of the introduction of the youth ‘Kent Freedom pass’ is evident. This type of ticket shows a rise above the consequent decrease in paid-for tickets and the ‘pass’ category.

‘Pass’ is a broad category, including not only school pupils’ passes but also weekly tickets, monthly, quarterly and annual season tickets, day returns, and the ‘Unirider’ season ticket for university students. It is this ‘pass’ category that shows the most striking difference between the Triangle and route 5, rising strongly on the Triangle up until mid-2011, whilst the same category remains level on the comparator route.

Stagecoach have indicated that the university student category is large and has grown during this period, but that the numbers of weekly and other period tickets have also grown. The University of Kent at Canterbury introduced a travel plan in 2006 and according to Stagecoach have also reduced their car parking provision on site as they have expanded their buildings across some of the car parking areas.

Since the beginning of 2012 Triangle patronage has held steady, whilst patronage on route 5 has fallen back slightly. 2012 was the year in which Stagecoach reports that it first saw effects of the economic downturn in East Kent.

The revenue-funded improvement from a 15 minute to 10 minute service in 2009 does not correspond to an obvious kink in any of the data trends. However, new patronage tends to build gradually, and the resumption of a rise in passengers from mid-2010 seems likely to be partly or wholly attributable to the upgrade in service frequency. This conclusion is supported by the fact that there is no increase in ridership on route 5 during this period. It is also notable that at this time the main growth category on the Triangle (i.e. the ‘pass’ category) includes various types of regular traveller that are likely to particularly value the better service frequency, and that this category does not increase on route 5.

Because the comparator route 5 does not serve the university, a question remains about the relative amounts of influence of the bus improvement and the university’s policies on travel planning, car parking and site development. The university has nearly 18,000 students and staff on its Canterbury campus[29], but only a proportion of these live in places served by the Triangle, and Stagecoach operate a dedicated ‘Unibus’ running every 8 minutes to the campus from the city centre. It is therefore not likely that the 15,000 extra weekly trips in the ‘Pass’ category since 2006 can be entirely attributed to changes at the university.

6.6 Interdependence of capital and revenue expenditure

A Stagecoach customer survey on the Triangle route in November 2010 indicated that 78% of users had access to a car[30]. Although a proportion of these customers may not have travelled at all without the bus service (especially those eligible for free concessionary travel), this figure indicates that the Triangle is probably achieving a relatively high ‘diversion rate’ from car to bus. For these people the high frequency turn-up-and-go service offered by the route is achieving a travel ‘offer’ that is preferable to the car, for some of their trips at least.

The use of revenue funding to achieve high service frequencies with low ‘waiting time penalties’ for users is likely to be critical to this outcome. The bus operator does, however, identify other factors that are also critical, including availability and pricing of car parking in the City of Canterbury. Stagecoach also point to the importance of enforcing parking controls so that illegally parked cars do not block bus priority measures, enabling buses to be time-competitive with cars on certain stretches of congested road. Deployment of revenue funding on enforcement can add to the value of revenue funding for service frequency increases, and to the value of capital expenditure on bus priority measures. It also can avoid the requirement for capital funding of new buses. Stagecoach have had to deploy extra buses to address delays on the Triangle, some of which have resulted from illegal parking (e.g. in Whitstable). Such expenditure is generally incurred by the operator, but as

[29] University of Kent (2011) *University of Kent Canterbury Campus Travel Plan* 2011-15
[30] Stagecoach 2011, *UK Bus Awards Nomination Form* p.4.

these case studies show, the efficient deployment of local authority revenue expenditure and capital expenditure is inter-related to operator expenditure. At the least, such extra costs inevitably work through to fare increases for users on commercial routes such as the Triangle.

The revenue-funded introduction of the youth Freedom Pass has had a clearly discernible effect on peak time traffic flows in East Kent, according to the bus operator. Stagecoach see a virtuous circle in which the Freedom Pass creates freer flows for buses themselves when students are travelling within them rather than in cars around them. Chapter 13 calculates a financial benefit (to traffic in general) from removal of vehicles by the Freedom Pass.

6.7 Conclusions

Key points from the East Kent case study evidence are that:

- Following revenue-funded service frequency upgrades and capital-funded improvements, both the Triangle route and the Diamond route experienced an increase in patronage above that of comparable unimproved routes.
- The overall patronage increases are very large, but attribution of particular increases to specific interventions is difficult because the patronage trends rise steadily without sharp changes.
- For the Triangle, the publicly-funded service frequency upgrade in 2010 was followed by a continued rise in patronage at a time when both the comparator routes were level or declining.
- For the Diamond, the publicly-funded service frequency upgrade in 2006 occurred at the same time as free concessionary fares for pensioners were introduced. It is nevertheless evident that patronage during this period outpaced the comparator routes (which also grew due to concessionary fares).
- The overall context for the patronage growth is a programme of multiple improvements, including both capital and revenue schemes, following the Quality Partnership signed in 2004 between Canterbury City Council and Stagecoach.

7. Case Study 2: Buckinghamshire bus improvements

7.1 Background information

This case study considers a set of bus routes that radiate across Buckinghamshire from its county town, Aylesbury. All the services are operated by Arriva, running to High Wycombe (route 300), Oxford (route 280), Milton Keynes (routes 100, 150) and Watford (route 500). These towns lie at comparable distances from Aylesbury (15-25 miles by road) and are of similar significance as destinations. All the bus routes have some of the characteristics of inter-urban express services. Route 100 was explicitly designed to fulfil this market, but the 280 also caters for many students at the Oxford end of its route and the 300 fulfils an intra-urban function close to High Wycombe and Aylesbury in addition to linking these settlements (and Princes Risborough) together. Routes 300, 280 and 100/150 have received short-term revenue investment to increase service frequency, whereas route 500 has not received similar support and provides a comparator route.

Figure 7.1 shows a schematic timeline of key events in the development of bus routes in Buckinghamshire.

The following sections consider the financial inputs to these bus services and the resulting outputs and outcomes. The data are drawn from Transport for Buckinghamshire's records of bus patronage data, with further information provided by the Team Leader for Transport Systems, whose time in post spans the period of the interventions under consideration.

7.2 Capital spending inputs and outputs

Figure 7.2 shows the annual breakdown of capital expenditure. Since 2009/10 all Aylesbury bus routes have shared an £18.5 million capital investment using funds obtained by the council from the Community Infrastructure Fund. This funded a new bus interchange and information facility in the town centre ('Aylesbury Public Transport Hub'), and equipped buses and bus stops with real time passenger information (RTPI)[31]. The RTPI system has also required revenue funding from the local authority, as detailed in the following section. The RTPI system was introduced gradually, but has been fully operational from 2010 onwards, according to Transport for Buckinghamshire. As well as telling passengers when their buses will arrive, RTPI has greatly improved the punctuality of bus services through providing bus schedulers with much better information about where the buses suffer delays.

The other source of capital investment has been the operator, Arriva, which bought seven new double-deckers for the 280 and six single-deck buses for the 300 at the beginning of 2009, at an advertised cost of £2 million. All these buses were low floor easy access designs, with leather seating in the 280. The Arriva press statement at the time of purchase states that the investment was possible due to (voluntary) partnership working with the council, that had improved bus services, marketed them and grown patronage: *"Together we have improved many local services and have introduced innovative marketing which has led to passenger growth. That passenger growth has now allowed us to re-invest in local bus services."* [32]

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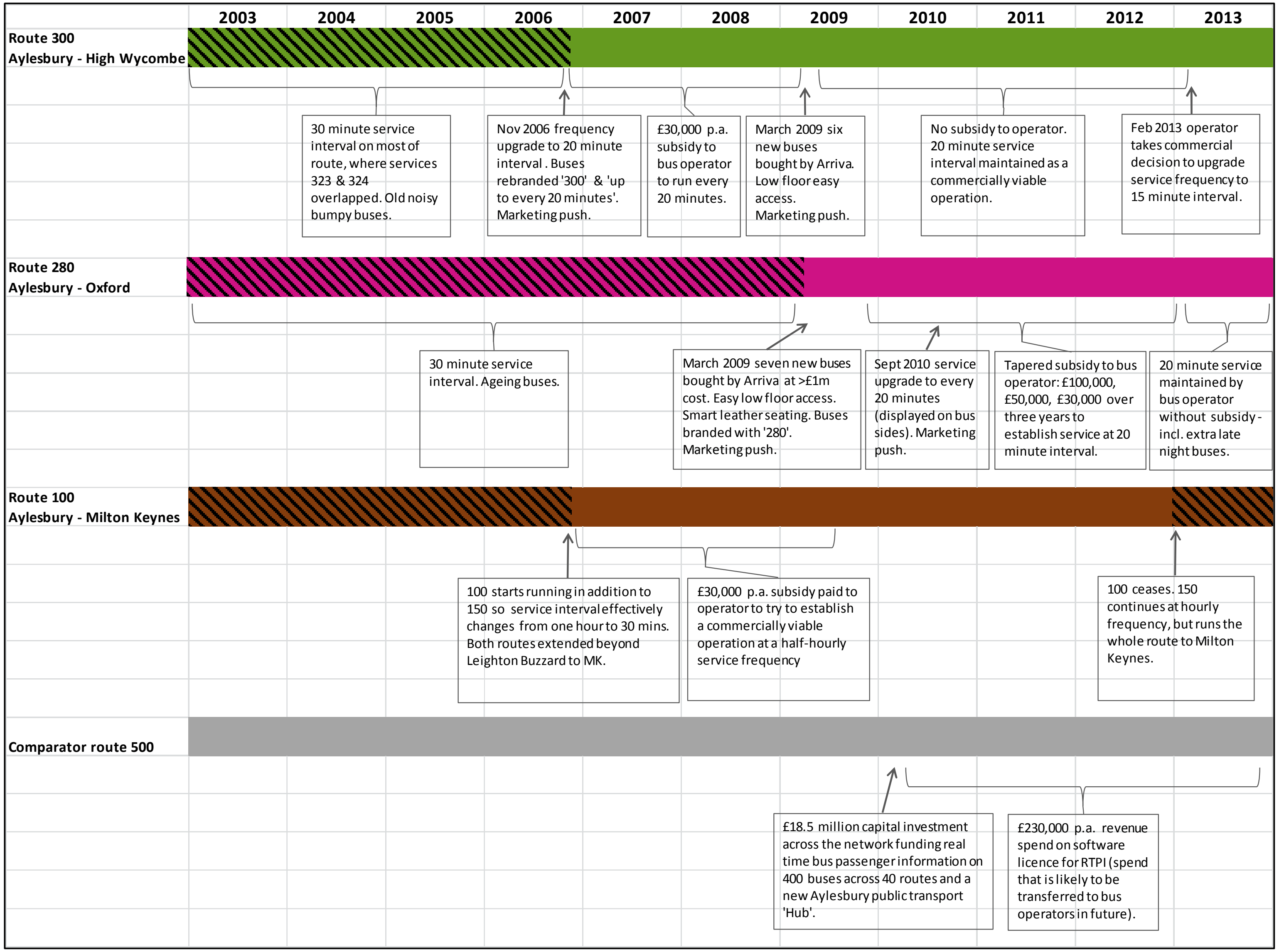
[31] Other works did not directly benefit buses. There was significant spend to build a new pedestrian and cycle bridge across the railway to Southcourt, but no figures have been made available so no deduction has been made in the tabulation in Figure 7.2.

[32] Bucks Herald (2009) *£2m investment for buses in Aylesbury* 20.01.2009. Transport for Buckinghamshire estimates the new buses came into service in March 2009. £2 million is probably an over-estimate of the cost.

Figure 7.1: Schematic timeline showing key events in the development of Buckinghamshire bus routes



7.3 Revenue spending inputs and outputs

Figure 7.2 shows the annual breakdown of revenue expenditure.

The 300, 280 and 150 were running on a commercial basis prior to the council's intervention with revenue funding to upgrade the routes[33].

Route 300 to High Wycombe was the first route to receive funding to increase its service frequency. In November 2006 the service increased from a 30 minute service interval provided by the overlap of two bus routes (323 and 324) to a 20 minute service interval provided by a simplified route (branded 300). This upgrade was supported by payment of £30,000 per year over a three year period from Local Transport Plan revenue funding. The amount was sufficiently small to allow award under *de minimis* rules rather than a tender process[34]. As part of the changes, the existing buses were given 300 branding, with an 'Up to every 20 minutes' strapline. The council specified this as part of a move to a unified branding for all its inter-urban services. In February 2013 the operator decided the patronage uplift was sufficient for the service to be further increased to run commercially every 15 minutes.

£30,000 per year revenue funding was also provided from 2006 in order to start route 100 as an express service to Milton Keynes to complement the existing 150 service. This did not prove successful, for reasons discussed later, and was discontinued at the end of 2012.

Route 280 to Oxford received revenue funding for three years from 2010 to improve the service interval from 30 minutes to 20 minutes. This tranche of funding was tapered as £100,000, £50,000, £30,000 in recognition that the operator would make an up-front investment in new buses. It therefore represents, in part, a deployment of revenue funding to lever in capital investment. Because this is an inter-county service, the funding also involved Oxfordshire, who contributed £30,000 in the first year. The upgraded service was branded in a similar style to the 300. From 2013 it has been taken into Arriva's premier 'Sapphire' branding and given a refurbishment, including features such as WiFi and charging points. Arriva have also taken a commercial decision to put on late night 280 services into Oxford.

A revenue spend of £230,000 per year was required (in addition to the capital expenditure already discussed) to introduce real time passenger information facilities. RTPI was gradually introduced across all of Buckinghamshire from 2009/10 onwards, covering 40 bus routes and about 400 buses. In addition to covering technical support, a large proportion of this money funds software licences. This revenue spend was large because the technology was relatively new and expensive at the time in comparison with more recent GPS technology. It is the council's intention that in future the cost will be borne by the operators, which has become normal practice elsewhere.

No breakdown of marketing spend specific to the routes under consideration is available, but the council estimates that its total marketing spend for bus services stood at £180,000 in 2006/7 and since then has fallen steadily to £80,000 in 2013/14. Transport for Buckinghamshire consider that a corresponding rise in marketing effort by the operator, Arriva, has resulted in the level of marketing outputs remaining fairly constant over the period in question for the routes under consideration.

[33] Excluding some subsidy for evening and weekend services, which is still required, particularly for the 300.
[34] Tender processes are hard to apply to service upgrades on routes which are already commercially viable, because paying other potential operators to run services in competition with the current operator would undermine rather than support the service. But see Greater Bristol case study for an instance of tendering in this situation.

Transport for Buckinghamshire says that it has, in general, sought to use its expenditure on buses to lever marketing effort from the operators.

Dave Roberts, Transport for Buckinghamshire Team Leader of Transport Systems, considers that there was, in general, a strong period of promotion of all bus services from 2006 onwards. The upgrade to the 300 at this time was backed by leafletting of households along the route and town centre events in High Wycombe, Aylesbury and the intermediate town of Princes Risborough. The town centre events included a bus as a focal point and free giveaways, probably including some free tickets. There may also have been additional radio marketing extending over several months. The provision of new buses in 2009 was supported with a similar marketing push. Arriva also backed its recent 'Sapphire' brand refurbishment of the 280 buses with a marketing campaign.

7.4 Relevant factors for the comparator route

Route 500 between Aylesbury and Watford has operated at an unchanged 30 minute frequency throughout the period under consideration and has not received new vehicles during this time. It has had an upgrade similar to the other routes in respect of real time passenger information provision and better interchange facilities at Aylesbury.

Figure 7.2: Inputs and outcomes for Buckinghamshire bus routes

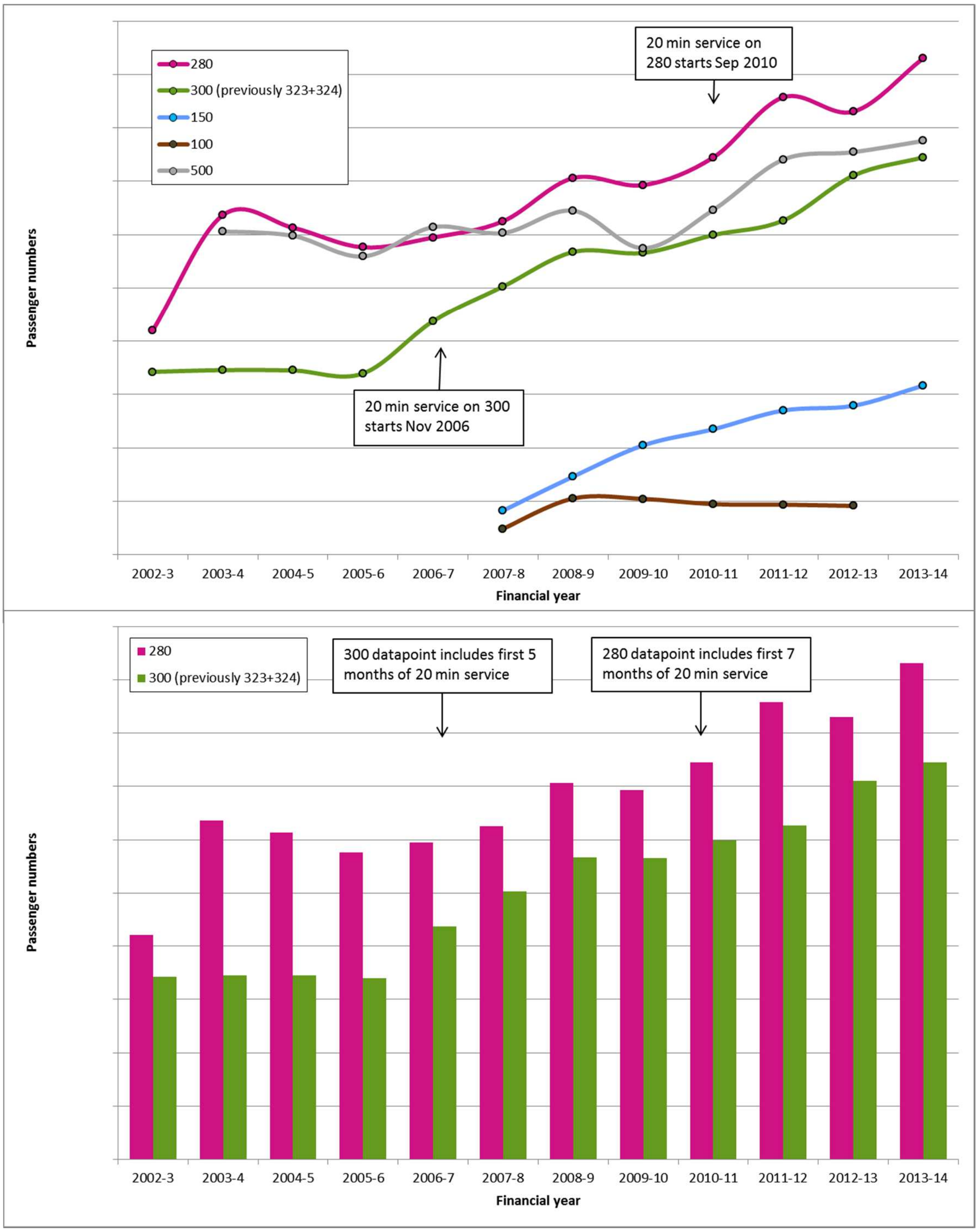
Financial year	2003/4	2004/5	2005/6	2006/7	2007/8	2008/9	2009/10	2010/11	2011/12	2012/13	2013/14
Inputs											
Revenue, LA[+] service subsidy route 300				30,000	30,000	30,000					
Revenue, LA service subsidy route 100				30,000	30,000	30,000					
Revenue, LA service subsidy route 280								100,000	50,000	30,000	
Revenue, LA RTPI[~], 40 routes							230,000	230,000	230,000	230,000	230,000
Revenue, LA marketing, all routes (est.[*])				150,000	140,000	130,000	120,000	110,000	100,000	90,000	80,000
Capital spend, LA, bus station, 40 routes							18,500,000				
Capital spend, LA RTPI, 40 routes[**]											
Capital spend, operator new buses 300						<1,000,000					
Capital spend, operator new buses 280						>1,000,000					
Outcomes											
Indexed patronage[#] 300	1.00	1.00	0.98	1.27	1.45	1.64	1.64	1.73	1.81	2.06	2.16
Indexed patronage 100	n/a[‡]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Indexed patronage 280	1.00	0.96	0.91	0.93	0.98	1.11	1.09	1.17	1.35	1.30	1.46
Indexed patronage 500	1.00	0.99	0.92	1.01	1.00	1.06	0.95	1.07	1.22	1.25	1.28

+ LA is local authority, generally Buckinghamshire County Council, but also Oxfordshire for the 280
~ Real Time Passenger Information
# Indexed to annual total of passengers in 2003/4
‡ 100 did not run until 2006
* £150,000 in 2006, £80,000 in 2013, extrapolated between. But Transport for Buckinghamshire feel Arriva are putting in more so that the overall marketing effort is unchanged.
** Assumed to be included in the £18.5 million expenditure on Aylesbury bus interchange and other works.

7.5 Outcomes from revenue and capital spending

Figures 7.3 to 7.7 show the patronage trends for routes 300, 280 and 100/150, alongside the trend for the comparator route 500.

Figure 7.3: Annual passenger numbers in absolute terms



For commercial confidentiality all numbers have been removed from the patronage axis in this and other figures, but the representation of the relationship between levels of patronage on the case study routes and the comparator route and the extent of growth above baseline is accurate.

Figure 7.4: Annual passenger numbers indexed to 2003/4

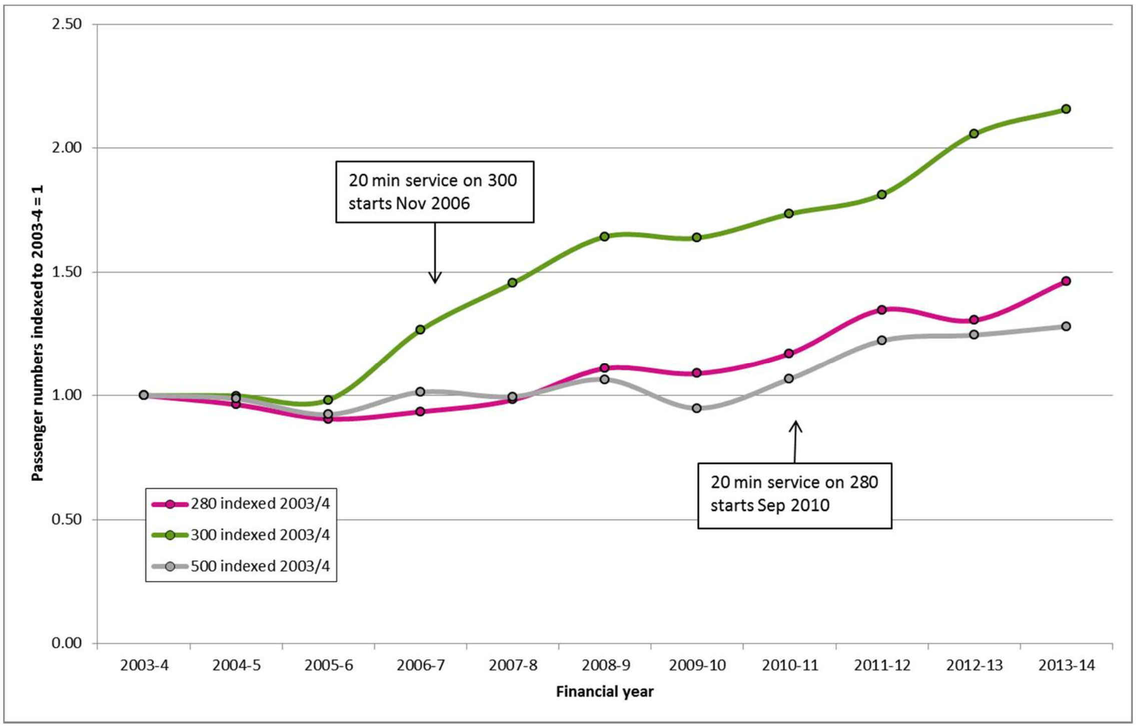


Figure 7.5: Annual passenger numbers indexed to 2008/9

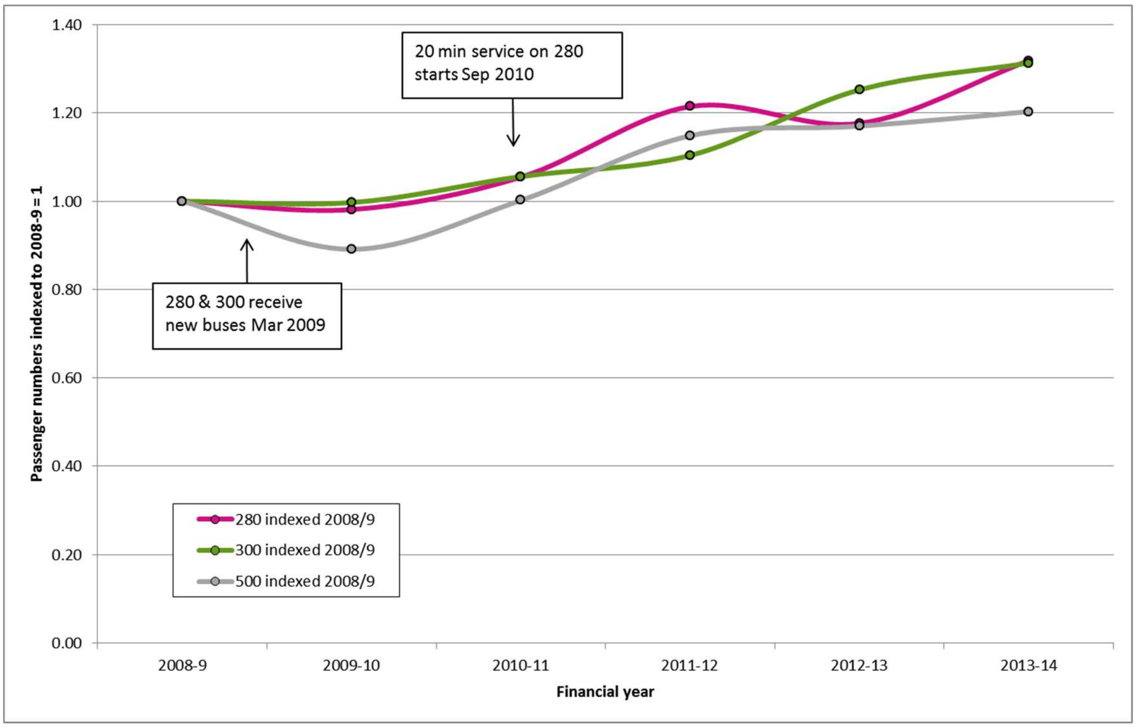
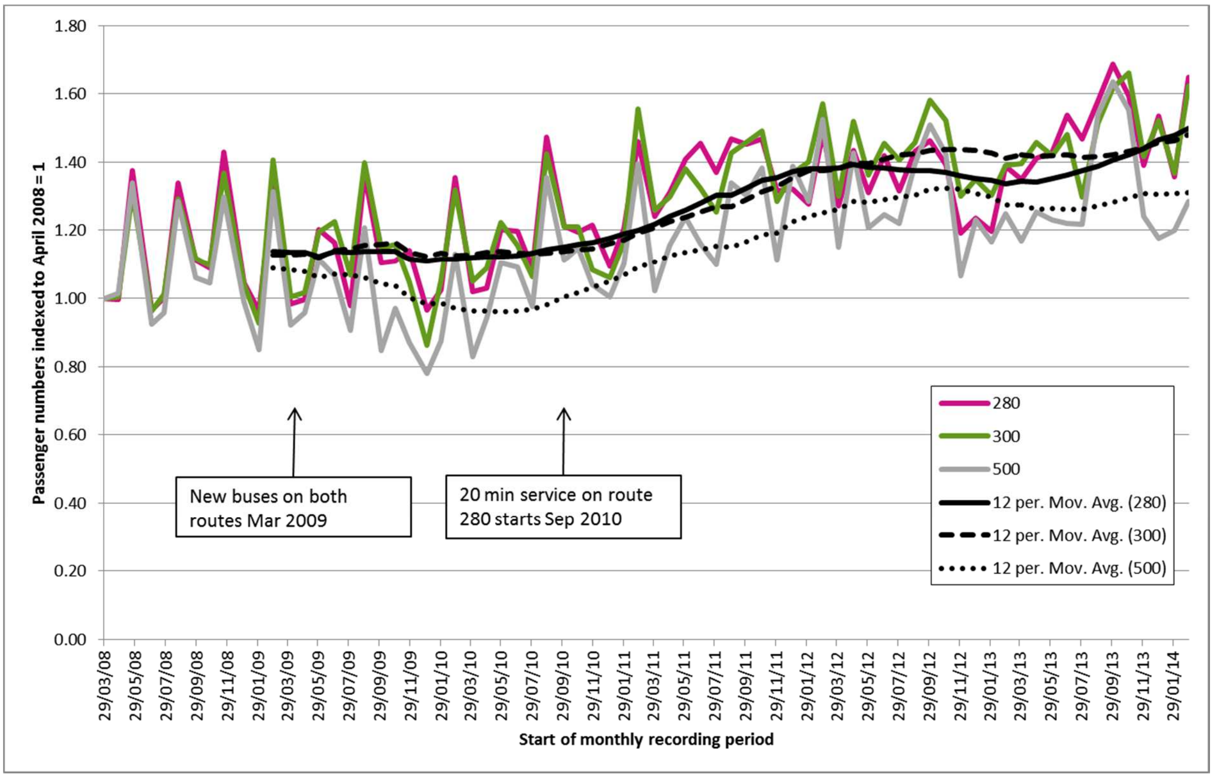


Figure 7.6: Detail of monthly passenger numbers indexed to April 2008



Route 300

For the 300 route, the annual patronage trends (Figures 7.3 and 7.4) show a sharp increase in 2006/7. The simplification of this route to a single branding, and frequency increase from two to three per hour, took place in November 2006.

However, more detailed monthly information (not graphed here) shows that the rise in patronage started about six months earlier, close to the time that free concessionary travel for older people was introduced in April 2006. Evidence from the Kent case study, where a breakdown of ticket types is available, shows the rise in concessions continuing from 2006/7 until the middle of 2008/9 and accounting for about half of the patronage rise seen over that period, so this is potentially a very significant conflating factor. However, both the 500 and 280 were unimproved during this period and show a level patronage trend. Transport for Buckinghamshire are not aware of any obvious reason that the 500 should not be a legitimate comparator with regard to concessionary fares, but do advise that the heavy student loading on the 280 could have masked concessionary fare use.

The available aggregated data therefore leads to the tentative conclusion that the service upgrade to the 300 did result in significant patronage uplift, with a marked rise relative to other similar routes, but that an unknown proportion of this rise is likely to be attributable to the advent of free concessionary travel for older people.

Route 100

2006 was also the year that the 100 express service was started with support from revenue funding. Figure 7.3 shows this rising for its first two years, but thereafter plateauing then falling slightly. The service was continued by Arriva after the period of subsidy but was eventually discontinued in 2013. This lack of growth is in marked contrast to the success of the 300.

Transport for Buckinghamshire attribute the failure of this route to three issues. Firstly the express was routed via the Stoke Hammond bypass, which also entails missing the substantial settlement of

Leighton Buzzard midway between Aylesbury and Milton Keynes. Secondly the service frequency did not reach the 20 minute interval that the other two improved bus routes have achieved (and for the 100/150, the 30 minute interval only applied to users not wishing to go to Leighton Buzzard). Thirdly, although marketed as an 'express' it took over one hour for a trip that takes ½ hour by car.

It is notable that the 150 via Leighton Buzzard achieved strong growth during the period the 100 was running, when it might have been expected to see depressed growth due to competition from the partly-parallel 100. In retrospect, boosting the 150 to a half-hourly frequency might have been a better use of the subsidy, although it is also notable that the uplift on the 150 the year after the 100 ceased operation is only sufficient to account for transfer of about half of the route 100 passengers, implying that there was indeed a market for an express route through to Milton Keynes.

Route 280
The patronage trends for route 280 in Figures 7.4, 7.5 and 7.6 do not show any dramatic deflections at the point of introduction of each of the revenue or capital funded interventions. There is no immediate deflection after route 280 received new buses at the beginning of the 2009/10 financial year (at which time the 300 buses were also renewed). But there is a subtle upward deflection by September 2010 after the 280 service frequency was improved from 30 minutes to 20 minutes.

There is also an overall rise in patronage during the following years, which is noteworthy in light of the increasingly recessional climate at the time. According to Transport for Buckinghamshire, the economic conditions started to have a noticeable effect on bus patronage from early 2009, but with most impact on shorter bus trips, rather than the inter-urban routes (a difference it tentatively attributes, in the absence of supporting evidence, to the possibility of passengers switching to walking for some of those trips).

The rise in 280 patronage generally outpaces the rise in the 500 comparator route. However, over the period from 2008/9 to 2013/14, the increase in patronage on the 280 is fairly similar to the rise on the 300 (which, over this time period, had no interventions and is hence effectively a second comparator). By the end of the period from 2008/9 to 2013/14, on an indexed basis, both the 280 and the 300 achieved an indexed rise of slightly over 150% of the indexed rise in the comparator route (i.e. +130% compared to +120%). Transport for Buckinghamshire note that a substantial proportion of the rise in patronage has been towards the Oxford end of the route.

7.6 Interdependence of revenue funding and bus company capital investment

Dave Roberts, Transport for Buckinghamshire Team Leader of Transport Systems, made the point that bus operators are traditionally risk-averse. Without intervention to break the catch-22 situation no-more-investment-no-more-patronage, it is very difficult for local bus managers to make the case that their routes are worth investment in better buses (and still more difficult outside the big urban areas). He considered that upfront revenue investment of the type used in Buckinghamshire can create a virtuous circle. That is, the council helps cover the financial risk of increasing service frequency (and helps market it); the result is a demonstrable rise in patronage; and the local bus manager can take this evidence to the company board to make the case that there is a well-positioned product that should yield more income if the company were to further improve it with investment in new buses.

This virtuous circle appears to have been the sequence of events for the 300. However, in the case of the 280 the route was already showing a rise in patronage at the time of purchase of the new buses, and the service upgrade took place subsequently. Transport for Buckinghamshire note that new buses were required to meet emissions standards in Oxford, where pollution problems have been severe, but the purchase also appears to have partly resulted from the perceived success of the 300 service upgrade and in anticipation of benefits from the planned investment in bus infrastructure and real time passenger information.

According to Dave Roberts, the council's subsidy of around £30,000 per year would almost certainly not have completely covered the operator's additional costs of deploying the required extra vehicles and staff to increase the service frequency (before any possible costs of new vehicles are considered), so the operator is also carrying some of the risk.

Dave Roberts also felt that a 20 minute service interval is an important threshold for the kind of inter-urban services under consideration. Under these conditions, with "attractors at either end", a 20 minute inter-urban service appears acceptable to users, whereas a 30 minute service requires users to aim for a particular bus rather than just turn up at the stop.

7.7 Conclusions

Key points from the Buckinghamshire case study evidence are that:

- Revenue-funded service frequency upgrades and capital-funded improvements appear to have led to patronage increases on two existing commercial routes, route 280 (to Oxford) and route 300 (to High Wycombe).
- Deviations in the patronage trends are subtle so it is not possible to associate patronage uplift at particular times with timing of specific revenue or capital interventions, but the overall effect of both is to lift patronage on these services significantly above that on the comparator route.
- The attempt to kick-start a completely new express commuter bus, route 100 to Milton Keynes, was not successful, either because the commuter market identified was insufficiently large or, more probably, because the offer was insufficiently frequent and fast to attract more commuters who also had an option to drive.

The benefits, costs and value for money of the interventions on routes 280 and 300 are considered further in Chapter 13.

8. Case Study 3: Greater Bristol bus improvements

8.1 Background information

This case study considers two bus routes that serve Bristol and its wider travel-to-work area in North Somerset. In recent years both routes have undergone service frequency upgrades using revenue funding from the Local Sustainable Transport Fund (LSTF).

The X1, operated by First Group, is an express bus between Bristol and Weston-super-Mare, 20 miles to the southwest. The X2 and X3 express[35] bus services, also run by First, connect Bristol to Portishead, 10 miles to the west, and are treated as a single route for the purposes of this analysis since they overlap for most of their routes.

Although LSTF funding is recent, two complete years of patronage data are now available for the X1, which was an early recipient of money from a 'Key Component' bid. The upgrade to the X2/3, although starting later, nevertheless shows a sufficiently sharp patronage change that an initial evaluation can be made at this stage.

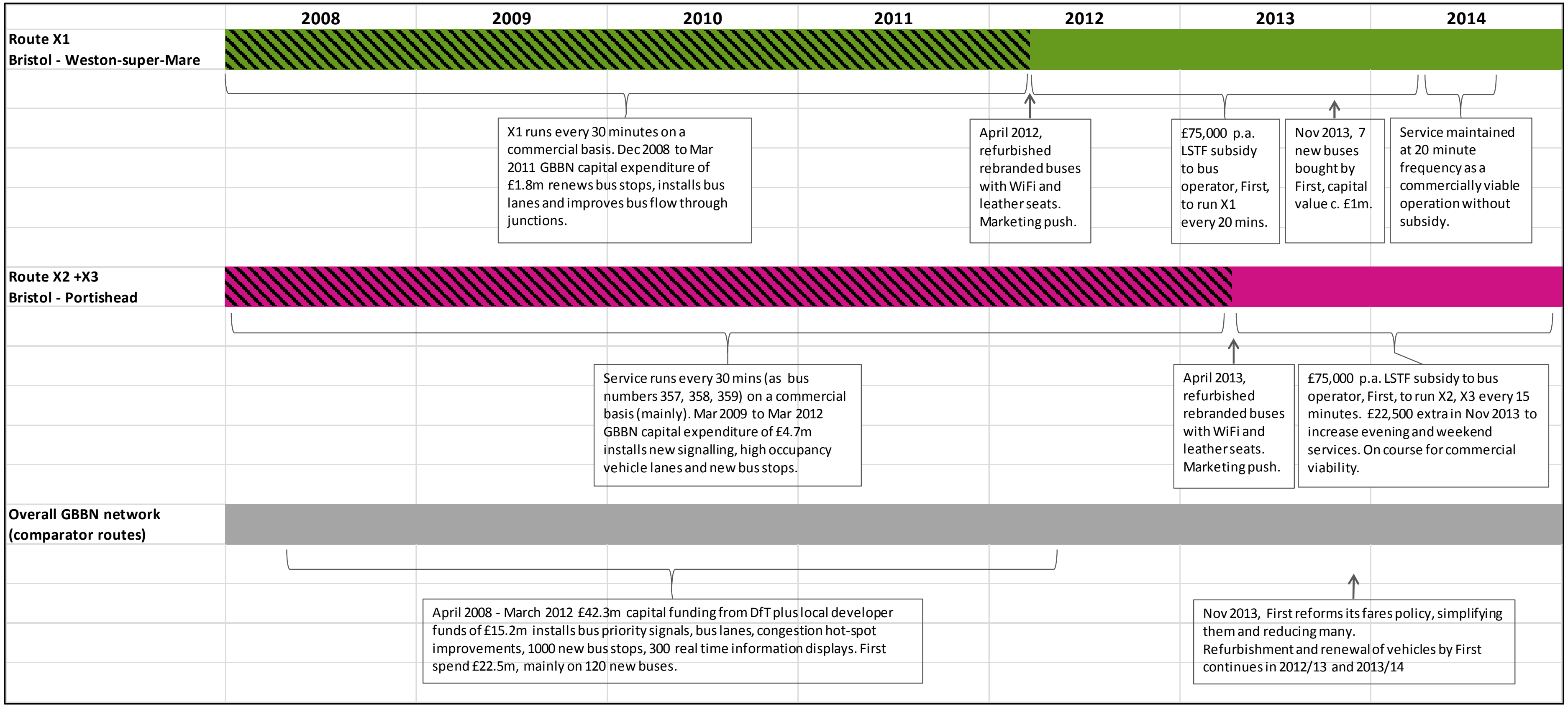
These buses operate for some of their route on corridors that, in previous years, were designated as part of the 'Greater Bristol Bus Network' (GBBN), which received a programme of capital expenditure on infrastructure improvements. The GBBN covers a large number of routes on 10 corridors, so the aggregated patronage figures for all GBBN bus services can serve as a comparator against which the performance of services that have also received dedicated revenue support can be calibrated.

Figure 8.1 shows a schematic timeline of key events in the development of bus routes in the Greater Bristol area.

The following sections consider the financial inputs to these bus services and the resulting outputs and outcomes. The data are drawn from records of bus patronage held by North Somerset Council. Further information has been provided by North Somerset Council Local Sustainable Transport Fund Public Transport Project Manager and Bristol City Council Public Transport Project Manager.

[35] Only the X1 is a limited-stop service. The X-branding, which is particularly aimed at commuters, promotes the quality of the service and the on-board experience as much as the speed.

Figure 8.1: Schematic timeline showing key events in the development of Greater Bristol area bus routes



8.2 Capital spending inputs and outputs

This section sets out in detail the capital spending inputs and resulting outputs for the case study routes. Year-by-year capital expenditure for each case study route is then summarised in Figure 8.5.

Spending on the Greater Bristol Bus Network (GBBN) was implemented during the four financial years 2008-9 to 2011-12. In total, £80 million was allocated to the 10 'showcase' bus corridors, comprising £42.3 million grant funding from the Department of Transport, £22.5 million from First and local developer funds of £15.2 million[36]. This expenditure was predominantly for capital measures, although it did also include some marketing initiatives. The main capital outputs included:

- Bus priority signals at junctions that turn green as buses approach
- Bus lanes
- Road widening at key congestion spots
- 1000 improved bus stops with level access, new shelters, new timetable cases
- 300 real time information displays
- 120 new buses (First expenditure)

The bus operators' commitment to the programme was formalised in six Quality Partnership Schemes with the local authorities. Capital expenditure by bus operators, in the form of newer refurbished buses and brand new buses, resulted both from the GBBN funding and from the revenue-funding contracts described in the next section.

Route X1

Capital spend on GBBN infrastructure improvements for the X1 route is shown in Figure 8.2, of which the amounts in brackets are the proportions that North Somerset Council advises are applicable to the X1 rather than being benefits to general traffic or to other bus routes.

Figure 8.2: GBBN capital spend on X1

Date completed	Expenditure	Source	Works implemented
Dec-08	£213,949 £20,847 (60%, £140,878)	DfT Local authority	B3440 Locking Road / New Bristol Road
Mar-09	£98,648 (70%, £69,054)	DfT	M5 J21 Westbound Approach
Mar-10	£184,203 (100%, £184,203)	DfT	A370 Congresbury Bus Lane
Mar-11	£1,315,647 (60%, £789,388)	DfT	Bus Stops - A370 North Somerset

Figures in brackets give proportions / amounts applicable to X1

In 2012/13 LSTF capital funding of £69,200 was used to install additional real time information units and associated equipment, of which 65% (£44,980) is estimated to be attributable to the X1 route.

As part of the (revenue-funded) contract for a service frequency upgrade to the X1 in April 2012, First cascaded newer 6-year-old double-deck buses to the route from Plymouth Park and Ride, re-spray-painted with an 'Express Yourself' brand and retrofitted with WiFi and leather seats. These in

[36] The West of England (2014) *Greater Bristol Bus Network Monitoring Report, Technical Report*

turn were replaced in November 2013 with brand new buses. Figures are not available for this purchase, but other First press releases indicate it amounted to a capital spend of about £1 million[37].

A conflating factor for recent patronage data on the X1 is disruption from road construction due to the Weston Transport Package. These works, involving a capital spend of £15 million (£11 million from DfT) took place between April 2013 and December 2013 and for the period considered in this study the disruptive effect of their installation has been to depress patronage. However, these works will in the longer term improve bus flows and facilities, with junction capacity improvements, bus priority measures, widening to accommodate bus lanes and an improved bus interchange at the station. Works at the roundabout for Junction 21 of the M5 are particularly relevant to route X1, which previously was subject to significant delays in considerable congestion at this point.

Routes X2 and X3
Capital spend on GBBN infrastructure improvements for the X2/X3 route is shown in Figure 8.3, of which the amounts in brackets are the proportions that Bristol Council advises are applicable to the X2/X3 rather than being benefits to general traffic or to other bus routes .

Figure 8.3: GBBN capital spend on X2/X3

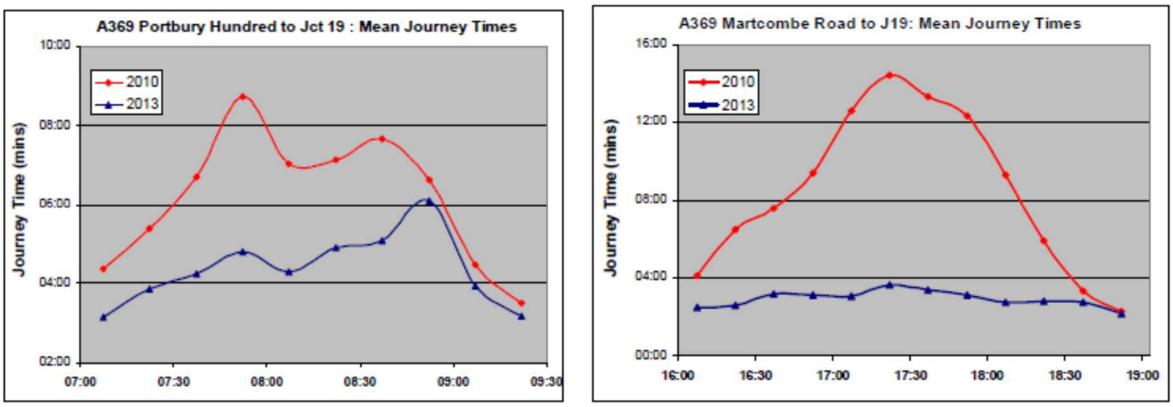
Date completed	Expenditure	Source	Works implemented
Mar-09	£96,583 £1,174 (80%, £78,206)	DfT Local authority	A369 Bridge Road Signals
May-10	£147,328 (100%, £147,328)	DfT	A369 Beggar Bush Lane High Occupancy Vehicle Lane
Mar-12	£678,879 (80%, £543,103)	DfT	Bus Stops - A369 North Somerset
Mar-12	£2,658,855 £642,090 £510,000 (10%, £381,095)	DfT Local authority Section 106 funding	St Georges Hill / Portbury High Street High Occupancy Vehicle Lane (approaches to M5 Junction 19 roundabout)

Figures in brackets give proportions / amounts applicable to X2/X3

The major works in March 2012 on the approaches to the M5 Junction 19 roundabout cut morning peak transit times across that obstruction by about 2-3 minutes during all of the morning peak hour and 5-10 minutes during the evening peak hour (Figure 8.4). North Somerset Council considers that these improvements partially worked through to changes in the X2/3 timetabled peak journey times. They also report that First advised that upgrading the service frequency would not be a viable proposition without these junction improvements.

[37] First (2014) *Investment in services combined with fare cuts has positive impact* press release 06 June 2014 notes ‘in 2013/14 First spent £7.4m on 48 brand new buses for the West of England’, i.e. c.£150,000 each.

Figure 8.4: Peak journey time reductions across the congested J19 roundabout, X2/3 corridor



Figures reproduced from North Somerset Council (2014) *Submission to National Transport Awards*

In 2012/13 LSTF capital funding of £27,800 was used to install additional real time information units along the route, of which 80% (£22,240) is estimated to be attributable to the X2/3 route.

The X2 and X3 did not initially receive brand new buses, but were provided with better quality single-deck buses equipped with WiFi and leather seats. These were rebranded with the 'Express Yourself' livery adopted for all the First express routes. In August 2014 the operator allocated brand new buses to the route.

8.3 Revenue spending inputs and outputs

This section sets out in detail the revenue spending inputs and resulting outputs for the case study routes. Year-by-year revenue expenditure for each case study route is then summarised in Figure 8.5.

The X1 was running without council subsidy prior to the council's intervention with revenue funding to upgrade the route. For the X2 and X3 routes the situation was a little more complex. The revenue funding resulted in these routes forming by amalgamation and modification of three preceding services, routes 357, 358 and 359. Of these the last two were commercial but the 357 received subsidy from a Section 106 agreement. Some weekend and evening services also received support.

Route X1

Route X1 was the first route to receive revenue funding to increase its service frequency. From April 2012, £150,000 from the Local Sustainable Transport Fund was used to increase the X1 service frequency from 30 minutes to 20 minutes. This improvement was tendered as a fixed-price 'what can you offer' contract covering the subsequent two years of operation (i.e. £75,000 per year revenue expenditure). Ten bids were received and were of good quality. First, the incumbent operator, won by a narrow margin. In addition to increasing the service frequency, and increasing the number of vehicles from 4 to 7 to enable the frequency upgrade, First also re-branded the route and deployed better buses, as described in the previous section.

The X1 upgrade was marketed by First with a mail drop to 26,000 homes along the route, offering a free taster journey, and later with a promotion targeted at commuters. Expenditure figures for the First marketing campaign are not available but, from these indications of its scale it appears likely to have amounted to a multiple of North Somerset Council's expenditure to market the X1, which was recorded as £5000 (LSTF) plus staff time to the value of £1000.

The operator has continued to run route X1 at a 20 minute interval on a commercial basis since the subsidy came to an end.

Routes X2 and X3
The frequency of the X2/X3 route was doubled to a 15 minute service interval from April 2013 (compared with their predecessor services 357, 358 and 359) using £150,000 LSTF revenue funding, provided on a similar basis to the previous year's contract for the X1. This revenue funding resulted in a capital contribution from First in the form of newer refurbished buses in the higher numbers necessary to support the frequency increase, as described in the previous section. The local authority provided a further £22,500 in November 2013 to add extra evening and weekend services. First undertook to run the service for a year beyond the contract period, a commitment estimated by the North Somerset Council to be equivalent to £75,000 of further revenue funding. Similarly First are estimated to have contributed an equivalent of £49,500 revenue funding to the later extended operation during evenings and weekends.

Further revenue funding with LSTF monies paid for marketing campaigns in 2012/13 and 2013/14, amounting to £8,500 and £11,500 respectively, plus a local authority revenue spend on staff time dedicated to marketing of £1,700 in each year. First also undertook marketing activities, for which no figures are available.

According to the GBBN Monitoring Report[38], 'the service is showing signs that it will be commercially viable in the longer term'. North Somerset Council report that the operator has just purchased brand new buses for the route, which appears to indicate that it is judged to be commercially viable at the new frequency. Peak-time buses are carrying standing passengers and off-peak services are also busy.

8.4 Relevant factors for the comparator routes

In broad terms, capital expenditure on the Greater Bristol Bus Network appears likely to have had a similar effect on other bus corridors to its impact on the two corridors used by the X1 and X2/X3 services. In this respect it is reasonable to treat patronage trends for the whole GBBN network as a comparator for the routes under consideration.

Patronage data from First has been made available for the whole GBBN network. Other operators account for a very small minority of services, so the First data provides a good representation of patronage trends across the whole network. Patronage on the X1 and X2/X3 has been subtracted to provide a comparator trend independent of those routes.

The GBBN Monitoring Report shows patronage on First services grew on most GBBN corridors from 2008/9 to 2013/14. However, for the purpose of comparison with the case study routes the overall GBBN trend should be considered to have been somewhat depressed by local conditions that caused one corridor to record an anomalous decline in First patronage over this period. The decline is attributed to two issues specific to this corridor: competitor services run by Abus and major disruption from 2012 onwards due to the redevelopment of Keynsham town centre.

Although the comparator trend can be taken as generally reflective of capital investment in GBBN rather than revenue funding to support service frequencies, it should be noted that there have been other service improvements on the GBBN in addition to those on the case study routes. Some of these improvements have arisen from commercial decisions by operators, at least one of which appears directly attributable to the GBBN traffic flow improvements resulting in time-savings and

[38] The West of England (2014) *Greater Bristol Bus Network Monitoring Report, Technical Report* p.14

reliability improvements that allowed a better service to be run without adding many more vehicles. One new bus service has arisen as a result of funding from a property developer[39].

In November 2013, First reformed its fares policy, reducing many fares. It estimates this change delivered 9% of the 15% uplift in patronage it experienced in the year to May 2014[40].

[39] The West of England (2014) *Greater Bristol Bus Network Monitoring Report, Technical Report* pp.7,8,9.
[40] First (2014) *Investment in services combined with fare cuts has positive impact* press release 06 June 2014

Figure 8.5: Inputs and outcomes for Greater Bristol bus routes

Financial year	2008/9	2009/10	2010/11	2011/12	2012/13	2013/14
Inputs						
Revenue, LA+ service subsidy, route X1					75,000	75,000
Revenue, LA service subsidy, route X2/X3						75,000
Revenue, LA marketing, route X1					6,000	
Revenue, LA marketing, route X2/3					10,200	13,200
Capital spend, LA, route X1	209,932	184,200	789,388		44,980	
Capital spend, LA, route X2/X3	78,206		147,300	924,198	22,240	
Capital spend, operator, refurb/new buses, X1					(refurb)‡	1,000,000
Capital spend, operator, refurb/new buses, X2/X3						(refurb)‡
Outcomes						
Indexed patronage# X1	1.00	0.90	0.89	0.92	1.05	1.17
Indexed patronage X2+X3	1.00	1.00	1.06	1.09	1.10	1.42
Indexed patronage GBBN (First only, minus X1,2,3)	1.00	1.04	1.11	1.16	1.10	1.15

+ LA is local authority: North Somerset Council
# Indexed to annual total of passengers in 2008/9
‡Operator known to have incurred refurbishment costs in these years, but level of expenditure is not known

8.5 Outcomes from revenue and capital spending

Figure 8.6 shows quarterly patronage trends for X1 and X2/X3 routes in absolute terms (with numbers on y-axis removed for commercial confidentiality). Figure 8.7 shows the quarterly data indexed to Q1 2008/9 (i.e. April-June 2008) so that comparison can be made with the rest of the GBBN. (Note that the comparator figures are annual rather than quarterly).

Figure 8.6: Quarterly passenger numbers for X1 and X2 + X3 in absolute terms

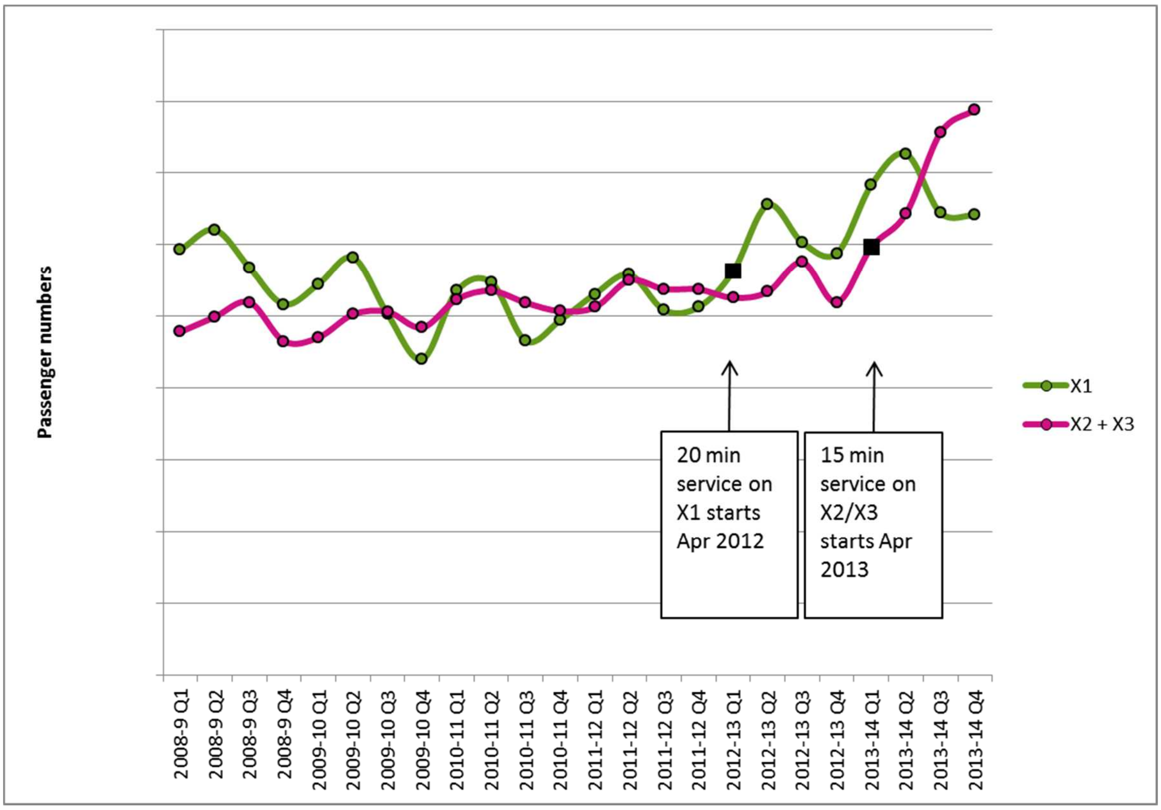
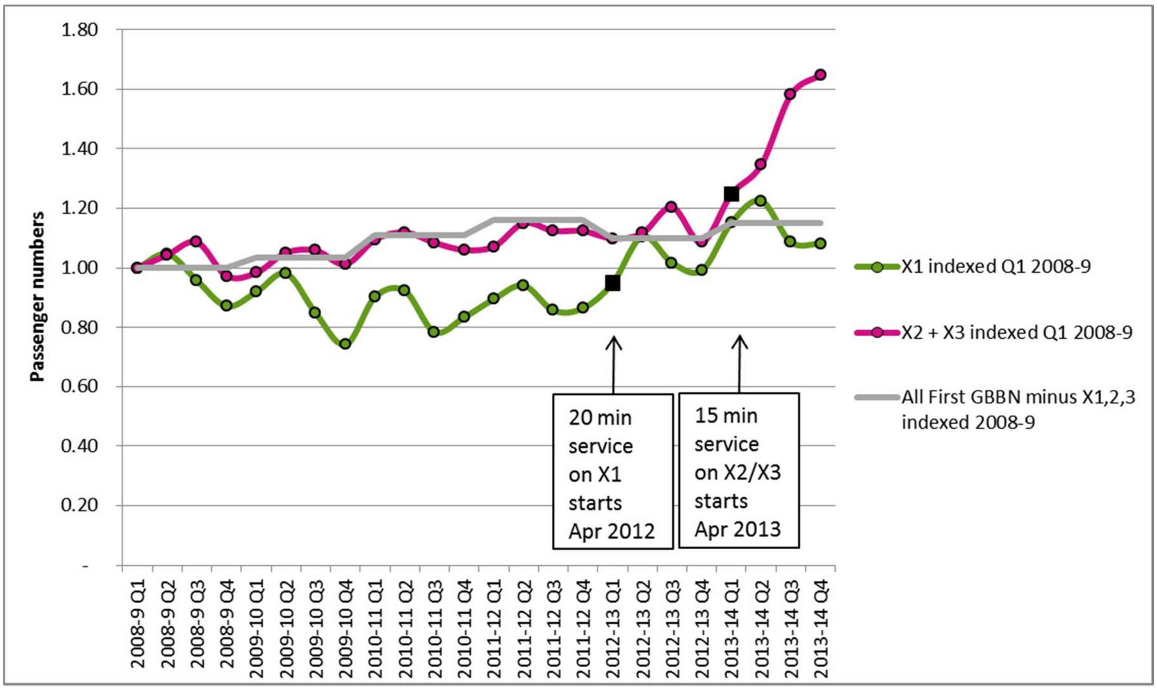


Figure 8.7: Annual passenger numbers for X1, X2 + X3 and GBBN, indexed



Route X1
Patronage on route X1 appears to show a marked seasonal influence. After making allowance for these fluctuations the general trend is of a decline during 2008/9 and 2009/10 then more stable patronage until the upgrade in service frequency at the beginning of the 2012/13 financial year (although arguably the two quarters prior to the intervention are beginning to show signs of improved patronage). After the service upgrade, patronage rises significantly, albeit still with a pronounced seasonal pattern.

At the point of the April 2012 service improvement, the X2/X3 routes remain unimproved and offer a comparison curve. For the two years before this point patronage on the X1 and patronage on the X2/X3 have largely been level-pegging, but with the service change the X1 shows a marked departure.

On the basis of annual average patronage numbers (as given in indexed form in Figure 8.5) the financial year 2013/14 shows a patronage increase of 30% from the 2010/11 – 2011/12 plateau period (i.e. 1.17 compared to 0.89-0.92). This increase was despite major roadworks taking place as part of the Weston Transport Package between April 2013 and December 2013, which North Somerset LSTF officer describes as having ‘a significant impact on services’.

Route X2/X3
Seasonal effects on the X2/X3 route are not so strong. Once these are discounted the patronage trend shows a gradual improvement from 2009/10. The indexed graph shows that this rise closely resembles the pattern for the comparator routes of the GBBN network as a whole. However, with the doubling of service frequency in April 2013 the patronage curve rises away from the comparator routes.

On the basis of annual figures (as given in indexed form in Figure 8.5) patronage in 2013/14 is 29% above 2012/13 (i.e. 1.42 compared to 1.10). Although only representing a single year of data, this rise shows a clear departure from previous trends. The GBBN Monitoring Report noted that ‘the service is showing signs that it will be commercially viable in the longer term’, and local authority officers consider that the operator’s commercial decision in August 2014 to buy brand new buses for the route tends to confirm that sufficient patronage has been achieved for continuation of the higher service frequency on a purely commercial basis.

8.6 Interdependence of capital and revenue expenditure

An interdependency between capital and revenue expenditure is illustrated by route X2/3. For this route, the operator, First, indicated to the council that it would be unfeasible to increase the service frequency unless highway works were first undertaken to reduce delays caused by traffic congestion. Delays around the roundabout serving Junction 19 of the M5 could, at worst, result in buses being stuck in queues of cars for 15-20 minutes. These delays and unreliability would have necessitated extra buses to support a higher frequency service, rendering it uneconomic (as well as making the route less attractive to users and harder to market).

8.7 Conclusions

Key points from the Greater Bristol case study are that:

- Revenue funding to increase service frequencies on the X1 and X2/3 appears to have resulted in sharp increases in patronage on both routes immediately after the upgrades were instituted. Both routes now appear commercially viable at the higher service frequency.

- The service upgrade on the X2/3 is known to have required preceding capital spend to alleviate congestion. Significant capital spending was also deployed to improve the X1 route. Although the congestion problems on this corridor were apparently not so critical for the service upgrade it is notable that subsequent works have been undertaken to contend with the worst remaining congestion point.

The benefits, costs and value for money of investment on the X1 and X2/3 routes are discussed further in Chapter 13.

9. Case Study 4: New Forest Tour

9.1 Background information

The New Forest Tour is an example of use of capital and revenue expenditure to kick-start a commercially viable bus offer in a rural area, for visitors to a National Park. It comprises three scenic circular bus services in the New Forest National Park, operated by the Go-Ahead Group using open-top double-decker buses. The first of the three routes was launched in 2004, a year before the area was designated a National Park, backed by local authority subsidy. The aim was to provide the area's several million visitors[41] with a 'car free alternative', whilst also adding additional bus links for local users[42].

Figure 9.1: Map of the three New Forest Tour circular routes; Green route bus in operation[43]

In its first two years the service used old buses and had relatively little marketing. Despite frequent mechanical problems and delays it was sufficiently successful to justify a major upgrade in 2006. This upgrade was enabled[44] by local authority capital spending to obtain newer buses, and revenue spending at a higher level to subsidise the enhanced service. In addition the National Park Authority committed officer time to promote the Tour. This officer also developed advertising income for the Tour, by selling advertising to tourist attractions along the Tour route, for which its day ticket provided visitors with an hourly 'hop-on-hop-off' service.

Growth in the popularity of the Tour was sufficient for a second route to begin in 2011, without requiring operational subsidy. By 2013, the original route was also able to run without operational subsidy. However, a further route was started in 2013, drawing on subsidy from the Local Sustainable Transport Fund.

A schematic timeline of key events in the development of the New Forest Tour is shown in Figure 9.2.

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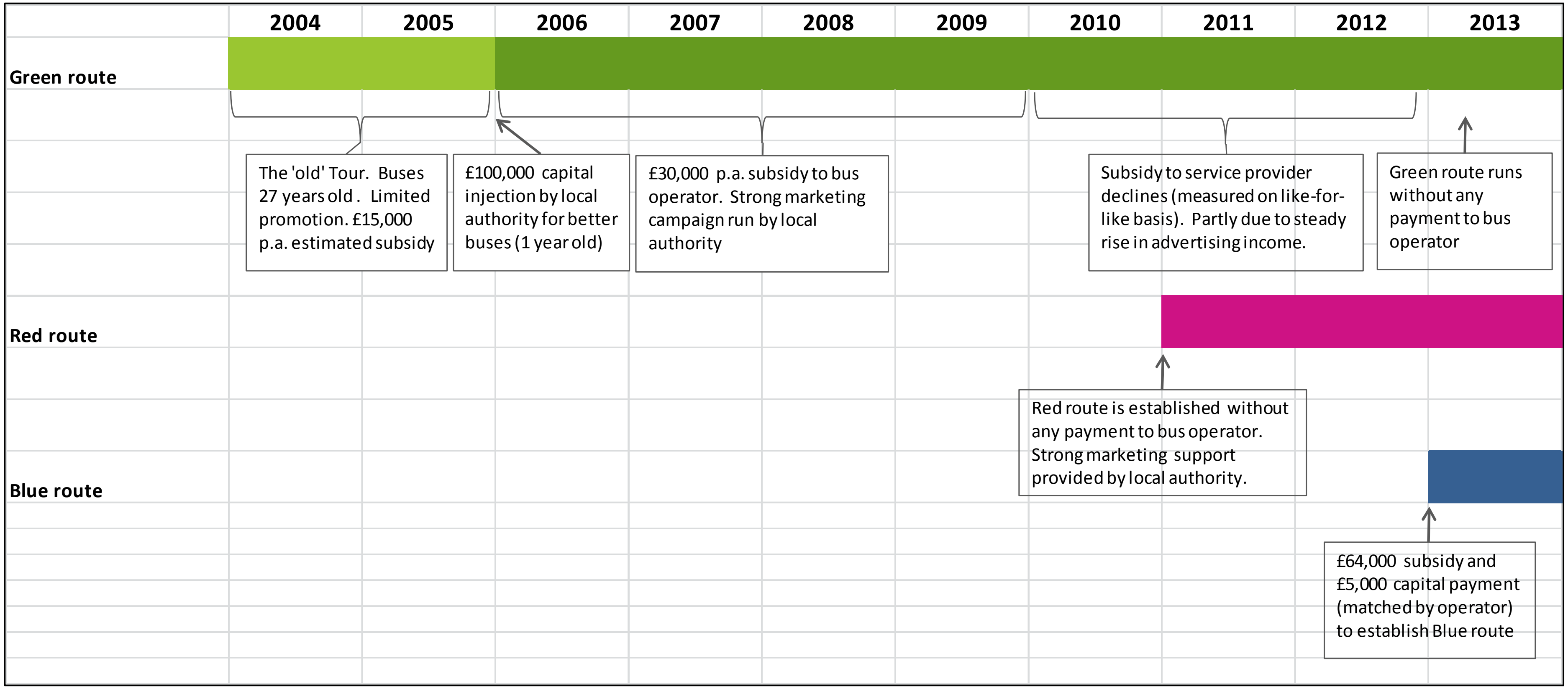
[41] New Forest National Park Authority (2007) *Tourism and Recreation Facts and Figures* reports that the New - Forest has 13.5 million 'visitor days'. -

[42] Hampshire County Council (2006) *The New Forest Tour 2006 Business Case*. -

[43] http://www.thenewforesttour.info/ -

[44] Hampshire County Council (2006) *ibid.* states that the Tour would cease without new buses, because it could - not be marketed with such old unreliable and uncomfortable stock. -

Figure 9.2: Schematic timeline showing key events in the development of the three New Forest Tour routes



The following sections consider the financial inputs to the Tour and the resulting outputs and outcomes. These data are drawn from a large number of internal National Park Authority and council documents, supplemented by information provided by the local authority officers who have been responsible for the Tour since 2007. Only those documents that are likely to be available in the public domain and valuable as sources of further information are specifically referenced.

9.2 Capital spending inputs and outputs

Figure 9.3 shows the annual breakdown of capital expenditure.

The upgrade of the New Forest Tour in 2006 was backed by £100,000 of capital expenditure from Hampshire County Council. This payment was made to the bus operator in return for it agreeing to transfer two one-year-old buses from another operation (Wilts and Dorset, a sister company in the Go Ahead Group), as replacements for the 27-year-old buses previously in use in the New Forest. The operator retained ownership of the buses, but guaranteed they would be used on the New Forest Tour for a minimum of three years, and longer if revenue support continued to be available thereafter or if the operation became commercially viable. Hampshire County Council's allocation of the money was conditional on revenue support for the service being made available by New Forest District Council and New Forest National Park Authority[45].

Although this money was categorised as capital spend, the council notice of the decision indicates that consideration was given as to whether a similar outcome could have been achieved through revenue expenditure. It appears that the council's budgets were such that only capital was readily available. This was argued to be the best-value approach[46]. It is notable, however, that this contrasts with the other bus case studies where revenue funding was used to achieve capital spend on buses by bus operators.

This is the only major item of capital expenditure that the New Forest Tour is recorded as having received. Other smaller items that may have come from capital budgets include Tour-branded flags at bus stops, and £5,000 match-funding of the operator's contribution to livery for the Blue Route when it was established. Funding of £15,000 on a rebuild of the Tour website in 2013 appears to have come from a revenue budget, but arguably could have been categorised as capital spend on the basis that it was investment in marketing infrastructure. Due to the lack of availability of revenue funding, the New Forest National Park Authority has investigated the accountancy case for this approach and the possibility that such investments build up sufficiently long-term value in the brand for it to be considered as investment in an intangible asset[47].

9.3 Revenue spending inputs and outputs

Figure 9.3 shows the annual breakdown of revenue expenditure.

In its first two years the New Forest Tour received operational subsidy from Hampshire County Council[48]. When the service was upgraded in 2006, the National Park Authority and New Forest District Council took over the service subsidy on a 50:50 basis, increasing the support to £30,000 per year, guaranteed to the operator for three years.

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[45] Hampshire County Council (2006) *The New Forest Tour 2006 Business Case.*

[46] Hampshire County Council (2006) *Project Appraisal: Car Free Tourism - New Forest Tour* para. 3.3. -

[47] See http://www.hmrc.gov.uk/manuals/bimmanual/BIM35640.htm -

[48] Hampshire County Council (2006) *Project Appraisal: Car Free Tourism - New Forest Tour* paras. 3.2 & 3.3. The - level of support is not known, but was probably c. £15,000 in view of the £2006 cost of a doubled service. -

The National Park Authority also stepped in with a significant level of marketing support that was then strengthened over the following years. This took the form of staff time from a new Tourism and Transport Officer, who initially deployed a revenue budget for marketing of about £5,000 (with some £3,000 operator contribution in addition)[49]. For most years, only estimated values for marketing spend are now available, but it appears that in general, marketing support increased as the Tour grew, with contributions from 'partners' as well as the National Park Authority. Comprehensive marketing plans were drawn up[50]. A key decision was to position the Tour as a 'unique visitor experience' rather than a bus service and to price it accordingly (2006 prices were £9.00 adult, £4.50 child, £22.50 family).

The main marketing outputs have been as follows:

- Brand and livery specifically designed for the New Forest (2007 onwards).
- Leaflet distribution (2007: 60,000 to 300 locations; rising to 2011: 100,000).
- Dedicated website that offers online ticket sales (2007 onwards; rebuilt 2013 to include video).
- Negotiation of joint marketing with visitor attractions around the routes (2006 onwards).
- Posters/banners at key sites, paid and unpaid adverts in visitor publications and websites.
- Marketing via accommodation providers, including ticket sales (2008 onwards).

Marketing spend has also been used to enhance the product:

- Production of a New Forest Tour Official Guide for all passengers (2007 onwards) which provides a written guide and contains discount vouchers for attractions and services around the route. A feedback form in the Guide has helped improve the Tour.
- Production of a professional recorded commentary (2008 onwards).
- Development of a pack of walking and cycling routes that fit with hopping on and off the Tour - (2006 onwards). -

In addition to these actions, various promotions and pricing options have been introduced to increase patronage, including group tickets and multi-day tickets. Officer time has also been devoted to customer surveys, other market research, media work and, in recent years, bringing in income for the Tour by selling advertising to the visitor attractions that the Tour serves.

After the subsidy agreement came up for renewal in 2009 the level of service subsidy showed a gradual decline. By 2011, the Tour patronage had grown to a level where, given the established level of marketing support, the operator was able to start a second route without subsidy. In 2012 subsidy was used to trial an extended season on the new and old routes. This was not judged to be worth continuing. In 2013 £64,000 was allocated from the Local Sustainable Transport Fund to kick-start a third route. This subsidy will fall in coming years (it will be £43,000 in 2014).

In recent years Hampshire County Council have incurred further revenue spend to facilitate the Tour because trees have had to be cut back along the route to enable the double-decker buses to pass safely.

[49] New Forest National Park Authority *New Forest Tour: 2007 Review* and *New Forest Tour: 2008 Review and Future Funding Arrangements.*
[50] New Forest National Park Authority *The New Forest Tour Product Marketing Plan 2007* and *The New Forest Tour Marketing Action Plan 2008.*

Figure 9.3: Inputs and outcomes for the three New Forest Tour routes

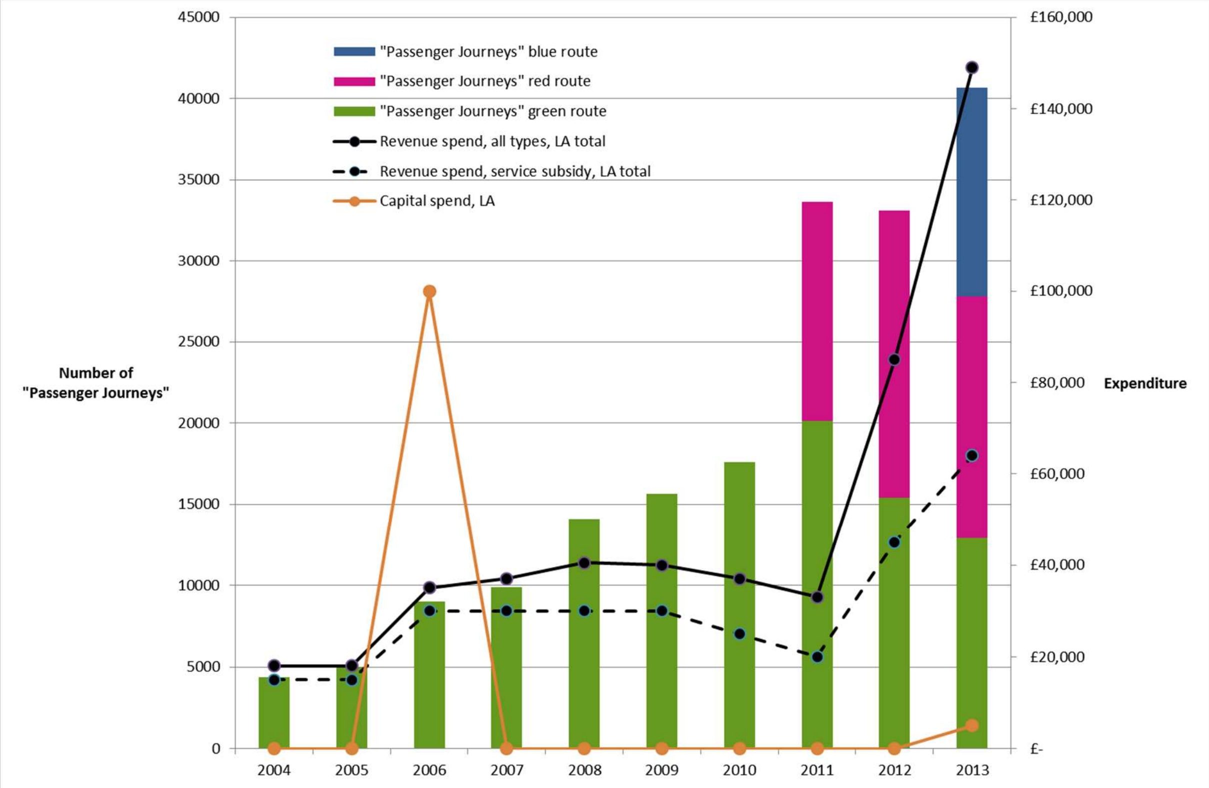
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Inputs										
Revenue, LA service subsidy, Green route+	15,000×	15,000×	30,000	30,000	30,000	30,000	25,000	20,000	33,500‡	(nil)
Revenue, LA service subsidy, Red route							*Red route starts 2011*	(nil)	11,500‡	(nil)
Revenue, LA service subsidy, Blue route									*Blue route starts 2013*	64,000
Revenue, LA marketing (officer estimate)	3,000	3,000	5,000	7,000	10,500	10,000	12,000	13,000	25,000	30,000
Revenue, LA tree cutting									15,000	55,000
Revenue, as LA staff time FTE (officer estimate)~	(nil)	(nil)	0.01	0.2	0.3	0.4	0.5	0.6	0.7	1.3
Revenue, operator, marketing (officer estimate)	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000
Capital, LA			100,000							5,000
Capital, operator										5,000
Outcomes										
Passenger journeys Green route#	4,400	5,005	9,015	9,879	14,103	15,623	17,600	20,127	15,389	12,893
Passenger journeys Red route								13,531	17,698	14,874
Passenger journeys Blue route										12,886
Advertising income*								8,700	14,150	19,000

+ LA **is** local authority**:** New Forest National Park Authority**,** New Forest District Council and Hampshire County Council
× Figures not available for these years, assumed pro rata at half the 2006 level for half the service level
‡ In 2012 £11,500 was provided to Green and Red routes for a trial extension of the 86 day season to 107 days
~ Full Time Equivalent
# 'Passenger journeys' include repeat boardings by passengers who use their day tickets to 'hop-on-hop-off' and are approximately double the number of individual ticket-holders
* This rising trend continues into 2014: as at May 2014 £35,000 of advertising had been sold in advance of the summer season

9.4 Outcomes from revenue and capital spending

The patronage outcomes from expenditure on the New Forest Tour are listed in Figure 9.3. Figure 9.4 shows the main data trends graphically.

Figure 9.4: Capital and revenue inputs and patronage outcomes for the New Forest Tour

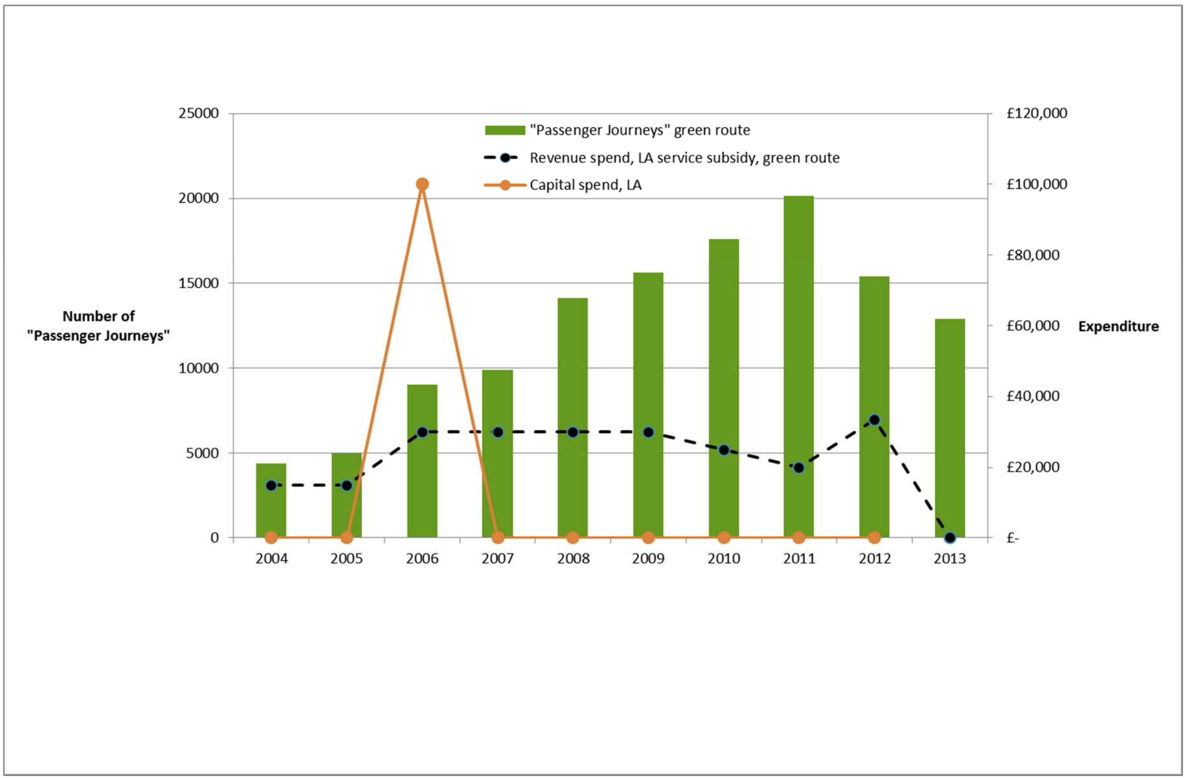


A complete picture of the local authority's revenue support would add the cost of the officer time dedicated to the Tour and would subtract income from advertising. However, these two items now largely offset one another. For 2014, advertising income sold in advance of the summer season was £34,000, a comparable sum to an officer salary, and the New Forest National Park Authority is hopeful that it will be able to use this income as a means to continue funding some or all of the officer time it deploys to support and promote the Tour.

It appears from Figure 9.4 that the introduction of the two new routes, whilst building overall patronage, has drawn away some of the custom on the original Green route. However, viewed in terms of fare income, the Green route has held steady. This route posted a record income in 2013 and received no service subsidy.

Because the financial support for the three routes is aggregated in Figure 9.4, the recent expenditure to kick-start an expansion in the service conceals the removal of service subsidy for the original Green route. Figure 9.5 strips out other factors and shows only the Green route patronage figures and its direct service subsidy. These trends reveal a gradual progression to commercial viability. 'Commercial viability' in this context is still dependent on continued support from the public authorities to cut trees and provide marketing. However, as noted above, the marketing effort is now able to use the size and local profile that the Tour has achieved to significantly offset its costs with advertising income.

Figure 9.5: Capital and revenue inputs and patronage outcomes for the Green route



9.5 Interdependence of capital and revenue expenditure

Hampshire County Council's 2006 Business Case for the Tour states that it would have been discontinued without capital investment for new buses. The old buses were so old, uncomfortable and unreliable that they could not be marketed and were drawing criticism. Moreover, two were required to offer cover breakdowns, so the service was only running at half the frequency that two buses should have been able to provide.

In retrospect, it is evident that there was a (latent) demand for a service like the New Forest Tour. However, in 2006 very few exemplars of a successful operation of this kind existed. The New Forest National Park Authority's 2007 Marketing Plan could only cite one other rural example of an open-top bus tour, the Isle of Wight Open Top Tour, which, like the New Forest Tour, was operated by a company within the Go Ahead Group.

If an operator (and the only likely candidate would have been Go Ahead, with their unique experience from the Isle of Wight) had been prepared to suffer a loss for some years, they could probably have built up the service to a level where fares covered operating costs. However, in addition to the operating costs a significant marketing effort has been required to build up the Tour, requiring a marketing budget and personnel. Potential operators faced a catch-22: higher spend and higher initial annual losses to achieve a quicker route to (possible) profitability; versus lower spend and a longer period of lower annual losses to achieve a slower route to (possible) profitability. Given that the bus industry is traditionally risk averse it is reasonable to assume that neither option would have happened without intervention by the local authorities. Both capital investment (in the form of new buses) and short-term revenue support were required to put the New Forest Tour on a sustainable long-term footing.

One difficulty for the local authorities in developing the business case for this support was that they lacked knowledge of operating costs, which were regarded as commercially sensitive by the operator. This meant that calculations of subsidy requirements had to be based on standard industry rates, and involved quite high uncertainties. Figures for projected and actual fare income in 2006 and 2007 (which cannot be reported here for commercial reasons) suggest that as a result of this uncertainty, the operator may have made significant windfall profits in some years, unless the operating cost was grossly under-estimated. The local authorities would have been better positioned to negotiate the subsidy level if they had had powers that ensured full visibility of the operator's costs under circumstances where public funding was being received, and to write claw-back provisions in contracts to avoid the subsidy becoming a windfall profit for an operator. In practice, achieving this outcome may require powers to contract on a gross cost rather than net cost basis, so that the local authority can receive the fare revenue and pay the operator a fixed fee for providing a service, whatever the ridership turns out to be. This approach would appear logical for other situations like the New Forest Tour where the local authority carries most of the initial risk.

9.6 Conclusions

Key points from the New Forest Tour case study are that:

- Local authority capital funding for new buses enabled the Tour to continue.
- A higher level of short-term revenue funding could probably have achieved the same effect as the capital spending (as in the other bus case studies) by covering a proportion of the operator's risk in deploying newer stock to the route.
- Revenue funding was required in addition to the capital funding to support operating costs in - early years and to market the improved services. -
- The combined funding resulted in a rapid build-up of patronage, to the extent that the operator made a commercial decision to launch a second loop of the Tour (providing its own vehicles) and the local authority has decided to deploy further revenue funding to launch a third loop.
- The successful marketing of the New Forest Tour rests on defining the Tour as a premium - product: a 'tourist attraction' rather than a 'bus service'. -
- The local authority lacked the means to obtain accurate information about operator costs and - this meant that the revenue funding level may have been higher than was necessary[51]. -

[51] This is also true for the other bus case studies, but in those other cases the initial revenue funding quickly resulted in bus operators purchasing new vehicles, which might justify higher margins. For the Tour the operator appears to have received a high margin whilst the local authority carried nearly all the initial risk.

10. Case Study 5: Cycling City and Towns

10.1 Introduction

Two overlapping programmes have delivered significant investment in interventions to encourage cycling in 18 towns and cities across England. The Cycling Demonstration Towns (CDT) programme ran between October 2005 and March 2011, and involved six towns. The Cycling City and Towns (CCT) programme ran from July 2008 to March 2011. It involved one large city (Greater Bristol) and a further 11 towns. Each town had the common goal of encouraging cycling, particularly for short, everyday trips, but delivered varying programmes of activity using a mix of revenue and capital investment.

The CDT /CCT programme was successful in increasing levels of cycling. All 18 towns and cities saw an increase in cycling levels as measured by automatic cycle count data, to varying degrees (Cope et al. 2012a, 2012b). Across the entire programme, the prevalence of cycling to work, as measured by Census data, showed a significant increase relative to that seen in three comparison groups (matched towns, unfunded towns, and a national comparison group) (Goodman et al. 2013).

This case study aims to assess how the variation in type of expenditure, and the interventions funded, affected the impact achieved in each town. We explore how the impact of the programme relates to:

- baseline conditions in the towns;
- the distribution of investment between capital and revenue;
- specific activities delivered in the towns.

Monitoring data, including automatic cycle counter data, were collected throughout both programmes. Analysis of this gives a measure of the total change in levels of cycling over time, expressed for each town as the change in the average daily count of cyclists per counter. If normalised to allow for the differing expenditures resulting from different lengths of the CDT and CCT programmes, this allows for comparison of change across all 18 towns.

10.2 Context for the programme

The 18 towns and cities began the programme with variable levels of cycling and with variable amounts of cycle infrastructure. In most cases, however, cycling levels at baseline were fairly typical of those seen in British cities. The notable exception to this was Cambridge, which started with very high levels of cycling.

Two measures may be used to illustrate the variation in baseline conditions in the towns. The first is the kilometres of dedicated cycling facilities per 10,000 population, which provides an indicator of the extent of baseline infrastructure (see Figure 10.1 for data); the second is average counts per counter per day, which provides a measure of baseline cycling levels or cycling ‘culture’ (see Figure 10.2 for data).

In broad terms, it appears that towns with more cycle infrastructure at baseline tended also to have somewhat higher baseline cycle counts, as might be expected, although the picture is not clear-cut. This is illustrated in Figure 10.3. Cambridge had the most cycle infrastructure (14.2km per 10,000 population) and one of the highest baseline counts (495, second only to Brighton with 503); Leighton Linslade had amongst the lowest levels of cycle infrastructure (2.0km per 10,000 population) and low baseline counts (40). There is one notable exception to this pattern: Brighton started with rather little cycling infrastructure for its population (1.5km per 10,000 population) but high average baseline counts (503). This anomaly may be because Brighton had a very high quality cycle path along its sea-front, with large flows of cyclists, but rather little cycle infrastructure elsewhere in the city at the start of the CDT programme.

Figure 10.1: Context (population and baseline cycle infrastructure) and inputs (capital and revenue expenditure) in the CDTs and CCTs

Town	Population*	Cycle facilities per 10,000 population at baseline (km)	Total capital investment ~	Total revenue investment ~	Percentage revenue investment
Cycling Demonstration Towns		**Oct-05 to Mar-11**			
Aylesbury	65,000	3.5	£4,328,841	£1,378,771	24%
Brighton	95,000	1.5	£4,049,976	£2,187,404	35%
Darlington	99,000	2.5	£4,798,213	£1,165,126	20%
Derby	105,000	12.5	£7,672,500	£2,290,489	23%
Exeter	115,000	7.2	£16,657,351	£1,522,387	8%
Lancaster	96,000	9.8	£5,544,897	£1,269,482	19%
Range of expenditure per head per year			***£7.70 - £26.30***	***£2.10 - £4.20***	
Cycling City and Towns		**Jul-08 to Mar-11**			
Blackpool	142,000	2.9	£6,890,000	£1,330,000	16%
Cambridge	180,000	14.2	£7,819,272	£1,134,728	13%
Chester	120,000	8.3	£2,672,022	£1,280,612	32%
Colchester	104,000	3.6	£3,619,015	£1,252,786	26%
Greater Bristol	570,000	n/a	£11,269,363	£8,444,559	43%
Leighton	38,000	2.0	£1,878,141	£787,887	30%
Shrewsbury	75,000	4.7	£2,837,449	£805,669	22%
Southend	160,000	1.1	£4,979,034	£1,720,526	26%
Southport	90,000	2.9	£2,490,391	£1,179,520	32%
Stoke-on-Trent	240,000	5.0	£6,032,327	£2,499,366	29%
Woking	91,000	4.8	£3,475,935	£865,657	20%
York	184,000	n/a	£5,383,080	£1,380,949	20%
Range of expenditure per head per year			***£6.60 - £16.50***	***£2.10 - £6.90***	

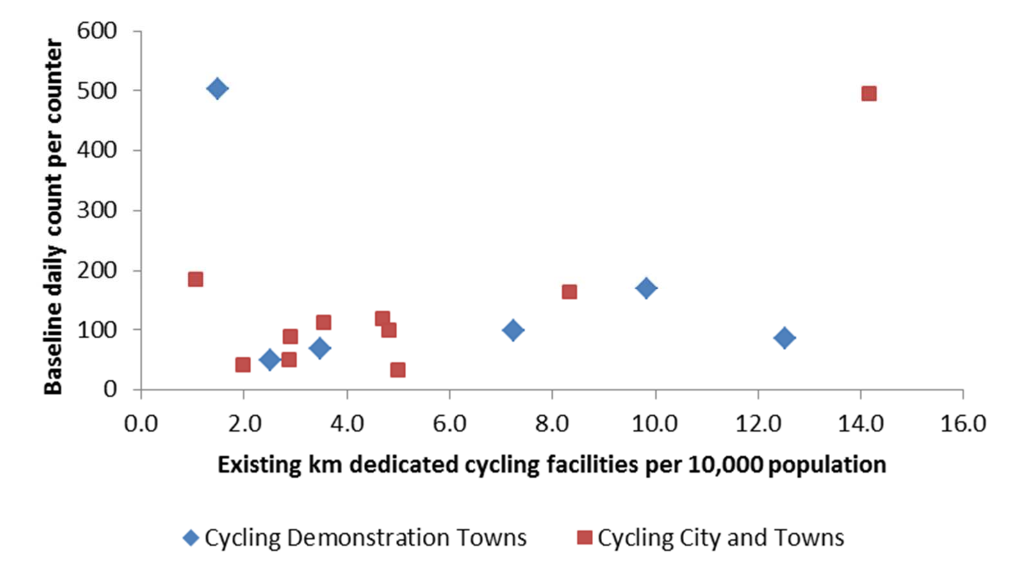
* Population figures taken from *Cycling City and Towns Programme Overview* (2010) Department for Transport (p5).
~ Expenditure figures include DfT grant and local contribution

Figure 10.2: Change in cycle counts in the CDTs and CCTs between baseline and final year, and number of workforce cycling to work in 2011

Town	Average daily count per counter		Absolute change in average daily count per counter between baseline and final year	Change in cycle counts against baseline year (baseline = 100%)	Number of workforce cycling to work in 2011
	Baseline year	Final year			
Cycling Demonstration Towns					
Aylesbury	68	72	4	106%	658
Brighton	503	600	97	119%	5,779
Darlington	50	79	29	159%	807
Derby	85	100	15	117%	4,258
Exeter	99	143	44	145%	3,927
Lancaster	170	220	50	129%	1,523
Cycling City and Towns					
Blackpool	87	95	8	109%	1,857
Cambridge	495	540	45	109%	18,938
Chester	163	197	34	121%	1,444
Colchester	111	132	21	119%	2,860
Greater Bristol	260	364	104	140%	18,842
Leighton	40	55	15	135%	356
Shrewsbury	118	135	17	115%	2,089
Southend	185	217	32	117%	2,163
Southport	50	65	15	130%	1,298
Stoke-on-Trent	31	51	20	162%	1,651
Woking	99	125	26	126%	1,072
York	209	222	13	106%	8,825

Sources: Cope et al. (2012a,b); 2011 Census data.

Figure 10.3: Baseline average daily count per counter against km of dedicated cycling facilities

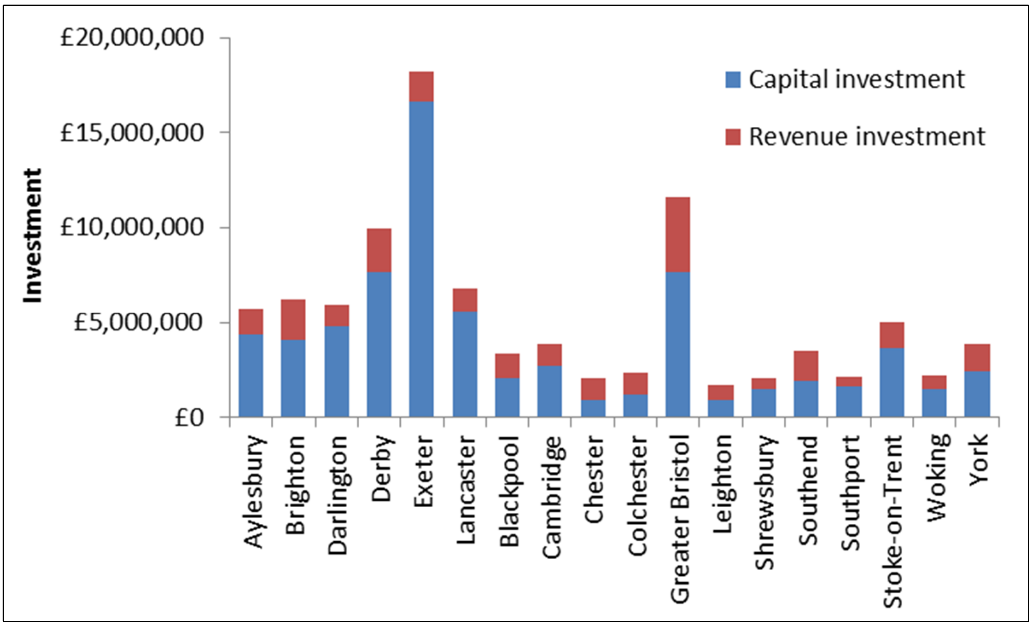


Kilometres of existing dedicated cycling facilities are not available for Greater Bristol or York; these are excluded from this analysis. The outlier at the top left of the plot is Brighton. Including all data points, the relationship between baseline cycling and existing cycling infrastructure is not significant (p=0.281). When Brighton is omitted, the relationship is significant (p=0.01).

10.3 Investment profile

In section 2.3 we described the breakdown of investment between capital and revenue expenditure in the CCTs and CDTs. Figures 10.1 and 10.4 re-present the same data in more detail. The percentage of total investment that was revenue ranged from 8% to 35% in CDTs (12% to 43% in the first phase, 7% to 28% in the second phase), and from 13% to 43% in CCTs. Expenditure per head per year ranged from £7.70 - £26.30 capital and £2.10 - £4.20 revenue in the CDTs; and from £6.60 - £16.50 capital and £2.10 - £6.90 revenue in the CCTs. Whilst all towns provided data on total expenditure, the information provided about expenditure on specific capital and revenue measures is less extensive. This restricts the degree of analysis that is possible.

Figure 10.4: Division of investment between capital and revenue expenditure in the CDTs and CCTs



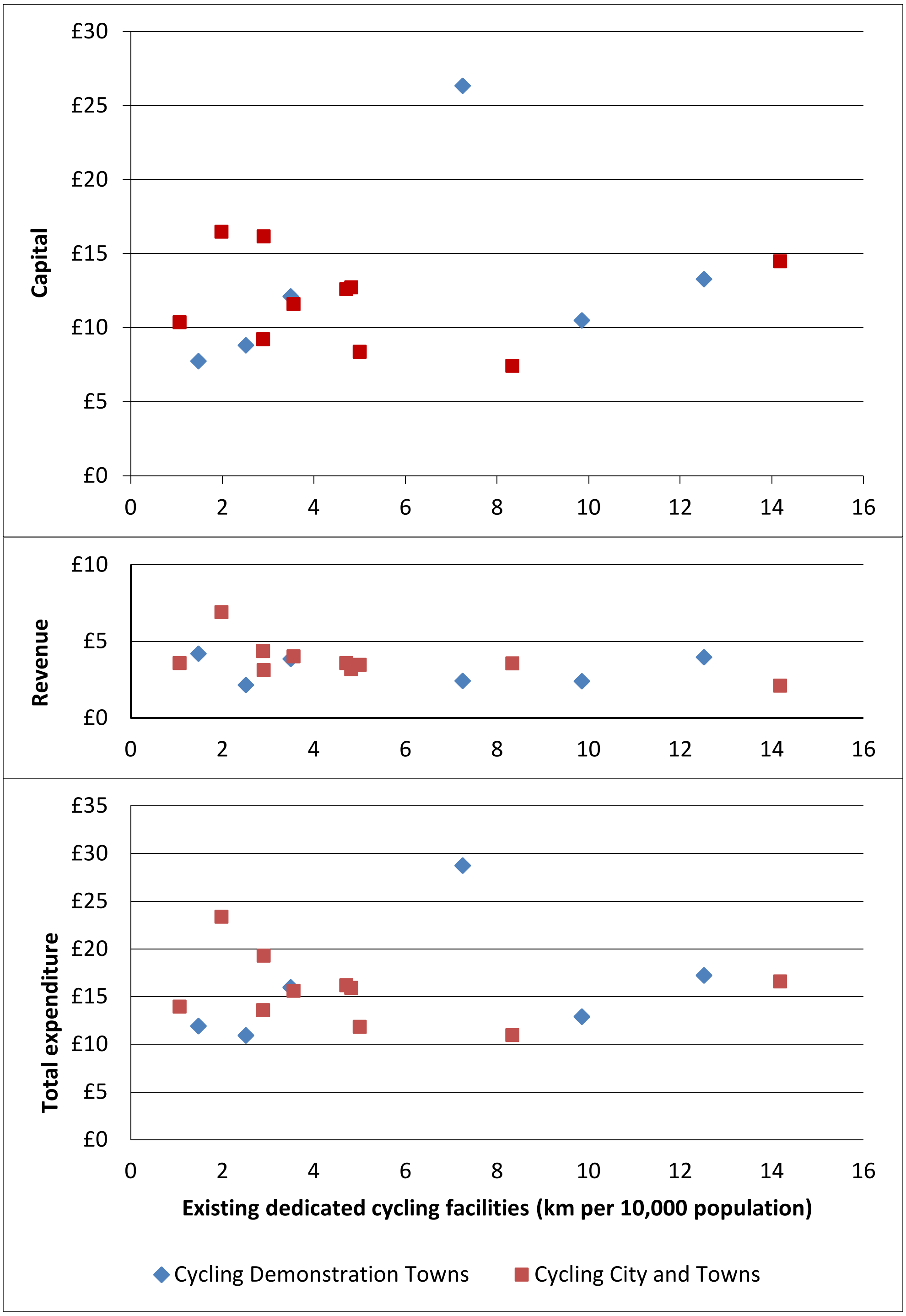
10.4 Relationship between baseline conditions and investment profile

Before examining how and whether the investment profile may have influenced the amount of uplift in cycling in the towns, we need to understand whether contextual differences at baseline show any relationship to investment profile. For example, did towns that started with good cycling infrastructure at the beginning of the programme tend to allocate less funding, in total or proportionately, to capital interventions; and did towns with high pre-existing levels of cycling feel less need to allocate funding to revenue initiatives such as promotion and training?

Figure 10.5 plots existing km of dedicated cycling facilities against capital, revenue and total expenditure, in each case normalised per head and per year. Neither the level of capital expenditure nor the level of revenue expenditure vary strongly (positively or negatively) with the amount of cycle infrastructure at baseline. That is, there is no clear tendency for towns that started with more cycle paths to have prioritised revenue investment over capital investment, or vice versa.

Figure 10.6 plots counts per counter in the baseline year against capital, revenue and total expenditure, again normalised per head and per year. Once again, normalised levels of capital and revenue expenditure do not vary strongly (positively or negatively) with pre-existing conditions.

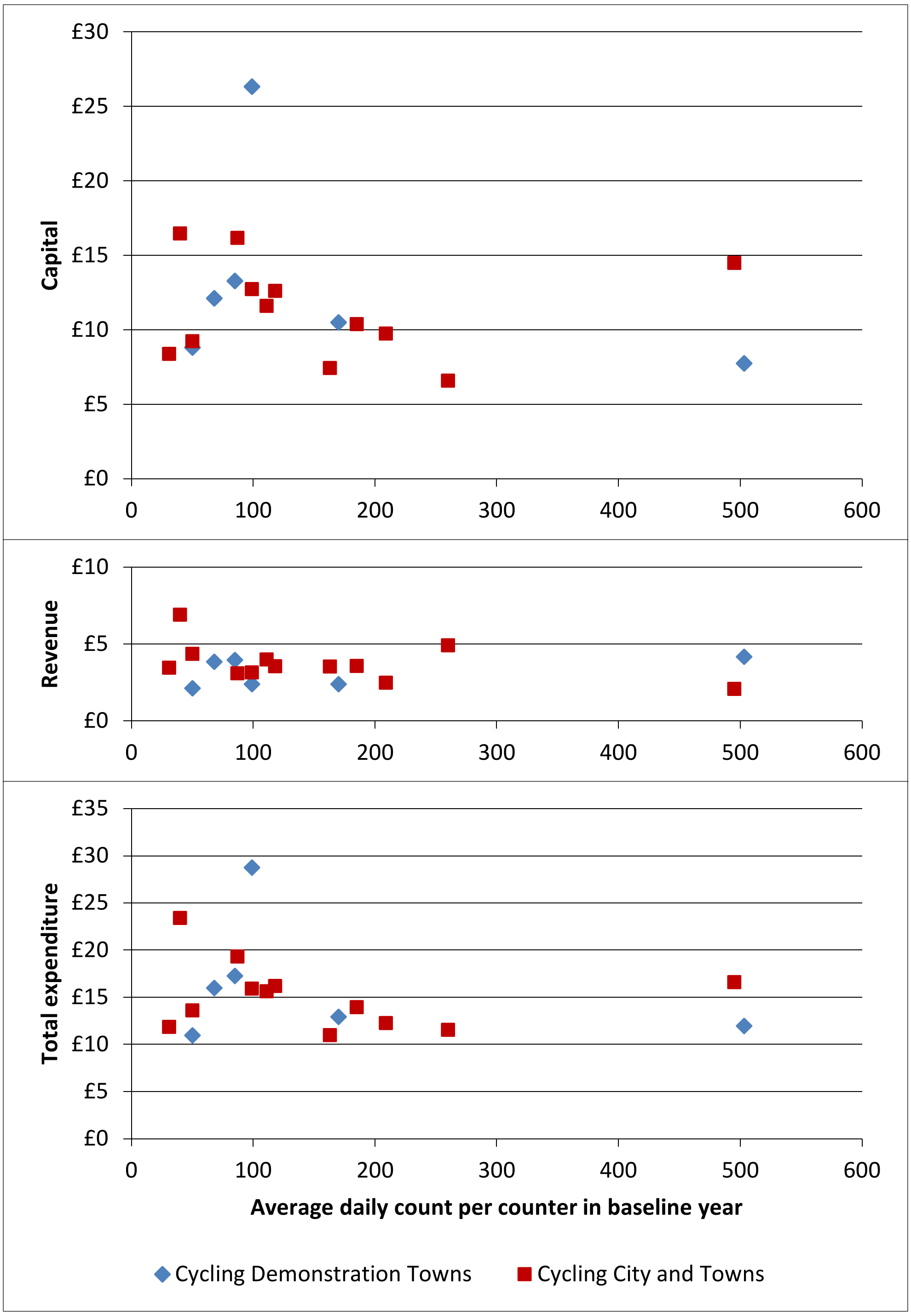
Figure 10.5: Capital and revenue expenditure (£ per head per year) according to existing dedicated cycling facilities (km per 10,000 population)



Kilometres of existing dedicated cycling facilities are not available for Greater Bristol or York; these are excluded from this analysis. The outlier in the 'capital' plot, with over £25 per head per year capital expenditure, is Exeter; this is due to a high local funding contribution to build the Exe Estuary Trail during the CDT programme period.

To avoid misunderstanding of this and several later figures, several graphs in this Chapter show a scatter of points measuring the distribution of values found, and should not be read as a failed test of a functional relationship. In some cases the distribution of points is the point of the figure, and in others the lack of a strong functional relationship **is** an important positive finding. Where there is evidence of an increasing or decreasing relationship that is discussed in the text.

Figure 10.6: Capital, revenue and total expenditure (£ per head per year) according to baseline cycling levels from cycle count data



10.5 Relationship between baseline conditions and uplift in cycling

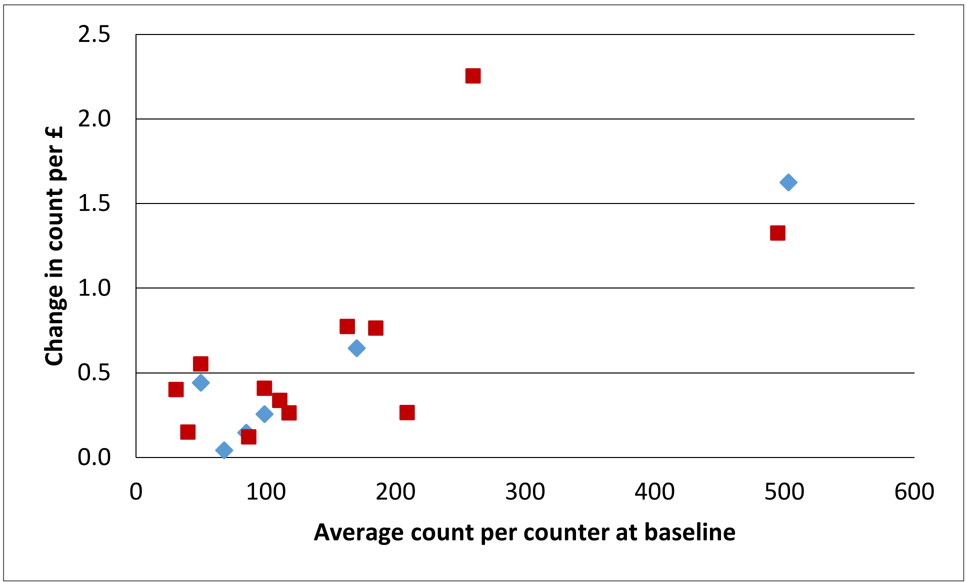
Next, we look at the relationship between baseline conditions and the impact of the programme.

Figure 10.7 plots average daily count per counter in the baseline year against the change in cycle counts per counter (normalised per £ total expenditure to allow for differences between the towns). The trend is for towns with higher baseline levels of cycling to show greater uplift in cycling per unit of expenditure. This relationship is significant (correlation coefficient 0.74; $p<0.001$). The towns showing high baseline cycling levels and high uplift in cycling are Brighton, Greater Bristol and

Cambridge. However, it is not universally the case that high baseline cycling levels are associated with high uplift: in particular, York began with only slightly lower baseline counts than Bristol, but saw a rather modest increase in cycle counts during the course of the programme.

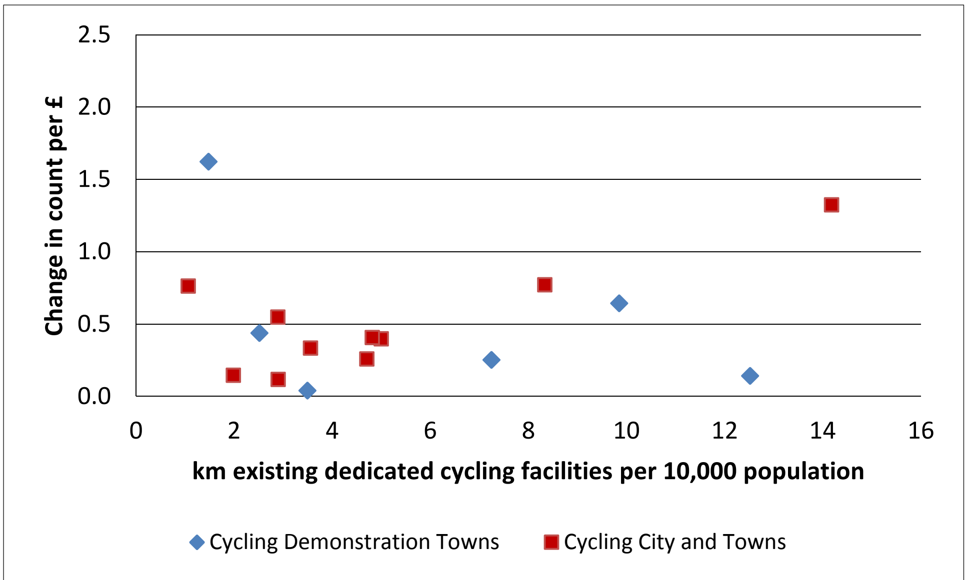
Figure 10.8 plots kilometres of dedicated cycling facilities at baseline against the change in cycle counts per counter (normalised per £ total expenditure). Here, the relationship is not significant (p=0.563).

Figure 10.7: Change in average daily count per counter per £ total expenditure against baseline daily count per counter



The outlying point is Bristol. Including all data points, the relationship between baseline counts and change in count per £ is significant (p=0.0003).

Figure 10.8: Change in daily count per counter per £ total expenditure against baseline km of dedicated cycling facilities



Kilometres of existing dedicated cycling facilities are not available for Greater Bristol or York; these are excluded from this analysis; p=0.563.

While the correlation between baseline counts and uplift in cycling cannot be taken as proof of causality, one hypothesis that would explain this relationship is that the success of the towns in raising cycling levels over the short term (2.5 – 5.5 years) was related – at least in part – to whether a cycling 'culture' was already in existence. Under this hypothesis, what mattered over the short term was not so much the quality and extent of cycle infrastructure (although, as implied by Figure 10.3, this may matter over the long term), but quite simply whether other people in the town were already cycling. Where many people cycled already and it was seen as a social norm, it was easier to encourage even more cycling. This would be an important finding, as it implies that (over a certain range) there is not decreasing marginal impact of spending, but increasing impact corresponding with a positive feedback or economies of scale, which has been speculated for some years but without clear evidence.

This hypothesis needs to be kept in mind as we now look at whether the investment profile in each town may have influenced the amount of uplift in cycling.

10.6 Relationship between investment profile and uplift in cycling

We turn now to the question of whether the differing revenue /capital splits in the 18 towns affected the success of their cycling investment programmes. Figure 10.9 plots the proportion of revenue expenditure against change in cycle counts (normalised per £ total expenditure).

This plot appears to show a general trend for a greater uplift in cycling where a greater proportion of the total budget was dedicated to revenue investment. The relationship is significant at the 95% level (correlation coefficient 0.529; $p=0.022$), but weaker than the relation between baseline levels of cycling and uplift in cycling. We again cannot be sure that this relationship is a causal one. In particular, we have to be cautious because the data points are not evenly spread, and two outlying points (Brighton and Greater Bristol) exert a strong influence on the correlation coefficient (in statistical terms, the data do not show homoscedasticity). These two towns with a high proportion of revenue expenditure also happen to be towns that started with a high baseline level of cycling.

Figure 10.10 re-plots the same data, but this time distinguishing between four groups of towns: those starting with very low levels of cycling at baseline (average daily counts per counter in the baseline year <70); those with low levels (85-120 daily counts per counter); those with medium levels (160-260 daily counts per counter); and those with high levels (490-510 daily counts per counter). The number of towns in each group is very small, and so no statistical significance can be attributed to any conclusions we draw from inspection of this plot. However, if we examine the data points *within* each of these groups, it is interesting to note that the towns with a higher proportion of revenue spending tend perhaps to have slightly greater uplift in cycling. It is also interesting that the towns with 'low' baseline cycling levels, which we might have expected to have delivered slightly more uplift in cycling than the towns with 'very low' baseline cycling levels, have not done so. We speculate as to whether this might be because they happen to have chosen lower levels of revenue spending.

On balance, we conclude that the uplift in cycling is more clearly related to baseline levels of cycling (i.e. to a pre-existing cycling culture), than to the investment profile. However, this apparently 'null' result is more important than it at first sounds. The proportion of revenue in the towns' investment programmes varied between less than 10% and over 40%, and if revenue expenditure were relatively speaking either substantially less or more effective than capital expenditure, we would have expected to see a relationship between uplift in cycling and proportion of revenue. The absence, or comparative weakness, of that relationship suggests that revenue and capital expenditure on town-wide comprehensive cycling programmes are, on average, rather similarly effective, if used in a way that is appropriate to local circumstances. However, we can only draw this conclusion for town-wide cycling programmes with proportions of revenue below 50%, as the nature of the funding for the CCTs / CDTs means that we have no instances of town-wide cycling programmes with higher proportions of revenue funding.

Figure 10.9: Change in daily count per counter per £ total expenditure, against percentage revenue expenditure

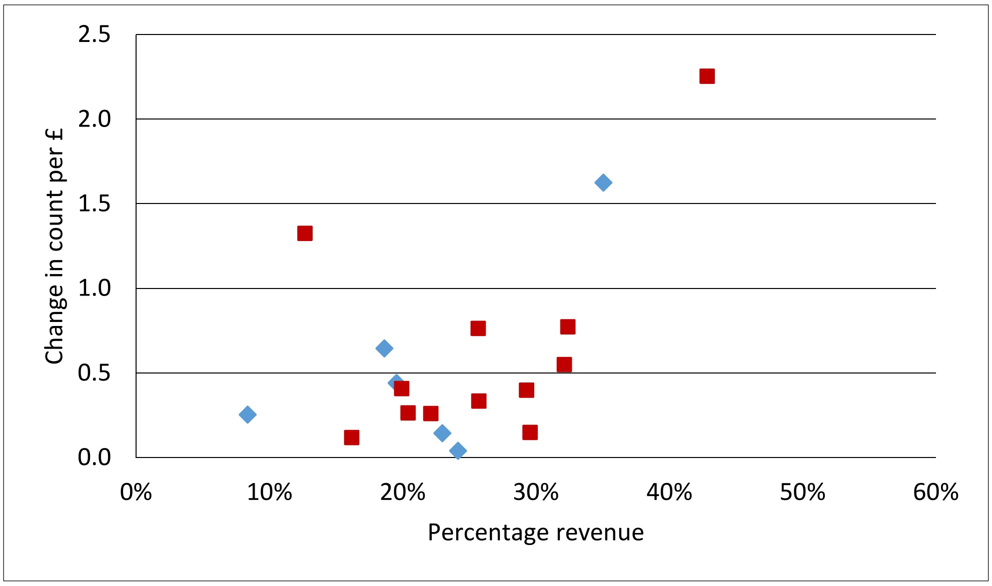
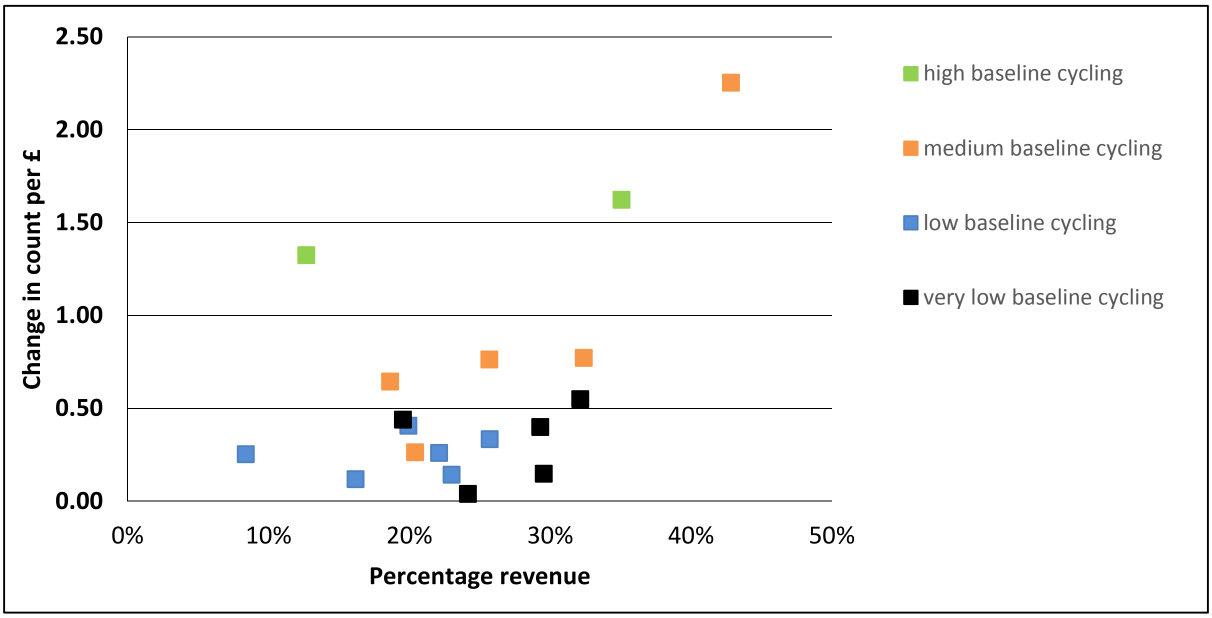


Figure 10.10: Change in daily count per counter per £ total expenditure, against percentage revenue expenditure, according to baseline cycling levels



Baseline cycling levels: ‘high’ = 490-510 average daily counts per counter; ‘medium’ = 160-260; ‘low’=85-120; ‘very low’ = <70.

10.7 Relationship between town level activity and changes in cycling

Outputs of the CDT and CCT programmes are included in end of programme reports. We tested for relationships between the outputs for different types of intervention and change in cycling during the programmes. The results of this analysis are presented in Figures 10.11 and 10.12. As noted previously, the factor having the greatest impact on levels of change achieved is the baseline level of cycling ($p<0.001$); the relationship between individual elements of the programme and impact is generally weak. Although there is a general impression that more of any particular intervention seems to be weakly correlated with more uplift in cycling, there is no single type of intervention that could be said to have 'driven' the uplift in cycling.

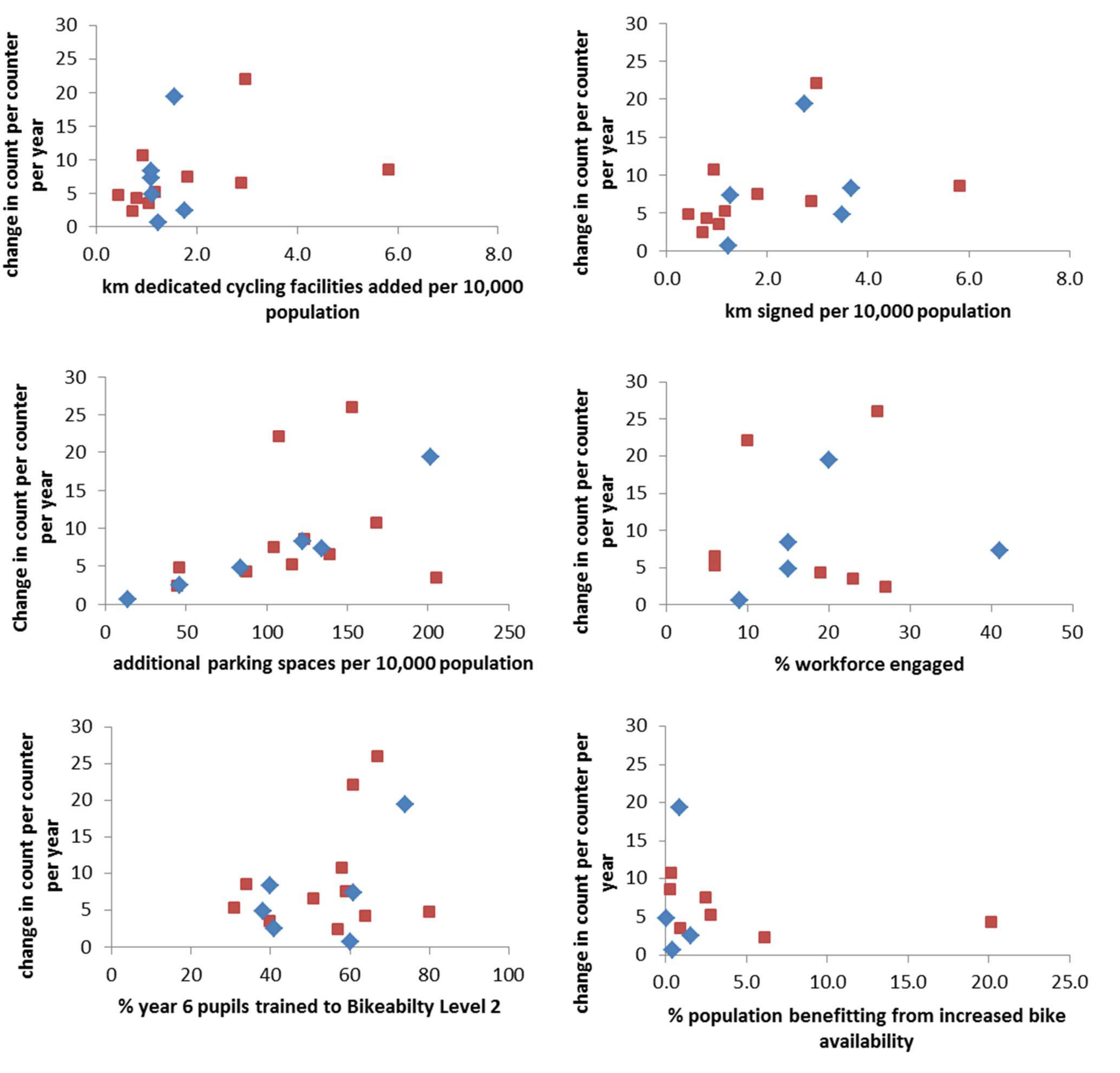
Thus, although pre-programme levels of cycling are positively influenced by the extent of existing dedicated cycling facilities (Figure 10.3), there is no strong relationship between expansion of dedicated cycling facilities and change in levels of cycling (Figures 10.11 and 10.12). This suggests that simply expanding cycling facilities does not drive the increase in cycling levels seen across the towns. Figure 10.11 gives us little insight into which individual interventions are important in increasing cycling levels in the towns.

Figure 10.11: Results of tests for relationship between programme outputs and change in cycling levels

	R	p	Number of towns included in analysis[b]
Capital			
Km dedicated cycling facilities added per 10,000 population	0.32	0.231	17
Km signed per 10,000 population	0.19	0.512	14
New cycle parking spaces per 10,000 population	0.51	0.034*	17
Revenue			
Percentage workforce engaged	0.09	0.777	12
Average percentage year six children trained to Bikeability Level 2[a]	0.37	0.139	17
Percentage population benefitting from increased bike availability	0.20	0.546	11

*indicates significance ($p<0.05$); [a] average across years of the programme; [b] Not all towns supplied details for all intervention categories

Figure 10.12: Change in cycling plotted against intervention outputs



In order to investigate the relative impact of capital and revenue investment, we reviewed the end of programme reports published by the towns and selected a subset of towns where detailed maps of improvements made during the programme had been included. These were used to broadly classify count sites as being close to new infrastructure developed during the programme[52]. Four towns were included in this analysis: Woking, Derby, Bristol and Exeter.

Combining count sites across the towns, we identified 16 sites anticipated to benefit from capital investment in route development during the programme period and a further 37 sites located

[52] This was done by visual assessment of maps only.

elsewhere in the towns[53]. The average annual percentage change in the count recorded at these sites are summarised in Figure 10.13.

Figure 10.13: Average annual percentage change in cycle counts at locations close to or removed from new infrastructure developments

	Average annual percentage change in count	
	weekday	weekend day
Near new infrastructure	7.5%	4.9%
Not near new infrastructure	4.4%	3.2%

There is not enough information available to be confident that counters located close to new infrastructure are not in areas also benefitting from smarter choices. Whilst there is no significant relationship between change in cycling at the town level and expansion of dedicated cycling facilities (Figure 10.11), this analysis suggests that sites close to new infrastructure, with or without smarter choices alongside, have seen, on average, a greater growth than locations not directly benefitting from infrastructure development (+7.5% per year compared to +4.4% per year for weekday counts, and +4.9% per year compared to +3.2% per year for weekend counts).

10.8 Conclusions

In this case study we have sought to explore the relationship between the profiles of expenditure in town-wide programmes intended to increase levels of cycling and the levels of change achieved. We have found that:

- Absolute change in counts of cyclists is positively correlated with baseline levels of cycling – there is a greater absolute change where towns start from a higher baseline (Figure 10.7). Although we cannot prove causality, one possible explanation for this correlation is that over the short-term, towns with a pre-existing culture of cycling find it easier to get more people cycling because they do not have to overcome conflicting social norms.
- Pre-existing infrastructure and pre-existing cycling levels are linked. With the exception of Brighton, towns with more extensive cycling facilities typically have (relatively speaking) higher baseline levels of cycling, and vice versa (Figure 10.3). This suggests that over the longer term, the amount of cycling infrastructure is an important factor in determining levels of cycling.
- In the short term, there is not a significant relationship between expanding cycling infrastructure and the absolute uplift in cycling (Figures 10.11 and 10.12). Nevertheless, there is evidence that new infrastructure encourages cycling, since count sites close to new infrastructure saw a greater growth in cycling than those not close to new infrastructure.
- From examining towns with similar baseline cycling levels, there are weak hints that some slight advantage may be conferred by higher levels of revenue spending i.e. towns which were otherwise similar but allocated more funding to revenue measures achieved more uplift in cycling (Figure 10.10). However, this is not a strong effect, and in general, opting to dedicate a significant proportion of investment to revenue schemes incurs neither a substantial advantage nor an obvious disadvantage. This seems to suggest that either type of investment can be roughly equally effective, possibly depending upon local needs and circumstances.

[53] Only sites with sufficient data to robustly calculate change in counts over time were included in the analysis.

11. Case Study 6: Exeter workplace cycling

In this case study we review data on levels of cycling to work following localised interventions to encourage commuting by bike. We focus on Exeter, one of the original six Cycling Demonstration Towns. Between 2005 and 2011 Exeter used funding to the value of £18.2 million to implement a town-wide package of cycling interventions. Our case study focuses on the second phase of the programme, between 2008 and 2011. During this time Exeter invested £13.5 million in capital measures and £1 million in revenue interventions.

We begin by describing the interventions delivered in Exeter targeting specific employment areas. We then discuss the identification of a suitable control before going on to analyse data from a series of continuous automatic cycle counters in both areas. This analysis addresses the following questions: i) is there evidence of a concentration of route use around commuting times; ii) have counts of cycles increased over time; iii) have counts of cycles seen a greater increase on days and at times of day associated with commuting than at other times; and iv) does change over time differ between intervention and control areas.

11.1 Exeter – interventions to encourage cycling to work

Between 2008 and 2011, route development took place alongside smarter choices measures targeted at industrial areas around Exeter. Following discussions with Cycle Exeter, we identified two distinct industrial areas suitable for inclusion in the case study: the Sowton Industrial Estate and Marsh Barton Trading Estate.

Sowton Industrial Estate is located approximately three miles to the east of the city centre. It is a well-established base for business, distribution and manufacturing.[54] £744,909 was invested in improving cycling infrastructure, including the completion of a route along the Exeter outer ring road to access to the Industrial Estate. Cycle Exeter engaged directly with workplaces to support establishment of Bicycle User Groups, travel planning, delivery of led rides and cycle maintenance courses. An online toolkit for workplaces was also developed (Devon County Council 2011). Six thousand employees were engaged through the Sowton Industrial Estate Transport Forum.

The Marsh Barton Trading Estate, located approximately one mile south of the city centre, is the largest industrial estate in Exeter. Over 500 businesses, mainly small enterprises, trade from the estate. These include retail outlets, car dealerships, builders' merchants and tool and plant hire.[55] During the CCT programme roads within the Trading Estate were re-designed and a new link was created providing a connection to the existing riverside route (the Exe Estuary Trail, which was also improved during this time period) and an alternate roadside shared use path. In total £209,432 was invested in capital interventions benefitting the Marsh Barton Trading Estate. There was less intensive engagement in this area, with businesses mainly benefitting from city-wide smarter choices and promotional activity, rather than specifically targeted interventions.

11.2 Identification of comparison area - Barnstaple

In order to assess whether changes in levels of cycling observed on the Exeter routes relate to interventions delivered in the surrounding area, a control location was selected for comparison. Following discussions with Local Authority officers, Barnstaple was identified as a suitable comparison area.

[54] http://www.exeter.gov.uk/index.aspx?articleid=10047
[55] http://www.exeter.gov.uk/index.aspx?articleid=10047

Barnstaple (population 20,000, compared to Exeter's population of 123,000) is located to the north west of Exeter. It has a well-established off-road cycle route, comparable to the Exeter's Exe Estuary Trail. Industrial estates and workplaces are accessed from the route. These include the Pottington Business Park, close to the Tarka Trail approximately one mile north-west of the town centre, and the Civic Centre area on the edge of the town centre. Revenue investment was not made in workplace initiatives in Barnstaple.

11.3 Analysis of automatic cycle counter data

Automatic cycle counter data can be disaggregated to allow analysis of cycle flows at the times of day associated with commuting. Without surveying route users it is not possible to estimate the proportion of trips made for commuting. For the purpose of this analysis, trips made at times of the day associated with the journey to/from work are used as a proxy for commuting trips.

With assistance from Cycle Exeter, we identified one counter on Clapperbrook Lane monitoring cycle access to the Marsh Barton Trading Estate and a second on the Sowton to Digby railway link cycle path monitoring access to the Sowton Industrial Estate. In Barnstaple a cycle counter monitors an access route to the Pottington Business Park and a second, close to Barnstaple Civic Centre, monitors access to key employment sites.

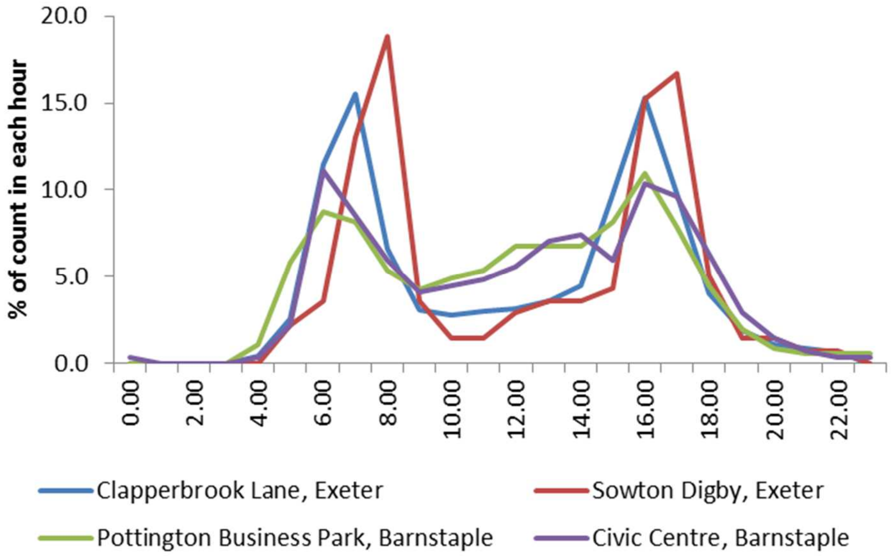
Daily and hourly count data for these locations were obtained from Devon County Council's online database. Data from the sites were analysed to address the following questions:

- Is there evidence of a concentration of route use around commuting times?
- Have counts of cycles increased over time?
- Have counts of cycles seen a greater increase on days and at times of day associated with - commuting (targeted by workplace-focussed cycling promotion) than at other times (not - targeted by cycling promotion programmes)? -
- Does change over time differ between Exeter (benefiting from route development plus smarter choices in workplaces) and Barnstaple (comparable infrastructure, no smarter choices measures)?

11.3.1 Is there evidence of a concentration of route use around commuting times?

Based on their locations relative to employment areas, the counters selected for analysis are expected to record commuting journeys. This is confirmed by examining the hourly distribution of counts across the day (Figure 11.1). Peaks in cycle counts at the times of day associated with commuting (7am-9am, 4pm-6pm) are evident for the Barnstaple and Exeter count sites, although usage is more concentrated at these peak times for the Exeter sites with less use recorded in the inter-peak period than at the Barnstaple sites.

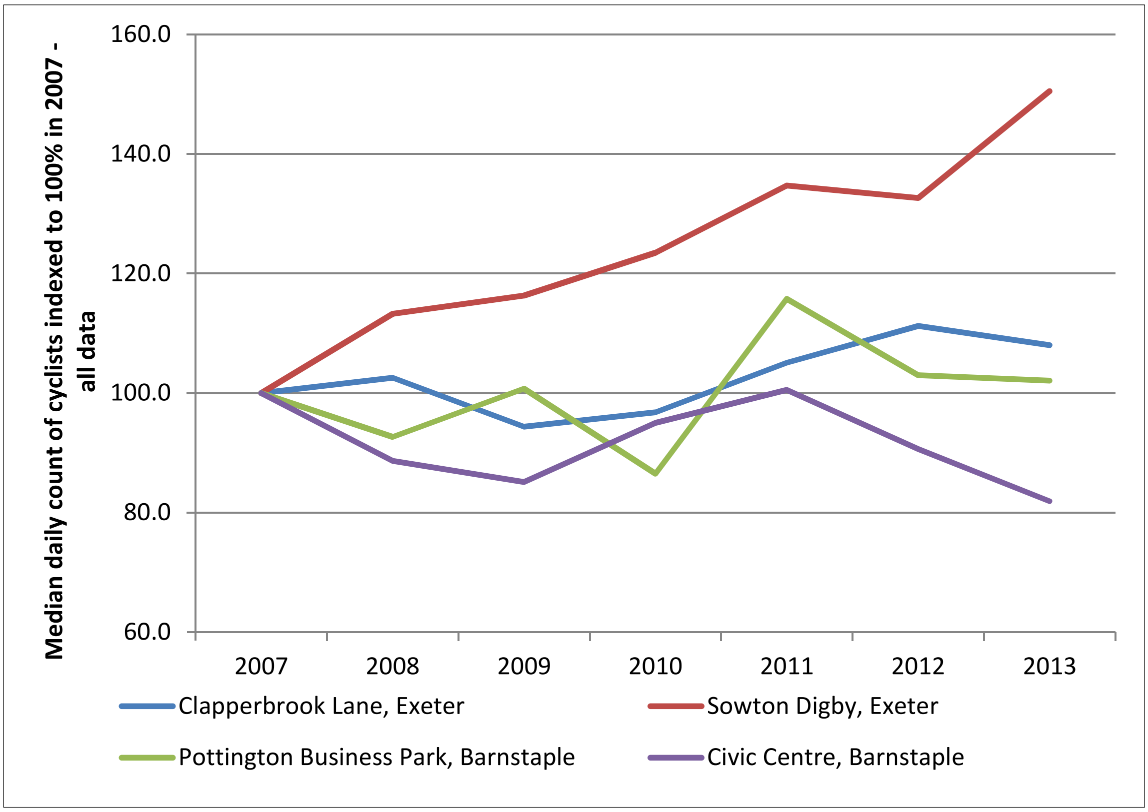
Figure 11.1: Distribution of cycle counts across the day (weekdays, 2012)



11.3.2 Have counts of cycles increased over time?

By indexing data to 100% in 2007, variation in the trajectory of change in counts over time is apparent (Figure 11.2). Cycling City and Towns funding in Exeter ceased in 2011. Figure 11.2 suggests that growth in counts achieved during the programme is sustained after this at the Sowton Digby site, whilst the Clapperbrook Lane site sees a drop off in volumes of cyclists recorded.

Figure 11.2: Annual median count of cyclist indexed to 2007, all data



The Mann-Kendall seasonal slope test[56] was applied to quantify the rate of change over time (Figure 11.3). This indicates growth in weekday and weekend day counts for all sites excluding the Civic Centre site in Barnstaple. None of these changes are statistically significant. Based on all data, weekend use generally has seen a greater growth (comparable growth in the case of the Sowton Digby site) than weekday use, suggesting the importance of the routes for recreational and utility journeys outside of commuting times.

Figure 11.3: Annual average change in the daily count of cyclists

	Annual average change in daily count of cyclists (%)	
Site	Weekday	Weekend days
Clapperbrook Lane, Exeter	+1.6%	+2.8%
Sowton Digby, Exeter	+5.5%	+5.1%
Pottington Business Park, Barnstaple	+1.4%	+3.8%
Civic Centre, Barnstaple	-1.3%	-0.2%

11.3.3 Have counts of cycles seen a greater increase on days and at times of day associated with commuting?

Figure 11.1 indicates a concentration of cycle counts around the times of day associated with commuting. The hourly distribution of counts (presented for 2007 and 2013 in Figure 11.4) suggests growth in usage at commuting times at the Sowton Digby site in Exeter, and to a lesser extent at the Clapperbrook Lane site, but not at the Barnstaple sites.

The median daily count calculated from commuting time data (indexed to 2007) is presented in Figure 11.5.

The change in commuting-time counts over time was quantified (Figure 11.6) using the Mann-Kendall Test as applied to the complete dataset (Figure 11.3). This analysis suggests the Sowton Digby site in Exeter saw a greater change in commuting-time counts than across the day as a whole (+7.0% and +5.5%, respectively). This difference is significant. Similarly, at the Clapperbrook Lane site, annual average change is+2.5% based on commuting-time data and +1.6% across the day as a whole (this difference is not significant). This suggests that interventions in these areas have been particularly successful in increasing volumes of commuting trips.

The Pottington Business Park site in Barnstaple sees a greater growth at commuting times (+2.0%) that across the whole day (1.4%), whilst the Civic Centre site has seen a decrease in use at these times. These differences are not significant.

[56] Hirsch RM, Slack JR, Smith RA (1982) *Technique of trend analysis for monthly water quality data* Water Resources Research vol.19, no. 1, pp107-121

Figure 11.4: median hourly counts of cyclists, weekday data

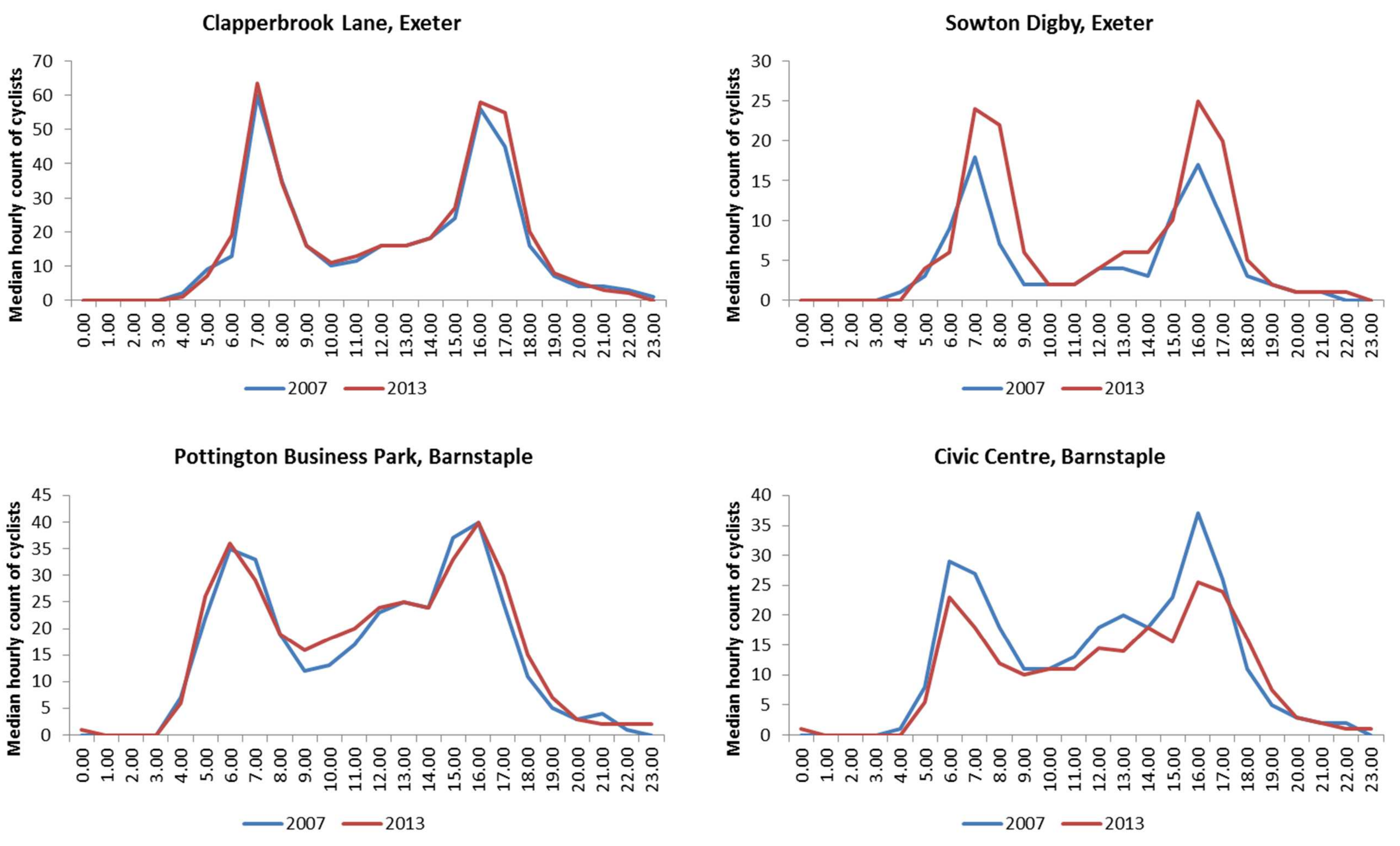


Figure 11.5: Median count of cyclists recorded during commuting hours (7am-9am, 4pm-6pm), indexed to 100% in 2007

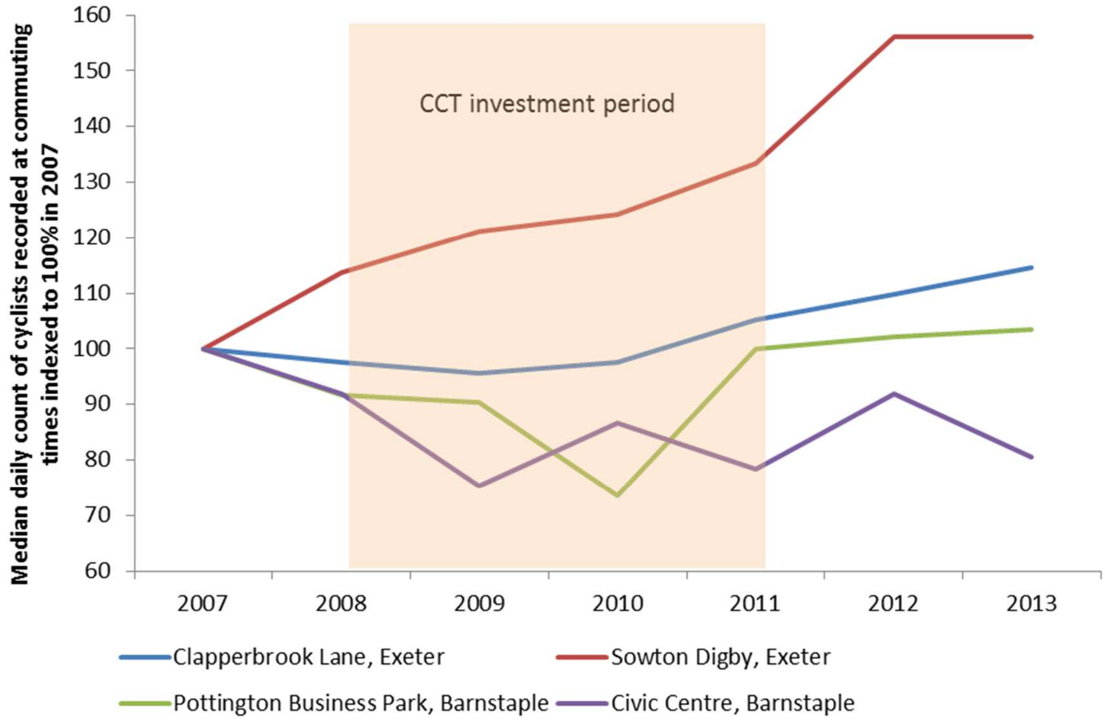
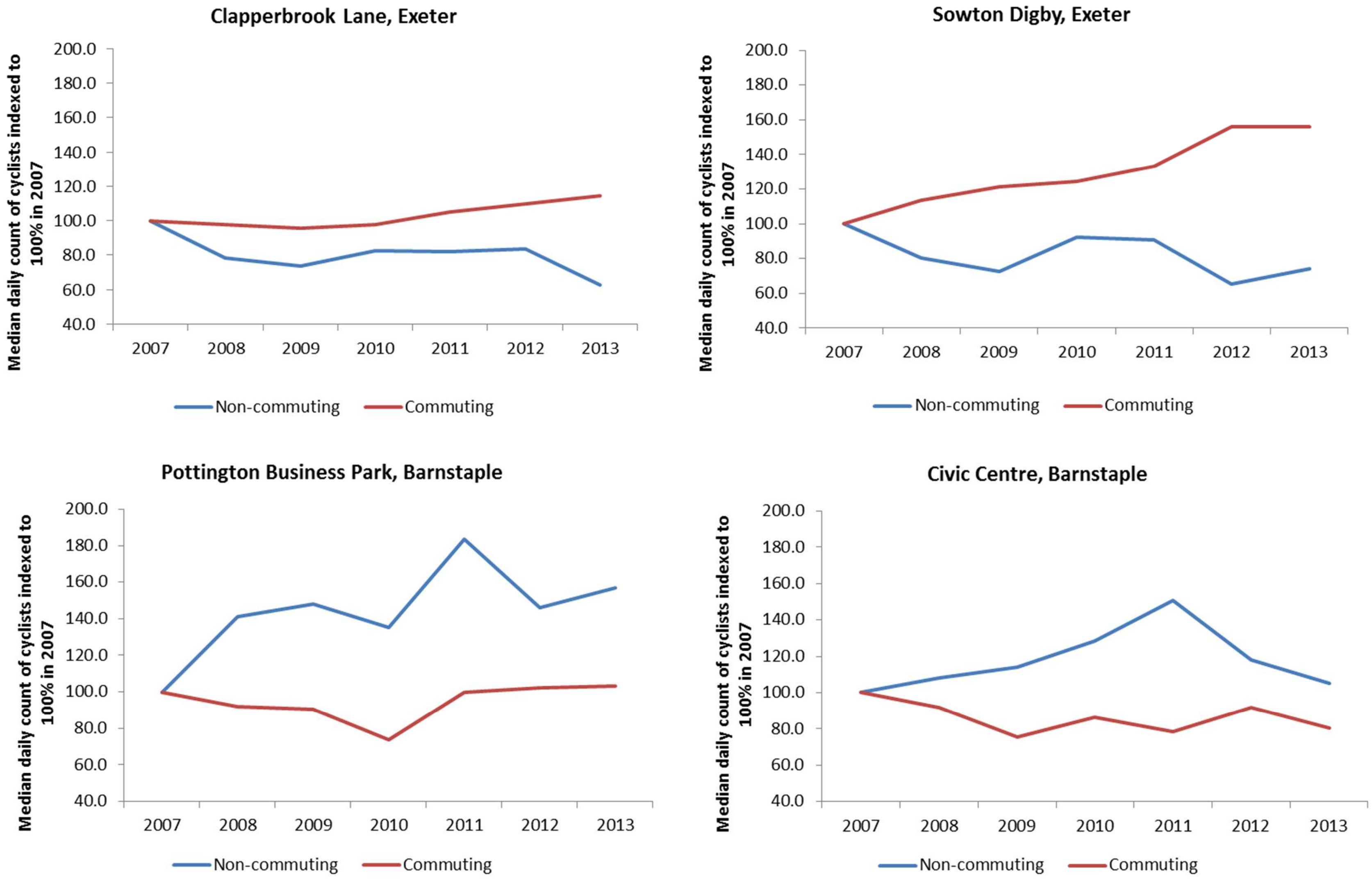


Figure 11.6: Annual average change in the daily count of cyclists (commuting hours only)

Site	Average annual change in daily counts of cyclists, weekday commuting times (%)	Average annual change in daily counts of cyclists, weekday all times (%)
Clapperbrook Lane, Exeter	+2.5%	+1.6%
Sowton Digby, Exeter	+7.0%	+5.5%
Pottington Business Park, Barnstaple	+2.0%	+1.4%
Civic Centre, Barnstaple	-3.0%	-1.3%

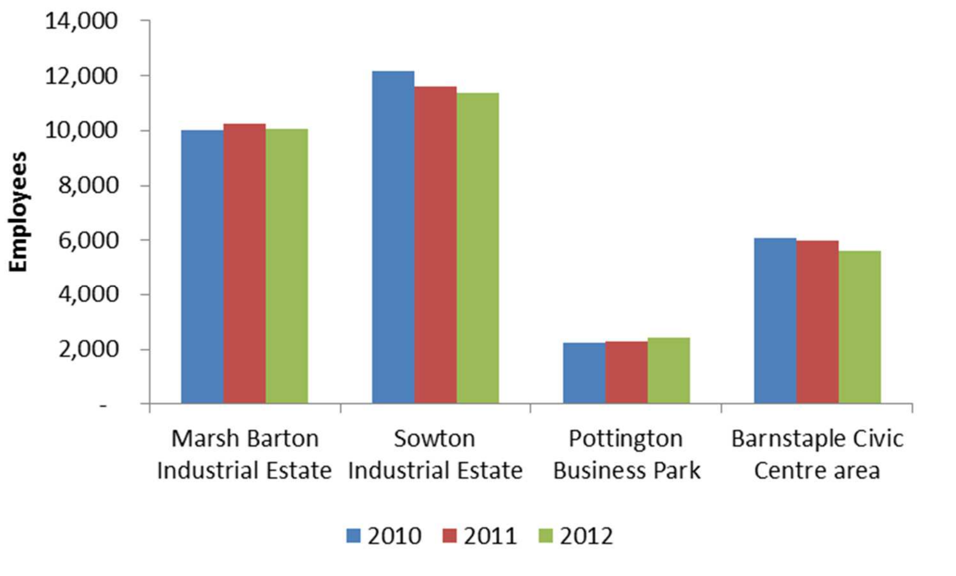
Figure 11.7 compares median weekday totals calculated from counts recorded during and outside of - commuting times, indexed to 100% in 2007. This illustrates the variations in the trajectory of change. -

Figure 11.7: Median daily count of cyclists calculated from data recorded during and outside of commuting times, indexed to 100% in 2007



Our analysis suggests that there have been changes in volumes of cyclists recorded at commuting times over the project period. However, this might have been influenced by changes in the levels of employment in the areas. To rule out this possibility, BRES (Business Register Employment Survey) data were obtained for the LSOA (Lower Super Output Area) corresponding with the industrial areas considered in the analysis (Figure 11.8).

Figure 11.8: Total number of employees in LSOA, 2010-2012



Levels of cycling in the Marsh Barton and Sowton area have seen a steady increase between 2010 and 2012 (Figure 11.5). Over the same period of time, the number of employees has remained constant in the Marsh Barton area and declined in the Sowton area (Figure 11.8). This suggests that the increase in cycling observed is in part due to a greater proportion of employees cycling, rather than a similar proportion of a larger workforce travelling by cycle.

11.3.4 Does change over time differ between Exeter (benefiting from route development plus smarter choices in workplaces) and Barnstaple (comparable infrastructure, no smarter choices measures)?

At a population level (based on Census data[57]) there was little change in commuter cycling in Barnstaple between 2001 and 2011, but an increase in Exeter (Figure 11.9). Interventions to encourage cycling in Exeter were delivered between 2005 and 2011. Therefore the Census data provide a useful measure of cycling to work before and after investment.

Figure 11.9: Mode of travel to work for workplace population in MSOA coinciding with built up areas in Exeter and Barnstaple recorded in the 2001 and 2011 Census

	Census 2001	Census 2011	%-point change
Exeter built up area	3.6%	5.0%	+1.4%-points
Barnstaple built up area	4.5%	4.8%	+0.3%-points

[57] Analysis of workforce population data for mid-layer super output areas (MSOA) coinciding with built up areas in Exeter and Barnstaple (assumed to be the location of the majority of workplaces)

The Census data support our analysis. Locations in Exeter benefitting from smarter choices measures in workplaces as well as high quality infrastructure record a greater volume of commuting-time trips than sites in Barnstaple, and have seen overall a greater growth in weekday usage (Figures 11.2 and 11.6). The analysis is limited by the necessary assumption that commuting-time counts equate to commuting journeys by employees at locations benefitting from the Cycling City and Towns programme. However the data do suggest a growth in commuting-time cycling in Exeter not apparent in the Barnstaple sites.

11.4 Conclusions

In this case study we have examined change in commuting-time cycling in employment areas in Exeter benefitting from route development and targeted smarter choices measures. We compare this to levels of cycling to work in comparable areas of Barnstaple where good quality infrastructure has been developed in the absence of smarter choices.

- Analysis of cycle counter data recorded at commuting times suggests greater growth in the area around the Sowton Industrial Estate in Exeter than in the area around the Marsh Barton Trading Estate. Both areas benefitted from route development, but Sowton Industrial Estate received more targeted workplace interventions.
- Around 40% of weekday trips recorded by the cycle counters in Exeter took place outside commuting hours. Whilst utility and leisure trips would benefit from infrastructure improvements, they were not subject to targeted revenue activity. Weekday growth at both the Marsh Barton site and the Sowton site was concentrated around commuting times, with trips at other times of day generally declining (Figure 11.7). This suggests that the combination of infrastructure development with workplace-focussed smarter choices has delivered an enhanced growth in the types of trips benefitting from these measures.
- Sites in Exeter were compared to others in Barnstaple (benefitting from good route development, but no smarter choices measures). The growth in cycling recorded in Exeter was not apparent in Barnstaple (Figure 11.5). This is corroborated by Census data. Between 2001 and 2011 commuting cycling in the workforce population of built up areas of Exeter increased by 1.5%-points. In the comparable area of Barnstaple, this change was +0.3%-points.

Bearing in mind the challenge of separating out the impact of one part of a multi-faceted, town-wide programme of delivery, the data do not permit strong conclusions to be made around the impact of smarter choices measures in workplaces when delivered alongside capital investment in cycling infrastructure. However, on balance, the evidence suggests that areas identified as benefitting both from infrastructure development and smarter choices interventions in workplaces have seen growth in commuting-time cycle journeys not matched in areas benefitting from route development only.

12. Case Study 7: Links to School and Bike It

This case study explores the impact of capital and revenue funded interventions on cycling mode share for the journey to school. Three different groups of schools are compared: i) schools benefitting from capital investment in route development only; ii) schools benefitting from both capital and revenue investment; iii) schools not directly benefitting from capital or revenue investment.

The capital investment programme considered in the case study is the Links to Schools programme. Initiated in 2004 with a grant from the Department for Transport of £9 million, the programme has helped to link schools to their local communities and cycle networks through dedicated cycling and walking capital infrastructure projects. Over the eight years of the programme, projects have been delivered in a total of 624 locations, serving 1,332 schools and 1.32 million pupils.

The revenue investment programme considered is Sustrans' Bike It project, working in schools to encourage cycling and walking amongst young people. The programme delivers activities designed to bring about behavioural change (including group cycle rides and walks, cycle training and bike maintenance). Schools may be engaged in Bike It for several years, with the intensity of engagement diminishing over time.

Levels of cycling to school in each group are derived from the Pupil Level Annual Schools Census (PLASC), which has historically included a question about pupils' usual mode of travel to school.

After outlining the process used to select schools for inclusion in the analysis, we compare mode share pre and post intervention between groups of schools with different combinations of investment. We then consider the impact of Bike It in the presence and absence of Links to Schools before going on to summarise evidence from other studies where capital and revenue measures have been delivered in combination.

12.1 Selection of schemes and schools

We followed a stepwise process to identify schools to include in the analysis:

- A list of all schools across England directly benefitting from Links to Schools in the time period coinciding with PLASC data (2007-2011) were obtained from project staff
- This was compared to a list of schools beginning Bike It after Links to Schools was delivered in order to identify schools receiving both interventions
- Using GIS mapping, we identified schools receiving neither Links to Schools nor Bike it (the no intervention group) and schools receiving Bike It only in the same broad geographic areas as Links to Schools only and Links to Schools plus Bike It schools
- Finally the selections were refined to include schools with PLASC data available in both the pre and post intervention year.

This resulted in four groups of schools: i) no intervention (22 schools); ii) Links to Schools only (20 schools); iii) Bike It only (three schools); and iv) Links to Schools + Bike It (five schools).

Because Bike It schools within the sample were predominantly primary schools, we have only included primary schools in the non-intervention and Links to Schools only groups. This makes the groups as comparable as possible beyond the presence or absence of the interventions.

12.2 Measure of cycling mode share

Between 2007 and 2011 PLASC, completed each January, asked about pupils' usual mode of travel to school. PLASC data were gathered from all school pupils, and in that regard it is a very comprehensive data set. However, a number of concerns have been raised about the data with respect to: variable modes of completion (input material can be collected from pupils or parents, and by different means); the possibility of 'carrying' a response to a question from year-to-year; the timing of data collection; and the use of the 'usual mode' question, as distinct from asking how pupils travel on the day of the survey. This latter issue is of particular significance, because it means that pupils who start cycling to school on an occasional basis (e.g. 1 or 2 days a week), which we know from other surveys to be a common behavioural response, are not recorded as having increased their cycling levels. The mid-winter timing of the survey is also problematic because it means that pupils who only cycle to school during the spring and summer are not recorded as cycling. Nevertheless, the data represent a valuable resource for the current study.

The PLASC data set was cleaned to remove schools with low response rates prior to analysis. Any suppressed data entries (recorded as ‘x’ in the PLASC database) were replaced with a value of one. Suppression is applied where fewer than three pupils respond in a particular category. By applying this assumption we are potentially underestimating levels of cycling.

For each school in the dataset, a ‘pre’ and ‘post’ intervention year was identified and PLASC data extracted for these years to calculate the proportion of children cycling to school. For schools with Links to Schools, the pre year was the year before the intervention was built. A pre year of 2007 was taken for non-intervention schools. The post year was 2011 for all schools.

After using the screening process described above, the Bike It only sample was reduced to three schools. One of the schools in this group had a vastly different measure of cycling to school in PLASC than the other two. Due to the small sample size and substantial variability within the group, we opted to remove the Bike It only group from the analysis.

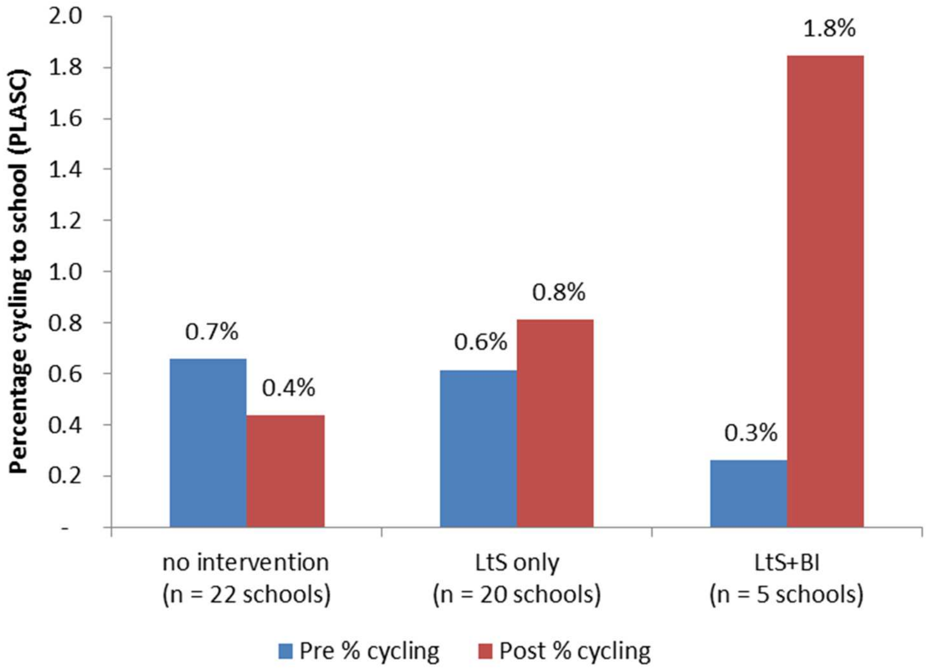
The number of pupils surveyed, the number cycling, percentage cycling and percentage point change in cycling between the pre and post intervention period in each group are summarised in Figures 12.1 and 12.2. As an initial assessment of impact on cycling to school, we summarise the direction of change between pre and post PLASC data for each intervention group. This suggests an increase in the proportion of schools showing growth in levels of cycling as the extent of intervention increases.

Figure 12.1: Numbers of pupils surveyed and number of pupils cycling in pre and post intervention years, and direction of change in levels of cycling following interventions

	Pre intervention			Post intervention			%-point change and %-change in cycling[a]	Direction of change in % cycling between pre and post (number of schools)		
	Total surveyed	Total usually cycling to school	% usually cycling to school	Total surveyed	Total usually cycling to school	% usually cycling to school		Increase	No change	Decrease
No intervention	7,154	47	0.7%	7,492	33	0.4%	-0.2%-points *(-33%)*	7 (32%)	4 (18%)	11 (50%)
Links to Schools only	4,868	30	0.6%	4,926	40	0.8%	+0.2%-points *(+32%)*	9 (45%)	7 (35%)	4 (20%)
Links to Schools + Bike It	1,528	4	0.3%	2,005	37	1.8%	+ 1.6%-points *(+605%)*	4 (80%)	0	1 (20%)

[a] due to rounding, percentage point change reported differs from the value resulting from the subtraction of the pre from the post percentages in the table

Figure 12.2: Percentage cycling to school in pre and post intervention years



Comparing schools in our sample to the national picture (Figure 12.3) gives an indication of how schools receiving these interventions compare to the norm in terms of baseline levels of cycling, and how any change in cycling following interventions compares to background change.

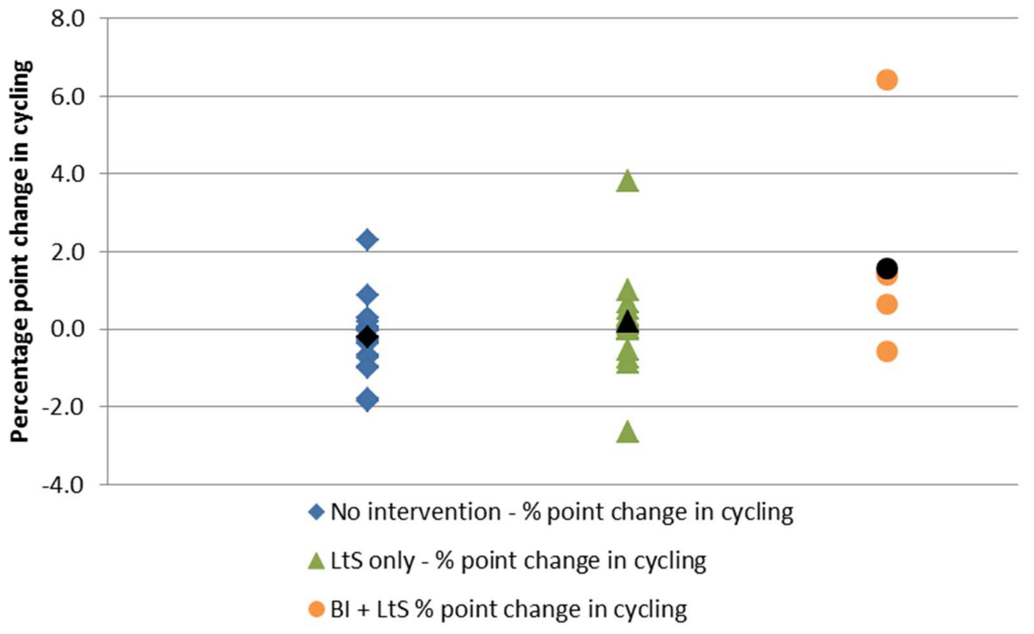
Figure 12.3: Percentage cycling to all English primary schools, 2007-2011

Year	% cycling
2007	1.1%
2008	1.1%
2009	1.0%
2010	1.0%
2011	1.0%

Comparing Figures 12.1 and 12.3, schools included in our analysis typically have a lower baseline cycling level than the national average. The non-intervention group shows a similar trend over time as in primary schools nationally (-0.2%-point decrease between 2007 and 2011, compared to a -0.1%-point decrease nationally).

Figures 12.1 and 12.2 suggest that there are some differences between the groups of schools considered, with apparently greater growth of cycling where infrastructure improvements (Links to School) have been followed by smarter choices measures (Bike It). However, the confidence that may be placed in this observation is limited by the small sample size. In Figure 12.4 below, we present the scatter of percentage point change in pupils cycling around the aggregated value for each group. This shows the variability within the groups, and suggests no strong difference between the no intervention and Links to Schools only groups. Figure 12.4 also highlights the influence of an outlying data point in the Links to Schools + Bike It group. Omitting this data point reduces the percentage point change from +1.6 %-points to +0.5%-points (compared to +0.2%-points for the Links to Schools only group).

Figure 12.4: Percentage point change in pupils cycling in schools: no intervention, Links to Schools only and Links to Schools + Bike It. Black symbols indicate aggregate percentage point change for each group



12.3 Changes in travel by all modes

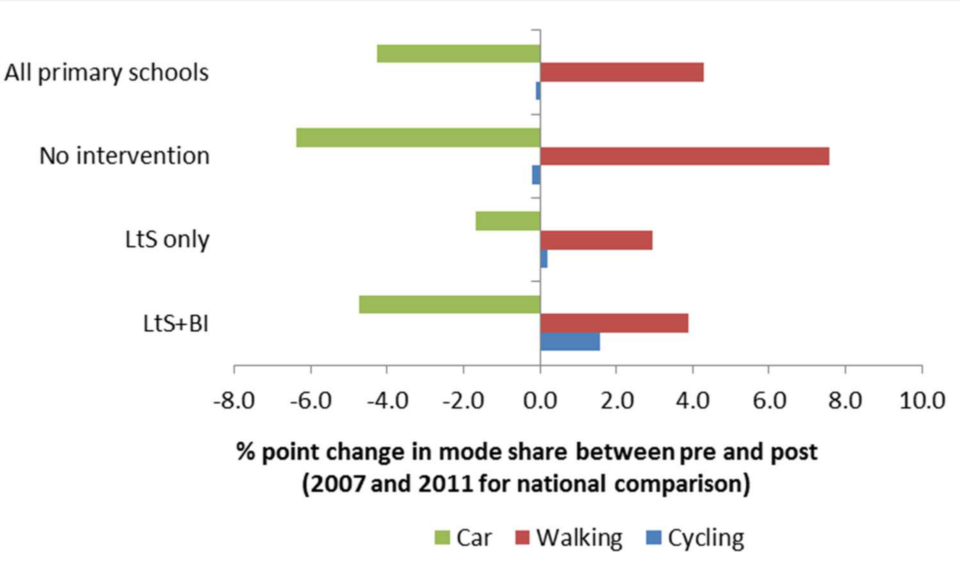
We have established that there are changes in levels of cycling before and after interventions, and that there are (tentative) differences between combinations of interventions. It is reasonable to expect that interventions designed to positively impact on one particular mode may also have an effect on other modes (Figures 12.5 and 12.6).

Figure 12.5: Percentage travelling by each mode in each group

	Pre % cycling	Post % cycling	%-pt change
No intervention	0.7%	0.4%	-0.2
Links to Schools only	0.6%	0.8%	+0.2
Links to Schools + Bike It	0.3%	1.8%	+1.6
All English primary schools[a]	1.1%	1.0%	-0.1
	Pre % walking	**Post % walking**	**%-pt change**
No intervention	62.1%	69.7%	+7.6
Links to Schools only	51.4%	54.3%	+2.9
Links to Schools + Bike It	62.0%	65.9%	+3.9
All English primary schools[a]	55.5%	59.8%	+4.3
	Pre % car[b]	**Post % car[b]**	**%-pt change**
No intervention	34.7%	28.3%	-6.4
Links to Schools only	43.3%	41.6%	-1.7
Links to Schools + Bike It	33.7%	29.0%	-4.7
All English primary schools[a]	39.3%	35.0%	-4.3

[a] For national data, data are compared between 2007 and 2011; [b]'car' includes car share

Figure 12.6: Mode share before and after intervention (2007 and 2011 for the no intervention and national groups)

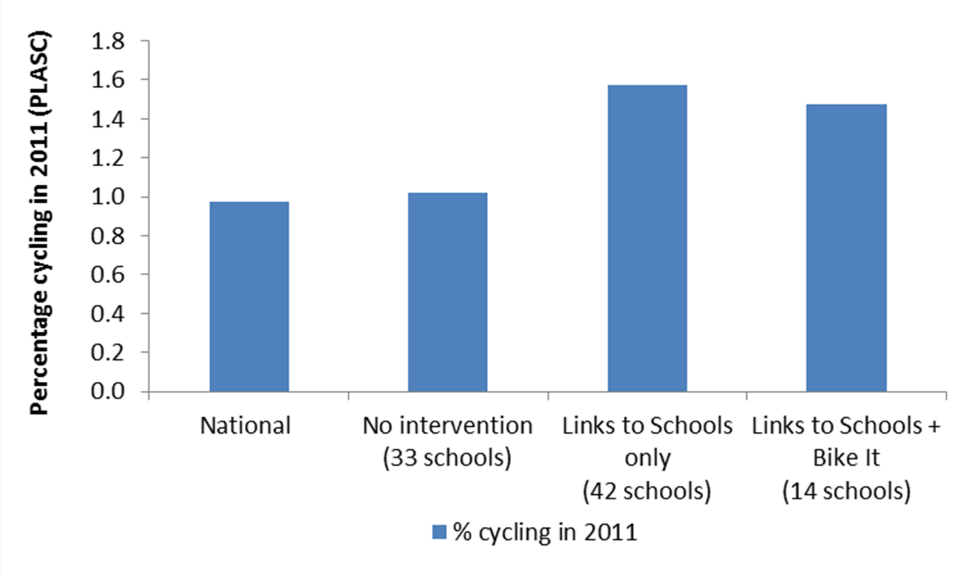


This analysis suggests that there is not a consistent pattern of change in mode share between the intervention groups. The Links to Schools + Bike It group shows a greater percentage point change in both cycling and walking than the Links to Schools only group, although overall the non-intervention group has seen the greater shift in walking. In terms of car use, the non-intervention group saw the greatest reduction.

12.4 Analysis of post intervention data only

The screening process we applied excluded schools benefitting from Links to Schools before 2007 because no pre PLASC data were available. By analysing post intervention data only, the sample size can be expanded to include all schools benefitting from Links to Schools or Links to Schools + Bike It at any time since 2004. The percentage cycling to school in 2011 in each group are presented in Figure 12.7, with the national (English) primary school percentage. The no intervention group is comparable to the national picture and whilst greater levels of cycling are seen in the two intervention groups there is no substantial difference between them.

Figure 12.7: Percentage cycling in 2011 in all English primary schools and intervention groups



12.5 - Comparing relative impact of smarter choices interventions delivered in the presence or absence of route development

Thus far, our analysis has used the national PLASC data set as a common measure of cycling in schools in all intervention groups. For schools in the Links to Schools + Bike It group, data on mode share are also available from the Bike It hands up surveys used to monitor the programme. This can be used to compare the relative impact of Bike It with and without Links to Schools.

Bike It hands-up surveys comprise a series of questions about travel to school. Children are asked about their frequency of travel by each mode, the mode used on the day of the survey and their preferred mode of travel to school. One of the key benefits of using this method to collect monitoring data for the Bike It programme is that it allows recording of pupils who infrequently cycle to school. There are, however, several limitations to the data. Data are collected in an open classroom setting, therefore pupils' responses may be biased by their peers or the presence of their Bike It Officer. There may also be some bias in favour of active travel given that data are collected in schools which have chosen to engage with Bike It and therefore may already promote active travel. Finally, although standard resources and guidance are provided, delivery of the survey may not always be consistent.

Hands up surveys are undertaken with pupils at the beginning and end of the academic year. The percentage of pupils reporting to cycle to school either every day or once or twice a week in the five schools in our sample benefitting from Links to Schools + Bike It are compared to schools in the same area engaged with Bike It only in Figure 12.8.

Figure 12.8: Percentage of pupils cycling to schools regularly (every day + once or twice a week) before and after Links to Schools + Bike It investment, compared to Bike It schools in the same local authority area (without Links to Schools), from Bike It hands up monitoring data

<table>
<tr><th rowspan="2"></th><th colspan="3">Links to Schools + Bike It</th><th colspan="3">Bike It only schools in area[a]</th></tr>
<tr><th>Pre</th><th>Post</th><th>% pt change</th><th>Pre</th><th>Post</th><th>% pt change</th></tr>
<tr><td>School 1
(Luton LtS 2008-09, BI 2008)</td><td>1.4%</td><td>16.6%</td><td>+15.2</td><td>10.9%[b]</td><td>23.3%[b]</td><td>+12.4</td></tr>
<tr><td>School 2
(Slough LtS 2008-09, BI 2008)</td><td>7.9%</td><td>14.6%</td><td>+6.7</td><td>11.2%[c]</td><td>27.9%[c]</td><td>+15.1</td></tr>
<tr><td>School 3
(Blackpool LtS 2008-09, BI 2009)</td><td>2.2%</td><td>22.9%</td><td>+20.7</td><td rowspan="2">8.7%[d]</td><td rowspan="2">21.6%[d]</td><td rowspan="2">+12.9</td></tr>
<tr><td>School 4
(Blackpool LtS 2008-09, BI 2009)</td><td>12.8%</td><td>26.3%</td><td>+13.5</td></tr>
<tr><td>School 5
(Luton LtS 2008-09, BI 2010)</td><td>0.3%</td><td>17.2%</td><td>+16.9</td><td>13.2%[e]</td><td>28.2%[e]</td><td>+16.7</td></tr>
</table>

[a] Bike It schools in the same local authority area, excluding Bike It and LtS schools; [b] n=5; [c] n=8; [d] n=5; [e] n=6

Schools benefitting from Links to Schools + Bike It generally started from a lower baseline level of cycling than other Bike It schools in the same area. These schools may have had a particular barrier to cycling (resulting in a low initial mode share) that the Links to Schools scheme was designed to help overcome.

In terms of percentage point change in regular cycling before and after Bike It, most Links to Schools + Bike It schools perform as well or better than other Bike It only schools in the same local authority area.

12.6 Impact of town-wide programmes encouraging cycling to school

We have focused at a very local level on the impacts of two particular types of intervention on cycling to individual schools. On a larger scale, elements of the town-wide Cycling Demonstration Towns and Cycling City and Towns programmes (delivered over several years using DfT funding) were designed to encourage cycling to school.

Derby, one of the six Cycling Demonstration Towns, focused their programme entirely on children and young people. Data are available for a number of automatic cycle counters across Derby. To explore the relative change at counter locations close to schools, we ranked all counters in order of increasing rate of change over time. Based on weekday data, there is a tendency for counters close to schools to appear higher in the ranking. When ranking is done on the basis of weekend day data, there is less clustering of counters close to schools near the top of the list. This suggests a generally stronger growth at count sites located close to schools than elsewhere in Derby.

Combined analysis from seven counters identified as being located close to schools indicated an increase of +33% against a 2007 baseline (compared to +15% for all counters). Both analyses indicate a greater growth at count sites close to schools than in other parts of Derby, consistent with the emphasis of the work programme delivered by Cycle Derby.[58]

[58] From analysis carried out for the Department of Transport, pending publication

12.7 Other sources of evidence

Two further studies provide evidence to suggest that combining route development with smarter choices interventions can deliver benefits in terms of levels of cycling to school exceeding those achieved by route development alone.

Firstly, a review of the Links to Schools programme in 2010 concluded that the provision of safer routes for walking and cycling can substantially increase the numbers of children travelling to school by foot or bike (Sustrans 2010). Examples reported in this review suggest that the combination of infrastructure with soft measures such as Bike It can enhance route usage, and lock-in the initial effect of capital investment. They also suggest that delivering Links to Schools with Bike It (i.e. with both interventions occurring in the same academic year) may be more effective than delivery of the interventions at different times (i.e. with Bike It taking place a year or more after the Links to Schools infrastructure is built). Specifically:

- In a Bike It school in Ashford also benefitting from a Links to Schools scheme, the proportion of children cycling to school regularly (measured using the Bike It hands up survey) was 28% in the pre-Bike It (but post-Links to Schools) survey. This increased to 66% at the end of the first academic year of Bike It delivery and 67% in a survey one year later. In a second Bike It school in the same area but not benefitting from Links to Schools, regular cycling to school increased from 15% in the pre-Bike It survey to 50% at the end of the first academic year of delivery. One year after this survey, the number of children cycling regularly to school was still high, at 35%, but had declined compared to the level immediately after Bike It. This suggests that Bike It can achieve substantial additional uplift in cycling levels (above that achieved solely by new cycling infrastructure). It also appears to show that where cycling infrastructure is good (in this case, as a result of a Links to School scheme), the increased levels of cycling resulting from a Bike It project may be sustained following initial engagement .
- Two Bike It schools in Exeter were identified as also benefitting from a Links to Schools scheme. Where Bike It began in the year following the Links to Schools intervention, a higher proportion of children cycling to school regularly was recorded in the pre-Bike It survey (11%) than when Bike It began in the same academic year as the Links to School intervention (6%). The percentage point increase in the proportion of children cycling to school regularly between the pre and post survey and also between the first and second post surveys was greater for the school where Bike It began in the same academic year as the Links to Schools intervention than when Bike It was delivered in the year following the intervention.

Secondly, a qualitative evaluation of Sustrans' infrastructure work around schools concluded that complementary intervention programmes, incorporating soft measures, were perceived as being more effective in encouraging active travel compared to infrastructure schemes delivered in isolation (CLES Consulting 2012). The impacts of infrastructure developments were found to be more sustainable when supported by other types of interventions. The research found that 64% of schools representatives agreed or strongly agreed that activities to promote walking and cycling had been just as important as infrastructure improvements. Children were found to respond more positively to promotion of cycling and walking through activities they could participate in rather than general promotion of the routes.

12.8 Conclusions

In this case study we have looked in detail at the impact on levels of cycling to school of capital investment made in the presence and absence of revenue measures. The data available to support this analysis is limited, therefore we can draw only tentative conclusions. Other evidence demonstrates the importance of both types of investment in increasing cycling mode share for the journey to school.

- Analysis is limited by the quantity of data available across the different intervention groups - (non-intervention, Links to Schools only, Links to Schools + Bike It). -
- Based on a limited sample, revenue investment following route development around schools appears to enhance impact, with a greater percentage point change in cycling being recorded at schools benefitting from Links to Schools + Bike It than those benefitting from Links to Schools only (Figures 12.1 and 12.2). Differences between groups are strongly influenced by outliers in the data set (Figure 12.4).
- Growth in cycling mode share due to infrastructure alone may be of the order of +0.4%-points (when compared with the trend at schools with no intervention). Growth in cycling mode share due to infrastructure and smarter choice measures combined may be in the range of +0.7 to +1.8%-points (compared to the trend at schools with no intervention, and with the range depending upon whether an outlying data point is included or excluded) (Figure 12.1).
- Schools in receipt of interventions tend to have a lower baseline level of cycling than the - national average (Figures 12.1 and 12.5). The non-intervention group is similar to the national - average in terms of change in percentage cycling between 2007 and 2011. -
- The proportion of schools seeing positive change in levels of cycling over time increases in the - order no intervention < Links to Schools only < Links to Schools + Bike It (Figure 12.1). -
- In order to increase the sample size, we compared the 2011 PLASC result for schools receiving Links to Schools only or in combination with Bike It in any previous year. There was no difference between the non-intervention group and the national picture, nor between the two intervention groups, although cycling levels were greater in the groups that had received one or both of the interventions (Figure 12.7).
- Data from other studies indicate the importance of a combination of capital and revenue - investment in increasing cycling mode share for the journey to school. -

Overall, the picture presented by the available data is not clear cut, but provides a tentative indication that combining smarter choice measures and infrastructure may deliver greater uplift in cycling levels than infrastructure alone. The limitations of small sample size and the weaknesses of the PLASC data mean that these figures should be treated with caution, and the actual uplift due to smarter choice measures could be either substantially more or less.

13. Economic analysis of the case study evidence

In this chapter, we report indicative BCRs for the various investments, both capital and revenue, that were described in the case studies. Our economic analysis is based on standard WebTAG methodology and assumptions as far as possible, but a number of additional assumptions were also required and these are explained in some detail in the following sections[59].

We also draw out some initial points about the effectiveness of revenue and capital funding in a variety of different circumstances.

We have carried out sensitivity tests where appropriate and the impact of variation in critical parameters is reported here. Our focus has been to try to achieve consistency of approach between the economic analyses of the different case studies, so as to enable comparison of approaches deploying different proportions of capital and revenue. As a general principle therefore, the **differences** between BCRs for capital-only schemes and capital-plus-revenue schemes should be considered most important, rather than the absolute BCR values[60]. As the low and high case scenarios in following sections show, the absolute BCRs are sensitive to the assumptions for input parameters, but the **relative** performance of the examples analysed is retained between the low and high cases.

To estimate the health benefits from additional cycling and walking (including walking to reach bus stops) the approach used in WebTAG Unit A5.1 Active Mode Appraisal[61] was followed. This presumes use of an average mortality rate for the 15-64 age bracket, which is not appropriate for all the case studies. For case studies where the population has a different age range the Office for National Statistics National Life Table has been used to apply average mortality rates.

A breakdown of the proportion of benefit derived from road decongestion, mortality reduction, bus user time savings and other factors is summarised in an appendix.

13.1 General economic assumptions applied to bus case studies

The bus case studies have many features in common and our economic analysis has applied consistent assumptions so far as possible. Figure 13.1 lists these 'global' assumptions and resulting input parameters, applied to all the bus case studies as default values in the absence of specific local information. Where local variations are applied to parameter values, the relevant local evidence is discussed in sections 13.2-13.5 that deal with the case studies one by one.

For input parameters where a range of values is shown, these have been applied to generate low case and high case BCRs. The purpose of applying a range of values was primarily to show the sensitivity of the model to the different parameters rather than generate extreme cases. Even the high case parameters are chosen to be conservative in comparison with values in the cited sources.

[59] There are some differences between the main focus of WebTAG and the task here. WebTAG has much emphasis on *ex ante* project appraisal where calculations depend on forecast future impacts with and without a project that does not yet exist. In our case studies, by contrast, we focus on *ex post* evaluation of projects that have already been implemented, and the effects are measured on the ground rather than forecast by modelling. Thus the statistics available are very much more reliable, but much less pure, than model outputs which make *ceteris paribus* assumptions not available in the real world. There is less use of hypothetical modelled alternatives, and more focus on making adjustment where necessary for real disruptive factors.

[60] Some readers less familiar with the high benefits available from the best sustainable transport projects may be surprised to see how well some of the projects have performed. Special reasons for high BCRs for the bus case studies are discussed below.

[61] This Unit is based upon the World Health Organisation's Health Economic Assessment Tool (HEAT).

Figure 13.1: Economic analysis default assumptions for bus case studies

Input parameter	Assumption	Rationale/method
Appraisal period and effect decay rate	60 years, No decay	Standard appraisal period and benefit profile for road infrastructure schemes. The capital spend in the three scheduled service bus case studies includes some highway alterations for buses. There is, however, also significant spending on items such as new bus shelters, for which the lifetime could be expected to be shorter. Rather than attempt estimations of different decay rates for different types of capital spend, the models factor in an ongoing maintenance cost at 1% p.a. of total capital spend and assume no decay. Regarding the revenue expenditure element, no decay rate is applied, because having boosted service levels to a commercially profitable frequency there is no reason to assume that the service level (or its benefit) should deteriorate. See texts for analysis of sensitivity to use of a shorter appraisal period.
Upkeep costs of capital items	1%	Costs of 1% of the total infrastructure expenditure are applied from the first date of capital expenditure.
Long-run patronage growth	Zero	Where the intervention is recent, patronage growth may not yet have stabilised. However, as a conservative assumption, no further growth is assumed beyond the period for which data are available i.e. patronage is assumed to flatten immediately.
Patronage uplift above do-nothing	Patronage parallel to comparator route(s) in absence of intervention	A year-by-year index of background change in patronage was generated from comparator route(s) and applied to baseline patronage on the intervention route so as to generate a do-nothing patronage curve.
Initial ramping up of benefits	Proportional relationship to patronage increase or to total spend as appropriate	Congestion and health benefits arise only from new patronage and are ramped up in proportion. Bus user time savings apply to base patronage as well as new patrons and are ramped separately where the rise in patronage is out of sync with the dates of journey-time-saving schemes.
Value of bus users' time	£6.43 per hour	The scheduled service routes considered carry significant but unknown proportions of commuters, so an average of the values of commuting time and other non-working time in WebTAG Databook table A1.3.1 was applied. Rule of a half was applied to time savings for new patrons (as opposed to pre-intervention patronage) on the basis that the time savings are a primary cause of the extra demand.

Input parameter	Assumption	Rationale/method
Diversion from car	20-30%	Based on Mackie et al. (2002)[62] and TAS (2002)[63] which found, respectively, that 32% and 33% of new bus users had previously travelled by car. National Travel Survey 2013 Table NTS0301 indicates that 64% of general car trips are as driver (rather than passenger). This would equate to a 21% diversion rate in conjunction with the above figures. However, all the bus routes in question cater for a significant commuter market. NTS0906 gives average car occupancy for commuter trips as 1.18, equating to a 28% diversion rate.
Average bus trip distance	5-8 km	A conservative range based on national average non-London local bus journey length of 7.6 km (calculated from National Travel Survey 2013 tables 0308/0309). This figure is conservative because the routes in question are inter-urban whereas the NTS figures also include urban buses.
Service interval penalty time	50% time penalty in Association of Train Operating Companies Passenger Demand Forecasting Handbook (reduced-fare users).	The ATOC PDFH table is applied in the absence of a similar bus-user specific listing of perceived penalty times. This treats the value of wait time as double the value of in-vehicle time; other sources[64] confirm the validity of this approach for buses, but as a very conservative assumption the input values used here are half the PDFH values[65].
Walking time to bus stops	1-3 minutes	Note that walking time is treated here as a health benefit, not a delay disbenefit. This approach is valid because this is an ex-post economic analysis of known numbers of bus users, not an ex-ante appraisal to estimate potential levels of use: the additional walking is a chosen response to improved service, not a forced response to service reduction, and therefore cannot be described as a disutility in terms of rational choice. 1-3 minutes is a conservative (low) range based on a 200m walk to the bus stop and a walking speed of 3miles/hr (80m/min). The normal rule of thumb for a bus stop 'catchment' is 300-400m.[66]
Operator spend and income	Excluded	Data unavailable due to commercial confidentiality. The BCR is therefore entirely on the basis of local authority spend. All the routes in question are, however, known to be profitable to the operator. See texts for a sensitivity analysis.

[62] Mackie, P.J., Bristow, A.L., Shires, J., Whelan, G., Preston, J., Huang, B. (2002) *Achieving best value for public support of the bus industry Part 1: Summary report on the modelling and assessment of seven corridors*, in - Commission for Integrated Transport / LEK (2002) *Obtaining best value for public subsidy for the bus industry*. -

[63] TAS Partnership (2002) *Monitoring quality bus partnerships volume 1: the evidence*, in Sloman (2003) *Less traffic where people live*. -

[64] Balcombe R. et al. (2004): Table 7.16 indicates that wait time weightings relative to in-vehicle time are - comparable for buses and trains, with a value of two or more under most circumstances. -

[65] So, for example, the PDFH indicates that a change from a 60-minute to a 30-minute service interval for rail - results in a 6 minute reduction in the waiting time penalty from 27 to 21 minutes (for reduced fare passengers, - treating wait time as worth double in-vehicle time), whereas we have used a reduction of 3 minutes. -

[66] See, for example, discussion in Daniels R and Mulley C (2013) *Explaining walking distance to public transport: the dominance of public transport supply* The Journal of Transport and Land Use 6:2 pp 5-20. -

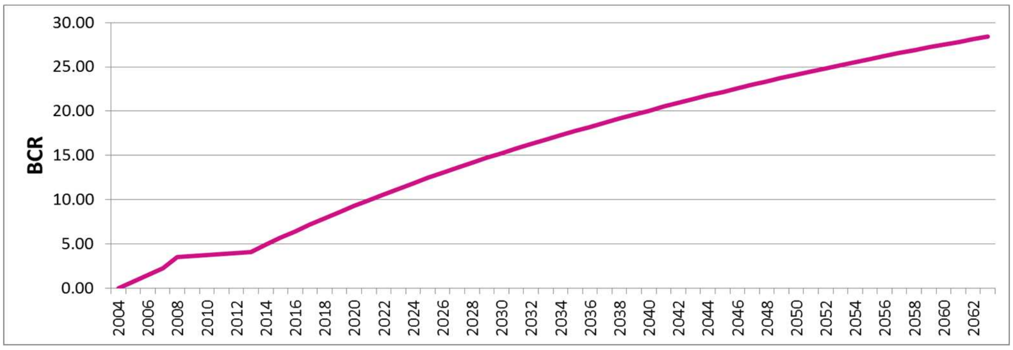
Input parameter	Assumption	Rationale/method
Journey quality benefits	Not included except where upgrade due to public funding known to be major	Since operator spend and revenue are excluded, journey quality benefits that can be identified as accruing from operator capital spend are also excluded. Where local authority funding appears to have resulted in a major benefit such as real time passenger information (RTPI), 'generalised minutes' of benefit are included in the high case as per WebTAG Databook table M3.2.1.

As noted in Figure 13.1, operator expenditure and income has generally not been made available for benefit-cost calculations, as a result of commercial sensitivities about operating costs and fare revenues. We do, however, have two routes where financial data are available, with which we can test the implications of omitting the operator finances. Excluding operator finances, the BCRs for the two routes in question lie at 17.0 and 28.4 (using mid-range input parameters). If operator costs and revenues are factored in these values fall to 3.8 and 5.3 respectively.

Because the primary purpose of this study is to assess the relative merits of varying proportions of capital and revenue expenditure, it is necessary to establish a common basis of economic assessment to allow comparison. Operator expenditure and income are therefore excluded from the analyses of all case studies. The BCRs discussed in this chapter thus should be treated as partial BCRs that reflect only the value of local authority expenditure. It appears from the instance above that the exclusion of operator costs and benefits can result in some unusually high BCRs. It is therefore advisable to place more weight on how BCRs compare with one another than on the absolute numbers, and to be aware that inclusion of operator finances would probably bring down most of the exceptionally high calculated BCRs to a more normal range of 10 or less. In addition we can be confident that inclusion of operator benefits and costs would not cause any of the lower calculated BCRs to fall below a value of one, because every bus route considered has a commercially viable status indicating that overall operator costs are significantly less than revenues.

The sensitivity of the calculated BCRs to the choice of appraisal period is illustrated in Figure 13.2, which shows how the BCR of the Kent Triangle bus route rises as the period of appraisal is increased. In this example, cutting the appraisal period from 60 to 30 years would decrease the BCR by 40%.

Figure 13.2: Illustrative example of relationship between BCR and appraisal period



Kent Triangle route appraised from 2004 with parameters set at the mid-range of input values listed in Figure 13.3

Once service frequency has been increased and patronage has risen to a level at which the new higher frequencies are commercially profitable, there is no reason to suppose that service frequency will be cut back again, or that the resulting benefits will decline over time. The benefits of investment could therefore be sustained for as long as, or longer than, the standard 60 year highway scheme appraisal period. However, the question arises as to whether this profitable opportunity would, at some point in the future, be exploited by bus operators anyway. The information presented by operator and local authority staff in the case studies indicates that in those particular instances, the bus operators would have been unlikely to step up service frequencies without public funding to cover a proportion of the risk. Nevertheless, it could be argued that the apparent success of some kick-start schemes means that in the future bus companies might become more ready to risk expenditure on higher service frequencies. Theoretically this eventuality could be represented in the economic appraisal by a shorter appraisal period, or a change to the do-nothing scenario, or as a decay to the revenue benefit, but in the absence of information about changes to bus operator behaviour no such adjustments have been factored into the models.

The extent to which benefits accruing from patronage increases and journey time savings are attributable to public spending (as opposed to commercial investment by operators) is discussed for each case study. It appeared in the case studies that the public spending was commonly the precipitating factor for operator spending on new buses, and in some cases also for significant operator spending on branding and marketing. So although operator expenditure is excluded from this economic analysis, it could be argued that it would be legitimate to attribute the benefits of the operator spending to the public expenditure. In practice, it is impossible to isolate the patronage rises that may have resulted from say, new buses (paid for by the operator) from rises that may have resulted from service frequency upgrades (paid for by the local authority), particularly since both changes often occurred simultaneously. The economic analyses therefore do include an unknown amount of benefit accruing from patronage uplift due to new vehicles. However, as noted in Figure 13.1, no journey quality improvement from new vehicles is included as equivalent ('generalised') minutes of time saving benefit.

Bus operators have made further improvements to some routes on their own initiative in the period after publicly-funded service enhancements and infrastructure improvements. In these cases, in order to avoid misattribution of any resulting extra patronage to the earlier public spending, our analysis caps the patronage curve prior to these further commercial interventions. The BCR is calculated on the conservative assumption that patronage would have levelled off immediately after the period of public expenditure and continued at that level thereafter.

13.2 Economic assumptions and BCRs for East Kent bus improvements

Case Study 1 (East Kent buses) showed that after revenue-funded service frequency upgrades and capital-funded improvements the Triangle route (to the north Kent coast) and the Diamond route (to the east Kent coast) showed an increase in patronage above that of comparable unimproved routes.

Although the overall patronage increases are very large, attribution of particular increases to specific interventions is difficult because the patronage trend is a steadily rising curve with no obvious deflections. However, it does appear that for the Triangle the publicly-funded service frequency upgrade in 2010 was followed by a continued rise in patronage at a time when both the comparator routes were level or declining. For the Diamond, the publicly funded service frequency upgrade in 2006 occurred at the same time as free concessionary fares for pensioners were introduced, but it is nevertheless evident that patronage during this period outpaced the comparator routes[67].

The economic analysis should be considered in the overall context of multiple improvements from 2004 onwards, following the Quality Partnership signed that year between Canterbury City Council

[67] The graphs in the case study by types of patronage indicate the comparator routes did receive substantial extra patronage due to concessionary fares, so it appears they are valid comparators in this regard.

and Stagecoach. Only the Triangle received significant spending on bus priority improvements, but both routes received new bus stops and highway works to improve bus access to stops. It is fair to assume that the kick-start revenue funding was responsible for triggering the operator spending on new buses, since that was part of the Kickstart bid discussions. However, in the case of the Triangle, long before the kick-start upgrade the operator had invested in marketing the route and putting on new buses (later replaced again at the time of the subsequent kick-start bid). This early expenditure took place from 2004 in parallel with council spending on bus priority measures for the Triangle, and the two strands appear to have arisen from the Quality Bus Partnership deal.

The three comparator routes all show patronage trends below those of the Triangle and Diamond, but the patronage trends differ significantly between them. In the absence of information to merit choice of a particular comparator, patronage for all three was combined to form an average comparator index and generate a ‘do-nothing’ scenario.

BCRs were calculated for both routes using a baseline year of 2004. For the Diamond, where the operator instituted further improvements on a commercial basis after the period of publicly-funded support (in 2012 and 2013), the analysis only considers the patronage rise to 2011. Patronage is assumed to plateau immediately thereafter. In addition, a BCR for the Triangle was calculated using a baseline year of 2008, excluding the earlier capital investment, to enable comparison between periods with different proportions of capital spend.

The high case for the Triangle assumes two minutes ‘penalty time’ saving from the reduction in headway between buses from 15 minutes to 10 minutes. Two more minutes saving are assumed to arise from bus priority measures, split evenly between the Sturry Road bus lanes installed in 2006 and 2007 and the Tourtel Road bus priority lights installed in 2009. The time savings on this stretch of road at peak time are probably greater than this, but the parameter value used is lower to account for off-peak periods and because these works only assist the ‘clockwise’ portion of the Triangle where buses are in-bound to Canterbury. The low case assumes just one minute of time saving.

The high case for the Diamond assumes three minutes penalty time saving from headway reductions (from one hour to 30 minutes, and from 30 minutes to 20 minutes, on different parts of the route at different times during the period of public support). The low case assumes just one minute of time saving.

New bus stops and raised kerbs were publicly funded, but are also not factored in as an equivalent time benefit on the conservative assumption that the effect of the operator-funded new buses was probably the main benefit perceived by users.

The patronage data includes a breakdown by type of user across the period of inception of free concessionary travel for older people and of a cheap ‘Freedom’ pass for 11-16 year olds. It is therefore also possible to identify the net patronage increase due to these 100% revenue-funded initiatives[68]. Two separate analyses calculate the BCR from these types of revenue spending on the Triangle.

For the Freedom pass, the reimbursement to the operator per trip is known, from which the total revenue cost to the local authority can be calculated. This varies between peak and off-peak trips but the split of these trip types has been provided by the operator, so a weighted average can be calculated (£1.31 per trip). The analysis offsets this cost against income to the local authority from

[68] Numbers switching from other ticket types at the time of inception are also evident and can be subtracted.

selling Freedom passes. The current price (£200 per year) is used in the economic model since the reimbursement rates are also present-day figures[69]. Health benefits from walking to bus stops are very small due to the young age range so the diversion rate from car to bus is the dominant factor in this analysis. The 'pool' of pupils not already using the bus is dominated by those walking and those getting a lift[70]. Given the significant parental outlay for a Freedom pass it seems reasonable to assume that most of the trips involved are not easily walkable. It is therefore reasonable to assume that a high proportion of the trips replaced would have been car trips. Furthermore it is likely that a significant proportion of these would otherwise have been two-way car trips dedicated to the school run. The high case assumes 80% of children would have had a lift if they had not taken the bus and that half of these would have been a dedicated return journey (i.e. equivalent to a diversion rate per one-way bus trip of 120%). The low case assumes half of this figure. These school trips particularly impact on peak time congestion but the analysis does not add benefit to account for this.

For older people's free concessionary passes the average reimbursement is £0.94 per Triangle trip. With this age group the health benefit from walking to the bus stop becomes more significant than the decongestion benefits. The average age of a pass user is assumed to be 67. The low case assumes a one minute walk to the bus stop at each end of the trip, as per other analyses. The high case assumes a four minute walk to the bus stop to account for slower walking speeds in this age group.

Indicative BCRs for the Triangle and Diamond are given in Figure 13.3. Although all the input assumptions are highly conservative, the economic analyses of the route improvements on both routes show very high BCRs, ranging from 8.8-55.8. As already noted, these high BCRs are in part due to the exclusion of operator spending. It is, however, perhaps not surprising that where public support of hundreds of thousands of pounds seems to have precipitated millions of pounds of capital expenditure by a bus operator, the outcome appears good value when analysed from the point of view of the public purse.

The analysis of revenue funding of free older person travel and a cheap youth pass shows more modest BCRs, as would be expected for schemes with revenue expenditure continuing indefinitely. Indeed it is noteworthy that this type of scheme can produce BCRs significantly above one (i.e. net economic benefit) for the high case input values, and close to one for the mid-range assumptions.

Figure 13.3: Benefit-cost ratios for East Kent bus routes)

	% revenue	**BCR**		
		High case	Mid-range	Low case
Kent Diamond (2004-2011)	67%	26.2	17.0	8.8
Kent Triangle (2004-2013)	44%	45.4	28.4	13.3
Kent Triangle (2008-2013)	55%	55.8	36.5	18.8
Kent Triangle (youth Freedom pass)	100%	1.8	1.1	0.6
Kent Triangle (pensioner free concessions)	100%	1.6	0.9	0.4

13.3 Economic assumptions and BCRs for Buckinghamshire bus improvements

Case Study 2 (Buckinghamshire buses) showed that revenue-funded service frequency upgrades and capital-funded improvements appear to have led to patronage increases on the existing commercial routes 280 (to Oxford) and 300 (to High Wycombe). The attempt to kick-start a new express

[69] Previous prices were £100 and in years prior to that £50.

[70] Pupil Level Annual School Census 2011

commuter bus (route 100 to Milton Keynes) was discontinued after patronage plateaued at an uncommercial level and is therefore excluded from this economic analysis.

The difference between the 280 patronage trend and the comparator route is quite subtle. For the 300, the difference is much sharper, but the period of service support corresponds to the advent of free concessionary fares for pensioners. No breakdown of fare types is available, so there is an unresolved question whether the comparator route 500 might be somehow different in character and therefore less attractive to new older patrons. However, the local authority cannot identify any obvious reason why it should not be representative of the background trend in this regard.

The context for the economic analysis is a significant local authority programme of revenue expenditure from 2006 onwards to market buses generally. This timing corresponded with the start of the kick-start funding for route 300 and continued through the period of kick-start funding for the 280 that started in 2010. The marketing budget steadily diminished over this period, but it appears that bus operators spent correspondingly more on marketing. The linkage between the operator's purchase of new buses and the kick-start funding is less clear than in Kent, with the new buses arriving at the end of the kick-start funding period for route 300 and eighteen months beforehand in the case of route 280. However, the press release at the time links the purchase to joint working.

There was no spending on bus priority measures that produced journey time savings for bus users on the routes concerned. However, in 2009 the local authority spent £18.5 million on a new bus interchange in Aylesbury and on real time passenger information (RTPI) at bus stops across the network. This appears to have been a major change that not only informed passengers but has enabled bus schedulers to see where buses are delayed and significantly improve bus punctuality. One 'generalised' minute of equivalent time savings is therefore factored into the high case BCR as per WebTAG Databook table M3.2.1 (in addition to two minutes user 'penalty time' savings for the headway reductions from 30 minutes to 20 minutes). The low case assumes just one minute of time saving. The RTPI project equipped 40 bus routes, so one-fortieth of the cost is allocated to route 280 and 300.

Both routes have characteristics of express bus services that seem likely to result in above-average trip lengths. In the absence of local evidence about bus journey lengths, the same high case input parameter was used as the known figure for the Bristol-Portishead route (13km), which appears comparable in route length and route character.

Three analyses were done. Route 280 was analysed from a baseline year of 2008, the year before it received new buses in preparation for the service frequency upgrade. Route 300 was analysed for 2003-2012 (after which the operator instituted a further frequency increase) and also for the period 2003-2008. The shorter analysis covers the period of kick-start revenue funding but ceases before the period of capital expenditure by the local authority. Patronage is assumed to immediately plateau at the 2008 level in the shorter analysis and at the 2012 level in the longer analysis.

It is notable that the truncated analysis excluding capital expenditure generates extraordinarily high BCR values (Figure 13.4). This raises the question of whether it is valid to consider periods of very low or zero capital expenditure independently of earlier or later periods of capital spending. In this instance, we know that after this period of purely revenue spending, the council saw fit to make a very large capital investment in bus infrastructure, of the kind that would be expected to be episodic and of benefit to bus services over a period of many years[71]. It is therefore reasonable to suppose

[71]Operator spending is not being considered here, but it is nevertheless notable that at the end of the kick-start period the bus operator also decided it was time to re-equip the route with new buses. Where kick-start

that the period of pure revenue spend could not have continued indefinitely without capital spend. The appearance of benefits being achieved ‘on the cheap’ in the short run cannot be taken as an indication that zero capital spending is a sustainable or good value approach in the long run. It does show that under circumstances where there is not an infrastructural obstacle to better bus services, short bursts of revenue funding may provide exceptionally good value. But more infrastructure spending is liable to be required sooner or later.

Figure 13.4: Benefit-cost ratios for Buckinghamshire bus routes

	% revenue	BCR		
		High case	Mid-range	Low case
Bucks 300 (2003-2012)	23%	16.3	9.8	4.5
Bucks 300 (2003-2008)	100%	88.4	54.1	25.1
Bucks 280 (2008-2013)	32%	10.1	6.6	3.1

13.4 Economic assumptions and BCRs for Greater Bristol bus improvements

Case Study 4 (Greater Bristol buses) showed sharp increases in patronage on two routes that received revenue funding to increase service frequencies: the X1 route (Bristol to Weston-super-Mare) and the X2/3 route (Bristol to Portishead).

The general context for the economic assessment is that the revenue-funded service frequency upgrades to the X1 (2012 onwards) and the X2 (2013 onwards) followed four years of major area-wide capital expenditure on the Greater Bristol Bus Network from 2008 to 2012. As the case study notes, a significant proportion of this expenditure on the corridors used by the X1 and X2/3 was designed to also benefit general traffic (and also benefitted other buses), so adjustments have been made to the capital spend to attribute an appropriate proportion to the intervention routes.

The X1 and X2/3 are particularly aimed at serving the peak commuter market, at which time the X2/3 is fully loaded, with passengers standing. The user profile and average trip length are therefore atypical. User surveys undertaken at peak time found average peak-period journey lengths on the X1 and X2/3 were 27 km and 13 km respectively. These values are used as high case inputs and are reduced to 21 km and 9 km for the low case, on the basis that off-peak non-commuter trips may tend to include more intermediate destinations.

The surveys also reveal that high proportions of people who have recently started using the bus previously travelled by car (as drivers): 64% in the case of the X1 and 68% for the X2/3. These figures are used in the high case and reduced to 46% and 50% in the low case.

The X2/3 corridor infrastructure improvements included works that had a major impact on delays across a feeder roundabout to Junction 19 of the M5. These delay reductions have been measured and are shown in graphs in the case study (Figure 8.4). These indicate that it is reasonable to assume a journey time reduction of four minutes (across the whole day) as a high case, with a further four minute penalty time saving due to the headway reduction from 30 to 15 minutes. For the low case, just two minutes of saving is assumed, on the basis that it is somewhat unclear how much of the time saving has yet carried through to the bus timetable.

revenue funds achieve capital spend on new buses ‘by proxy’, revenue-only funding is likely to be sustainable for longer periods than it would be in circumstances where the local authority undertakes vehicle procurement.

Two analyses of the X2/3 have been carried out. One runs from 2008 to 2013, including all the capital expenditure and the kick-start revenue funding. The second runs until 2012, including only the period of capital expenditure. In this case, only time savings attributable to the infrastructure measures are included and patronage is presumed to plateau from 2012 onwards.

The X1 has also been the subject of two analyses. One runs from 2008 encompassing both the capital and kick-start revenue funding periods. In this case the headway reduction is from 30 to 20 minutes so two minute penalty time saving is included in the high case. In the absence of delay measurement information on this corridor the timesaving impact of highway works is considered to be equivalent to the X2/3 in the high case (four minutes). For the low case just two minutes of saving is assumed. The second analysis starts in 2011, which on this corridor was a year without either capital or revenue spend and therefore provides a baseline to isolate and analyse just the subsequent kick-start revenue funding. In this case only the time saving from headway reduction is included (two minutes). The low case assumes just one minute of penalty time saving for bus users.

The comparator used to generate do-nothing patronage curves for the X1 and X2/3 is First bus patronage across the whole of the Greater Bristol Bus Network (GBBN) with X1 and X2/3 patronage subtracted.

These data have also been used as the basis for a further capital-only analysis, comparing the actual GBBN patronage results against a do-nothing situation based on the local authorities' modelled predictions for the network without the GBBN programme of capital expenditure. It should be noted that this is a different do-nothing scenario (i.e. no GBBN capital spend) to the do-nothing scenario for the X-routes (i.e. GBBN capital spend but no significant revenue spend).

The high case of the GBBN analysis assumes four minutes of user time savings from infrastructure expenditure and the low case assumes two minutes. The high case is equivalent to the level of improvements on the X2/3 route, which it might be argued suffered a particularly bad congestion hot spot. However, the GBBN programme included 300 real time information displays and 1000 new bus shelters. The WebTAG databook indicates that each of these improvements are perceived by users to be worth over a minute of generalised benefits, so the high case is not unreasonable given that the GBBN also instituted a major programme of bus priority lanes and signals. Just two minutes of savings are assumed for the low case.

BCRs for the Bristol routes are shown in Figure 13.5. In general these are much lower than for the Kent or Buckinghamshire routes. This appears to be a consequence of the analysis including a major programme of relatively big-ticket capital projects. The exception is the X1 analysed just for the period of kick-start revenue funding, which shows extremely high BCRs. As with the Buckinghamshire economic analysis, the question arises as to whether this short-run analysis is legitimate. It seems likely that the preceding capital works may have created good conditions in which a small injection of revenue support was extremely effective; in the absence of the capital investment it is possible that the kick-start funding for the X1 would have had less impact. For the Bristol X2/3, the operator First indicated to the local authority that it would not be feasible to upgrade the frequency without dealing with the congestion hot-spots on the corridor, because it would be too costly to deploy sufficient buses and drivers to cope with the delays. For this reason no revenue-only analysis has been made for the X2/3.

For the X1 the BCR is also adversely affected in the analysis from 2008 because the route saw declining patronage during 2008 and 2009 and did not recover until the service upgrade. It is not clear what caused this decline. Patronage on both the GBBN comparator and the X2/3 held up better during this period.

For the economic analysis of route X2/3 to 2012, patronage actually shows no increase above the GBBN comparator. This, however, is what would be expected because the GBBN was receiving an equivalent input of capital spending at the same time. Because patronage uplift above the do-nothing case is zero all the benefits in this period are time savings benefits to the baseline patronage rather than health benefits or congestion benefits from more people using the bus.

Figure 13.5: Benefit-cost ratios for Bristol bus routes

	% revenue	BCR		
		High case	Mid-range	Low case
Bristol X1 (2011-2013)	78%	51.6	37.5	25.1
Bristol X1 (2008-2013)	11%	4.7	3.1	1.6
Bristol X2/3 (2008-2013)	8%	8.5	5.5	2.5
Bristol X2/3 (2008-2012)	0%	2.8	2.1	1.4
Bristol GBBN (2008-2013)	0%	2.5	1.9	1.2

13.5 Economic assumptions and BCRs for New Forest Tour

Economic analysis of the New Forest Tour (Case Study 4) requires a somewhat different approach to take account of its seasonal tourist-based operation. This in part reflects the approach of the National Park Authority officers responsible for creating the Tour in its present form, who are clear that the key to it achieving commercial success has been to position the Tour as a premium-priced tourist attraction, as distinct from a ‘bus’ or a scheduled service. Each Tour user receives a guide including a feedback survey and the National Park also surveys visitors more generally, so we are equipped with good local data to understand the impacts and benefits of the Tour.

Average trip distances are well defined at 28 km, half the length of the total tour loop because each user hops off and back on an average of once at a tourist attraction (i.e. making two trips in total over the course of the day). However, there is more uncertainty about the vehicle trip distance that is being replaced than with the other case studies, because it is highly unlikely that any car user would choose to drive the Tour circuit and we do not know what distance they would travel if visiting some other destination. A day mileage of 56 km (the Tour circuit length) whilst sight-seeing does not, prima facie, appear excessive but we have no specific data from the visitor surveys against which this can be tested.

The diversion factor from cars requires some further assumptions. Surveys show that 55% of Tour users arrive by car, with an average of two people in each car, giving a high case diversion factor of 28%. However, the New Forest Tour might be regarded as a traffic generator due to its tourist attraction status. It is known that 49% of its users are day visitors who travel to it from outside the New Forest. In the low case, we exclude these day visitors, and assume that only the 51% of Tour passengers who are staying visitors in the National Park can be treated as diverting from cars. This gives a low case diversion factor of 14%.

Assessment of the amount of additional walking time and consequent health benefits generated by the Tour is also different to scheduled services, where it can be assumed that users that would have otherwise gone by car instead have to walk to and from bus stops. For the Tour, those visitors who come by car do not gain the benefit of walking to a bus stop from home. There is not, however, any central Tour boarding point with a dedicated car park, so it can be assumed that Tour users that come by car do have a short walk to reach the Tour bus stop from where they park their cars. It is also known that 71% of Tour users take advantage of the hop-off-hop-on ticket and will therefore gain some further exercise at that point. 4% of those that hop off do so specifically to walk or to cycle (the Tour carries bikes) and can be assumed to do so for more than the 30 minute that HEAT would consider to bring maximum health benefit. The low case assumes just one minute of extra health benefit per car user. The high case assumes an input parameter of three minutes of extra health benefit per car user, with an additional two minutes to add a health benefit equivalent to that received by the hop-off walkers and cyclists (who would otherwise require a separate input field).

Economic analysis of the Tour also needs to take account of the fact that in recent years it has generated significant income for the local authority in the form of advertising revenues (anticipated to amount to £35,000 in 2014). This income has now reached the stage where it almost entirely offsets the cost of National Park staff working on promoting and developing the Tour. Since these numbers negate one another both are omitted[72].

Another unique aspect of the New Forest Tour is the wider economic benefits it brings. These are more significant than for the scheduled bus services in the other case studies because the Tour is completely new and the wider economic benefits relative to the do-nothing case are therefore greater; its status as a destination and leisure activity in itself generates visitors; and it is designed to drop visitors at the doors of charging attractions, for which the value of the Tour service is sufficient that they spend significant sums of money advertising via the Tour.

Several approaches are available to estimate the economic benefits that accrue to other businesses as a result of the Tour, and similar input values arise from these different methods. The National Park Authority's 2013 Tourism Survey gives a figure for daily spend by day visitors of £25.13. Subtracting spend on the £7.54 Tour ticket leaves a further spend per Tour user of £17.59. Applying this number conservatively to just the 49% of Tour users who come to the area for the day specifically because of the Tour gives a benefit of £175,000 per year. This is equivalent to applying an input parameter of somewhat under £9 per head to all Tour users.

Alternatively, we can use the information that £35,000 is being paid by businesses to the Tour. It is understood that this advertising is from visitor attractions that believe the Tour transports customers to their doorstep. It would be safe to assume that these businesses consider that the Tour is bringing them income that is a multiple of their advertising spend. Assuming that businesses are unlikely to spend more than 10-20% of the anticipated additional revenue on advertising, the conservative end of this range also equates to a benefit to businesses of £175,000 or £9 per Tour user.

A further approach is to consider the reasons the Tour users give for hopping off (proportions are known for 'refreshments', 'visitor attractions', 'towns') and estimate the amounts of spend likely at each destination. Reasonable figures (for costs of food, entry fees, shopping respectively) produce a benefit of £106,000 or somewhat over £5 per Tour user.

How much of the tourism spend is regarded as 'benefit' depends on whether the perspective is local or national. The approaches above consider the local benefit accruing to the New Forest. This would be a legitimate approach to the cost benefit analysis if the entirety of the funding were also locally

[72] This approach might seem inconsistent with other case studies for which local authority staff costs are excluded without any counterbalancing income being factored in. However, the New Forest Tour receives a wholly different level of officer support, amounting to a full-time job in recent years.

sourced. A proportion of the funding is national, however, so it is relevant to consider how much of the Tour users' tourism spend is displaced trade from elsewhere and how much is wholly additional spending that would otherwise not have happened anywhere. For the modelling £9 is used for tourism spend per Tour user in the high case and zero is used for the low case. The range of parameters in this case represents not only uncertainty in the value but also a variation in standpoint (e.g. DfT vis-a-vis New Forest National Park Authority).

The final input that is specific to the New Forest Tour is the dependency on an ongoing marketing budget. This is assumed, on the basis of past spend, to be £10,000 per year for the low case and £30,000 for the high case. There are also significant ongoing costs of occasional tree cutting to get the double-decker buses safely around the route. These are estimated at £3000 per year in the low case and £5000 in the high case. Both this figure and the marketing cost are expressed as a 'maintenance cost' for the purposes of running the economic model (and for the overview analysis in Figure 13.8).

The New Forest Tour is notable amongst the case studies for being the only instance where local authority capital funds were deployed to procure newer buses. This approach was taken in 2006 but as new Tour routes have been added, the operator has borne this capital expense and the local authority input has been revenue support to the service. The economic analysis therefore includes an element of spend on vehicles that is absent from the other case study analyses. The proportion of revenue spend by the local authority is nevertheless very high, at 84%.

Figure 13.6 shows the BCRs resulting from the low and high range assumptions. The benefit from tourism spend and the level of ongoing revenue funding for marketing are dominant parameters. In particular, complete exclusion of the tourism spend causes the BCR to fall below one. However, two of the routes are already profitable without subsidy and the third is expected to achieve the same status, so this low case figure may be greater than one if the analysis included operator income and operator costs (operator income has been provided in confidence in this case but operator costs are not available).

Figure 13.6: Benefit-cost ratios for the New Forest Tour

	% revenue	**BCR**		
		High case	Mid-range	Low case
New Forest Tour (2005-2013)	84%	6.4	2.8	0.5~

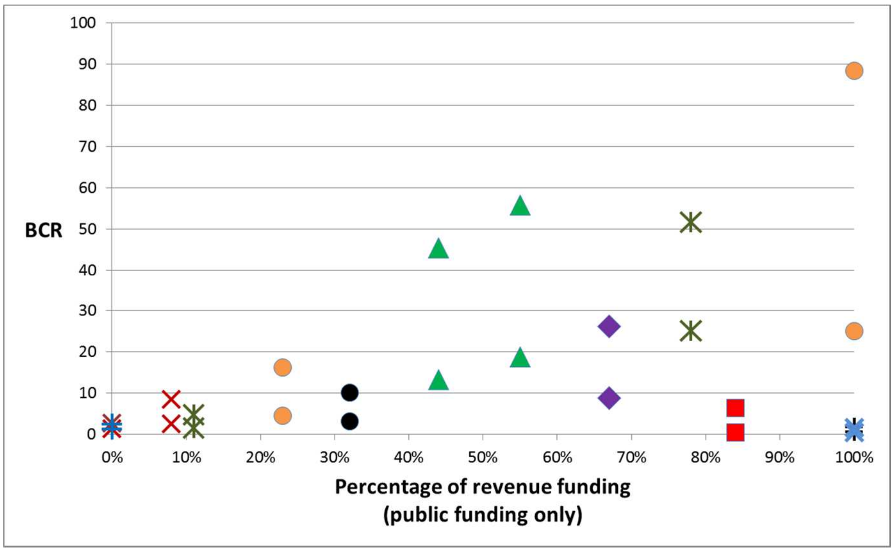
~ Low case BCR could be greater than one if the analysis included operator income and operator costs.

13.6 Bus case study economics compared

The outputs of the economic analyses of the bus case studies are tabulated in Figure 13.8. This table also lists key input parameters, colour coded to show the sensitivity of the economic model to the range of input parameters used to generate low and high cases.

Figure 13.7 plots the BCRs against the percentage of revenue funding. These figures are discussed further in Chapter 14.

Figure 13.7: Relationship of bus case study BCRs to percentage revenue funding



Key	
Kent Diamond	◊
Kent Triangle	Δ
Bucks 300	○
Bucks 280	○
Bristol X1	*
Bristol X2/3	×
Bristol GBBN	+
New Forest Tour	□
Triangle youth Freedom pass	+
Triangle retired people free fares	×

The chart shows two values for each economic analysis corresponding to low and high case input parameters

Figure 13.8: Bus case study BCRs under a range of assumptions

Route	BCR range	Rev % of public spend	Assumption: Low or High Case	Passenger time saving (mins)	Diversion factor from car	Walk time each end of bus trip (mins)	Bus journey distance (km)	Yearly maintenance cost capital items	Economic benefit per bus user (£)
Kent Diamond	8.8	67%	L	1	20%	1	5	1%	0
(2004-2011)	26.2	67%	H	3	30%	3	8	1%	0
Kent Triangle	13.3	44%	L	1	20%	1	5	1%	0
(2004-2013)	45.4	44%	H	4*	30%	3	8	1%	0
Kent Triangle	18.8	55%	L	1	20%	1	5	1%	0
(2008-2013)	55.8	55%	H	3	30%	3	8	1%	0
Kent Triangle	0.6	100%	L	n/a	60%[Δ]	1	5	n/a	0
(Freedom pass)	1.8	100%	H	n/a	120%[Δ]	3	8	n/a	0
Kent Triangle	0.4	100%	L	n/a	20%	1	5	n/a	0
(Concessions)	1.6	100%	H	n/a	30%	4[Δ]	8	n/a	0
Bucks 300	4.5	23%	L	1	20%	1	5	1%	0
(2003-2012)	16.3	23%	H	3[+]	30%	3	13[‡]	1%	0
Bucks 300	25.1	100%	L	1	20%	1	5	1%	0
(2003-2008)	88.4	100%	H	3[+]	30%	3	13[‡]	1%	0
Bucks 280	3.1	32%	L	1	20%	1	5	1%	0
(2008-2013)	10.1	32%	H	3[+]	30%	3	13[‡]	1%	0
Bristol X1	25.1	78%	L	1	46%	1	21	1%	0
(2011-2013)	51.6	78%	H	2[~]	64%[×]	3	27[××]	1%	0
Bristol X1	1.6	11%	L	2	46%	1	21	1%	0
(2008-2013)	4.7	11%	H	6[#]	64%[×]	3	27[××]	1%	0
Bristol X2/3	2.5	8%	L	2	50%	1	9	1%	0
(2008-2013)	8.5	8%	H	8[‡‡]	68%[×]	3	13[××]	1%	0
Bristol X2/3	1.4	0%	L	2	50%	1	9	1%	0
(2008-2012)	2.8	0%	H	4[◊]	68%[×]	3	13[××]	1%	0
Bristol GBBN	1.2	0%	L	2	20%	1	4**	1%	0
(2008-2013)	2.5	0%	H	4[◊◊]	30%	3	7	1%	0
New Forest Tour	0.5	84%	L	n/a	14%[Δ]	1[Δ]	28	13%[++]	0
(2005-2013)	6.4	84%	H	n/a	28%[Δ]	5[Δ]	28	35%[++]	9[Δ]

Sensitivity index	Percentage upwards variation in BCR from the Low Case value to the High Case value (with other parameter values set at mid-range)
Very High	100% +
High	50% to 99%
Medium	20% to 49%
Low	0% to 19%

* Assumes one minute additional saving from the Sturry Rd bus lanes installed prior to 2009
\+ Assumes one 'generalised minute' of equivalent time savings due to real time passenger information
‡ High case assumes similar 'express' bus user profile to the similar length Bristol-Portishead X2/X3 route
‡‡ Major junction improvements and large headway reductions each appear to contribute approximately 50% of these time savings
~ Time saving from headway reduction only, since no capital spend on road improvements post-2011
\# Taken to be as per the general GBBN time saving from infrastructure measures plus a time saving for the headway reduction
× From peak time passenger survey on this service; low case presumes more (shorter) non-commuter transfer from other modes
×× From peak time passenger survey data on this service; low case presumes non-commuter trips may be shorter
◊ From measured peak journey time data across key congestion spots, with assumption that off-peak time savings are smaller
** Substantial urban area so likely to generate shorter journeys than the other case study routes
◊◊ Range taken to be as for the X2/3 corridor in the absence of other information
++ No maintenance costs have been incurred on buses bought. Tree cutting and marketing costs are represented as a % of capital spend
Δ See texts for derivation

13.7 Economic assumptions and BCRs for Cycling City and Towns

The economic analysis for Cycling City and Towns, and also for the other two cycling case studies, was handled in a rather simpler way than for the bus case studies, because less project-specific data were available.

Case Study 5 (Cycling City and Towns) showed that there had been an increase in cycling levels in all 18 towns involved in the CCT / CDT programme. Larger uplift in cycling per unit of expenditure was seen in towns that started with higher levels of cycling at baseline.

In order to estimate BCRs, we used two sets of data: the percentage uplift in cycling for each year between baseline year and final year as shown by automatic cycle counters, and Census data on the number of people in the workforce who cycled to work in each town in 2011 (the final year). This allowed us to estimate the number of additional people cycling to work in the final year relative to baseline. This figure was factored up to give an estimate of the number of additional cyclists for all trip purposes, using National Travel Survey figures for the proportion of cycling for commuter trips compared to trips for other purposes in areas similar to the CDTs / CCTs.

We used an appraisal period of 30 years, but adjusted this by means of a decay rate to allow for the presumed declining effect of revenue expenditure. Because the majority (57-92%) of expenditure was capital, we assumed that the overall effect would be sustained for at least 10 years, but then allowed (under high, mid-range and low scenarios) for decay rates of 0%, 10% and 40% per year[73].

Key assumptions are summarised in Figure 13.9 and indicative BCRs in Figure 13.10.

Figure 13.9: Economic analysis assumptions for Cycling City and Towns

	Assumption	Rationale
Scheme cost	Capital and revenue costs include DfT grant and local contribution, as summarised in Figure 10.1. Costs treated in all cases as evenly spread over four years	Spread of costs over four years is a simplifying assumption; investment period was shorter at 2.5 years for the CCTs, and longer at 5.5 years for the CDTs. This assumption has the effect of slightly overestimating BCRs for the CCTs, and slightly underestimating for the CDTs, but by a marginal amount (approximately 0.1).
Appraisal period	30 years	Recommended appraisal period for cycling and walking infrastructure schemes. (Use of a 30 year appraisal period for cycling and walking schemes rather than the 60 year period used for road and public transport schemes introduces a bias against cycling and walking schemes, but does not affect the relative BCRs that we are interested in here). Shorter-term influence of revenue interventions is determined by decay rate assumptions (see below).
Uplift in cycling	Actual percentage uplift in cycling in each town, derived from automatic count data, as summarised in Figure 10.2	

[73] Ideally, different decay rates would be used for the effects of capital and revenue schemes, but we have no empirical way of measuring these.

	Assumption	Rationale
Number of cyclists at baseline	Figures back-calculated from 2011 Census data for number of people in the workforce cycling to work within each town's main intervention area, using the percentage change shown by automatic count data, and factoring up by 2.6 to allow for non-commuter cycling.	Special tabulation from National Travel Survey data (2011 NTS Table 0410) shows 38% of all cycle distance in areas classified as 'urban cities and towns' is for commuting[74]. Most of the remainder is for leisure.
Effect decay rate	High case: Effect sustained for 60 years with no decay; Mid-range: Effect sustained for 10 years then decays at 10% per year; Low case: Effect sustained for 10 years, then decays at 40% per year	
Diversion from car	37%	The 'pool' from which new commuter cyclists might be expected to be drawn is the CCT non-cycling workforce with trip distance to work of up to 10 km. Using 2011 Census workplace population data, car drivers make up 49% - 61% of this pool (mean = 57%) in four sample CCTs (Leighton Linslade, Southport, Exeter and Greater Bristol). For non-commuter cyclists (mostly making leisure trips), a lower diversion from car is likely; this is estimated at 25%. This gives a weighted average diversion factor of 37%.
Average trip distance	3.0 miles	National average one-way trip length for cycle trips in 2011 (all journey purposes) from National Travel Survey data (2011 NTS Tables 0409 and 0410)

With the mid-range assumption for decay rates, most towns have BCRs in the range 1.5-3.9. Two towns have BCRs of less than 1.0, and the three towns that saw the greatest uplift in cycling have BCRs of 6.2-11.4.

If the towns with high baseline cycling levels and high uplift in cycle counts are excluded, the proportion of revenue funding has little impact on the BCR. As discussed in section 10.6, it appears that most of these towns' strategies were (broadly speaking) similarly effective, with higher levels of revenue spend introducing neither an advantage nor a penalty to the cost-effectiveness of the programme. Exeter, with just 8% revenue spend, delivered an uplift in cycling with a BCR of 2.2-3.5 (with the range depending on decay rate scenarios), while Chester and Southport, with 32% revenue

[74] 'Urban cities and towns' is the most appropriate classification for the CDTs / CCTs (including Greater Bristol) from the Rural – Urban Classification for England. However, note that NTS might underestimate the proportion of cycle distance *within urban areas* that is for commuting, if a substantial proportion of leisure cycling by urban residents took place outside their home location (e.g. cycling in rural areas whilst on holiday). As a cross-check, we examined data from a household travel survey carried out in Darlington (one of the CDTs) in 2008, filtered to only include cycle trips with both an origin and a destination in the town. This showed 39% of cycle distance as being for commuting (with 36% for leisure).

spend, delivered an uplift in cycling with a BCR of 2.1-3.3 and 2.7-4.3 respectively. One explanation for this lack of relationship is that the towns each made broadly correct judgments about what was the priority for investment in their own particular circumstances.

As pointed out in section 10.6, this conclusion may only hold good for proportions of revenue funding within the range of 10% to 40%. Because of the nature of the funding for the CCTs/ CDTs, we have no examples of towns where the investment in cycling was above 50% revenue.

Figure 13.10: Benefit-cost ratios for Cycling City and Towns

	% revenue	BCR		
		High case	Mid-range	Low case
Cycling Demonstration Towns				
Aylesbury	24%	0.3	0.3	0.2
Brighton*	35%	7.8	6.2	4.9
Darlington	20%	2.6	2.1	1.7
Derby	23%	3.3	2.6	2.0
Exeter	8%	3.5	2.8	2.2
Lancaster	19%	2.6	2.1	1.7
Cycling City and Towns				
Blackpool	16%	1.0	0.8	0.6
Cambridge*	13%	9.2	7.3	5.7
Chester	32%	3.3	2.7	2.1
Colchester	26%	4.9	3.9	3.1
Greater Bristol*	43%	14.4	11.4	9.0
Leighton	30%	1.8	1.5	1.1
Shrewsbury	22%	3.9	3.1	2.5
Southend	26%	2.5	2.0	1.5
Southport	32%	4.3	3.4	2.7
Stoke-on-Trent	29%	3.9	3.1	2.4
Woking	20%	2.7	2.1	1.7
York*	18%	3.5	2.8	2.2

* Towns with high levels of cycling at baseline

13.8 Economic assumptions and BCRs for Exeter workplace cycling

Case Study 6 (Exeter workplace cycling promotion) showed that there had been an increase in cycle commuting to businesses at two large industrial estates in Exeter (Marsh Barton and Sowton), both of which had received a combination of cycle infrastructure improvements and workplace-based revenue-funded promotional activity.

Comparison of commuter cycling levels in Exeter (which were increasing) with those in Barnstaple (which were not) suggested that the observed increase in cycling to work in Exeter was unlikely to be simply a result of an underlying demographic or socio-economic change. Comparison of Exeter cycle count trends *during* commuting hours (which were increasing) with those *outside* commuting hours (which were slightly declining) further suggested that the observed increase in commuter cycle activity could not be attributed solely to the provision of new cycle infrastructure. Both these observations lent some weight to the hypothesis that the observed increase in cycle commuting in Exeter might be attributable to revenue investment designed specifically to support cycling to work.

In estimating benefit-cost ratios for the investment at Marsh Barton and Sowton, we assumed that there would have been no change in cycle commuting without expenditure on both new infrastructure and cycle promotion activities. We conservatively assumed that capital expenditure on infrastructure in the vicinity of Marsh Barton and Sowton should be attributed in its entirety to these industrial estates, although inspection of the geographical locations of some elements of new infrastructure suggests that these would have also benefitted people commuting to other workplaces. We did not assume any benefit for non-commuter trips.

We used an appraisal period of 30 years, but (as for the CCTs as a whole) adjusted this by means of a decay rate to allow for declining effect of revenue expenditure. Because the majority (84-90%) of expenditure is capital, we assumed that the overall effect would be sustained for at least 10 years, but then allowed (under three scenarios) for decay rates of 0%, 10% and 40% per year.

Key assumptions are summarised in Figure 13.11 and indicative benefit-cost ratios in Figure 13.12. Both examples have high BCRs, in the range of 2.7-4.8 depending upon which decay rate scenario is adopted.

Figure 13.11: Economic analysis assumptions for Exeter workplace cycling promotion

	Assumption	Rationale
Scheme cost	Marsh Barton estate: £209,432 capital expenditure; £41,250 revenue Sowton estate: £744,909 capital expenditure; £82,500 revenue	Capital: details of cycle infrastructure relevant to Marsh Barton and Sowton industrial estates supplied by Devon County Council. Note that some cycle infrastructure benefitted other locations as well as the industrial estates. Revenue: expenditure is difficult to quantify, because records of revenue expenditure for Cycle Exeter are not geographically disaggregated, and because employees at both locations may have been influenced by town-wide cycling promotion activity as well as activities specific to their sites. Figures are estimated at £5-10,000 per year for Marsh Barton and £10-20,000 per year for Sowton, over 5.5 years[75].
Appraisal period	30 years	Recommended appraisal period for cycling and walking infrastructure schemes. Shorter-term influence of revenue interventions is determined by decay rate assumptions (see below).
Uplift in cycling by employees	Marsh Barton: +15% (2007-2013) Sowton: +56% (2007-2013)	Case study evidence: actual change in cycle activity during commuting hours as measured by automatic cycle count data between 2007 and 2013.

[75] Exeter's total revenue expenditure on cycling during the 5.5 year period 2005-2011 was £1.5 million i.e. approximately £280,000 per year, covering work with schools, cycle training, personal travel planning and promotional events as well as workplace engagement. We assume that about £100,000 per year was spent on workplace engagement across the whole city, involving a combination of city-wide activities (not targeted at specific employers) and activities focussed on individual employers.

	Assumption	Rationale
Number of commuter cyclists at baseline	Marsh Barton: 372 (2007) Sowton: 266 (2007)	Figures for number of cyclists at baseline are back-calculated from 2011 Census workplace zone data for number of people in the workforce cycling to work at each industrial estate.
Effect decay rate	High case: Effect sustained for 60 years with no decay; Mid-range: Effect sustained for 10 years then decays at 10% per year; Low case: Effect sustained for 10 years, then decays at 40% per year	
Diversion from car	68%	The 'pool' from which new cyclists might be expected to be drawn is the non-cycling Marsh Barton / Sowton workforce with trip distances to work of up to 10 km. Using 2011 Census workplace population data, car drivers in the relevant Exeter MSOAs make up 67% (Marsh Barton) and 69% (Sowton) of this pool.
Average trip distance	3.2 miles	National average one-way trip length for commuter cycle trips in 2011 from National Travel Survey data (2011 NTS Tables 0409 and 0410).

Figure 13.12: Benefit-cost ratios for Exeter workplace cycling promotion

	% revenue	BCR		
		High case	Mid-range	Low case
Marsh Barton	16%	4.8	3.7	2.7
Sowton	10%	4.5	3.5	2.7

13.9 Economic assumptions and BCRs for Links to School and Bike It

Case Study 7 (Links to School + Bike It) suggested that the effect of Bike It when combined with Links to School may be to deliver a larger uplift in cycling than is the case for schools that receive Links to Schools infrastructure only. That is, for schools that received Links to School investment only, the proportion of pupils for whom cycling was the usual mode of travel to school increased by 0.4%-points relative to 'do-nothing'. For schools that received Links to School + Bike It, the proportion for whom cycling was the usual mode of travel increased by 1.8%-points relative to 'do nothing'. However, if one outlier school was excluded from the analysis, the uplift in cycling as a result of Links to School + Bike It was only +0.7%.

In assessing the value for money of Links to School projects (both with and without Bike It), we took account both of the uplift in cycling amongst pupils as reported by PLASC data, and of the probability that new cycling infrastructure would result in increased cycling amongst (unrelated) adults. To estimate how many additional adult trips might be expected to occur, we drew on user surveys undertaken by Sustrans before and after development, on 53 Links to School schemes. We also incorporated an assumption that a proportion of the pupils increasing their cycling through Bike It would go on to cycle as adults.

We assumed that the increase in cycling levels as a result of new infrastructure would be sustained over the full 30 year appraisal period, but that the effect of Bike It would last for only ten years. For a combined programme of Links to School + Bike It, the full effect was assumed to last for ten years, after which it fell to a residual level reflecting only the ongoing effect from the Links to School infrastructure.

Our base case was that Links to School + Bike It delivered an uplift in cycling of 1.8% relative to do-nothing, but we also carried out a sensitivity test in which the uplift from Links to School + Bike It was only 0.7%.

Other assumptions are summarised in Figure 13.13.

Figure 13.13: Economic analysis assumptions for Links to School + Bike It

	Assumption	Rationale
Scheme cost	Links to School: £88,637 per school Bike It: £2,778 per school for 3 years	Total cost of case study Links to School schemes was £2,215,931, benefitting 25 schools (20 Links to School only; 5 Links to School + Bike It). Bike It officer costs £50,000 per year, engaging 12-18 schools.
Appraisal period	30 years (but see text for sensitivity testing)	Recommended appraisal period for cycling and walking infrastructure schemes. Shorter-term influence of Bike It is determined by decay rate assumptions (see below).
Uplift in cycling by pupils	Links to School: +0.4% compared to do-nothing Bike It increment: +1.4% Links to School + Bike It: +1.8% compared to do-nothing	Case study evidence: change in proportion of pupils who usually cycle to school, from PLASC.
Uplift in cycling by adults	Estimated 2,930 additional adult cycle trips per year as a result of Links to School infrastructure Estimated 1 additional adult cycle trip per child cycle trip as a result of Bike It	Links to School: usage estimates from surveys undertaken before and after Links to Schools schemes in 53 locations were used to calculate average additional trips per year. Half of these additional trips were attributed to the new infrastructure. Bike It: Assume that for primary-age children, most child cycle trips to school will be accompanied by an adult.
Pupils per school	300	Average number of pupil responses (i.e. approximate school size) from schools included in case study was 288 pre-intervention; 306 post-intervention.
Effect decay rate	No decay of effect from infrastructure Effect of Bike It is assumed to last for 10 years and then fall to zero See text for sensitivity testing	Analysis by Sustrans of approximately 30 schools previously engaged in Bike It found that school cycling levels as measured by ‘hands up’ surveys remained higher than baseline over at least four years (longer time-series data not yet available). In addition, it seems reasonable to assume that individual pupils who begin cycling at primary school following exposure to Bike It will be more likely to cycle as teenagers.

	Assumption	Rationale
Diversion from car	Children: 100% Adults: 37%	50% of additional child cycle trips to school would otherwise have been car escort trips; each child cycle trip replacing a car escort trip would have involved a return car trip by the driver. SQW (2010) Table 10-1 found from route survey data from 15 Links to School routes that 37% of respondents making an 'additional' cycle trip had chosen not to take a car for their trip.
Average trip distance	Children: 1.8 miles Adults: 3.0 miles	National average one-way trip length for trips to primary schools. National average cycle trip length (NTS 2011)

Benefit-cost ratios for Links to School alone, Links to School combined with Bike It, and the 'Bike It increment' are summarised in Figure 13.14. It should be noted that these figures are partial BCRs, not including any benefit from Links to School infrastructure as a result of increased walking.

Figure 13.14: Links to School and Bike It benefit-cost ratios

		Base Case		Low Bike It effectiveness	
	% revenue	**Pupil cycling uplift compared to 'do nothing'**	**BCR***	**Pupil cycling uplift compared to 'do nothing'**	**BCR***
Links to School only	0%	+0.4%	4.0	+0.4%	4.0
Links to School + Bike It	9%	+1.8%	4.3	+0.7%	3.9~
Bike It increment	100%	+1.4%	8.0	+0.3%	2.4

* BCR values include benefits from increases in adult cycling (see assumptions table)

~ Based on the data used in this analysis, benefits to children are a modest proportion of the overall benefit of Links to Schools schemes (around 2%). Minor changes to assumptions around the effectiveness of Links to Schools + Bike It have a disproportionate impact on the overall BCR. In this case although the net benefit to children from Links to School + Bike It is higher than for Links to School only (£10,739 and £5,705, respectively), because is it such a small proportion of the overall costs (we are not apportioning costs to children only) the ratio responds negatively in sensitivity testing.

PART III: POLICY CONSIDERATIONS FOR REVENUE AND CAPITAL INVESTMENT

14. Is there an optimum ratio of revenue to capital investment?

In the previous chapter, we generated benefit-cost ratios for various sustainable transport and cycling schemes, at a variety of scales of investment ranging from around £100,000 - £40 million, and with a range of proportions of revenue to capital investment. We now consider whether this evidence provides any pointers as to whether there may be an optimum proportion of revenue funding for a cycling or sustainable transport project to achieve maximum value for money. All our conclusions at this stage should be considered highly tentative, as they are inevitably based on limited examples that started from different baseline conditions. We begin by considering the theoretical case for an optimum ratio. We then take the case of bus projects separately to that of cycling projects, and consider how well these support our theoretical case. We also briefly examine the evidence from the Local Sustainable Transport Fund Large Projects. Finally, having examined the quantitative evidence from the seven case studies and Local Sustainable Transport Fund, we consider qualitative evidence from the expert interviewees.

14.1 Theoretical case for an optimum proportion of revenue and capital

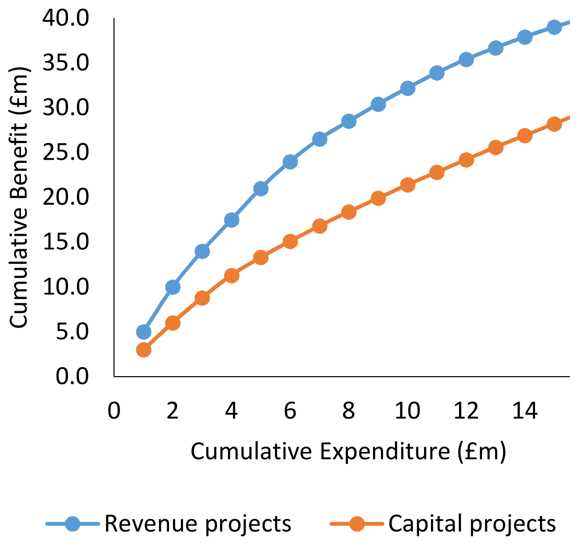
In section 4.4, we outlined the theoretical case that in general it is sensible to have some expenditure on capital and some on revenue projects, starting with the best ones of each, rather than to spend all the money on the one with the best average return. We also explained why the optimum balance should theoretically be different for different total budgets.

Figure 4.3 from Chapter 4 is redrawn here as Figure 14.1, but this time for two curves identified as revenue projects and capital projects. The imaginary (but plausible) data used to generate the plot is also shown. The projects have first been divided into revenue (blue) and capital (orange), and then placed in order of decreasing BCR. In this hypothetical example, each project is treated as involving the same expenditure of £1 million. Having ordered the projects, they may then be arranged according to decreasing BCR along a line of cumulative expenditure on the x-axis and cumulative benefit on the y-axis. The BCR of each project is (incremental benefit) / (incremental cost), relative to the previous project. The high value-for-money revenue projects (blue dots) on the left of the plot have BCRs of 5, 5, and 4, progressively decreasing along the line towards the right, so that by the time a cumulative expenditure of £16 million is reached, the last project has a BCR of just 1. Similarly, each potential capital project (represented by an orange dot) is arranged in order of decreasing BCR moving from left to right, starting with a BCR of 3 and ending with a BCR of 1.3.

For any given total budget, it is possible to spend any proportion between 0% and 100% on capital projects, and the remainder on revenue projects. For a total budget below £5 million, the highest overall BCR is obtained by investing entirely in revenue projects, since there is £5 million-worth of revenue projects with a BCR of 3.5-5 and the highest BCR for a capital project is only 3. As the total budget increases, it becomes worthwhile to spend on a mixture of revenue and capital projects in order to obtain the highest overall BCR.

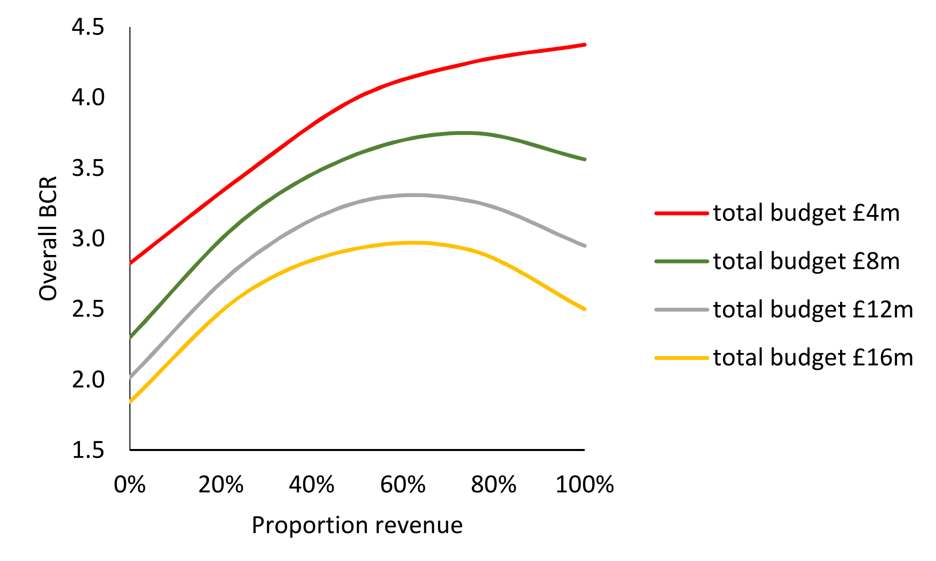
If a decision is made to spend more than the optimum proportion of the budget on either revenue projects or capital projects, the overall BCR of the total investment is reduced. Figure 14.2 illustrates this, with a series of curves for different total budgets, derived from the same project data as Figure 14.1. The curves each exhibit an 'inverted-U' shape, except for the special case of the curve for the lowest total budget (£4m), where the apex of the inverted-U is at 100% revenue.

Figure 14.1: Hypothetical example of revenue and capital projects, arranged in order of decreasing BCRs



Cumulative expenditure (£m)	Cumulative benefit (£m)	Project BCR	Cumulative benefit (£m)	Project BCR
0	0.0		0.0	
1	5.0	5.0	3.0	3.0
2	10.0	5.0	6.0	3.0
3	14.0	4.0	8.8	2.8
4	17.5	3.5	11.3	2.5
5	21.0	3.5	13.3	2.0
6	24.0	3.0	15.1	1.8
7	26.5	2.5	16.8	1.7
8	28.5	2.0	18.4	1.6
9	30.4	1.9	19.9	1.5
10	32.2	1.8	21.4	1.5
11	33.9	1.7	22.8	1.4
12	35.4	1.5	24.2	1.4
13	36.7	1.3	25.6	1.4
14	37.9	1.2	26.9	1.3
15	39.0	1.1	28.2	1.3
16	40.0	1.0	29.5	1.3

Figure 14.2: Variation in BCR according to proportion of revenue and total budget



Curves are generated from the hypothetical data in Figure 14.1.

As the total budget increases, diminishing marginal returns due to inclusion of less beneficial projects means that the maximum possible figure for the overall BCR falls. In this particular example, as the total budget increases, the optimum proportion of revenue expenditure at which the highest overall BCR is achieved shifts to the left, although the reverse could happen if the BCRs of the available capital and revenue projects were different.

If a programme manager had perfect knowledge of the BCRs of each potential project before any projects were implemented, it would be possible to always achieve the highest overall BCR for a given budget. However, in the real world, knowledge is imperfect and so some projects with lower

BCRs are implemented ahead of, or instead of, others that would have had higher BCRs. Some projects may face difficulties in implementation and delivery, or in other external or local factors, so that the overall BCR is less than the maximum that is theoretically achievable. There may not be complete freedom to spend the available budget in any proportion of revenue and capital, and so the programme manager may be constrained to a particular area of the plot. All these factors mean that in the real world, we might expect BCRs for particular types of sustainable transport project to lie not along the inverted-U curve, but beneath it. In other words, the inverted-U represents the upper bound of what BCRs are achievable at differing proportions of revenue and capital expenditure.

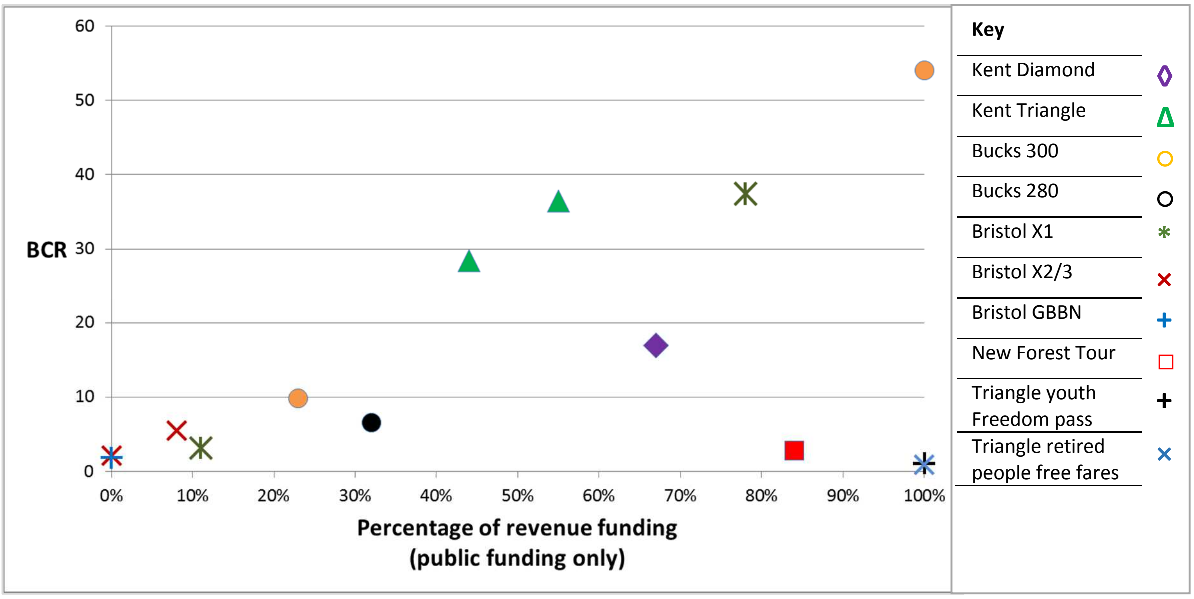
We turn now to consider whether this hypothesis is supported by the evidence from our case studies.

14.2 BCRs for bus case studies

The four bus case studies allow us to consider the effect of variations in the balance between revenue and capital spending for projects that otherwise share many features, including an objective of boosting service frequencies to commercially viable levels. Other features shown by the different case studies included, to varying extent, real-time passenger information, changes to junction layouts, bus lanes, bus shelter improvements, marketing, new buses, and so on. Thus each case study scheme can be considered as a package of a number of different project elements.

Figure 13.6 in the previous chapter summarised the outputs of the economic model for all analyses of the bus case study routes, showing both a 'high' and 'low' value based upon sensitivity testing. The same evidence is now reproduced as Figure 14.3, but this time simplified to show the BCRs for mid-range input parameters (half way between the high and low case values).

Figure 14.3: Mid-range BCRs for all bus case study bus routes and all data time-series selections



The general pattern is that BCRs appear to be low at the left of the chart (at low proportions of revenue funding), but show a wide variation from low to high at the right of the chart (at high proportions of revenue funding).

The plot includes two identical markers wherever a single route was analysed for two different time periods (i.e. short-run and long-run) with different proportions of revenue expenditure. The four examples of this are as follows:

- Kent Triangle route: long-run = 2004-13; short-run = 2008-2013 and excludes period when there was significant capital spend on bus priority measures.
- Buckinghamshire route 300: long-run = 2003-2012; short-run = 2003-2008 and excludes period when there was major capital spend on bus interchange facilities and real-time information.
- Bristol X1: long-run = 2008-2013; short-run = 2011-2013 and excludes period when there was - capital spend on bus priority measures and new bus shelters. -
- Bristol X2/3: long-run = 2008-2013; short-run = 2008-2012 and excludes the subsequent year of kick-start funding.

As discussed in Chapter 13, the selection of shorter time periods that focus on periods of kick-start revenue funding results in some exceptionally high BCRs. These can only be considered to be achievable in special circumstances, and for quite short time periods, when there is no infrastructural obstacle to increased service levels. Equally, it seems probable that periods selected to deliberately exclude kick-start revenue funding might result in BCRs that are lower than could be achieved in the longer-term.

Figure 14.4 identifies separately the short-run and long-run BCRs. There are three cases where the long-run analysis involves a lower proportion of revenue expenditure than the short-run, and in these the long-run BCR is lower. There is one case where the long-run analysis involves a higher proportion of revenue expenditure, and here the long-run BCR is higher. For this small sample of four examples, the effect of changing the proportion of revenue funding appears to be to change the BCR by a relatively consistent amount i.e. the gradients of the short-run to long-run trajectories are relatively similar. These are listed in Figure 14.5 and all lie roughly in the range of 0.4 – 0.7. The significance of the relationship does not lie in its absolute value[76] but in the fact that, for addition of a given proportion of revenue of a rather specific kind (kick-start funding for bus services) it appears that, **considering a period of just a few years**, a relatively constant additional proportion of BCR is added. This conclusion should be treated tentatively in view of the small number of data points.

Since the short-run economic analyses represent special circumstances, with very high BCRs that could not be sustained indefinitely, we now look at the effect of removing them from the picture. Once this is done, the remaining data points appear as in Figure 14.6. The pattern here is significantly different. Removal of the short-run analyses has resulted in removal of both of the high BCRs associated with very high proportions of revenue spend. The remaining points with a very high proportion of revenue spend show more modest BCRs (the New Forest Tour, Kent Triangle youth Freedom pass subsidy, Kent Triangle free pensioner fare subsidy[77]). The overall distribution of the BCRs from the long-run analyses suggests that, when a longer time period is considered, highest benefits are likely to come from a fairly balanced deployment of capital and revenue. The shape of the plot is consistent with the hypothesised inverted-U of Figure 14.2. The number of data points is too few to indicate where the peak of the inverted-U might lie, although it can be noted that highest two long-run BCRs are for projects in the range 40-70% revenue.

[76] The absolute value is dependent on the input parameters to the economic model. This is illustrated by Figure 13.7 in Chapter 13, from which it can be seen that the gradients between twinned (short-run / long-run) high case points are steeper than the gradients between low case points.

[77] The Freedom pass and free travel for pensioners are unlike the other data points in that they do not represent schemes primarily intended to boost bus patronage (although they have) and that they rely on ongoing revenue spend. However, if these points were excluded on the basis that they may belong to a separate 'population' of interventions of a different type, the overall inverted-U pattern would remain.

Figure 14.4: Effect of separating short-run bus case study economic analyses

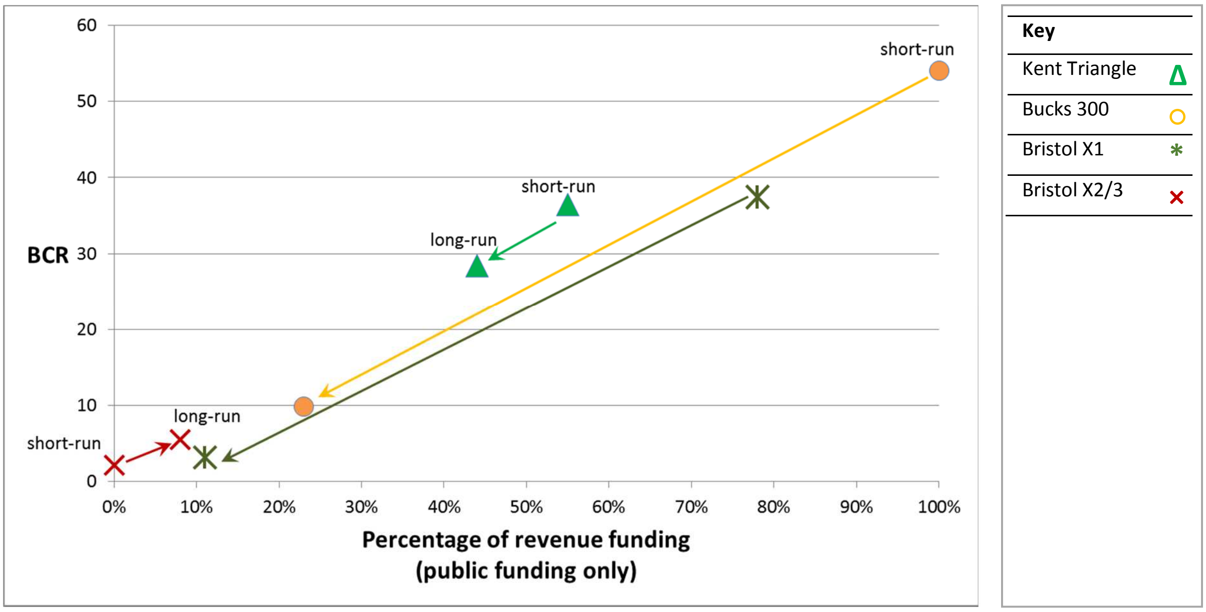
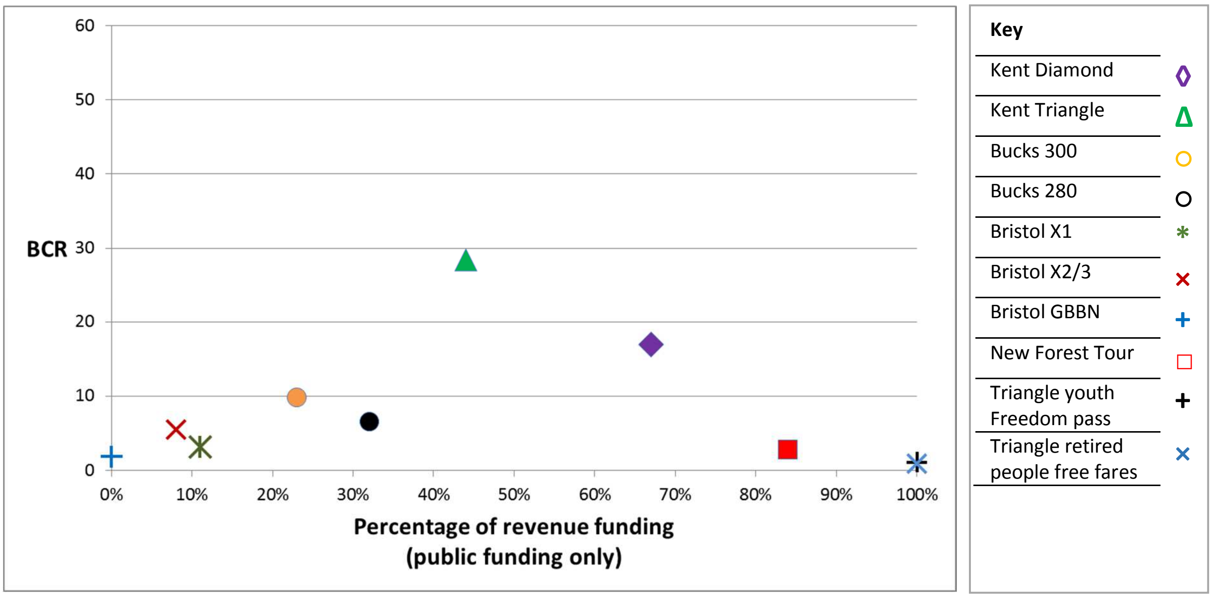


Figure 14.5: Ratio of increase in BCR to increase in percentage revenue funding

Kent Triangle	0.73
Bucks route 300	0.57
Bristol route X1	0.51
Bristol route X2/3	0.42
Average	**0.56**

Figure 14.6: Mid-range BCRs for all bus case study bus routes, long-run data series only



One question begged by Figure 14.6 is whether the observed pattern might be a function of the scale of expenditure, with the higher BCRs arising from unusually small projects. The tabulation of total expenditure of public funds in Figure 14.7 indicates that this is not a determining factor. Most of the projects have expenditure in the range £500,000 - £1.4 million. The point showing the highest

BCR (Kent Triangle) is in the middle of the range of expenditure. The second highest point (Kent Diamond) is the lowest expenditure, but not by a significant margin compared with several routes with lower BCRs. There is an indication of a project size effect with the Greater Bristol Bus Network (GBBN), a whole-city project applied to many bus routes and corridors with expenditure of £40 million, an order of magnitude greater than the other examples. Referring back to our hypothetical inverted-U curves in Figure 14.2, we might consider that, strictly speaking, the Bristol GBBN example should be treated as a member of a different inverted-U curve for large-budget projects, which would be expected to have generally lower BCRs.

Figure 14.7: Mid-range BCRs ordered by project size, long-run data series only

Project	Total public spend		BCR
Kent Diamond (to 2011)	£	550,000	17.0
Bucks 300 (to 2013)	£	604,250	10.3
New Forest Tour	£	670,500	3.5
Bucks 280 (from 2008)	£	683,750	6.6
Kent Triangle (from 2004)	£	962,000	28.4
Bristol X2/3 (from 2008)	£	1,270,344	5.4
Bristol X1 (from 2008)	£	1,384,500	3.2
Bristol GBBN	£	40,079,250	1.9

The number of data points in Figure 14.6 is small, so the association of higher BCRs with balanced deployment of capital and revenue cannot be considered conclusive. However, it does fit with practical experience and common sense, both of which indicate that obstacles to improvement of bus services fall into categories that require both capital and revenue solutions, and that both of these need to be addressed in the long run if the trend of improvements and benefits is to be sustained.

This pattern of long-run BCRs should not be taken to mean that there are no high BCR revenue projects available in the short term, in instances where infrastructure is capable of sustaining higher patronage and more frequent services. To the contrary, the short-run economic analyses in the bus case studies appear to have identified some examples where ‘low hanging fruit’ exists and has been successfully and cheaply picked.

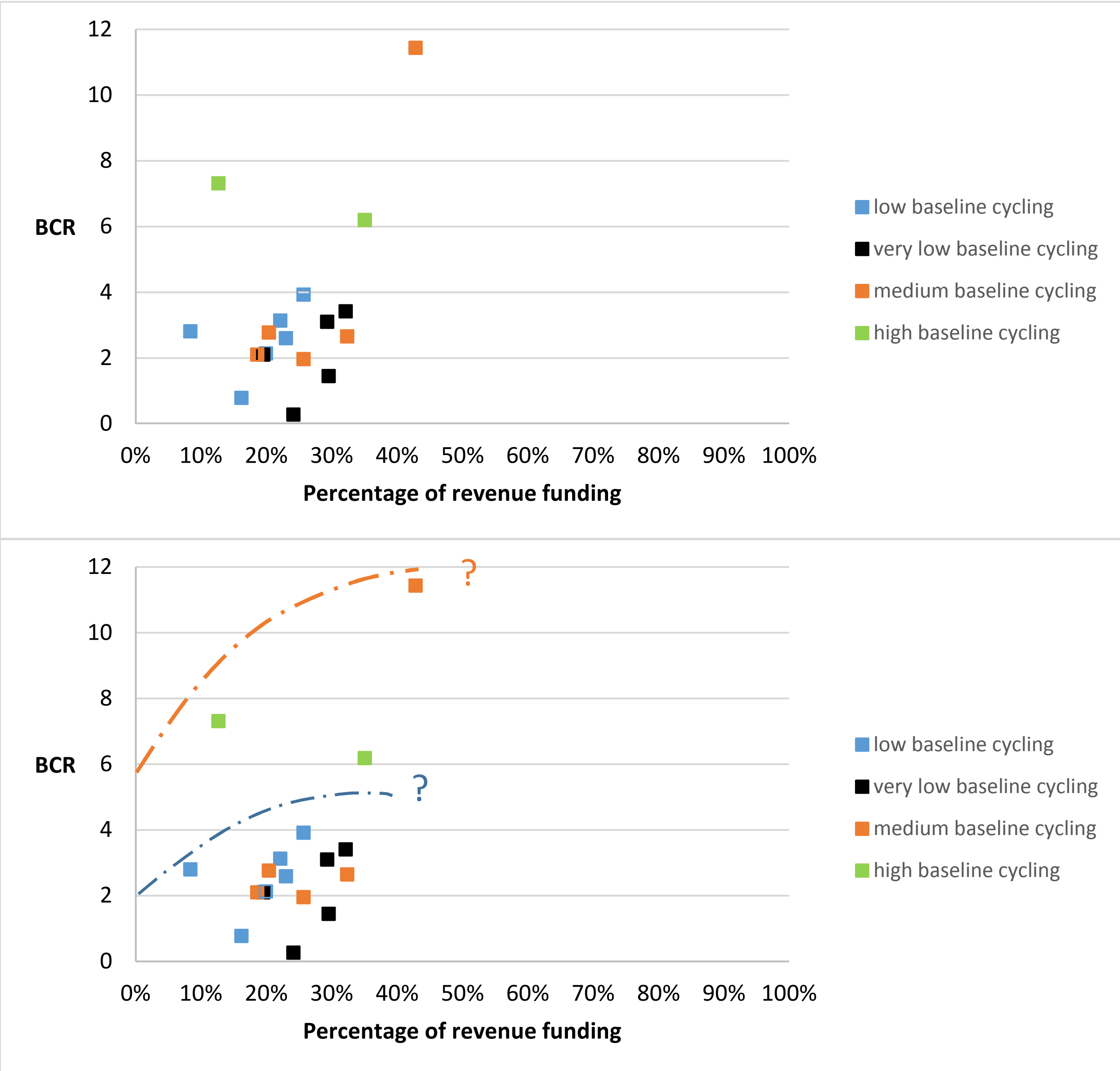
14.3 BCRs for cycling case studies

The cycling case studies offer somewhat less information to test against our inverted-U curve hypothesis. The most relevant information is from Case Study 5 (Cycling City and Towns), reported in Chapter 10. There, we concluded that the towns where a higher proportion of the total budget had been revenue showed a greater increase in cycling per unit of expenditure. However, this was complicated by the (probably coincidental) association of higher proportions of revenue spending with a stronger pre-existing cycling ‘culture’ in a small number of towns. This was illustrated in Figure 10.10 in Chapter 10, which distinguished between towns with very low, low, medium and high levels of cycling at baseline.

Figure 14.8 now plots BCRs against the proportion of revenue funding for the CCTs, again distinguishing four sub-groups of towns according to their baseline level of cycling, and using the mid-range assumption that the effect of the investment would be sustained for 10 years and then decay at 40% per year. Because the proportion of the budget that was revenue was below 50% in all 18 CCTs, there is no data in the right-hand side of the plot. All we can say is that the distribution of data points is not inconsistent with an inverted-U hypothesis. As before, we can perhaps see that there may be two distinct populations of towns: those with medium-to-high levels of cycling at baseline, which in some cases have higher BCRs; and those with low or very low levels of cycling at baseline, which have lower BCRs.

While the data are insufficient to test the inverted-U hypothesis, it does seem implausible that over the long-run, a town-wide cycling investment programme that involved very high proportions of revenue (say 80-100%) would provide high value-for-money, unless the existing cycle network was of good quality and essentially complete.

Figure 14.8: Mid-range BCRs for Cycling City and Towns



Upper and lower plot show same data, but with speculative inverted-U bounding curve added to lower plot for two different groups of towns: those with very low or low baseline cycling (blue line), and those with medium or high baseline cycling (orange line).

Data from Case Study 6 (Exeter workplace cycling promotion) is not included in Figure 14.8, but would tend to emphasise the main CCT data cluster. The interventions to encourage cycling to Marsh Barton and Sowton industrial estates involved 10-16% revenue funding, and had mid-range BCRs of 3.5-3.7.

Data from Case Study 7 (Links to School + Bike It) is also not included in Figure 14.8. This is for very much smaller budgets than the ‘whole town’ programmes in the CCTs (less than £100,000 per school compared to between £2 million and £20 million per town), and so we would not necessarily expect it to show the same pattern. However, two of the BCRs again fall close to the CCT data. In Figure 13.14 in the last chapter, we reported that Links to School only (with 0% revenue) had a BCR of 4.0 and Links to School + Bike It (9% revenue) had a BCR of 4.3. The Bike It increment forms an outlier at 100% revenue with a BCR of 8.0. This hints at a similar phenomenon to the bus case studies, where very good short-run BCRs are obtainable from deployment of pure revenue under certain specific circumstances where the necessary infrastructure is in place. In this case, the BCR of the Bike It increment is for projects at schools which have received infrastructure investment in the form of Links to School. In the same way that bus revenue initiatives are liable to reach a point where further capital spend on infrastructure is required, it is reasonable to assume that a large-scale Bike It programme in a town might eventually reach the point where all ‘easy’ schools with good cycle infrastructure had been targeted, and further 100% revenue investment in Bike It at ‘difficult’ schools with poor cycle access would result in poorer results and a reduction in the long-run BCR. At this point, the appropriate response would be to switch emphasis from revenue-funded Bike It to capital-funded cycle infrastructure, either to improve cycle path access to schools which had not previously been targeted, or possibly to enhance the on-site cycle infrastructure (e.g. cycle parking) at schools where this had become a constraining factor. However, the data for Bike It and Links to School do not provide information about the timescale on which this interdependency between capital and revenue funding might operate.

14.4 BCRs for Local Sustainable Transport Fund Large Projects

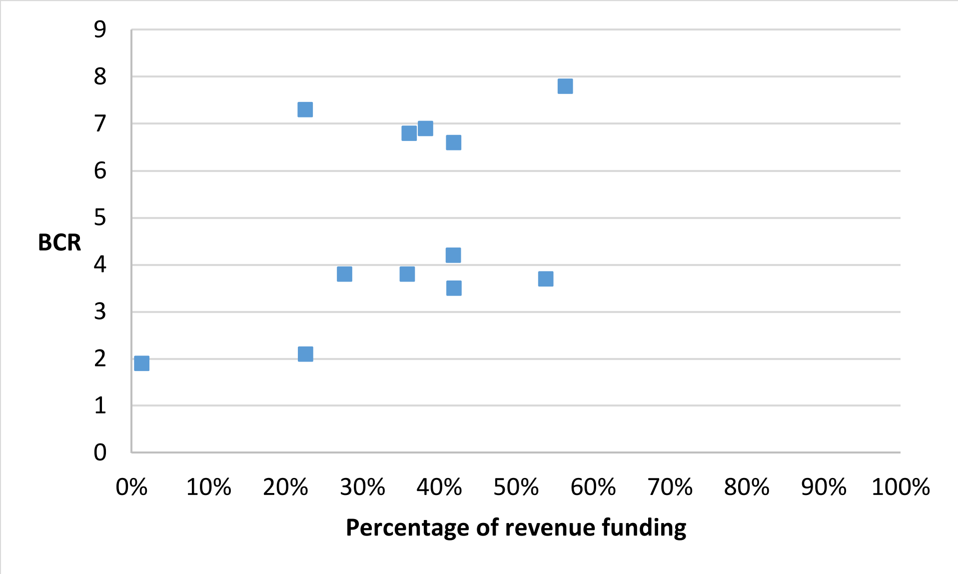
In Chapter 2 we reviewed the varying proportions of revenue funding for projects supported by the Local Sustainable Transport Fund. Amongst these, the 12 Large Projects were required to submit a detailed business case to the Department for Transport as the basis for their funding bid. This included an economic appraisal of the expected BCRs of their proposed projects. Although the BCRs quoted by the Large Projects in their business cases were prepared in line with WebTAG (in this case in accordance with ex ante appraisal of projects that had not yet been implemented), the underlying assumptions they used were not necessarily consistent, and thus cannot be directly compared. There is insufficient published data at this stage to enable post-implementation calculation of BCRs based on actual outcomes.

However, the Department for Transport has recently carried out its own economic appraisals for each of the 12 Large Projects, adjusting input assumptions used by the project proposers where necessary, so that BCRs are calculated on a consistent basis (Department for Transport 2014c).

Data for the proportions of revenue and capital in the budgets for the 12 Large Projects are not available for the full three-year period of the grant, because the Large Projects report the breakdown of their local contribution retrospectively. We do have data on the breakdown between revenue and capital in the local contribution for the two financial years 2012/13 and 2013/14 (i.e. two-thirds of the grant period) from Annual Output Reports. Working on the assumption that the proportion of revenue in the *final* local contribution is likely to be similar to that in the first two years, it is possible to estimate the overall proportion of revenue and capital in total project expenditure, including both the DfT grant and the local contribution.

Figure 14.9 plots the DfT-adjusted BCRs against estimated proportion of revenue for the 12 Large Projects. Again, this does not provide clear evidence of an optimum proportion of revenue to deliver the highest BCR, in part because we have no data on the right hand side of the plot. However, it does suggests that it is possible to produce high BCRs at proportions of revenue funding that range from around 20% to around 60%.

Figure 14.9: DfT-adjusted *ex ante* BCRs for Local Sustainable Transport Fund Large Projects



Percentage of revenue funding is relative to the whole project budget including DfT grant and local contribution. Revenue proportion for the DfT grant is known, but revenue proportion for the local contribution is estimated, based on actual revenue / capital split for the first two years of the fund (two-thirds of the grant period), as reported in annual output reports.

It is worth noting that the 12 Large Projects show a much smaller range in the proportion of revenue funding than the small (< £5 million) LSTF projects. Figure 2.2 in Chapter 2 showed the proportion of revenue in the LSTF small projects ranged from 0-90% (in 2011/12 to 2012/13 i.e. for that part of the project period for which data was available). This closer clustering for the Large Projects may perhaps be a scale effect. That is, if project managers' choices are based on informed judgment of what projects are likely to be most beneficial, in their particular local circumstances at a particular point in time, it is plausible that for small budgets the best projects to do next could be drawn either largely from the population of 'revenue projects', or largely from the population of 'capital projects', or from a mix of the two. However, for larger budgets, it is far less likely that all the best projects will be either all revenue projects or all capital projects, and much more likely that the optimum overall benefit is achieved through a mix of the two types of project. Thus the concept of an optimum ratio may become more relevant as programme budgets increase.

14.5 Qualitative evidence on optimum ratio of revenue to capital investment

Finally in this chapter, we summarise the qualitative evidence on factors that might influence the optimal ratio of capital to revenue investment, based on the comments of the expert interviewees.

Five interviewees were asked about the factors that might be expected to influence the optimal ratio of revenue to capital investment for a cycling project. Key factors explored were size of urban area; overall scale of the investment programme; cultural starting point; and programme duration and stage. The interviewees' views are summarised in Figure 14.10.

Four interviewees were asked about the factors that might be expected to influence the optimal ratio for a wider sustainable transport project (not specifically focussed on cycling). Key factors explored were size of urban area; overall scale of the investment programme; cultural starting point; and programme duration. Views are summarised in Figure 14.11.

What is clear from the interviewees' comments is that as practitioners with extensive experience in the delivery of cycling and sustainable transport projects, they recognised a very wide range of factors that might potentially have a bearing on the optimum proportion of revenue and capital. These factors might interact in a complex way, so that it would be difficult for a decision to be made about the optimum balance in any particular area in the absence of local knowledge. It was also clear that both revenue and capital funding were seen as playing an important part, with the strongest message perhaps being that what mattered most to the design of good sustainable transport investment programmes was not so much the absolute proportion of revenue funding, than the principle that capital funds should always be accompanied by some revenue funding, even if this was only a rather modest proportion of the total.

Figure 14.10: Expert interviewee views on factors influencing the optimal ratio of revenue to capital investment for a cycling project

Factor	Expert interviewee comments
Size of urban area Larger urban areas may require a higher proportion of capital investment than smaller urban areas	Medium and large towns need a high quality segregated cycle network in order to persuade people to start cycling. This requires substantial capital investment. In Seville (population 750,000), the €32 million investment between 2007 and 2011 was almost entirely capital, providing a network of 140km of segregated cycle paths. There was some revenue expenditure (for example, on public campaigns to promote cycling, and work with schools and hospitals), but this only amounted to 2-3% of the total investment. In contrast, some small towns may need smaller scale changes to infrastructure to adapt existing streets so that they are cycle-friendly (20mph zones, traffic calming etc). If conditions for cycling are already fairly suitable (i.e. roads have relatively low traffic volume and moderate speeds), the priority is instead to build a cycling culture, and to make it normal to be a cyclist. In these areas a higher proportion of revenue may be appropriate – potentially as much as 50%.
Overall scale of investment Smaller budgets might involve a higher proportion of revenue than larger budgets	If the budget available to a local authority over a particular time period is too small to build a complete high quality cycle path, there is little point in building a section of path that is not connected to the rest of the cycle network. In this situation, it is better to spend on revenue measures to promote uptake of cycling (working with schools or universities), coupled with inexpensive capital schemes such as cycle parking, traffic calming, infrastructure improvements around schools, and improving integration between cycling and public transport (e.g. at rail nodes). If the budget in a particular time period is larger, this offers an opportunity to build complete sections of high quality cycle paths.
Cultural starting point Proportion of revenue funding may need to be higher in places which lack a cycling culture	In areas where there is little or no cycling culture but there is some potential, one interviewee suggested that the priority should be revenue investment in behaviour change programmes targeted at 'key influencers'. Until such programmes have had some effect, it would be difficult to make a robust business case for a high level of capital investment in infrastructure. In Seville, our interviewee commented that the major cycle infrastructure investment programme took place in the context of about 30 years of work by the cycling association to create a popular groundswell of support for cycling. Shortly before the decision was made to build the cycle network, an opinion poll showed that an overwhelming majority of the population (95%) thought that a cycle network was needed. With the economic boom in about 2006, the city was heavily congested, and so cycling seemed like a more efficient way to travel. The large university population in Seville also

Factor	Expert interviewee comments
	meant that conditions for cycling were favourable. Under these circumstances, with a cultural predisposition to cycling, the capital investment in the cycle network had a rapid and major effect.
Programme duration Long-term funding settlements – whatever the proportion of revenue and capital – are of greater value than short term settlements	The Odense interviewee was strongly of the view that short-term investment programmes are of no value, and that cycling investment programmes must be for an absolute minimum of five years. Odense has been investing consistently in cycling for 40 years and this investment has turned a town where cycling was dying out (in the 1970s) into a town where 'everybody cycles'. Over that time, the rationale for investing in cycling has changed (originally safety, then the environment, and most recently health), but there has been consistent funding over the entire period. In Andalusia, the Seville interviewee commented that the regional government had in the past offered short-term funding to local authorities and this had been used to build isolated sections of cycle network. This was counterproductive: it was impossible to persuade people to cycle on an incomplete cycle network, and the disconnected sections of cycle path had few or no cyclists.
Stage of the programme Proportion of revenue funding may be high at the early and late stages of a long-term (20-30 year) programme, but lower in the middle period	Several interviewees concurred with the view that the ideal proportion of revenue investment might change over a relatively long timescale of several decades. Initially, the proportion of revenue may need to be high, because the priority is to stimulate interest in cycling, through work with key influencers or support for social change / campaigning groups. If this results in a groundswell of support for cycling, it may be followed by a period when the priority is to invest in high quality cycle facilities, involving major capital expenditure. At this point the proportion of revenue will fall, although the absolute amount may not change. Once a high quality cycle network has been built, the amount of capital investment may decline, and the priority will be to promote use of the network, through provision of services (cycle training, bike loan etc.) and engagement with schools, workplaces etc., so the proportion of revenue funding will rise again. This pattern is evident in London. After about a decade of fairly significant revenue investment, it has now increased its capital investment in cycling very substantially, so the proportion of revenue has gone down, although the absolute amount of revenue expenditure has not greatly changed. The current 'mini-Hollands' programme of investment in cycling in four London boroughs is front-end loaded with capital investment in the first two to three years to deal with important physical barriers to cycling. In later years, it will have a higher proportion of revenue funding in order to encourage people to use the new cycling facilities.

Figure 14.11: Expert interviewee views on factors influencing the optimal ratio of revenue to capital investment for a sustainable transport project

Factor	Expert interviewee comments
Both capital and revenue are important	There was a general feeling that the proportion of revenue funding was less crucial than the principal that every capital programme should always come with some element of revenue.
Size of urban area No consistent view on whether	The PTE interviewee felt that there was no simple relationship between the size of an urban area and the optimal proportion of revenue. One of the TfL - interviewees made the point that in suburban areas with lower population -

Factor	Expert interviewee comments
proportion of revenue should be different	density, and hence higher car ownership, it is necessary to 'work harder' to achieve behaviour change, but it is not clear whether this necessarily implies a different ratio of revenue to capital. However, the bus operator interviewee felt that some smaller towns (particularly historic cities e.g. York) tended to have quite limited road space, and that this offered relatively fewer opportunities for capital investment in bus lanes or other measures to reallocate road capacity, compared to metropolitan areas. The optimal proportion of revenue investment might be higher in this type of town (although there are clearly other small and medium-sized towns which do have wide roads, and where road capacity is not a constraint). Although not a point made by interviewees, small urban areas probably also have less potential for large-scale capital investment in tram or metro systems.
Overall scale of investment Smaller budgets might involve a higher proportion of revenue than larger budgets	The local authority interviewee felt that the optimum proportion of revenue was likely to be inversely related to the size of the programme: i.e. a £2 million programme might be more revenue-focussed than a £20 million programme.
Cultural starting point May not affect optimum proportion of revenue for bus projects	The bus operator interviewee felt that the recipe for increasing bus use was essentially the same, regardless of the cultural starting point. He compared Harrogate with Keighley: towns with similar populations about 25 miles apart in West Yorkshire. Harrogate was 'poor bus territory' in that it was prosperous and the bus was not seen positively. Keighley was much better bus territory, in that income levels were lower and it had significant unemployment. Over a period of a decade, the bus operators and the respective local authorities worked to increase bus use in both towns, in similar ways: the bus company focussed on increasing service frequencies and improving quality, while the local authority in Harrogate and the PTE in Keighley made comparable capital improvements. Bus use rose steadily in both towns over about a decade. In Harrogate, overall growth was 70% over 12 years, and per capita bus use had overtaken the figure for Keighley by the end of that period.
Programme duration Long-term funding settlements – whatever the proportion of revenue and capital – are of greater value than short term settlements. Short-term funding should be focussed on 'quick win' capital schemes	One of the TfL interviewees made the point that the funding arrangements between TfL and the boroughs involve a rolling three year programme, and that this gives the boroughs confidence to be able to plan properly. While not necessarily affecting the relative proportions of revenue and capital, it does mean that money is more wisely spent. Several interviewees commented that the 'stop start' funding cycle is a major impediment to effectiveness, and that one-year funding programmes are problematic, especially for revenue programmes. One commented that *"the notion of having an LSTF Travel Choices team who were tasked with policy objectives and had a revenue budget to deliver those objectives over a sustained period of time* [implied about a decade] *would be nirvana".* Another interviewee commented that the shorter the planning period, the greater the emphasis should be on 'quick win' capital schemes, because any revenue investment would be wasted.

15. Mutability of definitions of revenue and capital

So far in this research we have avoided strict definition of what constitutes 'revenue' and what constitutes 'capital' expenditure. The informal starting point has been to treat the distinctions between expenditure on 'capital and revenue', 'infrastructure and operations' and 'hard and soft measures' as rather closely related to each other. However, this is not compatible with the respective legal and technical definitions, and the detail is considerably more complex.

The starting point in distinguishing between revenue and capital expenditure by public bodies (which is what mainly concerns us here) is the accounting principles of private companies. Guidelines for local government by CIPFA (2010) state: *"Capital expenditure is defined as expenditure on the acquisition, creation or enhancement of assets which will last longer than one year".* This is mainly in practice spending on physical assets such as buildings, land, and machinery including vehicles, and also grants and advances to the private sector or the rest of the public sector for capital purposes.

However, more detailed guidance is based on the definitive rules by HMRC (2014) in the Business Income Manual. This states (BIM35010):

"It is not possible to draw up a list of items, the cost of which is capital, nor is it possible to draw up a list of items, the cost of which is revenue. The classification, capital or revenue, is not uniquely determined by the nature of the item involved, rather it is determined by the circumstances of the transaction. What is capital in one person's hands may well be revenue in another's. Although there is no universal recipe to decide in any given circumstance if an expenditure is on capital or revenue account, there are a number of broad criteria. Some may be more useful than others in particular cases. The criteria include the following:

- *Whether expenditure is capital is a question of law - see BIM35035.*
- *Accountancy treatment may be informative but does not answer the question, capital or revenue - see BIM35205.*
- *'Perpetual' payments are unlikely to be capital - see BIM35310.*
- *The question (capital or revenue) is answered by the effect of the expenditure and not the purpose - see BIM35320.*
- *Generally capital expenditure will result in the acquisition, disposal or modification of an identifiable capital asset, tangible or intangible - see BIM35320.*
- *Capital expenditure will usually produce an enduring result …*
- *Where expenditure is abortive, the same result applies as would have applied if the expenditure had achieved its objective - see BIM35325.*
- *If it is no part of the company's trade to deal in the asset in question then the expenditure is likely to be capital - see, for example, the cases of Glenboig (BIM35600) and Bullrun (BIM35625)."*

It is an essential part of the status of these rulings and interpretations that they derive their authority, in the most part, from legal rulings in court (which are, as is the way with such cases, from time to time overruled by higher courts and later disputes). One which may become particularly relevant to sustainable transport is the guidance on intangible assets and branding (BIM35640). This states:

"Generally there is unlikely to be a strong case for making a capital argument because the courts have been reluctant to accept that expenditure is capital where no tangible asset has been created. The name itself might be an asset or goodwill may have been created or enhanced. But the reality is

often that if anything is created it is transitory and not sufficiently durable to be regarded as capital. This recognises that consumers are often fickle and can change allegiance relatively quickly.”

However, if demand responses to a short lived intervention are themselves more long lived than the intervention – which is the case in the very well evidenced finding that demand elasticities have a profile of up to 10 or 20 years – then a much stronger case can be made that it can be treated as capital, if there is an advantage in doing so. We are not aware that this has yet been tested in court.

When applied to transport, the key effect of these distinctions is that in a very large number of cases, there is a grey area enabling expenditure to be argued as either revenue or capital. That argument may not always be resolved in the same way, depending on the view of auditors. In our discussions with local authorities during the course of this research we were informed of one example where the project manager for a cycling programme supported under the Linking Communities Fund had argued, and auditors had agreed, that the following items should correctly be classed as capital expenditure:

- General programme management: human resources to deliver the cycling programme and the - resulting assets, including both internal staff costs and external consultancy to support specific - projects. -
- Training for staff in *new* knowledge and skills to support the delivery of the programme - (justified under BIM35660). -
- Fees to architects, planning fees, project management costs, construction / refurbishment costs and website development for a family cycling centre.
- Design fees, prototype costs, planning fees, project management costs, construction costs, and purchase of bikes for a network of bike ‘docking stations’; consultancy to develop a plan for operation of the assets; and brand and website / software development to support operation of the facilities and realisation of the asset.
- Manufacture of 15 ‘pedal buses’ and development of associated infrastructure (‘bus’ stops and storage depot): design fees; prototype costs; safety consultancy support through VOSA testing; project management costs; manufacture costs; bus stop infrastructure costs; pedal bus depot design and construction costs; marketing infrastructure e.g. website, signage, brand design.
- Planning consent fees, design costs and installation costs for physical signage.
- Capital grants via a cycling facilities fund, and the human resources to support development and award of grants.
- Monitoring and evaluation costs such as cycle counters and human resources for the analysis of data arising from counters.

All the items in the above list may be considered – using the CIPFA definition – as related to the acquisition, creation or enhancement of assets which will last longer than one year. By contrast, the ‘hard’ and ‘soft’ distinction is not about the longevity of the item of spending at all. WebTAG Unit M5.2 (DfT 2014b) states:

“1.2.2 Although different Smarter Choice measures often have similar aims, different techniques are required to model different measures. In particular, a distinction is required between:

- *measures which have a direct impact on travellers’ generalised cost, whether financial cost or time (defined as ‘hard’ measures in this Unit); and*
- *measures which affect behaviour without affecting travellers’ cost, instead changing travellers’ response to cost (defined as ‘soft’ measures in this Unit).”*

This does not correspond at all closely to the type of funding: for example, one of the easiest items to model by including as a formal measured element of generalised cost would be the money cost of travel, and it is definitely 'hard' in that sense, but the spending of public funds on a fares reduction or concessionary entitlement to certain groups of travellers would always be classified as revenue spending. It is usually thought (though as noted above this has not been tested) that this would probably be the case even if the concession was successfully intended to produce an increase in demand which lasted for longer than a year.

In contrast to the extensive legal and technical guidance to British public authorities on what expenditure may be treated as revenue and what as capital, and the extent to which this issue exercises the creativity of local authority project managers, it was notable that our search of the non-British literature found almost no examples where a distinction was made between revenue and capital accounts. It was also clear from our interviews with Danish and Spanish cycling experts that the distinction was not seen as important or relevant for their work. This therefore appears to be a peculiarly British issue.

Where the issue has been addressed in the past in Britain, it has principally been by those who have seen it as a distortion. Thus the Commission for Integrated Transport (2010) advised that different rules of availability of funding according to the distinction of capital and revenue were a barrier to optimal spending plans:

"6.4.12. We would also like DfT to explore ways of adjusting the balance between capital and revenue spending so as to avoid the current position whereby smarter choices schemes with high BCRs are being squeezed out by lower BCR capital schemes, simply because capital funding is more easily available."

16. - Conclusions: policy benefits of an investment programme combining revenue and capital

16.1 - High-level policy objectives

Our expert interviewees identified four high level reasons why intervention in support of cycling and sustainable transport is important:

- **To support well-functioning economies**. Cities need mass transit in order to function efficiently. Because transport markets are not perfect (in the strict economic sense), some level of public subsidy or revenue intervention is needed if services are to be optimised.
- **To reduce emissions and improve air quality**. High levels of car and lorry use are a main cause of developed economies' emissions of climate-damaging carbon dioxide, and of pollutants that are damaging to health.
- **To enhance social inclusion and health**. Transport systems need to work effectively for everybody, including old and young, people with low incomes, and people with disabilities. Active travel (cycling and walking) should be encouraged because the resulting health gains will give people a better quality of life as they get older, and because they will lead to savings elsewhere (i.e. reductions in long-term health service costs).
- **To maximise safety**. Lower levels of car use (especially by high-risk groups such as young males) will result in fewer road deaths and injuries; education and enforcement (requiring revenue) and engineering (requiring capital) are needed to reduce risks for all road users.

The evidence presented in this report suggests that these objectives may be more readily achieved through an investment programme that involves a combination of revenue and capital.

16.2 - Local authority demand

Chapter 2 demonstrated that **strong demand exists from local authorities for revenue funding for sustainable transport**. In general revenue funding is less available from other sources than capital funding, so national government has a key role to play as a provider of this. Expert interviewees commented that the *principle* that all government funding programmes for cycling and sustainable travel should offer both revenue and capital was in a sense more important than the absolute proportions. For example, one interviewee commented that:

> *"Any number greater than zero would be fantastic. Just getting the principle established that with capital expenditure comes a revenue line – that's a battle worth fighting, even if the first percentage is small."*

16.3 - Addressing all the barriers to behaviour change

In Chapter 3, we saw that the **combination of revenue and capital funding provided a means of addressing all the barriers to behaviour change**. The outputs typology based on activities undertaken with the support of the Local Sustainable Transport Fund identified 51 different types of activity to encourage increased cycling or sustainable travel. These could be organised into eight distinct groups, based on the nature of the activity (marketing / information / transport services / civil engineering) and the obstacle to behaviour change that it was designed to overcome (habitual behaviour / social norms; perception that sustainable travel options were absent or difficult; real inadequacies in the transport system). Revenue-funded activities featured in seven of the groups; capital-funded activities featured in three. Interventions to overcome barriers stemming from habit, social norm and perceptions required largely revenue-funding, whereas activities to solve real deficiencies in transport infrastructure and services required both capital and revenue funding. An investment programme that allowed of only one sort of expenditure, whether revenue or capital, would be severely limited in what it was able to achieve. Illustrative examples of local cycling and sustainable transport programmes in Stafford, Goole, Middlesbrough, Leighton Buzzard, Devon and South Hampshire showed that in practice these programmes had involved a mixture of both capital and revenue activities.

16.4 Opportunities offered by revenue projects

The expert interviewees identified several examples of specific interventions that had proved very worthwhile in achieving the high-level policy objectives, and that could only be delivered with revenue funding. Similar examples were evident from review of the Local Sustainable Transport Fund outputs database and from the illustrative local programmes described in section 3.2. Interventions that could only be achieved through revenue funding included:

- **Pump-priming new bus services to major hard-to-reach employment sites for low-paid workers** (e.g. services to Heathrow; Job-Connector services to car-dependent locations in South Yorkshire; Local Link services in Greater Manchester).
- **Helping businesses to get better access to labour markets** (e.g. through workplace travel - planning services provided to businesses such as Asda in Nottingham). -
- **Helping fleet operators to reduce carbon emissions** through the Ecostars project, which - originated in Barnsley and is now being rolled out in other local authority areas. -
- **Reducing carbon emissions** (and transport costs) through support for car-sharing schemes. In - one county, Devon, the provider estimates that the service is now saving 4.6 million car km - each year. -
- **Providing new bus services for major housing developments**, to ensure new residents have a - good service available from the outset, for example in Ipswich and Leighton Buzzard. -
- **Enabling young people with special needs to travel independently**, which in the longer term - will reduce revenue requirements from social services budgets. -
- **Encouraging active travel through** cycle training, cycle repair schemes at workplaces, bike loan schemes and refurbishment schemes to provide low-cost bikes, all of which were being used in a number of LSTF projects.
- **Tackling intractable safety issues**, for example through training programmes in London which - enable cyclists and HGV drivers to 'swap' places. -

16.5 Synergy between capital and revenue projects

Case study evidence, illustrative examples, and the expert interviewees all pointed to evidence that the **value of some types of purely capital projects could be markedly enhanced by the addition of revenue funding.** Examples included:

- Transport for South Hampshire's LSTF Large Project, where its modelling estimated that - revenue spending on behaviour change measures would add 17% to the cost of the capital - programme, yet result in a 64% uplift in the calculated value of project benefits. -
- Kick-start bus funding, which could substantially increase the value-for-money of capital investment in bus priority measures, and create a business case for bus companies to invest in new vehicles. For example, in the case study analysis of the Bristol X2/3 route, revenue funding for increased service frequencies more than doubled the overall BCR (from a BCR of about 2 for the capital-only programme of bus infrastructure improvements, to a BCR of above 5).
- Projects encouraging cycling at schools. The case study evidence suggested that the - combination of new cycle infrastructure (Links to Schools) with cycle promotion (Bike It) at -

primary schools could deliver more cycling than a Links to School project on its own (in the base case, an uplift of +1.8% relative to 'do-nothing' in the number of pupils who usually cycled to school, compared to +0.4% where cycle infrastructure was provided in the absence of cycle promotion).

- Projects encouraging cycling at workplaces. Transport for London found that revenue interventions supporting cycling by employees (cycle parking, cycle training and cycle safety checks) at businesses close to new Cycle Superhighways increased cycling mode share at targeted businesses from 11% to 14%.
- Workplace travel planning programmes to increase the operational effectiveness of transport infrastructure. The Highways Agency reported that area travel plans at traffic-generating employment sites near to congested sections of the strategic road network had BCRs of between 4 and 14 (using similar methods to those used to appraise highway capacity schemes). The cost of the initiatives was about £100,000 per site.

16.6 Underperformance of capital schemes in the absence of revenue funding

There was also evidence that **some types of capital project could be significantly degraded without associated revenue spending**. Examples of this cited by expert interviewees included:

- Instances where bus operators felt that revenue funding for enforcement of bus lanes or - parking controls was essential to the effective operation of bus priority measures (funded - through capital investment). Without the enforcement, the capital investment would be - wasted. -
- Instances where local authorities had removed real time information systems because they did not have the revenue funding to maintain them.

Nevertheless, application of revenue funding was not a guarantee of success. There were examples of projects combining both capital and revenue investment that failed and were abandoned, such as a bus service frequency upgrade on an 'express' route between Aylesbury and Milton Keynes. This may have been unsuccessful either because the commuter market identified was insufficiently large or, more probably, because the offer was insufficiently frequent and fast to attract more commuters who also had an option to drive. The abortive expenditure in this case appears to have been modest, and offset by benefits from successful projects combining capital and revenue on other routes in the same geographical area.

16.7 Value for money of revenue schemes compared to capital schemes

In the case studies, and also in examples from the literature, **sustainable transport schemes that were 100% capital did not, in general, show the highest value** (although particular sustainable transport capital projects can show good BCRs and will be very worthwhile).

The case studies suggested that in some instances, **100% revenue projects may show exceptionally high value**. This is most likely where prior capital funding has laid the ground, or where limited project size or a short project timescale offer 'windows' of high-value opportunity. There is likely to be only a limited pool of projects in this category, but these are worth identifying and picking as cheaply available 'low-hanging fruit'.

16.8 Optimum proportions of revenue and capital at the local authority level

Theory predicts that **there is an optimum balance of revenue and capital funding to achieve the highest value combination of projects**, but does not predict what the optimum proportions may be.

The experience of the expert interviewees suggested that the optimum balance between revenue and capital will depend on local circumstances, including the cultural, economic and social starting point; project type; available budget; and duration and stage of the project.

The concept of an optimum balance becomes more meaningful as the scale of programme increases and as the timescale increases. For a small budget, the 'best next-available projects' could be almost entirely revenue, or almost entirely capital, or a mixture. For a large budget, or over a longer timescale, it is likely that the 'best next-available projects' will be a more balanced mixture of revenue and capital. Thus, the LSTF Small Projects span almost the entire range of possible proportions of revenue and capital, while the LSTF Large Projects span a smaller range. The range in proportions of revenue in the LSTF Large Projects (20-60%) is liable to have been influenced by the short time window available for spending, which militates against major infrastructure projects, and by the association of the LSTF with smarter choice measures. For these reasons, it is possible that a longer implementation timescale might have shown lower demand for revenue (say, in the range of 10-30%).

16.9 Mutability of definitions of revenue and capital

Boundaries between revenue and capital are blurred. For example, maintenance of physical assets such as bus lanes may be funded via capital budgets, but enforcement of the same bus lanes to ensure that they can be used efficiently and are not obstructed by illegally parked vehicles would be considered to require revenue funds.

There is some potential (possibly not always fully exploited) for local authorities to take advantage of these blurred boundaries to secure funding from revenue or capital accounts according to whichever is under less pressure. There could be merit in work to identify a broader range of activities that legitimately can be undertaken from either capital or revenue funds (for example, training on new RTPI equipment purchased with capital funds; marketing activity to promote buses bought with capital funds; short-lived interventions which do not create a physical asset but have a demand response over the long-term i.e. at least 10-20 years).

However, in general, **capital funding remains more easily available for local authorities than revenue funding.** It seems likely that as a result **some lower-BCR capital projects may be receiving funding while higher-BCR revenue projects are not**. While addressing this problem was beyond the scope of our research, there are a variety of ways in which it might be tackled:

- DfT funding deployed via Local Enterprise Partnerships and the single local growth fund could carry a condition that a proportion is earmarked for revenue projects.
- Local authorities could be given greater flexibility to develop cycling and sustainable transport projects that did not involve creation of a physical asset using capital budgets, so long as it could be demonstrated that the effect of the project would substantially outlive the funding period.
- A centrally-administered fund such as the Local Sustainable Transport Fund, entirely focussed on revenue, could be established for the long term, to complement capital funding from other sources.

16.10 Optimum proportions of revenue and capital at the national level

There is clear evidence that *both* capital and revenue schemes can be effective in increasing cycling and sustainable travel, and that the combination of revenue and capital schemes is likely to offer synergistic effects. While there is no single 'right answer' as to the optimum proportion of revenue and capital for cycling and sustainable transport initiatives at the local authority level, it is likely that across the country as a whole, variation in different local authorities' requirements may tend to average out. Over the long-term, a national investment programme for cycling and sustainable transport that gives local authorities flexibility as to whether to prioritise capital or revenue investment is likely to offer the best overall value for money, since it will enable local authorities to always pick the best projects, regardless of artificial constraint. In contrast, a national investment programme that specifies that investment should be solely capital, or solely revenue, is likely to deliver less effective results for cycling and sustainable travel, and to offer lower value for money.

17. Appendix: Breakdown of total benefits according to benefit type -

	Road decongestion (road user time benefit)	Road accidents	Greenhouse gas emissions	Health benefit as mortality reduction	Health benefit as absenteeism reduction	Cycling journey quality	Bus user time savings	Benefit to tourism economy
Kent Diamond (2004-2011)	32%	5%	2%	17%	0%	0%	45%	0%
Kent Triangle (2004-2013)	30%	4%	2%	16%	0%	0%	49%	0%
Kent Triangle (2008-2013)	22%	3%	1%	11%	0%	0%	63%	0%
Kent Triangle (youth Freedom pass)	84%	11%	4%	1%	0%	0%	0%	0%
Kent Triangle (Pensioner free concessions)	32%	5%	2%	61%	0%	0%	0%	0%
Bucks 300 (2003-2012)	41%	6%	2%	16%	0%	0%	36%	0%
Bucks 300 (2003-2008)	35%	5%	2%	15%	0%	0%	44%	0%
Bucks 280 (2008-2013)	17%	2%	1%	6%	0%	0%	75%	0%
Bristol X1 (2011-2013)	50%	10%	5%	13%	0%	0%	22%	0%
Bristol X1 (2008-2013)	3%	0%	0%	0%	0%	0%	97%	0%
Bristol X2/3 (2008-2013)	20%	4%	2%	10%	0%	0%	64%	0%
Bristol X2/3 (2008-2012)	-1%	0%	0%	-1%	0%	0%	102%	0%
Bristol GBBN (2008-2013)	5%	1%	1%	6%	0%	0%	87%	0%
New Forest Tour (2005-2013)	30%	4%	2%	3%	0%	0%	0%	61%
CDTs / CCTs	13%	2%	1%	78%	1%	6%	0%	0%
Exeter Marsh Barton	21%	3%	1%	69%	2%	5%	0%	0%
Exeter Sowton	20%	3%	1%	70%	2%	5%	0%	0%
Links to School	14%	2%	1%	79%	0%	4%	0%	0%
Links to School + Bike It	16%	2%	1%	77%	0%	5%	0%	0%
Bike It increment	26%	3%	1%	65%	0%	6%	0%	0%

Figures are normalised to 100% after removal of taxation dis-benefits from reduction in car use. Benefits that contributed less than 1% to overall benefit not shown: these were decreased wear on road network, local air quality and road noise.

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