Concessionary Fares - Guidance and Calculator

15/03/2024

SYSTRA

frontier economics

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Executive Summary

The English National Concessionary Travel Scheme (ENCTS) is a national, mandatory, scheme which enables eligible individuals in England to travel on any off-peak local bus service in England, free at the point of use. Eligibility is determined by age and disability.

Bus operators are reimbursed for carrying passengers under the ENCTS on the principle that they should be "no better, and no worse (NBNW) off" for carrying those passengers than they would be in the absence of the scheme except for temporary Statutory Instruments introduced as a result of the COVID-19 pandemic, that expire in April 2024.

To help with the reimbursement process, the Department for Transport (DfT) provides an extensive set of guidance and an associated calculator to all operators, Travel Concession Authorities (TCAs) and other interested stakeholders through its website to enable the calculation of operator reimbursement for any party who wishes to use it. TCAs are not required to use this calculator, but must follow the NBNW principle.

Since its development in 2008/9, the calculator has been updated for aspects such as inflation, but has not had a comprehensive review. SYSTRA and Frontier Economics were commissioned by the Department for Transport (DfT) to review these processes and tools. This project remains consistent with the NBNW principle and has retained the structure of the calculations from the previous research, focussing on updating many of the parameters within that calculation.

As part of the study, primary and secondary research has been undertaken to (a) build an understanding of how the ENCTS, guidance and tools are currently working for stakeholders, and how they could be improved, and (b) inform the economic analysis undertaken as part of this study, including examining the evidence for updating the scheme, the economic implications, and assessing the overall value for money of the ENCTS.

An evidence review, followed by stakeholder interviews, surveys and analyses in travel patterns identified the need for a greater degree of granularity and variation in the guidance and calculator, to increase accuracy, along with an update to the reimbursement parameters.

Following the evidence review, a number of analyses were undertaken to review the generation factor, the Average Fare Forgone calculation methods, and the costs (Marginal Operating Costs, Marginal Capacity Costs, Peak Vehicle Requirement Costs, Service Frequency Elasticity). These analyses have all led to recommendations which are summarised in the following chapter. The impact of these recommendations was assessed through a series of case studies.

Summary of recommendations

INTRODUCTION

SYSTRA and Frontier Economics were commissioned by the Department for Transport (DfT) to review the processes and tools established to assist bus operators and Travel Concession Authorities (TCAs) in calculating reimbursement for operators carrying eligible passengers under the English National Concessionary Travel Scheme (ENCTS). The ENCTS is a national, mandatory scheme which enables eligible individuals in England to travel on any off-peak local bus service in England, free at the point of use. Eligibility is determined by age and disability. This study has been informed by engagement with industry participants, notably TCAs and bus operators as well as engagement with the public, a detailed review of the latest relevant literature available, and extensive data analysis.

The provisions of ENCTS are enshrined in law and unchanged except for temporary Statutory Instruments introduced as a result of COVID-19 that expire in April 2024. These provisions require that bus operators are left financially "no better and no worse (NBNW) off" as a result of carrying ENCTS passholders. To achieve this, operators are reimbursed for:

- the bus fares that would have been paid by passholders, known as the Average Fare Forgone, for journeys which have not been generated by the scheme (that would have been made by bus even if payment of that fare was required);
- the additional costs accrued by carrying passholders for journeys that would not have been made in the absence of the scheme (generated journeys).

The DfT publishes a calculator and guidance for TCAs, operators and other interested stakeholders on GOV.uk on how to calculate the appropriate level of reimbursement.[1] The evidence in these documents was established in 2009, and has not been substantively updated since then.

This review has assessed that the core processes established in 2009 to underpin the calculation of bus operator reimbursement remain fit for purpose. The core processes include how bus operators are reimbursed for carrying passengers under ENCTS on the principle that they should be NBNW for carrying those passengers than they would be in the absence of the scheme. However, a number of changes are recommended for adoption, guided by industry engagement and analysis of available data. Many of these changes relate to detailed and technical points in the calculation of reimbursement due to bus operators. The recommendations are summarised below with further details in the main body of the report and annexes, and relate to the:

1 Available from https://www.gov.uk/government/publications/guidance-on-reimbursing-bus-operators-for-concessionary-travel

- Generation Factor;
- Inflation / Deflation
- Average Fare Forgone (AFF);
- Additional Costs.

The table below summarises the aspects of the approach to reimbursing operators that are, and are not, recommended for change following the analysis in this study. Further details are provided after the table.

Table 1. Aspects of the approach to reimbursing operators

Aspect of reimbursement	Recommended for change or not
Operators reimbursed on NBNW basis	No (set in legislation)
"Shape" of the demand curve	No, but the distinction between "old" and "new" passholders should be removed which would simplify the calculations considerably
Number of demand curves	No, but recommend changing from PTE/non-PTE to urban/non-urban
Parameters of demand curves	Yes, to reflect latest evidence but building on the research conducted by ITS.
Methods to calculate AFF	No
Available lookup tables	Yes, to reflect latest evidence on concessionary passenger travel patterns
Inflation adjustments	Yes, by using CPI for deflating fares; and introduce a bespoke cost index for increasing operator costs
Marginal Operating Costs	Yes, to reflect cost inflation
Marginal Capacity Costs (including service frequency elasticity)	Yes to reflect cost inflation, and to provide a new figure for service frequency elasticity based on latest evidence.
Mohring factor	No

GENERATION FACTOR (GF)

The generation factor is the proportion of ENCTS journeys that are only made because they are free under the ENCTS. The calculation of the generation factor is therefore a central component in the estimation of the level of reimbursement due to operators for carrying passengers under the ENCTS. It determines the proportion of ENCTS passengers for whom operators are reimbursed at the Average Fare Forgone and those for whom operators are reimbursed at the additional cost. The generation factor is estimated based on a demand curve, which estimates how many passengers would travel at the Average Fare Forgone.

To assist DfT policy makers, we draw the following conclusions and make the following recommendations:

- Recommendation GF1: retain the current form of the demand curve (a damped exponential) as this formulation has a number of attractive theoretical properties and is already known to stakeholders. We recognise that this formulation of the demand curve assumes that passengers respond to changes in the fare level, rather than to the absolute level of the fare (and so, for example, TCAs with high fares but low fare increases will ultimately end up with a lower generation factor than a TCA with low fares but high levels of increase) and suggest that this is a topic which could be considered further in additional research;
- Recommendation GF2: remove the distinction in the calculator between "old" and "new" passholders on the basis that, 15 years after the introduction of the nationwide free fares scheme, the vast majority of current passholders are now "new" in the sense of having started using the ENCTS since the nationwide free fare scheme was started;
- Recommendation GF3: retain two demand curves, but update those to "urban" and "non-urban". We conclude that retaining only two demand curves strikes an appropriate balance between ease of use for stakeholders and accuracy, although we note that this means that the demand curves will not fully account for local factors such as the level of disposable income or road conditions. While there is a conceptual case for differentiating demand curves for disabled passengers and rural areas we conclude that there is not currently sufficiently robust evidence available to support separate demand curves for older and disabled people;
- Recommendation GF4: adjust the parameters of the demand curves to reflect the implied generation factors from bespoke analysis conducted for this study using the National Travel Survey (NTS). This would likely result in generation factors which are lower on average than are typically seen in the current calculator. We acknowledge the uncertainty inherent in any econometric exercise of this type, but believe that the benefits of transparency outweigh this and that the alternative of attempting to derive the demand curve parameters from within the broad range of price elasticities available in the academic and industry literature is less desirable;
- Recommendation GF5: do not further reduce the generation factor based on post-pandemic evidence. We conclude that the analysis of the post-pandemic travel patterns using HOPS data on smartcard journeys from six TCAs does not support a further reduction in the generation factor as the changes in pass use are not consistent with what would be expected if the generation factor had materially reduced.[2] We note that this is an area of particular concern to stakeholders and where robust evidence is not available and we recommend that this is revisited as additional evidence becomes available (see Post Review Recommendation below);
- Post Review Recommendation 1: reassess the evidence on the generation factor

2 Host Operator or Processing System (HOPS) – a central back office which securely processes all smart transactions

within the next 2-3 years as more data on post-pandemic travel patterns emerges and as the current impacts of policies at a local and national level affecting bus fares become clearer;

- Post Review Recommendation 2: conduct further research to assess the level of generation at different levels of journey making.

We note that further academic and industry research into passenger behaviour post-pandemic; and for disabled passengers in particular, would be beneficial in increasing the robustness of the evidence base.

Based on this assessment, we have derived a set of recommended parameters for the demand curves to be used in the calculation of the reimbursement due to operators.

INFLATION / DEFLATION

Within the calculator there is a function to inflate costs from the baseline year and deflate fares to the baseline year. Within the current calculator the same approach to inflating costs and deflating fares is used, with this being based on a combination of historical CPI data and forecast GDP Deflator data. The study considered the most appropriate approaches, and produced the following recommendations:

- Recommendation Inflation/Deflation 1: Update the approach to inflating costs and deflating fares within the calculator, to use two different approaches in line with the conclusion that it is not appropriate for the same measure of inflation to be used for the two purposes;
- Recommendation Inflation/Deflation 2: Update the approach to deflating fares within the calculator to be based entirely on CPI data;
- Recommendation Inflation/Deflation 3: Update the approach to inflating costs within the calculator to be based on a bespoke weighted cost index based on driver and other staff costs (60%), fuel costs (15%) and other costs (25%).

AVERAGE FARE FORGONE

For journeys which would have been made in the absence of the ENCTS, there is a loss of commercial revenue received by the operators. Under the current reimbursement arrangements within guidance and the calculator, operators are permitted to claim compensation for each passenger which would have paid a commercial fare without ENCTS – this claim per passenger is referred to as the Average Fare Forgone (AFF).

This study considered the four current methods of estimating the AFF in the guidance and developed seven recommendations for policy makers to consider:

- Recommendation AFF1: The Discounted Fares Method should remain the preferred approach;

- Recommendation AFF2: The Basket of Fares Method and Average Cash Fare Method should be retained where the Discounted Fares Method might not be appropriate;
- Recommendation AFF3: The Average Cash Fare Method should be discouraged from use unless the operator only offers Single and Return tickets;
- Recommendation AFF4: In general operators/TCAs should seek to collaboratively produce their own Lookup Tables using local data;
- Recommendation AFF5: The default Lookup Table should be updated from 2009 NoWcard data to 2022/23 HOPS data;
- Recommendation AFF6: A set of four Lookup Tables using the HOPS data should be included in the updated calculator to ensure operators/TCAs which do not have their own Lookup can use more appropriate data. The revised Lookup Tables should reflect: Large Urban, Medium-Sized Urban, Mixed Urban/Rural and Rural Areas;
- Recommendation AFF7: The guidance and calculator should be clear that whilst there are four Lookup Tables for different geographies, operators and TCAs are permitted to develop their own bespoke Lookup Tables using local and robust data.

BUS OPERATING COSTS

As outlined above, a proportion of ENCTS journeys are only made because travel is free at the point of use. This increase in journeys by bus due to the scheme increases the costs incurred by the operator because they:

- carry more passengers which impacts on costs including fuel consumption and wear and tear on the vehicles;
- might have to increase the service frequency to meet demand.

The increase in operating costs is reflected through Marginal Operating Costs (MOCs). The general concept of Marginal Cost is that it reflects the additional cost of providing one more unit of output. Therefore, in the calculator, MOCs reflects the additional Operating & Maintenance cost incurred for each additional passenger served by an operator. There are also Marginal Capacity Costs (MCCs) incurred by operators where they need to add additional capacity into the network because of the demand created by the ENCTS. Administration Costs and Peak Vehicle Requirement Costs can also be associated with the Scheme, their scope and application is explained in more detail in the guidance on reimbursing bus operators for concessionary travel. These have not been reviewed in depth, but the guidance has been updated to further clarify where they apply.

The current MOCs and MCCs date from 2009 and have been updated for inflation since then. To assist the DfT's policy makers, we draw the following conclusions from the research and analysis and make the following recommendations on MOCs:

- Recommendation C1: The MOCs in the current calculator should be uplifted to reflect the growth in Operating Costs analysed, 43% from 2009/10 to 2023/24 in the current calculator;
- Recommendation C2: The uplift applied to MOCs should be 47.5% to 2023/24 prices to reflect a central value across Metropolitan and Shire Areas analysed;
- Recommendation C3: MOCs should be directly estimated from econometric analysis of operator Operating Costs to re-evaluate the relationship established by ITS.
- Recommendation C4: Uplift of 49.0% to the MCC per hour from 2009/10 to 2023/24 and 23.3% from 2009/10 to 2023/24 for the MCC per mile, as opposed to 42.9% from 2009/10 to 2023/24 in the current calculator.
- Recommendation C5: Change the service frequency elasticity to 0.71.
- Post Review Recommendation 3: The analysis is revisited in 2-3 years' time to consider the longer-term impact of the pandemic and the current levels of inflation.

1 Introduction

1.1.1 The English National Concessionary Travel Scheme (ENCTS) is a national, mandatory, scheme which enables eligible individuals in England to travel on any off-peak local bus service in England, free at the point of use. Eligibility is determined by age and disability.

1.1.2 Bus operators are reimbursed for carrying passengers under the ENCTS on the principle that they should be "no better and no worse (NBNW) off" for carrying those passengers than they would be in the absence of the scheme except for temporary Statutory Instruments introduced as a result of the COVID-19 pandemic, that expire in April 2024.

1.1.3 The reimbursement due to operators for carrying passengers under the ENCTS is agreed between operators and Travel Concession Authorities (TCAs) using a range of approaches . However, the Department for Transport (DfT) provides an extensive set of guidance and an associated calculator to all operators, TCAs and other interested stakeholders through its website to enable the calculation of operator reimbursement for any party who wishes to use it. TCAs are not required to use this calculator, but must follow the NBNW principle.

1.1.4 The theory that underpins the DfT's reimbursement guidance and calculator are based on research carried out by the Institute for Transport Studies (ITS) at the University of Leeds and other experts (Professor Phil Goodwin and Andrew Last) in 2008/09. That extensive programme of research recommended particular approaches to estimating the components of operator reimbursement outlined above. Since its introduction, the calculator has been updated for aspects such as inflation, but has not had a comprehensive review.

1.1.5 Operator reimbursement has two key components:

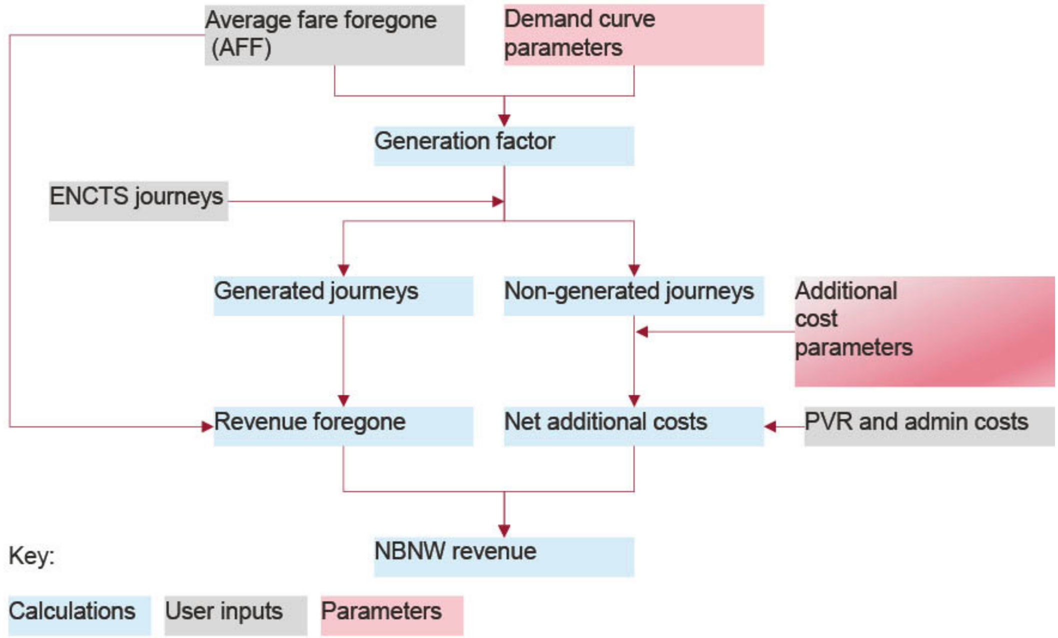
- for those journeys that would have been travelled by bus without the ENCTS (known as non-generated journeys), the operator is reimbursed for the fare that the passenger would have paid (known as the Average Fare Forgone (AFF));
- for those journeys which are only made by bus because the passenger can travel for free under the ENCTS (known as generated journeys), the operator is reimbursed for the additional costs incurred by that generated journey.

1.1.6 In the guidance published by the DfT, a bus journey is defined as a single bus boarding. The journey starts when the concessionary passenger boards the bus at a bus stop and ends when the passenger alights the bus. A journey is different from a trip in that a trip can include several separate bus boardings/journeys. However, the word 'trip' can sometimes be used to mean 'journey' in such expressions as 'trip frequency', 'trip rate', 'trip making'. It is worth noting that the definition of "journey" and "trip" can vary in the literature, and the two terms can sometimes be used interchangeably.

1.1.7 The generation factor (the ratio of generated journeys to total ENCTS journeys) is a central component of the estimation of the level of reimbursement due to operators for carrying passengers under the ENCTS as it determines the mix of ENCTS passengers for whom operators are reimbursed at the Average Fare Forgone and those for whom operators are reimbursed at the additional cost. This generation factor is derived from a demand curve.

1.1.8 The figure below summarises the components of the reimbursement calculation.

Figure 1. Concessionary travel reimbursement calculation



1.1.9 SYSTRA and Frontier Economics Ltd ("Frontier") have been commissioned by the DfT to undertake research and analysis, and provide recommendations on several areas of concessionary travel by bus in England (including London). SYSTRA and Frontier are working with Ernst & Young (EY), who are providing a critical friend role, and independent consultants Nic Greaves and Jeremy Meal. The study team has benefited from advice from Prof. Phil Goodwin (Emeritus Professor of Transport Policy, University College London) and Tom Worsley CBE (Visiting Research Fellow, ITS, University of Leeds). Prof. Goodwin's advice has focussed on the concessionary reimbursement, while Tom Worsley's advice has focussed on the value for money assessment . EY undertook a review of the recommendations which are proposed in this report. Where appropriate, recommended changes from the critical friend support have been incorporated within this report.

1.1.10 This project remains consistent with the NBNW principle and has retained the structure of the calculations from the previous research, focussing on updating many of the parameters within that calculation.

1.1.11 The overall aim of the project is to conduct research and analysis into:

- the key elements of concessionary reimbursement;
- the concessionary appeals process;
- the eligibility criteria for the disabled concessionary bus pass;
- the potential of extending the eligibility times for the concessionary bus pass;
- the overall value for money of the statutory scheme.

1.1.12 This report is focussed on the first of these aspects - the key elements of operator reimbursement. Our overall approach has been to review the components of the calculator and recommend updates to the current approach/values where the evidence supports it.

1.1.13 The remainder of this report is structured as follows:

- section 2 provides more context on the study;
- section 3 summarises the analysis, results and recommendations of the study relating to the generation factor;
- section 4 outlines the analysis, results and recommendations of the study relating to calculating the Average Fare Forgone;
- section 5 outlines the analysis, results and recommendations of the study relating to calculating the additional costs incurred by operators as a result of the ENCTS;
- section 6 details the results of four case studies showing the potential impacts on operator reimbursements from the recommendations made sections 3-5;
- section 7 provides recommendations and conclusions.

1.1.14 There are a number of appendices providing more detail on the analysis which has been undertaken.

1.1.15 SYSTRA and Frontier are grateful for the input and comments provided by two advisory committees during this study: a Technical Advisory Committee (focussing on the economic aspects of the research) and a Disability Advisory Committee (focussing on the impacts of the potential to extend the eligibility criteria for the disabled concessionary bus pass). We note that members of these advisory committees have expressed a range of opinions on different topics throughout this study, and not all members of the advisory committees will necessarily agree with all the conclusions and recommendations made in this report.

1.1.16 SYSTRA and Frontier are also grateful to all the operators and TCAs who have made their data available for this study and to stakeholders and members of the public who took part in the stakeholder engagement.

2 Study context

2.1 Introduction

2.1.1 This section provides details of the methodology that underpins this study. The study has involved the following stages:

- Research and stakeholder engagement: building an understanding of how the ENCTS, guidance and tools are currently working for stakeholders and how they could be improved. The findings from the research informed the analysis described in the rest of this report.
- Economic analysis: examining the evidence for updating the scheme, their implications and assessing the overall value for money of the ENCTS in its current form and of any changes/extensions proposed.
- Guidance and tool creation: drafting guidance and creating/updating the reimbursement calculator.

2.2 Research with stakeholders

2.2.1 As part of the study, primary and secondary research through stakeholder engagement has been undertaken to (a) build an understanding of how the ENCTS, guidance and tools are currently working for stakeholders, and how they could be improved, and (b) inform the economic analysis undertaken as part of this study, including examining the evidence for updating the scheme, the economic implications, and assessing the overall value for money of the ENCTS.

2.3 Evidence review

2.3.1 This research and stakeholder engagement stage included an evidence review, delivered as a Rapid Evidence Assessment (REA). The scope of the evidence review was limited to evidence items which addressed the study objectives and met the following criteria:

- focused on concessionary travel;
- addressed the groups of interests, specifically disabled people and young people;
- focused on the UK, or other countries that offer concessionary travel;
- were published in English.

2.3.2 Using the agreed review parameters, searches for appropriate evidence sources were completed through suggestions made by DfT, SYSTRA, project team members, and also systematic searches of academic databases using appropriate search strings. Members of the Advisory Groups were also asked to identify relevant evidence sources.

2.3.3 A total of 115 sources were found through these search methods. All 115 sources were recorded in a Source List and screened against the study objectives to develop a prioritised shortlist of best available evidence sources, which comprised 25 pieces of evidence. Following approval of the prioritised evidence shortlist by DfT, a full review of the prioritised evidence sources commenced. This involved recording information for each source in an Analysis Proforma, including source details, mode addressed, objectives met and methodology overview.

2.3.4 In addition to the prioritised source list, a further 23 sources were identified as 'reference only'. These were sources which were not selected for a full review, but included useful reference material which was referred to in the evidence review.

2.3.5 As part of this evidence review, data from DfT's Call for Evidence (2021) consultation were analysed.[3] The Call for Evidence was undertaken in 2021 and provided TCAs and bus operators with the opportunity to contribute to DfT's proposed concessionary travel recovery strategy. It also included feedback from TCAs and bus operators on how DfT's reimbursement guidance, calculator and appeals process could be improved.

2.3.6 The evidence review identified two core areas to be assessed within the reimbursement guidance and calculator. Firstly, it suggested that the guidance/calculator might benefit from a greater degree of granularity and variation to increase accuracy. Population, demography, and journey patterns vary significantly across TCAs and the reimbursement calculator does not currently distinguish between journey purposes. However, when this was further tested with the Technical Advisory Group, there was not a consensus within the Group on the benefits of further disaggregation, with different stakeholders having different opinions, and some stakeholders making an active case for simplification of the calculations as this would be easier for smaller operators to engage with. This discussion highlighted that there is a trade-off between accuracy and simplicity in regards to the level of granularity of the calculator and guidance.

2.3.7 The stakeholder engagement also identified that ENCTS costs are not always aligned with funding, which is provided through the Local Government Finance Settlement, but this is out of scope for this study.

2.3.8 Secondly, it identified the need for an update of parameters. This included the damping factor used in demand curves, fares elasticity used in demand curves, fares deflator used to generate 'real' fares, default cost values used for Marginal Operating Costs and Marginal Capacity Costs, and fare and service elasticities of demand. This is explored further in subsequent sections.

3 DfT's Call for Evidence feedback exercise ran for a period of 8 weeks in August/September 2021.

2.3.9 These findings were used to inform the economic analysis which is described in the following chapters. In addition, the evidence review helped shape the questions asked in the stakeholder interviews and surveys with TCAs and operators. This helped ensure questions could be asked where there were clear gaps in evidence or to supplement research that had already been undertaken, to inform the analysis as part of the wider study.

2.4 Primary research with stakeholders

2.4.1 During June/July 2023, research was undertaken with the following stakeholders:

Table 2. Primary research methodology

Stakeholder	Methodology	Number of responses/ stakeholders	Response rate	Distribution/ sampling
Bus and coach operators	Online survey	64	75%	Sent to DfT mailing list on concessionary travel
TCAs	Online survey	64	75%	Sent to DfT mailing list on concessionary travel
Representatives from local authorities, operator/TCA consortiums, disabled/ older persons charities	In-depth interview	16	-	Targeted to include an equal mix of stakeholder types

2.4.2 Through a mix of interviews/surveys, feedback was gathered on the reimbursement guidance and calculator, as well as the other aspects of the study set out in paragraphs 1.1.11., 7.1.6, Appendix F.1.

2.4.3 The operator survey and the TCA surveys were developed with the purpose of understanding experiences of the ENCTS and where improvements can be made.

2.4.4 DfT emailed a hyperlink to the survey to all operators of local bus and coach services, and to all TCAs across England who were part of the DfT mailing list on concessionary travel. The primary response channel available was an online version of the survey response form. Word/PDF versions of the survey were provided on request.

2.4.5 A total of 64 bus and coach operators responded to an online survey (including four of the 'big five' operators). A total of 64 TCAs also completed an online survey; a response rate of 75%.

2.4.6 In addition to the surveys with TCAs and operators, in-depth interviews were conducted with 16 stakeholders. The interviews explored the aspects of the ENCTS which were asked about in the online surveys, but in more depth. Topic guides were used for the interviews and tailored according to the experiences and responsibilities of each stakeholder. Stakeholders were invited to be interviewed via e-mail, and interviews were conducted on video/voice call using Microsoft Teams, lasting approximately 45 minutes.

2.4.7 Stakeholders included local authorities, organisations representing older and disabled people and operator/TCA consortiums. Originally 15 stakeholders were invited to be interviewed, and these stakeholders were targeted to include an equal spread across stakeholder types. A mix of disability charities were also chosen to ensure the views of those with non-visible disabilities were represented. Due to the willingness of stakeholders to take part, an additional charity was interviewed, bringing the overall total interviewed to 16.

2.4.8 The findings have been used to inform the economic analysis conducted within this study. This included feedback from the TCA and operator surveys and stakeholder interviews whereby they felt the guidance and calculator needed updating due to changes to travel patterns post COVID-19, perception that the underlying research and assumptions were outdated, and increases to bus operating costs and inflation should be accounted for.

2.4.9 As also identified in the evidence review, simplification of the calculator and guidance was identified by a large proportion of respondents from the surveys and interviews.

2.4.10 Suggestions received from both the TCA and operator surveys and stakeholder interviews as to how to improve the guidance/calculator, included having separate urban and rural values, clarity on how/when to apply local evidence or specific methods, and clearer/more specific guidance to avoid speculative appeals. Some stakeholders interviewed also mentioned that more research should be undertaken to estimate the more granular assumptions and demand curves. For example, for non-urban, less dense networks with less regular bus service frequencies.

2.4.11 Updates to the calculator have reflected the need to mitigate the complexity of the calculator through improved guidance and a simplified calculator structure whilst retaining the existing level of granularity.

2.5 General population survey

2.5.1 During June 2023, three approaches were used to survey the general public who were aged 60+ and/or people with a disability or their carers. All respondents were therefore currently or soon to be eligible for an older person's bus pass, whilst some respondents were currently eligible for a disabled person's pass. All people in the survey lived in England and the sample included both bus users and non-bus users.

2.5.2 To capture the views of this sample the survey was undertaken using three approaches:

Table 3. General population survey methodology

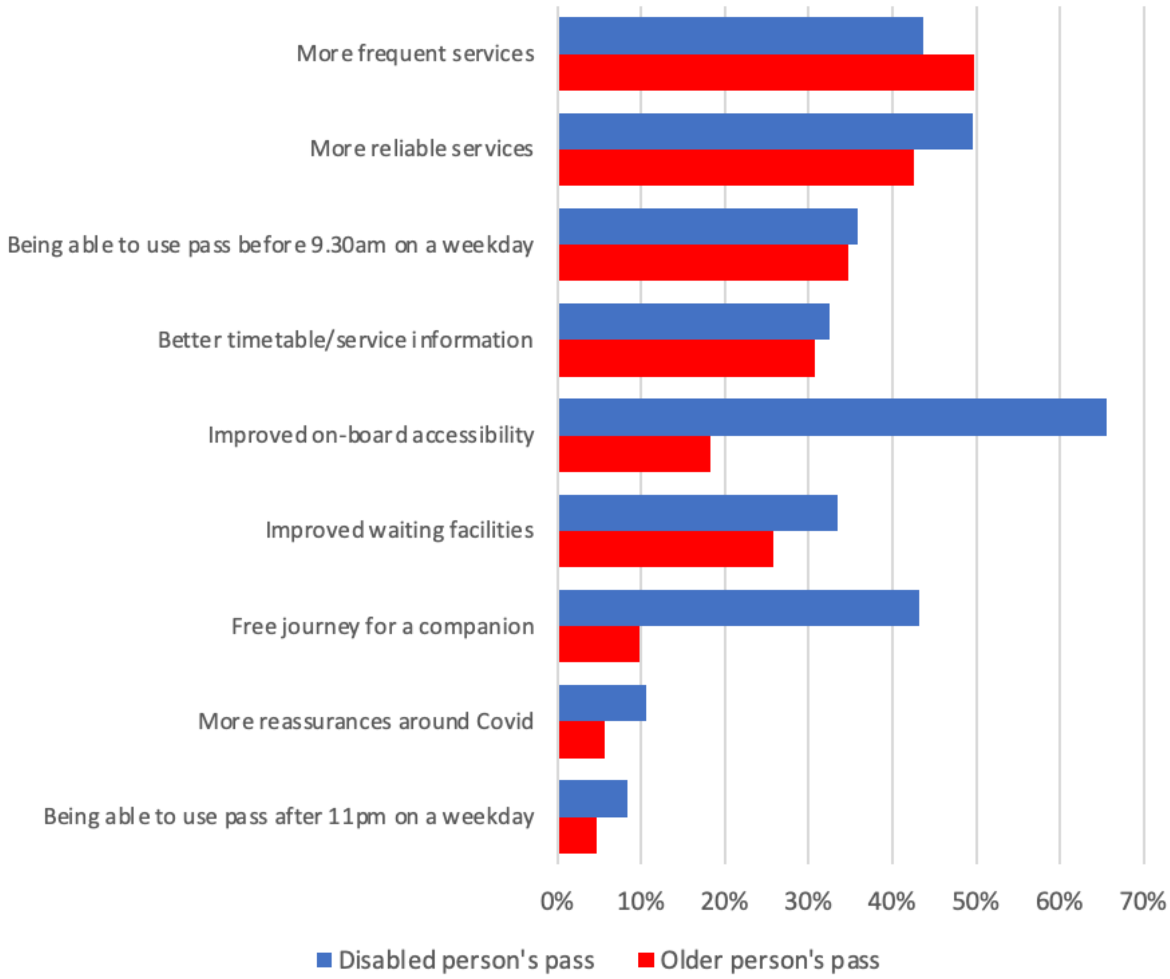
Approach	Number of responses
An online survey using a specialist consumer panel for disabled people and carers aged 18+ (Research Institute for Disabled Consumers' - RiDC)	1,408
An online general population survey to capture people aged 60+, some of whom also had disabilities (Teamsearch)	751
A telephone survey to capture people aged 60+ classified as digitally disengaged (undertaken by Teamsearch). Respondents were classed as digitally disengaged if they categorised themselves as having low/no confidence in using the internet, and who do not use the internet to make purchases/carry out online banking/access government services etc.	50
TOTAL	2,209

2.5.3 A total of 2,209 survey responses were received across all three approaches. Of the total respondents (n= 2,209), just under half (49%) were frequent bus users (travelling by bus at least once a month), around a quarter (24%) were less frequent bus users (travelling once or twice a year) and a further quarter (26%) were non-bus users.

2.5.4 The aim of the survey was to understand current travel behaviour, concessionary pass usage and where improvements could be made to encourage bus travel. The questionnaire explored areas such as journey purpose, impact, and barriers to using the pass more; understanding why non-passholders do not have a pass, and the impact that owning a pass may have, and barriers to bus use.

2.5.5 As shown in Figure 2, the survey results highlighted that of those respondents with an older person's pass (n=1,108), half (50%) would make more concessionary journeys if service frequencies increased, 43% would make more journeys if services were more reliable, and 35% if they could use their pass before 09:30 am on a weekday. Respondents with a disabled person's pass (n=407) would make more concessionary journeys if on board accessibility was improved (66%), services were more reliable (50%) or if services frequencies increased (44%).

Figure 2. What would encourage you to use your concessionary pass more?



2.6 Changes in travel patterns since previous research

2.6.1 In addition to the stakeholder engagement and evidence review we also examined changes in travel patterns since the ITS research was conducted with a focus on changes in the bus market since the COVID-19 pandemic. The following paragraphs summarise the travel pattern changes since the pandemic, using available data sources.

2.6.2 Two data sources have been reviewed to understand how trends in bus patronage have evolved since the pandemic:

- NTS Data (2002 to 2021) provided by the UK Data Service;
- a separate analysis of HOPS data between 2019 and 2022, undertaken and reported by Chartered Institute of Logistics and Transport (CILT)/University of Plymouth with support from Smart Applications Management (SAM).

2.6.3 We also received a research report from an operator on a confidential basis, which we reviewed carefully and which helped to inform our analysis of secondary data sources.

2.6.4 The key findings can be summarised against a set of research questions which were defined to provide structure to the analysis:

- can the effects of the COVID-19 pandemic on bus usage be understood from the time series available? Each of the three data sources support that there is a reduction in travel post-pandemic. The most recent data is from the CILT/University of Plymouth and operator reports which demonstrate that concessionary travel has reduced by between 30% and 40% from 2019 to 2023.
- is there any regional variation in bus usage by age group or disability status? It has not been possible to consider this question by disability status due to a lack of data. However, for the Over 65s there are higher journey rates in London and the North East in comparison to other regions. This might reflect the importance of service frequency, network coverage and differences in car access by region in the use of the concessionary pass.
- do journey rates vary by access to car and does this vary by age group and/or disability status? The NTS data suggests that journey rates are highest for those with no access to car travel and lowest for those with access as a main driver.
- do journey rates vary for disabled passengers and how does this vary across different disabilities? The CILT/University of Plymouth and operator reports demonstrate that the impact of the pandemic on disabled concessionary travel is a reduction of around 20% between 2019 and 2023.

2.6.5 The above summary has a set of implications for the ENCTS update. Firstly, the reduction in concessionary travel means that revenue forgone for operators carrying concessionary passengers will be lower, this will be reflected in the reimbursement which operators receive.

2.6.6 Secondly, the lower demand also impacts on the amount of additional operating and capacity costs incurred by operators from carrying concessionary demand. Such costs will be reduced and this will be reflected in the reimbursement which operators receive.

2.6.7 Thirdly, the amount of compensation received by operators for revenue lost is calculated using the AFF relationship and, when using the Discounted Fare method, the underlying Lookup Table. The Lookup Table captures journey frequency distributions and the ticket type choices which would have been made to estimate the AFF (and thereby revenue) per concessionary passenger. The differences in journey distributions across regions, underpinned by likely differences in car access and public transport services, means that there should be more Lookup Tables included in the calculator to reflect different geographies.

2.6.8 Having reviewed this background data, the next section presents the results of several pieces of analysis aiming to assess the generation factor.

3 Generation factor

3.1 Introduction

3.1.1 As outlined in section 1, the generation factor is the proportion of journeys made by passengers under the ENCTS that are only made because the passenger can travel for free under the ENCTS. The calculation of the generation factor is therefore a central component of the estimation of the level of reimbursement due to operators for carrying passengers under the ENCTS as it determines the mix of ENCTS passengers for whom operators are reimbursed at the Average Fare Forgone (discussed in the next section) and those for whom operators are reimbursed at the additional cost (discussed in section 5).

3.1.2 ITS, together with other experts (Phil Goodwin and Andrew Last) developed an approach to estimating this generation factor based on demand curves with a particular form (a "damped exponential" demand curve) for which the parameters were derived based on a programme of research and expert judgement.[4] They recommended two demand curves; one for areas covered by a Passenger Transport Executive (PTE), or with PTE-like characteristics; and one for non-PTEs.[5] These recommendations were subsequently reflected in DfT guidance and the calculator.

3.1.3 ITS had to address the complexity caused by the movement since April 2006, at the time it was conducting its research, to a statutory national free fares scheme from the previous situation of a local free fares scheme, and before that a statutory local half fare scheme. To do this, it developed a concept of "old" and "new" passholders, where old passholders were those who received discounted fares before the national free fare scheme, and where new passholders were those who started travelling by bus in response to the national free fares scheme.

3.1.4 Central to the calculation of the reimbursement factor is the shape of the demand curve. We agree with the ITS observation that "there is little direct evidence on which to choose between alternative demand forms".[6] The ITS research considered a range of formulations of the demand curve and proposed the use of the damped exponential demand curve as being defined at zero fare and the fare elasticity increasing with the level of the fare, but in a less than proportional way.[7] SYSTRA and Frontier have

4 This is a demand curve, with the form of $Q=ke^{\beta(P^\lambda)}$ where Q is the number of bus trips at fare (P), e is a mathematical constant and k, β and λ are model parameters. More information is available in Annex C of the Guidance.

5 PTEs no longer exist, but covered the metropolitan counties of the West Midlands, Greater Manchester, West Yorkshire, Merseyside, South Yorkshire and Tyne and Wear..

6 ITS (2010), "Concessionary fares main report: third draft", 2 September, para. 23.

7 See, in particular, Research Paper 4.

concluded that this formulation should be retained but updated where supported by evidence.

3.1.5 SYSTRA and Frontier have undertaken a number of analyses to derive recommendations on the appropriate way to estimate the generation factor going forward. These pieces of analysis include:

- review of datasets including NTS and HOPS to assess whether travel patterns have changed since the previous research;[8]
- a review of the academic and industry literature on price elasticities;
- analysis of NTS data to directly establish the level of generation;
- assessment of the Stated Intentions (SI) survey carried out for this study;
- analysis of detailed smartcard data from HOPS to seek to establish whether there are material changes in travel patterns following the COVID-19 which would support changes to the generation factor;
- analysis of other factors to see whether other factors are likely to have changed the generation factor.

3.1.6 There is no single source of evidence which provides the “right” answer: by definition, the state of the world in which there is no ENCTS cannot be observed and so creating a “no better and no worse off” framework relies on assessing different pieces of evidence and forming a judgement on how to balance them. SYSTRA and Frontier have reviewed the evidence outlined above to arrive at recommendations for a revised approach to estimating the generation factor. However, we recognise that other parties may form different views from the same evidence and ultimately it is for policy makers to form their own views on the evidence available.

3.1.7 The remainder of this section outlines the different pieces of analysis conducted for this study as relates to the generation factor, before drawing some conclusions and recommendations on the generation factor.

3.2 Literature review of price elasticities

3.2.1 A price elasticity is defined as the percentage change in passenger demand in response to a percentage change in price (the fare), all other things being equal: it is a measure of how responsive passengers are to changes in fares. Price elasticities are typically negative, meaning that a higher price results in a fall in demand. So, a price elasticity of -0.6 can be interpreted as meaning that a 1% increase in price would result in a fall in passenger demand of 0.6%.

3.2.2 A price elasticity is a central part of assessing the reasonableness of the demand curve by examining whether the price responsiveness implied

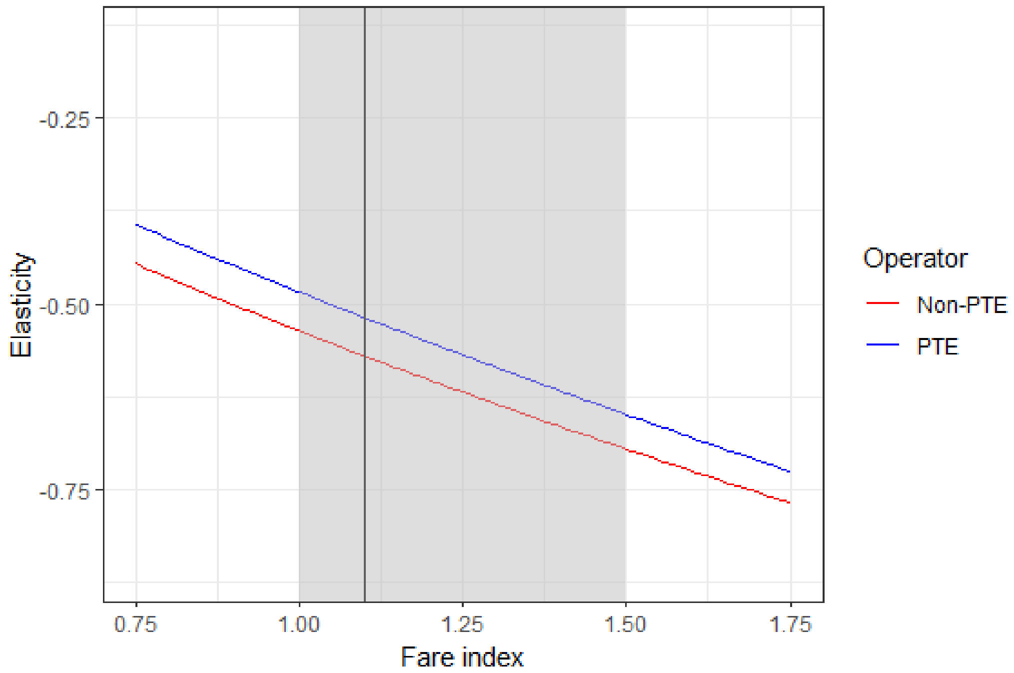
8 Host Operator or Processing System (HOPS) – a central back office which securely processes all smart transactions

by the chosen demand curve is consistent with the observed passenger behaviour in the market.

3.2.3 The demand curve used in the calculator implies a particular relationship between the level of fares and the price elasticity: specifically, that the price elasticity increases with the level of fares, but at a rate which is less than proportional. Therefore, before assessing the new evidence on price elasticities available from academic and industry literature, it is helpful to begin by assessing what the current version of the calculator implies about price elasticities.

3.2.4 The current (2023/24) calculator refers to a baseline of fares in 2005/06 and requires the user to calculate an index of fare increases since then to determine the price elasticity. There are a number of ways of doing this available in the calculator, explored in more detail in section 4. The figure below plots the price elasticities implied by the current calculator for a range of fare indexes; and for PTE-areas and non-PTE areas separately.

Figure 3. Price elasticities implied by the current (2023/24) calculator[9]



3.2.5 In general, there have been real increases in fares since 2005/6, and based on statistics from the DfT,[10] the average fare index might be around 1.10 (representing the rise in CPI-deflated fares since 2005/6). There is currently a substantial spread in commercial non-capped fares in different TCAs. Based on the study team's experience, the highest average fares across a TCA may be approximately 50% higher than the lowest average fares across a TCA. Combining this information, a plausible range for F

9 Source: 2023/24 calculator and SYSTRA/Frontier calculations.
10 Source: DfT bus statistics BUS04ii provides an index of average fares in England, relative to 2005/6.

(the current real fare, relative to that in 2005/06) would be 1.00 to 1.50, with a mean around 1.10.

3.2.6 Based on these approximations, the calculator produces the elasticity ranges:

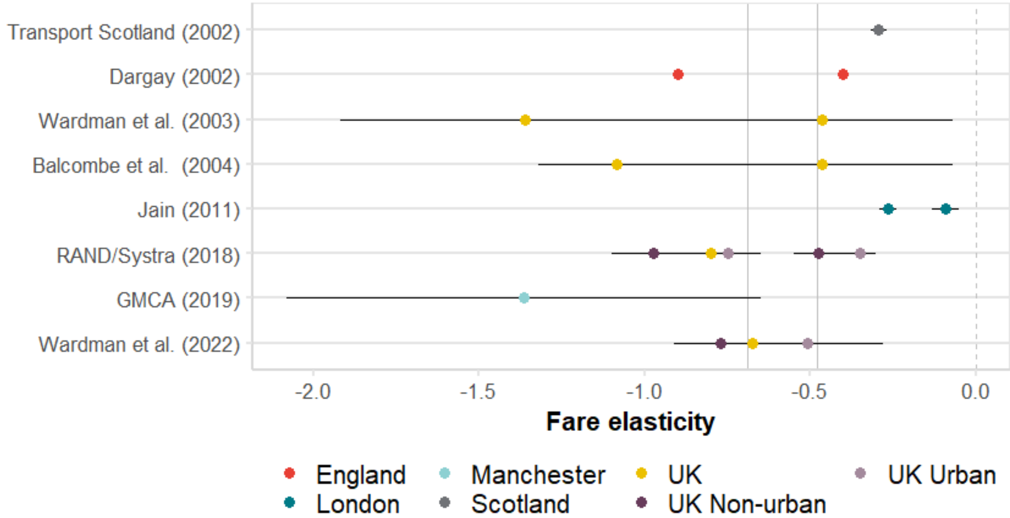
- PTE-area elasticity: [-0.48, -0.65]
- Non-PTE-area elasticity: [-0.54, -0.69]

3.2.7 In reality, as many operators will have adopted differing fare change policies since 2005/06, there will likely be a broader range of elasticities contained within the calculator than this. However, this exercise establishes a reasonable range of the elasticities yielded by the current parameters in the calculator. Having established this current state, we proceed to look at the price elasticities contained within the academic and industry literature.

3.2.8 We have reviewed the industry and academic literature on price elasticities of bus travel to seek to identify how the evidence has developed since the ITS research from 2009. Further details on these studies are provided in Annex A.

3.2.9 There are a number of additional studies by industry practitioners (particularly by RAND/SYSTRA and for Greater Manchester Combined Authority (GMCA)) and by academics (the most notable of which is a meta-analysis of price elasticities by Wardman et al).

Figure 4. Price elasticities contained within the academic and industry literature[11]



3.2.10 As can be seen from Figure 4, there are a wide range of elasticities contained within the literature. What can be seen is that urban areas

11 Source: various, as outlined in the figure. Full information is provided in Annex A.

are typically less responsive to changes in price (they have a lower - in absolute terms - price elasticity) than non-urban areas. This is likely to be because the alternative transport options (such as private car) are more accessible and/or more appealing in non-urban areas compared with urban areas.

3.2.11 The current calculator elasticity range captures a relatively narrow central interval within the (wide) range of elasticity estimates found in the literature.

3.2.12 Therefore, the evidence does not provide a robust case for change as the range of price elasticities contained within the literature is too broad to narrow down the parameters of the demand curve, and there is limited evidence that the market has changed since the ITS research given the spread of price elasticities contained in the literature.

3.2.13 Our literature review has not identified price elasticities that are specific to disabled passengers or rural areas. Therefore, while there is a conceptual case for differentiating demand curves for disabled passengers and rural areas, there is no empirical evidence that we have identified on how the price responsiveness of disabled people or rural areas differ from the market as a whole. Even if there are some studies that we have not been able to identify, we therefore conclude that there is insufficient empirical evidence to support a separate demand curve for disabled people or rural areas and recommend that a demand curve which combines older and disabled people is retained, and that a separate demand curve for rural areas is not produced.

3.2.14 This evidence of price elasticities from the academic and industry literature also does not reflect changes in passenger behaviour from post-COVID-19. This is not surprising given the typical lead times needed to gather data, conduct analysis and publish findings of this type of research. Nevertheless, further research into the price elasticity of passengers post-pandemic would be valuable.

3.2.15 We also note that this literature is usually focussed on the price responsiveness of the whole market rather than on concessionary passengers (or more broadly, those eligible for free travel under the ENCTS); and assessing what the price elasticities of these groups of passengers are would also be a valuable contribution to better understanding operator reimbursement for carrying passengers under the ENCTS.

3.2.16 In summary, this review of the existing literature has identified that there are a wide range of price elasticities estimated in the academic and industry literature but it is difficult to put great weight on the findings in developing precise recommendations on the form of demand curves to be used in calculating reimbursement for operators carrying passengers under the ENCTS. The next sub-section outlines the results of econometric analysis of the National Travel Survey (NTS).

3.3 NTS econometrics

3.3.1 We have conducted an econometric analysis of the NTS which seeks to directly estimate the generation factor by assessing the difference in the number of bus journeys between people eligible for an ENCTS pass, and not eligible, after controlling for other personal characteristics known to affect journey making such as age, income, employment, etc.

3.3.2 We use data from 2010-2021 (data for 2022 was not available at the time of the analysis being conducted), for NTS respondents over the age of 50. This data was supplied to SYSTRA/Frontier Economics by the UK Data Service and consists of an average survey of 33,300 individuals (although the 2020 and 2021 surveys were substantially smaller at 13,800 and 21,600 responses respectively).

3.3.3 The overarching objective of the analysis is to use the NTS responses to predict the number of bus journeys to be made by ENCTS passholders if they were not able to travel by bus for free, using data on the travel patterns by survey respondents.

3.3.4 We adopted two approaches to the analysis, both of which make different assumptions:

- A "narrow control group" which uses the non-concessionary population to estimate the number of journeys made by the concessionary population; with the difference between this estimation and the actual number of journeys made by the concessionary population being attributed to the ENCTS;
- A "wide control group" which includes both the concessionary and non-concessionary populations in a regression model that estimates the difference in journeys between these groups.

3.3.5 More detail on the econometric specification and results is available in Annex B.

3.3.6 The NTS econometrics provides an estimate of the generation factor of approximately 40%-50%. For comparison, based on our consortium's expertise, the current calculator typically produces generation factor estimates in the range of 45%-65%, depending on the area and the fare index. This econometric analysis therefore supports an estimate of the generation factor which is towards the bottom end of the range typically seen in the current calculator.

3.3.7 It is important to note that this analysis does not capture changes in passenger behaviour arising from the COVID-19 pandemic (as the data series ends in 2021), does not control for fares in different areas and does not track individual changes in behaviour in response to receiving their ENCTS card. We recommend that further research could seek to extend this analysis in those directions. Nevertheless, this econometric analysis of the NTS provides a new insight into the level of the generation factor which is specific enough to be used for the calibration of demand curves as explained in the conclusions & recommendations section.

3.3.8 As this analysis did not assess for differences in passenger behaviour before and after the COVID-19 pandemic, we considered evidence from a Stated Intentions survey carried out for this study and evidence from ENCTS smartcard data (HOPS) to assess whether there is evidence of a change in the generation factor arising from the Covid-19 pandemic, as explained in the next sub-sections.

3.4 Stated Intentions survey

3.4.1 Stated Intention questions were included in the General Population Survey described in paragraph 2.5.1 to understand the level of generation from the ENCTS. This provides one of two pieces of evidence this study has on post-pandemic travel patterns.

3.4.2 These survey questions asked respondents who are currently making bus journeys using ENCTS passes: whether they would stop travelling by bus if ENCTS is discontinued (respondents were not asked by how much they would decrease their journey making), and the extent to which owning a concessionary bus pass influences their bus use.

3.4.3 Based on the surveys, Table 4 presents estimates of the proportion of journeys that would be lost if ENCTS is discontinued, which is used to proxy the generation factor.

3.4.4 The table also presents a scaled down version of the generation factor after removing from the analysis those respondents that initially said that having the ENCTS pass would not change their behaviour, but later said they would stop travelling if the ENCTS is discontinued.

3.4.5 Generation Factors from Stated Intention Survey

Generation Factors	**Generation Factors**		**Scaled Generation Factors**	
Stated Intention Survey	**(based on all responses)**		**(after removing the respondents that would not change their behaviour)**	
Area Type	Journeys	Sample size	Journeys	Sample size
London	40%	31	37%	29
Other Metropolitan	47%	79	47%	76
Rural	39%	24	36%	21
Other Urban	54%	207	52%	189
Total	49%	341	47%	315

3.4.6 These generation factors may be overstated because of strategic response bias that tends to affect the findings from such surveys. Specifically, survey respondents will often say that they will change behaviour to a greater extent than occurs in reality (e.g. Bennett and Blamey, 2001).[12] However, the specific question asked in the survey did not give the respondents the option to decrease the number of journeys they make if ENCTS would be discontinued which may affect the implied generation factors. The lack of a question in the survey about the extent to which passengers would reduce their travel in the absence of the ENCTS means that it is hard to draw firm conclusions from this analysis.

3.5 HOPS data analysis

3.5.1 SYSTRA/Frontier were provided with data from six TCAs on ENCTS pass usage in 2019-20 and 2022/23. These TCAs provide a wide range of geographic coverage and types of area, covering large urban (former PTE) areas, medium-sized urban areas, mixed urban / rural areas and rural areas. The names of the specific authorities are not provided as some requested to remain anonymous.

3.5.2 This data contains information on concessionary boarding numbers (data included journeys by date, operator and pass type). This data was requested for both 2019/20 and 2022/23 in order to understand how journey frequencies have changed pre- and post-pandemic.

3.5.3 This analysis involved assessing over 130 million transaction records as individual transaction records were aggregated to calculate the average number of journeys by passholder by week, and then averaged for each week over a year. This provided an average number of pass uses, by passholder, by week.

3.5.4 There are three types of passes:

- Passes for individuals in both years of data (2019/20 and 2022/23);
- Passes which are in the 2019/20 data but not in the 2022/23 data;
- Passes which are in the 2022/23 data but not in the 2019/20 data.

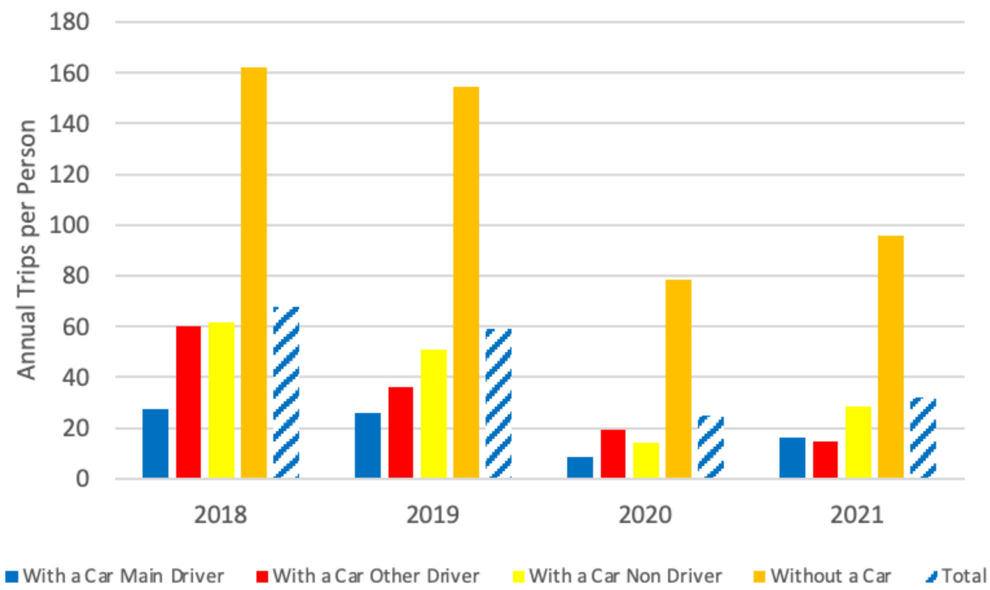
3.5.5 All passes for individuals which appeared in both 2019/20 and 2022/23 were grouped as existing passes for the purposes of analysing and summarising trends in HOPS data. Any passes which only appeared in 2022/23 were grouped and defined as new passes. Any passes which appeared only in 2019/20 were grouped and defined as legacy passes.

3.5.6 Further information on the data, its processing and the results are provided in Annex C.

12 Bennett, J., Blamey, R., 2001. The Choice Modelling Approach to Environmental Valuation. Edward Elgar Publishing, Cheltenham.

3.5.7 Inferring changes in the generation factor from journey numbers is challenging and so it is important to start from the perspective of setting out a hypothesis on what could be expected to be observed in the data if the generation factor had materially reduced. One hypothesis is that a substantial number of passholders who made small numbers of trips before the pandemic would leave the market, leaving behind a smaller number of passholders who use the bus more frequently. The rationale for this is that infrequent pass usage may be more likely to indicate that those passengers had an alternative option to making a journey by bus (perhaps by another mode, or not making the journey at all). Therefore journeys made by those passengers are more likely to be generated than journeys made by passholders who make frequent journeys because passengers with alternative options are likely to be more price sensitive than passengers who make lots of journeys. The figure below shows the number of bus journeys made by people over the age of 65, split by whether they have access to a car, which clearly shows the importance of not having access to a car in influencing the number of bus journeys made.

Figure 5. **Bus journeys per person by car access**[13]



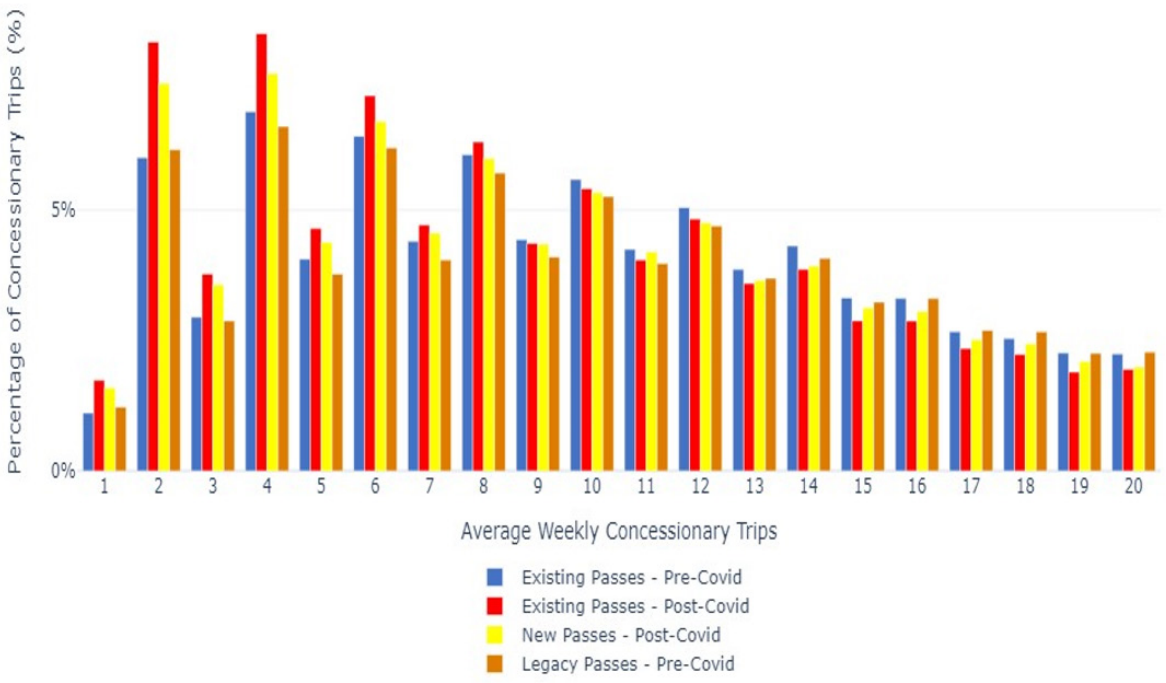
3.5.8 Further research into this question could be conducted, for example, by using the NTS to further consider the characteristics of passengers who make frequent compared with infrequent journeys, such as levels of car ownership.

3.5.9 The figures below provide an example of the data that is available: the first figure shows, for one TCA, the average distribution of the number of ENCTS journeys, per week, split between passes which are in the 2019/20 data but are not in the 2022/23 data ("legacy passes"), the number of

13 Source: NTS.

journeys made by passes which are not in the 2019/20 data but are in the 2022/23 data (“new passes”), and passes which are in both the 2019/20 and the 2022/23 data (“existing passes”) shown separately for journey patterns in 2019/20 (“pre-COVID-19”) and in 2022/23 (“post-COVID-19”).

Figure 6. Journey frequencies comparison plot[14]

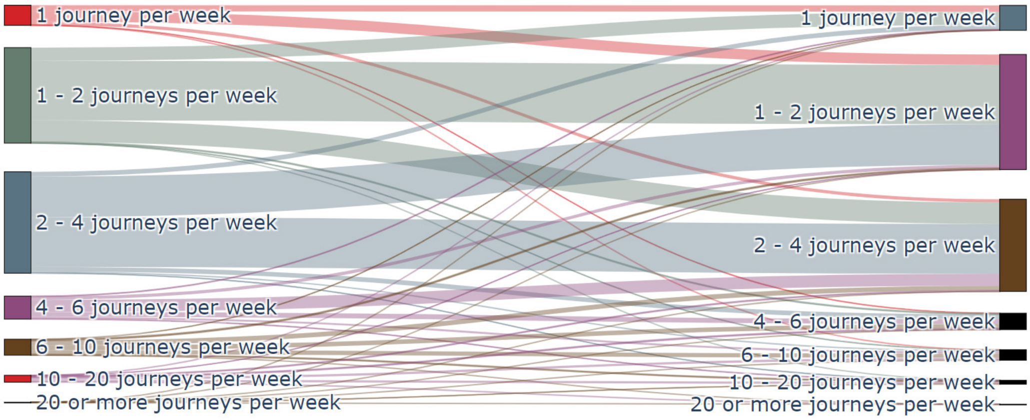


3.5.10 This figure shows that the passes in the 2019/20 data (“legacy passes” and “existing passes - Pre-COVID-19”) have a greater proportion of passholders making a greater number of journeys than the passes in the 2022/23 data (“new passes” and “existing passes - Post-COVID-19”). This is consistent with the widespread reduction in concessionary bus usage. However, there appears to be a broad reduction in the number of journeys being made, and an increasing proportion of passholders making relatively low (less than five) journeys per week.

3.5.11 For those passes for which the same passholder is in both years of data, it is possible to assess how their journey making patterns have changed. An example of this is shown for a TCA (a different TCA to the figure above) in the figure below.

14 Note: trip distribution truncated at 20.Source: SYSTRA/Frontier calculations.

Figure 7. **Change in journey frequency from 2019/20 (left hand side) to 2022/23 (right hand side)** [15]



3.5.12 As can be seen from this figure, there appears to be a broad move to passengers making, on average, fewer journeys with movements from 4-6 journeys per week in 2019/20 to 2-4 journeys per week in 2022/23; and from 2-4 journeys in 2019/20 to 1-2 journeys per week in 2022/23.

3.5.13 The evidence set out in this sub-section has been reviewed for all six TCAs that data is available for. There are differences across the TCAs, but overall, we observe:

- a reduction in active passholders between pre- and post-pandemic;
- that the passholders who have "left the market" appear to be drawn from all parts of the journey distribution;
- that the level of journey making appears to have reduced at all levels of the journey distribution.

3.5.14 This evidence is not consistent with what would be expected if the generation factor had reduced materially following the COVID-19 pandemic and therefore we do not recommend any further change to the generation factor supported by the NTS econometrics (outlined in the previous sub-section). However, drawing firm conclusions from this evidence is challenging and any conclusions are necessarily tentative at this stage. We recommend that further analysis, along the lines of the NTS econometrics in the previous sub-section, is conducted in 2-3 years' time as data becomes available to test the impact of the COVID-19 on the generation factor. We further recommend that additional research could be carried out to better identify the level of generation at different journey levels.

15 Source: SYSTRA/Frontier calculations.

3.6 Other factors

3.6.1 The existing calculator assumes that the only factor affecting the level of generated demand is the level of the fare charged, relative to a baseline. It assumes that other changes known to affect the demand for buses such as income, population, cost of driving, bus journey time, average bus headways, etc do not affect the proportion of ENCTS passengers who would travel at the prevailing commercial fares.

3.6.2 Typical demand forecasting methods used to estimate rail passenger demand have a set of elasticities for a range of factors that are continually updated in a guidance document known as the Passenger Demand Forecasting Handbook (PDFH) which allows analysts take explicit account of the different factors in terms of their impact on the number of journeys made by different user groups.

3.6.3 We have used a similar approach to that used in the rail sector to quantify what the impact of some of these factors could have been on the number of bus journeys since 2010 and found that population is a significant driver of demand. Factors such as fuel cost, bus headways and journey times had a significantly smaller impact. The current calculator builds from the total number of concessionary journeys made in a year to split between generated and non-generated journeys. However, this total number is not known when reimbursement is being negotiated and so this approach could be used in future to produce better forecasts of the number of journeys made under the ENCTS in the year for which the reimbursement is being negotiated.

3.6.4 We understand that the current calculator implicitly assumes that all factors apart from price affect the generated and non-generated journeys at the same rate, and that it is only price that affects the number of journeys with and without ENCTS. This implicit assumption appears reasonable, particularly in the absence of evidence to the contrary, from the point of view of exogenous factors. We recommend that the guidance is made clearer about this implicit assumption.

3.6.5 We also suggest that additional research is undertaken to understand the extent to which the generated and non-generated journeys are affected at the same rate from the point of view of bus service quality related factors such as bus journey times, bus headways and reliability, as we have been unable to identify whether there are likely to be differences in response to these factors for passengers with high levels of generated journeys and those with low levels of generated journeys.

3.7 Inflation

3.7.1 The existing Calculator uses historical Consumer Prices Index (CPI) data and Gross Domestic Product (GDP) deflator forecast data for two purposes:

- To deflate fares when calculating reimbursement factors,
- To take account of operators' cost inflation.

3.7.2 The CPI data is used from 2005 to the latest year for which data is available. Due to a short data lag, this is typically a year behind the year in which the reimbursement calculations are being undertaken. The GDP deflator is used for the remaining years (the year in which calculations are undertaken, and the year for which reimbursement calculations are for).

3.7.3 Our review concluded that it is not appropriate for the same measure of inflation to be used for the two purposes, as the drivers of the changes in operators' costs may not adequately be captured by a measure of consumer price inflation such as the CPI which is appropriate for deflating fares.

3.7.4 The discussion below gives our recommendation for how fares should be deflated when calculating reimbursement factors; our recommendations for how operators' costs should be inflated is given in section 5.5.

3.7.5 We tested alternative indices to the CPI for deflating fares, including the Retail Price Index (RPI) and the GDP deflator) based on:

- what the index measures and how it is designed;
- whether good historical data as well as future forecasts exist;
- whether the methodology is stable over time;
- how often the index is updated.

Table 4. CPI Table

CPI Table	CPI	RPI	GDP deflator
What is measured?	Change in consumer prices	Change in consumer prices (use now discouraged by the ONS)	Change in the price of all goods and services across the economy
Good historical data?	Yes	Yes	Yes
Forecasts exist from OBR?[16]	Yes (currently to Q1 2028)	Yes (currently to Q1 2028); may be discontinued	Yes (currently to Q1 2028)

16 Forecasts from other sources are available, but the OBR is the UK Government's official economic forecaster

CPI Table	CPI	RPI	GDP deflator
Is the methodology stable over time?	Yes	Yes	Yes
How often are the historical indices updated?	Monthly (ONS)	Monthly (ONS)	Quarterly (ONS)
How often are forecasts made?	Twice a year (OBR)	Twice a year (OBR)	Twice a year (OBR)

3.7.6 We recommend that the CPI is retained as the index for deflating fares for historical and future years because it is designed to measure the cost of living for consumers and is thus a more suitable indicator of how passengers respond to price changes relative to the GDP deflator.

3.7.7 The RPI is discounted because it is not an index that is supported by the ONS.[17]

3.7.8 As required, CPI forecasts are also available from the Office of Budget Responsibility's Medium-Term Forecasts.[18]

3.8 Conclusions & recommendations

3.8.1 This section has outlined the results from five pieces of analysis to assess how to derive a more accurate generation factor. Each piece of analysis has strengths and weaknesses, and each is uncertain. Nevertheless, it is necessary to reach conclusions on what this evidence means for the generation factor so that this can be included in the calculation of operator reimbursement for carrying passengers under the ENCTS. Different parties may take different views on the evidence presented and how to combine that: ultimately, it is for policy makers to take a view on the different evidence to arrive at a definitive demand curve for inclusion in the calculator.

3.8.2 To assist the policy makers, we draw the following conclusions and make the following recommendations:

- we recommend retaining the current form of the demand curve (a damped exponential) as this formulation has a number of attractive theoretical properties, and is already known to stakeholders. We recognise that this formulation of the demand curve assumes that passengers respond to changes in the fare level, rather than to the absolute level (and so, for example, TCAs with high fares but low fare increases will ultimately end up with a lower generation factor than a

and so we have only considered whether forecasts are available from the OBR.

17 https://www.ons.gov.uk/economy/inflationandpriceindices/articles/shortcomingsoftheretailpricesindexasameasureofinflation/2018-03-08

18 https://obr.uk/forecasts-in-depth/the-economy-forecast/inflation/#CPI.

TCA with low fares but high levels of increase), and suggest that this is a topic which could be considered further in additional research;

- we recommend removing the distinction in the calculator between “old” and “new” passholders on the basis that, 15 years after the introduction of the nationwide free fares scheme, the vast majority of current passholders are now “new” in the sense of having started using the ENCTS since the nationwide free fare scheme was started;
- we recommend retaining two demand curves, but updating those to “urban” and “non-urban” (rather than PTE and non-PTE). We conclude that the available evidence does not support separate demand curves for older and disabled people; and that retaining only two demand curves strikes an appropriate balance between ease of use for stakeholders and accuracy, although we note that this means that the demand curves will not fully account for local factors such as the level of disposable income or road conditions (which would be difficult to source/develop/use);
- we recommend adjusting the parameters of the demand curves to reflect the implied generation factors from the NTS econometrics, and that those parameters are cross-checked with the results of the literature review into price elasticities.[19] We acknowledge the uncertainty inherent in any econometric exercise but we consider that the results of the NTS econometrics are more robust than the results of the SI survey and place relatively little weight on the results of that survey. We consider that this is a more appropriate method of deriving the parameters of the demand curves than beginning with the results of the literature review as the range of price elasticities contained within the literature is wide and the level of uncertainty around any model parameters derived from that literature review would be correspondingly wide. This econometrics-based approach would likely result in generation factors which are lower than are typically seen in the current calculator;
- we conclude that the analysis of the post-pandemic travel patterns using HOPS data on smartcard journeys from six TCAs does not support a further reduction in the generation factor (beyond that arising from the changes outlined in the previous bullet) as the evidence is not sufficiently strong to support any further changes at this time, although we note the challenges raised by stakeholders in forming any data-based view on changes to reimbursement factors following the COVID-19 pandemic.

3.8.3 In addition to the recommendations relating to this review, the following recommendations for further analysis have also been proposed:

- we recommend reassessing the evidence on the generation factor

19 We find that there is no particular basis to prefer the “wide control group” or “narrow control group” formulation and so recommend using the average of the two.

within the next 2-3 years as more data on post-pandemic travel patterns emerges and as the current impacts of policies at a local and national level affecting bus fares become clearer;

- we recommend conducting further research to assess the level of generation at different levels of journey making;
- we note that further academic and industry research into passenger behaviour post-pandemic; and for disabled passengers in particular, would be beneficial in increasing the robustness of the evidence base.

3.8.4 Based on this assessment, we have derived a set of recommended parameters for the demand curve, using the following process:

- set up the demand curve, using the same form as developed by ITS. This requires assumptions to be made on two parameters: β and λ;
- set an initial basis of λ, based on the research conducted by ITS;
- adjust the values of β, solving for the value of β which aligns with the generation factors from the NTS econometrics (44.5% for urban areas and 51.5% for non-urban areas, which are the average across "wide" and "narrow" control groups and over all years in the sample);[20]
- assess whether that combination of β and λ deliver a demand curve which provides price elasticities which are consistent with the literature, and with the price elasticity of urban areas being lower, in absolute magnitude, than the price elasticity of a non-urban area. If these constraints are not met, then adjust the starting values of λ and repeat step ii and iii until a satisfactory result is derived.

3.8.5 Table 6 below provides recommended parameter estimates, although we acknowledge that other combinations of parameters could probably be derived: as outlined earlier, this is a complex and uncertain area.

Table 5. Recommended parameter estimates[21]

Recommended parameter estimates	Urban area	Non-urban area
β	-0.5963	-0.7226
λ	0.7	0.9
Price elasticity at fare index = 1	-0.41	-0.65
Implied generation factor	0.445	0.514

The difference between the implied generation factor of 0.514 and the generation factor derived from the NTS econometrics of 0.515 (or equivalently 51.5%) is due to rounding in the solving process referred to above.

20 2019 is used as the basis for the fares index because it is not affected by Covid-19 and the widespread use of fare capping arising in the intervening period (particularly the £2 single fare cap, but also a number of other local fare caps introduced as part of various Bus Service Improvement Plans (BSIPs). This further supports the recommendation to reassess the evidence on the generation factor in two years' time as, by that stage, the impact of these fare mechanisms will likely be clearer than they are currently.

21 Source: SYSTRA and Frontier analysis.

3.8.6 In this context, an “urban area” is derived from the “urban conurbation” category and the implied generation factor is the average of the wide and narrow control groups. The “urban conurbation” category is broadly comparable to the former PTE-areas. The “non-urban area” is the average of the other categories.

3.8.7 The use of 2019 fares as the baseline updates the departure point for future fare increases.

3.8.8 The impacts of this change are outlined in section 6.

3.8.9 This section has explored the approach to understanding the generation factor - that is, the proportion of ENCTS journeys which are generated by passengers being able to travel for free. For those passengers who would have travelled at the commercial fare, operators are reimbursed at the average commercial fare that those passengers would have paid in the absence of the ENCTS, this is the “Average Fare Forgone”. This is explored in the next section.

4 Average Fare Forgone

4.1 Introduction

4.1.1 As explained in section 1, under the ENCTS, eligible passengers can travel for free on all local bus services in England. This travel consists of:

i. passenger journeys which would have been made regardless of whether or not a commercial fare was required;

ii. passenger journeys which are only made because travel is free to the passholder.

4.1.2 For journeys which would have been made regardless of the ENCTS (non-generated), there is a loss of commercial revenue received by the operators. Under the current reimbursement arrangements within the guidance and the calculator, operators are reimbursed for the revenue forgone for each passenger which would have paid a commercial fare without ENCTS. This amount per journey is referred to as the Average Fare Forgone (AFF).

4.1.3 There are four approaches to empirically estimate the AFF set out in the current guidance, of which three are directly included in the current calculator. These methods are summarised in Table 7, as extracted from the current guidance. Some TCAs and operators have their own methods for deriving the AFF, but these are not included in the current calculator because these are bespoke and it would be unfeasible to account for all possibilities of estimation.

Table 6. AFF Methods

Method	Approach	Recommended for Use (Current Guidance)
Average Cash Fare	A weighted average (by passenger journeys) across all tickets which have a fixed limit on the numbers of journeys which can be made on it (i.e Single, Return and Carnet)	For operators with cash fares only
Basket of Fares Method	The weighted average (by passenger journeys) across a range of ticket types for all fixed limit (i.e. Single, Return and Carnet) and periodic tickets (i.e. Daily and Weekly) available	For operators with: ▪ At least 60% of concessionary boardings on services where average weekday daytime frequency is no greater than 1 bus per hour ▪ No cash fares (as the Discounted Fare Method will not work with such fares) ▪ A ratio of the Daily ticket to cash fare price greater than 5 ▪ Concessionary demand using a much higher proportion of daily or period tickets than the commercial demand
Discounted Fare Method	A discount rate is applied to the Average Cash Fare. The discount rate is applied to adjust the AFF to reflect that some passengers will buy periodic tickets which are typically priced cheaper per journey than the Average Cash Fare. The discount rate is based on the price multipliers for each periodic ticket type (i.e. Daily and Weekly) relative to the Cash Fare (i.e. Single and Return). The relative price multipliers are applied to ticket sales for each ticket type to estimate a factor (discount) relative to total journeys undertaken. The factor is then applied to the Average Cash Fare to derive the AFF.	The preferred method in most circumstances
Local Methods	Any other approach which can be justified as appropriate	For operators in large urban areas such as PTEs where journey patterns are significantly different (than outside of PTE areas); this could include deriving a Lookup Table bespoke to the local geography

4.1.4 It is important to note that the Discounted Fare Method uses a Lookup Table to estimate the AFF. There is a single Lookup Table in the current reimbursement calculator which is based on NoWcard data for Lancashire from 2009. The Lookup Table represents a distribution of journeys by different combinations of pricing ratios. The ratios are for the relative prices of Weekly and Daily tickets to the Average Cash Fare (i.e. 10:2:1 for Weekly:Daily:Average Cash Fare prices). The distribution of journeys is used to estimate the discount factor applied to the Average Cash Fare.

4.1.5 In this research area, the overall aim is to consider the suitability of the above methods in the current calculator and recommend potential revisions as part of the update to the calculator and guidance. Under this research aim, the objectives are to:

- re-evaluate the strengths and weaknesses of each of the main approaches to estimate the AFF;
- evaluate the AFF pre- and post-pandemic using empirical examples for each of the main approaches;
- determine any impact that the COVID-19 pandemic might have had on the estimates of AFF;

4.1.6 Following the completion of the above aim and objectives a set of recommendations will be made regarding the preferred method, considering the:

- theoretical strengths and weaknesses of the different methods;
- size of the empirical estimations and differences between the values using different methods;
- impact of the pandemic on the different approaches;
- practicality of estimation.

4.1.7 This section of the report summarises the findings in relation to the above aim and objectives. The full reporting for this research area can be found in Annex D to this report.

4.2 Strengths & weaknesses

4.2.1 The first objective investigated for the research area involved examining the theoretical strengths and weaknesses of each approach. In considering such strengths and weaknesses, a set of criteria has been defined as listed below. The criteria are based on a review of the current guidance and with consideration of the practicality of use by operators and the TCAs. Each criterion is listed in terms of how a strength to the approach is demonstrated:

- data requirements are low: the more data that is required, the more likely it is that data processing is disproportionate to the scale of the claim for smaller operators in particular;
- estimation is simple: the method should be accessible across a range

of users in the industry for ease of use and understanding of the processes involved;

- auditing is simple: it would be preferable if inputs and assumptions to the method, and also the representativeness of the method to concessionary journey frequency, can be checked quickly;
- comparisons can be made across TCAs and/or operators: it would be preferable if the reasons behind differences across TCAs and/or operators can be explained through comparative underlying data inputs and assumptions;
- representative of a range of ticket types: the method should reflect the different options passengers would have and the distribution of prices to pay if they were undertaking commercial travel;
- representative of the concessionary journey frequency distributions: the method should reflect the frequency of concessionary journeys to ensure the prices passengers would pay are consistent with their demand for bus services. Using commercial journey data is unlikely to accurately reflect concessionary travel decisions.

4.2.2 It should be noted that there have been several changes to tickets since 2010, as summarised below. These changes might impact on the method chosen by the operator and TCA in the calculation of AFF. This would be on the basis of potential trade-offs between which method is theoretically stronger and practicalities of information available:

- Off-bus sales of tickets have become more prevalent, which impacts on how to allocate ticket sales and revenues to a particular service, route and network. This could result in average ticket prices being calculated inaccurately, thereby distorting the estimated AFF when the average fare per ticket type is included in the calculator;
- Capping of fares on contactless EMV or ITSO cards has become more widespread.[22] ITSO smart ticketing is a system which electronically stores a travel on a microchip and is typically embedded in a smartcard. This means that the charge to each passenger is applied post-travel using the most cost-effective product, rather than through a pre-purchased ticket and then travelling. This means the most appropriate product is applied to customers but might impact on revenues and the estimation of AFF;
- There has also been a shift towards more multi-operator ticketing products. When calculating an average fare for reimbursement purposes, all such product sales need to be taken into account when calculating an average fare. This isn't always straightforward, particularly when capping is in place. This point means that a Lookup Table across all operators within a TCA would be preferable to one that is specific to each operator;

22 Europay, Mastercard and Visa; or Integrated Transport Smartcard Organisation

- A current, short-term issue is the introduction of the £2 flat fare from 2023, which has been extended several times and now runs until at least December 2024. This has encouraged customers to purchase more single tickets rather than season products which distorts the ticketing market. This has an impact on how to calculate an average fare using the basket of fares method in particular. The choices passengers would make without the £2 flat fare would likely be very different than the weighted average of sales data. Annex J has been included in the concessionary guidance[23] to address the impacts of the fare cap in calculating AFF.

4.2.3 Table 8 summarises the assessment of the strengths and weaknesses of each method against the previously outlined criteria. It is presented in order of most strengths/fewest weaknesses. The reasoning behind these ratings is provided in full in Annex D to this summary report.

Table 7. Strengths and weaknesses of AFF Methods

Criteria	Discounted Fare Method	Basket of Fares	Average Cash Fare	Local Methods
Data requirements are low	Strength	Strength	Strength	Unknown
Estimation is simple	Strength	Strength	Strength	Unknown
Auditing is simple	Weakness	Weakness	Weakness	Weakness
Comparisons can be made across TCAs and/or operators	Strength	Strength	Weakness	Weakness
Representative of a range of ticket types	Strength	Strength	Weakness	Unknown
Representative of the concessionary journey frequency distributions	Strength	Weakness	Weakness	Unknown

4.2.4 Based on the above table, the following summary is provided:

- the Discounted Fare Method appears to be the strongest method overall. It has similar strengths to the other methods, most notably the Basket of Fares Method (data requirements are low, estimation is simple, comparisons can be made across TCAs and/or operators, and it is representative of a range of ticket types). The Discounted Fare Method has the further advantage of reflecting concessionary journey frequency distribution and implied ticket choices;
- the Basket of Fares Method carries the risk that commercial data is used rather than the concessionary journey frequency distribution and implied ticket choices in the calculations;
- Average Cash Fare is very straightforward but it is not representative

23 https://www.gov.uk/government/publications/guidance-on-reimbursing-bus-operators-for-concessionary-travel

unless the operator only offers fixed tickets and ignores the concessionary journey frequency distribution;

- Local Methods carry a lot of risk as it isn't clear what the method will be and what the relative strengths and weaknesses are. This also has the potential to make auditing more difficult as the method will be bespoke. The authors of this report are not aware of any practical examples of where Local Methods have been applied to estimate the AFF. However, the Discounted Fare Method and Basket of Fare have been varied to exclude certain product types through negotiation between the operator and the TCA.

4.2.5 From the above summary, it is recommended that the Discounted Fare Method remains the preferred approach but that pragmatism should be retained where, in particular, the Basket of Fares Method is allowed. For example, where the use of one of the default Lookup Tables in the calculator is not representative of concessionary journey frequencies in the relevant local area but the effort and data required to produce a local and up to date Lookup Table is disproportionate to the scale of the operator and/or TCA.

4.2.6 The recommendation that the Discounted Fare Method is the preferred approach is consistent with the research undertaken by ITS which was published in 2010. The 2010 research found that the Discounted Fare Method would be the most accurate method (in most circumstances for reimbursement). This is because it accounts for the 'discounts' on Daily and Weekly ticket types relative to Single and Return (Cash Fares) tickets, in conjunction with the concessionary journey frequency distribution. Therefore, the method directly accounts for the prices which concessionary passengers would have paid under commercial travel arrangements based on journey frequency distributions. The other methods either miss out the discounts on periodic tickets (Cash Fare) or the journey frequency distributions (Basket of Fare Method).

4.2.7 It is also recommended that the Average Cash Fare Method only remains for use when operators sell fixed journey tickets (i.e. Single, Return, Carnet) and do not offer periodic tickets (i.e. Daily and Weekly) and that Local Methods are strongly discouraged unless the operator can give good justification for using a bespoke method. For example, where the operator can demonstrate the other methods are not representative of concessionary travel on their services.

4.3 The impact of COVID-19 & empirical estimation

4.3.1 A series of AFFs have been estimated using the three principal methods in the calculator and guidance (Average Cash Fare, Basket of Fares and Discounted Fare Methods). Local Methods have not been applied because there is no single method of estimation and comparison.

4.3.2 One of the purposes of the estimation is to consider any impact which COVID-19 might have had on the frequency of journeys being undertaken, as this could influence which method is most appropriate. For example, reduced journey frequencies would imply Daily and Weekly tickets are much less likely to be used and might mean the Discounted Fare Method is no longer as appropriate – for example if people are undertaking journeys which are more suited to Single or Return tickets, a lack or absence of frequent journeys might lead to the Basket of Fares Method being preferred.

4.3.3 A second purpose is to consider whether the default Lookup Table is suitable in the current calculator as it is based on journey frequencies for Lancashire using NoWcard data from 2009, which is nearly fifteen years old and unlikely to be representative.

Data

4.3.4 Two sets of data were requested from TCAs and operators to estimate the AFFs. The first is HOPS data which was requested from TCAs, as set out in section 3.

4.3.5 For each TCA, fares data was requested from operators for the calendar year of 2022. The TCAs in which the operators run services vary. This means that AFFs cannot be estimated for each operator in all TCAs. The data was requested for 2022 to reflect that it is the distribution of concessionary journey frequency pre- and post-pandemic that is of interest for comparison on a consistent basis (i.e. the price per ticket remains constant across the years of analysis). Furthermore, from 2023 onwards, single fares were temporarily capped at £2, which is a distortion best isolated from the impacts of the pandemic for this analysis.

4.3.6 The fares data provided by three operators contains information on average fares for the following groups of ticket types (as yields per passenger across all routes and individual ticket types). The fares data refers to sales and revenue data across different platforms including bus paper ticket sales, smart card and mobile app sales but excludes multi-operator products:

- Single (including Carnet);
- Return;
- Daily;
- Weekly.

4.3.7 All the operators who provided this data were “large” operators. It is possible that other operators would have a different fare structure which could change the estimated AFF. However, we do not consider this is likely to be a material issue for this analysis as the purpose of this analysis is to compare the AFF calculated using different methods. When it comes to using the calculator, each operator will continue to be able to use its own fare structure as is currently the case.

Method

4.3.8 Empirical estimations of AFFs were produced using the data summarised in the previous sub-section for the following approaches – Local Methods were not analysed as these would be bespoke and difficult to compare on a like-for-like basis:

- Average Cash Fare;
- Basket of Fares Method;
- Discounted Fare Method.

4.3.9 A four-stage process to estimating the AFFs was applied:

i. Stage One: The HOPS data was analysed for each TCA to determine total journeys per week across all cardholders – this allowed the exclusion of any weeks from the data which appear to have unusually high or low journeys compared to general trends, which might suggest errors within some of the HOPS datasets. Any cardholders which do not have a unique, anonymised reference number associated with them are removed from the data too as this will aggregate multiple cards and overstate journeys per person. Within the retained data, journeys per day were aggregated by cardholder. The number of rows removed by TCA is summarised in Table 8 and demonstrates between 15% and 27% of the records have been removed through the cleaning process;

Table 8. HOPS Records Removed in Data Cleaning Process

TCA	Pre-Cleaning	Post-Cleaning	Removed	% Difference
1	8.6m	6.5m	2.1m	24%
2	11.8m	9.6m	2.2m	19%
3	54.0m	45.8m	8.2m	15%
4	13.4m	10.2m	3.2m	24%
5	38.7m	31.6m	7.1m	18%
6	5.2m	3.8m	1.4m	27%

ii. Stage Two: The HOPS data was analysed using average yields per ticket across each TCA and operator available for the following ticket types:

1. Single
2. Return
3. Daily
4. Weekly

iii. Stage Three: The HOPS data on journey frequencies from Stage One and the average yields from Stage Two were combined to understand the fares choices which concessionary passengers would have made had they been required to pay a fare. The choices were aggregated to understand:

1. Journeys per sale (by ticket type)
2. Total journeys per ticket type
3. Sales (by ticket type)

iv. Stage Four: AFFs were estimated and compared against output from the current calculator for each of the three methods listed above across the range of TCAs and operators for which data is available.

Output

4.3.10 The estimates of AFF are presented in Table 10 below for 2019/20 and 2022/23 for each method. This output shows a lot of variation by method and combination of TCA and operator. However, the change from 2019/20 to 2022/23 is very low. This suggests that choosing the appropriate method of estimation is important to avoid overstating or understating the AFF, whereas the impacts of COVID-19 have been less than 5% (when comparing the change between 2019/20 and 2022/23):

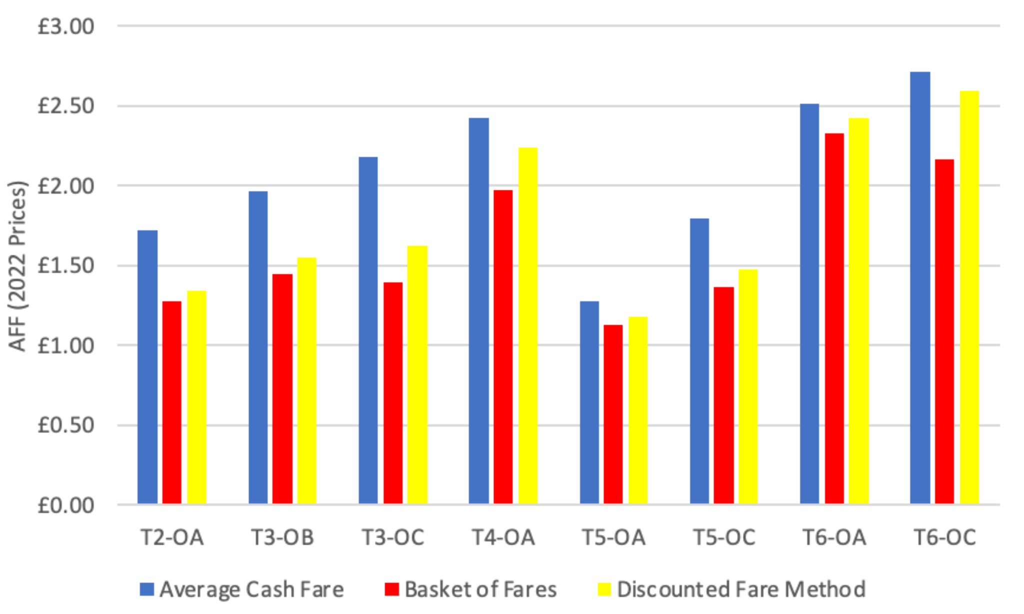
- In 2019/20, the minimum AFF is £1.13 under the Basket of Fares Method, in comparison to a maximum of £2.71 under the Average Cash Fares Method. Note: the £1.13 appears to be because for this operator and TCA the average price of a Single is more expensive than a Return, which reflects a weakness in the data;
- In 2022/23, the minimum AFF is £1.17 under the Basket of Fares Method, in comparison to a maximum of £2.71 under the Average Cash Fares Method. The minimum of £1.17 appears to be because for this operator and TCA the average price of a Single is more expensive than a Return, which reflects a weakness in the data;
- On average, the change from 2019/20 to 2022/23 under each method is:
  - Average Cash Fare: £0.01 (0.2%)
  - Basket of Fares: £0.08 (4.4%)
  - Discounted Fare Method: £0.07 (3.8%)

Table 9. AFF estimates

TCA	Operator	2019/20	2019/20	2019/20	2022/23	2022/23	2022/23	% Change	% Change	% Change
TCA	Operator	Average Cash Price	Basket of Fares	Discounted Fare	Average Cash Price	Basket of Fares	Discounted Fare	Average Cash Price	Basket of Fares	Discounted Fare
1	A	-	-	-	£2.12	£1.80	£1.95	-	-	-
1	C	-	-	-	£2.02	£1.78	£1.89	-	-	-
2	A	£1.72	£1.28	£1.34	£1.73	£1.32	£1.39	0.4%	3.7%	3.8%
3	B	£1.94	£1.44	£1.55	£1.96	£1.50	£1.61	0.1%	4.3%	4.3%
3	C	£2.18	£1.39	£1.63	£2.18	£1.47	£1.72	0.0%	5.6%	5.6%
4	A	£2.42	£1.97	£2.24	£2.42	£2.03	£2.29	0.0%	2.6%	2.6%
5	A	£1.28	£1.13	£1.18	£1.30	£1.17	£1.23	1.6%	3.7%	3.9%
5	C	£1.79	£1.37	£1.47	£1.80	£1.43	£1.54	0.3%	4.4%	4.3%
6	A	£2.52	£2.33	£2.42	£2.52	£2.35	£2.45	0.0%	1.0%	1.0%
6	C	£2.71	£2.16	£2.59	£2.71	£2.20	£2.64	0.0%	1.7%	1.7%

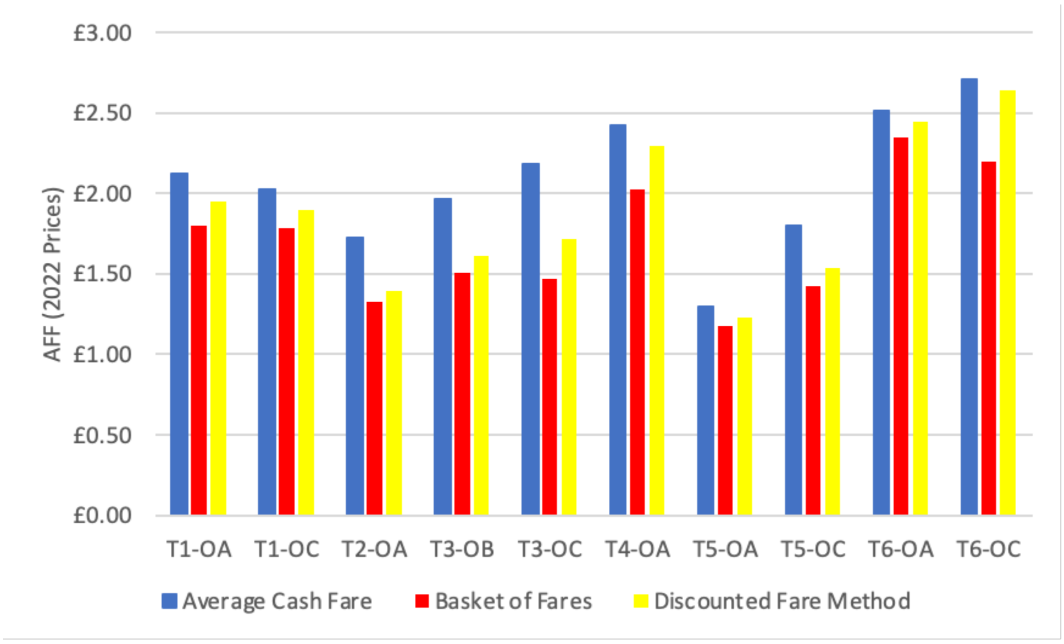
4.3.11 The range of AFFs by method is summarised in the graph below for 2019/20. This highlights that there are differences between methods and combinations of operators and TCAs, highlighting the importance of the appropriate method and journey frequency distribution being applied.

Figure 8. Range of AFFs by Method – 2019/20



4.3.12 The same graph is presented for 2022/23, which further reinforces the importance of an appropriate method and reflecting of journey distribution being applied across each TCA and operator.

Figure 9. Range of AFFs by Method – 2022/23



4.3.13 In Table 7, the output of the Discounted Fare Method is compared for the updated outputs in comparison to the current calculator for each year, TCA and operator analysed. These outputs show that there are reasonably large differences in using the NoWcard default Lookup Table, in comparison to estimating AFFs using journey frequencies from the HOPS data. There is again little difference between years. This implies that the NoWcard data is no longer representative of concessionary travel and there is likely to be variation across area types such as rural and urban which should be accounted for. Therefore, as part of this study four new lookup tables have been created for inclusion in the calculator.

Table 10. Discounted Fare Method outputs

TCA	Operator	2019/20	2019/20	2019/20	2022/23	2022/23	2022/23
TCA	Operator	Current Calculator	Updated Outputs	Difference	Current Calculator	Updated Outputs	Difference
1	A	-	-	-	£1.96	£1.95	-£0.01
1	C	-	-	-	£1.90	£1.89	-£0.01
2	A	£1.63	£1.34	-£0.29	£1.64	£1.39	-£0.25
3	B	£1.83	£1.55	-£0.28	£1.83	£1.61	-£0.22
3	C	£1.92	£1.63	-£0.29	£1.92	£1.72	-£0.20
4	A	£2.22	£2.24	£0.02	£2.22	£2.29	£0.07
5	A	£1.26	£1.18	-£0.08	£1.28	£1.23	-£0.05
5	C	£1.68	£1.47	-£0.21	£1.69	£1.54	-£0.15
6	A	£2.39	£2.42	£0.03	£2.39	£2.45	£0.06
6	C	£2.42	£2.59	£0.17	£2.42	£2.64	£0.22

4.3.14 Based on the above, the recommendation is that the Lookup Table in the calculator is updated to reflect more recent data and area type (i.e. rural and urban).

4.4 Discussion & recommendations

4.4.1 The aim of this research was to investigate the suitability of the AFF in the current calculator and recommend potential revisions as part of a package of updates to the calculator and guidance. The following objectives were pursued:

- re-evaluate the strengths and weaknesses of each of the main approaches to estimate the AFF;
- estimate the AFF pre- and post-pandemic using empirical examples for each of the main approaches;
- determine any impact that COVID-19 might have had on the estimates of AFF;
- provide recommendations as to the preferred method.

4.4.2 There are four methods to estimate AFF in the current guidance, of which three are directly included in the current calculator:

- Average Cash Fare (included);
- Basket of Fares (included);
- Discounted Fare (included);
- local methods – any other approach which is not included in the template calculator.

4.4.3 In the current guidance, the recommendation is for the Discounted Fare Method to be the preferred approach (unless services are infrequent – in which case the Basket of Fares Method is preferred because Daily and Weekly tickets are much less likely to be used if the ENCTS were not in place, and fares paid).

4.4.4 Recommendation One: It is recommended that the Discounted Fare Method remains the preferred approach. From this research, there has been no reason to disagree with when the method might not be appropriate based on current guidance. The strengths appear to be greater than the other methods – in particular, that concessionary journey frequency distributions and implied ticket choices under commercial travel are reflected in the Discounted Fare Method.

4.4.5 Unless operators only offer fixed journey tickets, the Average Cash Fare does not seem appropriate to use – it will likely overstate the value of concessionary journeys unless very few journeys per passholder are undertaken each week and Single or Return tickets would have made sense to use under commercial travel.

4.4.6 The use of Local Methods should also be discouraged unless there is a strong argument for using them – it makes auditing and comparisons potentially difficult and time consuming. Where it could be relevant is where:

- the commercial ticket choices and/or pricing structures are bespoke to the TCA and/or operator; or
- the journey frequency distribution is very different to other TCAs or operators; or
- the above might combine to mean the other methods in the guidance could be argued as potentially producing unrepresentative results (but this would need justified by the operator).

4.4.7 Nevertheless, Recommendation Two is that the other two methods which are included in the current calculator (Average Cash and Basket of Fares) are also retained in the updated calculator.

4.4.8 The advantages of this are:

- the inclusion of the different methods allows for TCAs and operators to select a method which is suitable for their ticketing structure (some operators might not offer periodic tickets such as Daily and Weekly);
- it also allows for TCAs and operators to select a method suitable for their concessionary journey frequency distribution (low numbers of journeys per person might mean it is unlikely periodic tickets would be used if passengers were required to pay a fare);
- there are known weaknesses of the Discounted Fare Method stated in the guidance at present (the Basket of Fares Method is recommended in the current guidance where operators have no cash fares, operate

predominantly low frequency services or where the Daily ticket to Average Cash fare price ratio is greater than 5[24]), where these conditions are met it is reasonable to offer TCAs and operators other options.

4.4.9 The disadvantages are:

- offering multiple methods might mean that TCAs and operators are uncertain over which is the most appropriate method to apply. Clear guidance should mitigate this potential problem;
- the calculator needs to account for more inputs, assumptions and calculations – though this is a feature of the current calculator anyway and can be re-organised to improve the presentation;
- the Average Cash Fare is only really relevant for operators which offer Single and Return tickets only;
- the Basket of Fares Method does not directly account for the journey frequency distribution of concessionary travel, whereas the Discounted Fare Method does and could be based on Lookup Tables bespoke to the region;
- beyond the theoretical considerations, the empirical estimations serve to demonstrate that the Average Cash Fare approach should not be used unless the operator only offers fixed tickets (i.e. Single and Return) – for operators which offer Daily and Weekly tickets, the Average Cash Fare is likely to overstate the AFF owing to the discount on periodic tickets. Recommendation Three is that that the Average Cash Fare approach is discouraged from use for operators offering Daily and Weekly tickets.

4.4.10 The differences between the estimation of AFFs using the current calculator and the bespoke Lookup Tables (using the Discounted Fare Method) demonstrate that the HOPS data is more representative of the current journey frequency distribution of concessionary travel than the NoWcard data. This is unsurprising as the NoWcard data is from 2009, whereas the HOPS data is from 2019/20 and 2022/23. It is Recommendation Four that the default Table is updated to more recent data. However, it should remain in the guidance that operators/TCAs can collaboratively produce their own Lookup Tables in place of the default Table. This approach might also mean that Local Methods become irrelevant for use because atypical journey frequency distributions and bespoke pricing structures can be accounted for in the bespoke Lookup Tables.

4.4.11 The impact of COVID-19 on average (across each combination of TCA and operator) between 2019/20 and 2022/23 has been estimated as follows across each method:

24 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1121607/Reimbursement_Guidance_2023-24__ACCESSIBLE_Final_V2.pdf: Table 5.1

- 0.2% under the Average Cash Fare Method;
- 4.4% under the Basket of Fares Method;
- 3.8% under the Discounted Fare Method.

4.4.12 These changes in AFF on average are only slight (in proportional terms) and are driven by the changes in the distribution of journey frequencies pre- and post-pandemic which are fairly small across each TCA (Annex C). Therefore, the impact of the pandemic on AFFs on which method might be preferable and/or the scale of AFFs is minimal. That the impact of the pandemic appears low serves to reinforce that the changes in AFFs estimated in relation to the current calculator are driven more by improved data (HOPS) in comparison to the NoWcard data which informs the Lookup Tables in the current calculator.

4.4.13 For Recommendation Five, the default Lookup Table in the calculator (which is based on NoWcard data for Lancashire from 2009) should be updated. The data is nearly fifteen years old and is unlikely to be representative of current concessionary travel patterns across the range of geographies of England – which is reinforced by differences in the AFFs estimated in this research. It should be noted that the NoWcard data was used in the current calculator and guidance because it was the best available data to produce a Lookup Table at the time.

4.4.14 It is agreed (Recommendation Six) that the following four Lookup Tables are developed for inclusion, which should reflect a range of journey distributions driven by differences in service frequencies/population densities which vary by area type (which will impact on journey frequencies per concessionary passenger and ultimately AFF estimated):

4.4.15 Large Urban Area: the options here are TCA 3 and TCA 5 to reflect former PTE areas. There is little to choose between the areas but it is recommended that TCA 3 is used on the basis of the processing being easier due to the absence of multi-modal journeys.

4.4.16 Medium-Sized Urban Area: it is recommended that TCA 2 is used as it offers a reasonable balance between a large settlement and complexity in data.

4.4.17 Mixed Urban/Rural Area: it is recommended that TCA 1 is used as the current Lookup Table in the calculator is based on a mixed urban/rural area. Therefore, it enables closer comparison to be made pre- and post-implementation of changes to the Lookup Tables which could be beneficial to understand.

4.4.18 Rural Area: the options here are TCA 4 and TCA 6. There is relatively little basis on which to choose between these, as the data quality appears to be similar. It is recommended that TCA 4 is used.

4.4.19 The advantage of the update to include four Lookup Tables rather than the single default Lookup Table in the original calculator is that it allows a wider reflection of the different journey frequency distributions across a range of geographies. This will enable the user to select the most appropriate Lookup Table for their TCA and improve the accuracy of their reimbursement estimates.

4.4.20 This leads to Recommendation Seven that the guidance and updated calculator should note that whilst there are four default Lookup Tables, it also remains possible for bespoke Lookup Tables to be produced for a TCA – this is a practice that occurs already and using more local data (provided it is robust and representative of concessionary travel) would arguably be more representative of local conditions and produce more accurate AFFs.

4.4.21 For the bespoke Lookup Tables to be used they need be robust and reliable which requires the following considerations:

- The underlying data must contain and reflect the amount of journeys undertaken by bus under ENCTS for each unique cardholder in the TCA by date of travel;
- Data should be from HOPS or a similar data source which records the above information;
- The Lookup Tables should be constructed using the outline methodology in the guidance.

4.4.22 The above considerations have been followed in the production of the four Lookup Tables included in the updated calculator. The approach to derive each Lookup Table is discussed in Annex D.5 of this report. In summary, each Lookup Table has been derived using HOPS data for case studies of concessionary journeys within different geographies of England. The data included all journeys starting in a case study area (e.g. Large Urban Area case study) on smartcard-enabled buses for the year 2022/23. It was cleaned to remove anomalous or incorrect records. From the cleaned data, journey frequencies across concessionary passengers per day and week were analysed to understand the ticket type choices which would have been made under different hypothetical ratios of fares (i.e. Daily to Average Cash Fare and Weekly to Average Cash Fare price ratios) if the ENCTS was unavailable. The Lookup Table for each area type summarises the distribution of journeys across each ticket type (Cash Fare, Daily, Weekly) under each hypothetical fare ratio assumed/tested.

4.4.23 The guidance should recommend that the TCA and operator agree prior to use of the calculator in any submission on whether they use one of the default Lookup Tables or a bespoke version. It is recognised that some TCAs and operators might not have access to data or resources which will enable reliable, bespoke Lookup Tables to be produced and one of the default four will need to be used instead.

4.4.24 It is not recommended that Lookup Tables are developed for each operator as this would only capture journeys made on that operator's services. In TCAs where there are multiple operators, this would bias the choice of ticket that a passenger may have bought when there are multi-operator tickets available. Lookup Tables by TCA, as recommended, could benefit smaller operators who could use more local data but not incur the resources to develop them.

4.4.25 To conclude this section of the report, a summary of the recommendations is provided below:

i. Recommendation One: The Discounted Fares Method remains the preferred approach;

ii. Recommendation Two: The Average Cash Fares and Basket of Fares Methods are retained where the Discounted Fares Method might not be appropriate. Local methods are allowed but discouraged from use unless there is strong justification for why the other methods are inappropriate;

iii. Recommendation Three: The Average Cash Fare is discouraged from use unless the operator only offers Single and Return tickets;

iv. Recommendation Four: It remains feasible for operators/TCAs to collaboratively produce their own Lookup Tables using local data;

v. Recommendation Five: The default Lookup Table is also updated from 2009 NoWcard data to 2022/23 HOPS data;

vi. Recommendation Six: A set of four Lookup Tables using the HOPS data are included in the updated calculator to ensure operators/TCAs which do not have their own Lookup can use more appropriate data. The revised Lookup Tables will reflect: Large Urban, Medium-szied Urban, Mixed Urban/Rural and Rural Areas;

vii. Recommendation Seven: The guidance and calculator should be clear that whilst there are four Lookup Tables for different geographies, operators and TCAs are permitted to develop their own bespoke Lookup Tables using local and robust data.

5 Costs

5.1 Introduction

5.1.1 For journeys generated by the ENCTS (i.e. those journeys that would not have been made if passengers were not charged the commercial fare), operators are compensated for the extra costs incurred for carrying each passenger. These are set out below. However, it should be noted that Marginal Capacity Costs and the Peak Vehicle Requirement might not always be used in reimbursements because the concessionary patronage might be possible to accommodate on existing services and frequencies:

- Marginal Operating Costs (MOCs): these are the costs to a bus operator of carrying an additional passenger assuming a fixed level of service. From the analysis summarised in Annex E, these are assumed to comprise labour costs (driver, maintenance and other), the cost of parts, fuel and insurance costs. It is noted that the current guidance has set this at a central value of 6.1p per generated journey (at 2009/10 prices);
- Marginal Capacity Costs (MCCs): these are the costs to a bus operator of carrying additional passengers by increasing the frequency of bus services;
- the Peak Vehicle Requirement (PVR): these are costs associated with the requirement to run additional vehicles in the peak period due to the generated concessionary travel.
- Administrative costs: costs incurred by operators in operating the scheme.

5.1.2 In the existing calculator, the Marginal Operating Costs and Marginal Capacity Costs are allowed to increase with an inflation index based on both the CPI and GDP deflator (to 2021/22 the index is based on CPI, but thereafter is adjusted by growth in the GDP deflator), relative to the base year of 2009/10. Administrative costs are entered directly into the calculator and not subject to calculation.

5.1.3 As part of this study, SYSTRA and Frontier have reviewed the current approach in relation to Marginal Operating Costs. With respect to PVRs, the intention is to update the guidance to make the requirements for operators clearer. For Marginal Capacity Costs, increases in costs relevant to MCCs have been assessed in Annex E – which are costs per vehicle hour (based on driver costs) and costs per vehicle mile (based on fuel costs). Furthermore, the service frequency elasticity which is used to forecast the demand-response to changes in service frequency has also been assessed in Annex F. However, the general approach to estimating MCCs and PVRs has remained the same as in the current guidance and calculator.

5.1.4 We have also not looked at scheme administration costs and recommend that how they are covered remains a matter for negotiation between the TCA and the operator. However, the guidance has been updated to provide some further clarity as to how administration costs should be accounted for.

5.1.5 Separate from updating the costs to current prices (2023/24), we have also assessed how the costs should be inflated in future years.

5.1.6 It is important to note that we have sought to update the existing Marginal Operating and Capacity Costs to current prices based on actual growth rates. We have not re-estimated the underlying relationship used to produce the Marginal Costs using econometric analysis for example.

5.1.7 The remainder of this chapter is organised as follows:

- summary of methodology;
- summary of findings;
- implications for the calculator;
- cost inflation;
- conclusion.

5.2 Summary of methodology

5.2.1 Marginal Operating Costs are the costs to a bus operator of carrying an additional passenger assuming a fixed level of service. In our review, they comprise labour costs (driver, maintenance and other), the cost of parts, fuel and insurance. For our review of Marginal Operating Costs:

- we have compared detailed data on Average Costs obtained from the Confederation of Public Transport (CPT) against different inflation indices to assess which inflation-based adjustment would adequately represent how operators' costs have changed. The current calculator uses CPI to 2021/22 and the GDP Deflator thereafter. In this analysis, CPT data from 2010 to 2022 is analysed;
- we assumed that the relationship between Average Costs and Marginal Costs derived as part of the previous update by ITS Leeds remains unchanged. To review this assumption would require comprehensive econometric testing which is beyond the scope of this study, but is recommended as a potential area of future work. Nevertheless the assumption has been tested in two ways (Sections 7.1.6 and E.17). Firstly, cross-checks of the recommended uplifts were compared against a separate dataset of operating cost changes from the DfT. Secondly, a bottom-up estimate of MOCs by ITS was uplifted using factors specific to each driver of MOCs and then compared. In both instances the overall impact on MOCs looked consistent and were considered to be reliable;

- A set of output growth indices from the CPT data was produced by cost category and also across total costs which were considered to reflect marginal items (by average metropolitan area, shire area and across both of these types). These growth indices were benchmarked against other data (adjusted for inflation where relevant) on operating costs from DfT's data and from a bottom-up estimate of MOCs undertaken by ITS Leeds. The bottom-up estimate is in the current guidance. This was to help understand if other data produces consistent results to the analysis against CPT data (see Annex E).

5.2.2 For Marginal Capacity Costs, we have used the same approach to update unit costs; and conducted a new analysis of operator data to analyse the service frequency elasticity.

5.3 Summary of findings

5.3.1 For the different components of Marginal Operating Costs, we give the findings of our comparison of the detailed CPT data with the CPI and GDP deflator based inflation index used in the existing calculator.

5.3.2 Firstly, considering driver costs, maintenance costs and other labour and staff costs:

i. Driver costs: the data suggests that driver costs from 2010 to 2022 have increased by 6 percentage points higher than the inflation assumption in the current calculator in metropolitan areas. In shire areas, the increase is 9 percentage points higher.

ii. Maintenance costs: the data suggests that maintenance costs from 2010 to 2022 have increased by 8 percentage points higher than the inflation assumption in the current calculator in metropolitan areas. In shire areas the increase is 16 percentage points higher.

iii. Other Labour and Staff Costs: the data suggests that these costs have risen by 10 percentage points lower than the inflation assumption in the current calculator in metropolitan areas. In shire areas, the increase is 6 percentage points lower.

5.3.3 Across these three components, operator's costs have on average (across areas analysed) increased by 5 (Metropolitan Areas) and 9 (Shire Areas) percentage points higher (in total from 2010 to 2022) than the inflation assumption in the current calculator. The index growth rates are shown for these area types in Figure 10 and Figure 11.

Figure 10. Index Growth in Labour Costs - Metropolitan Areas

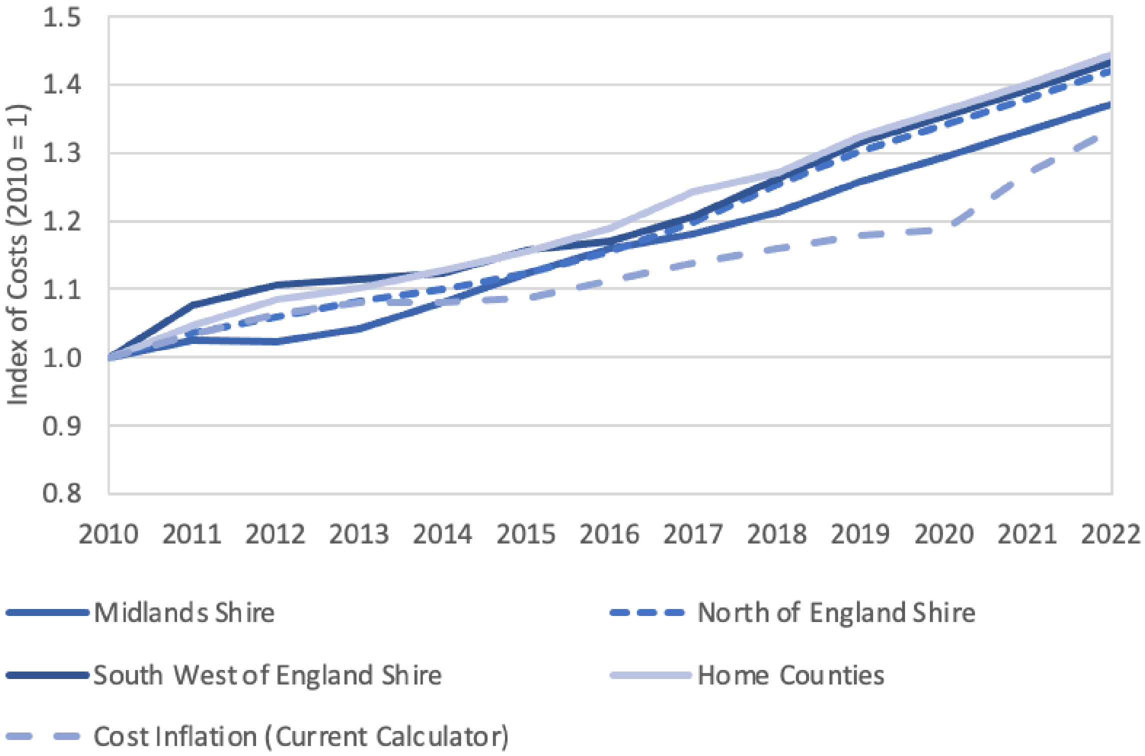
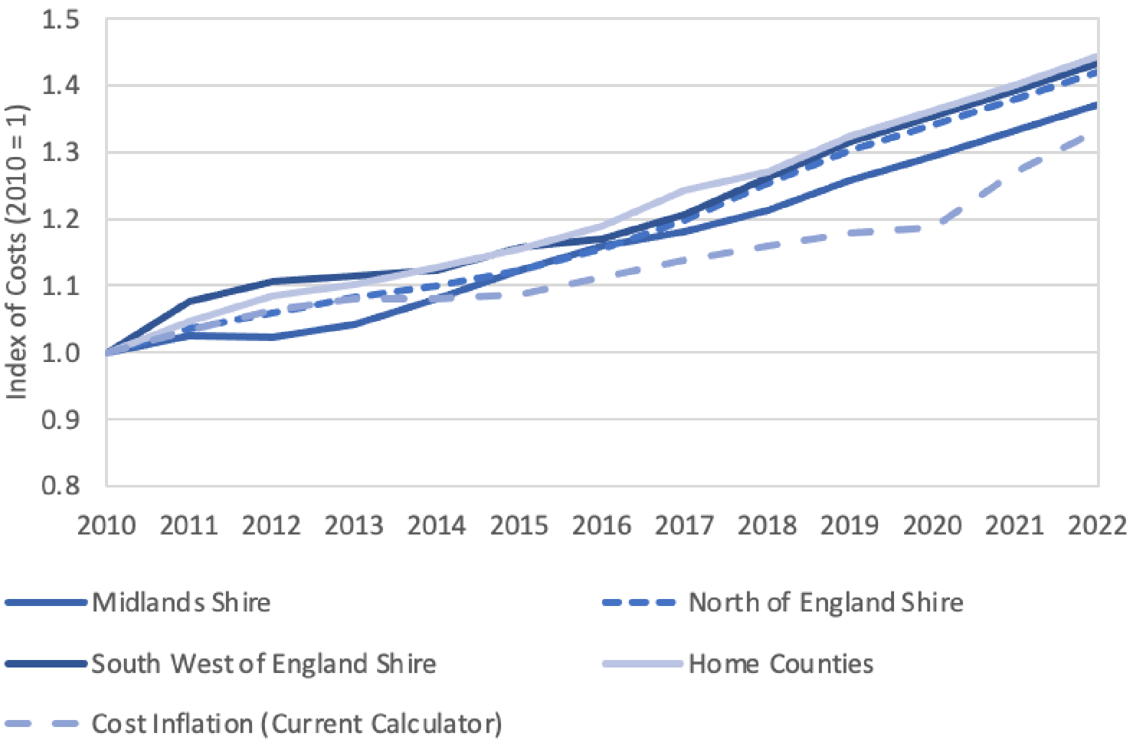


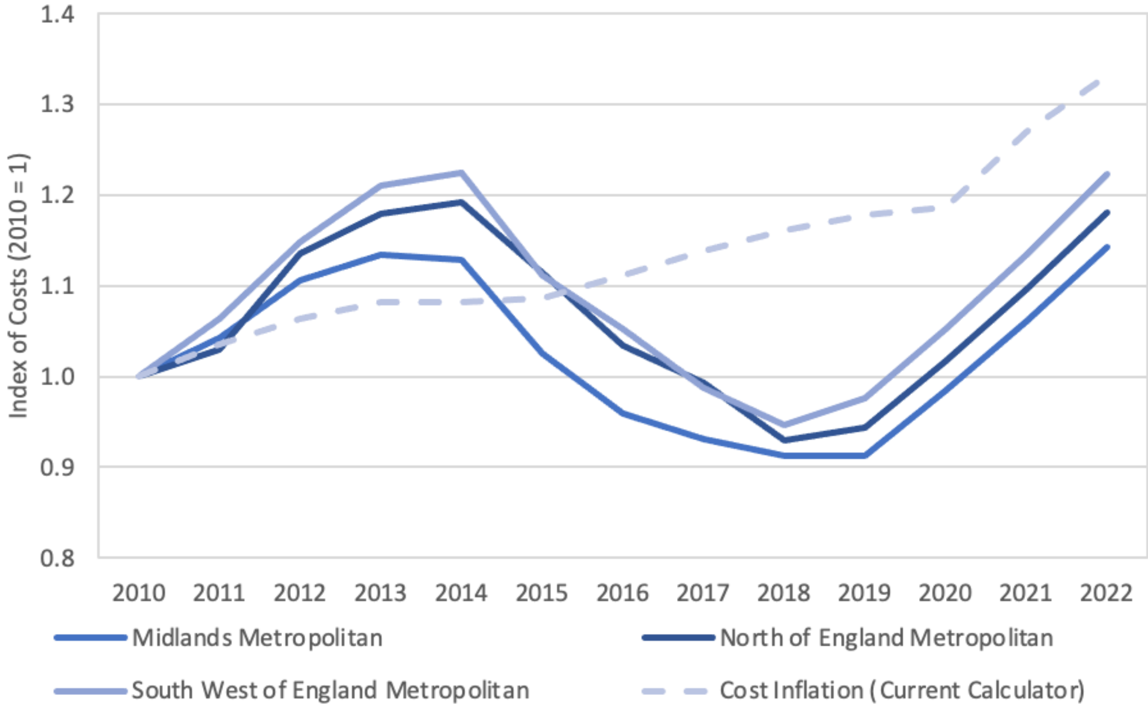
Figure 11. Index Growth in Labour Costs - Shire Areas



5.3.4 The CPT data analysed shows that the costs of parts increased on average across each metropolitan area by 134 percentage points higher than the inflation assumption in the current calculator and 144 percentage points higher across each shire area (in total from 2010 to 2022). Graphs are shown in Annex E for this cost item but not here as the contribution to operating costs is small (less than 5%).

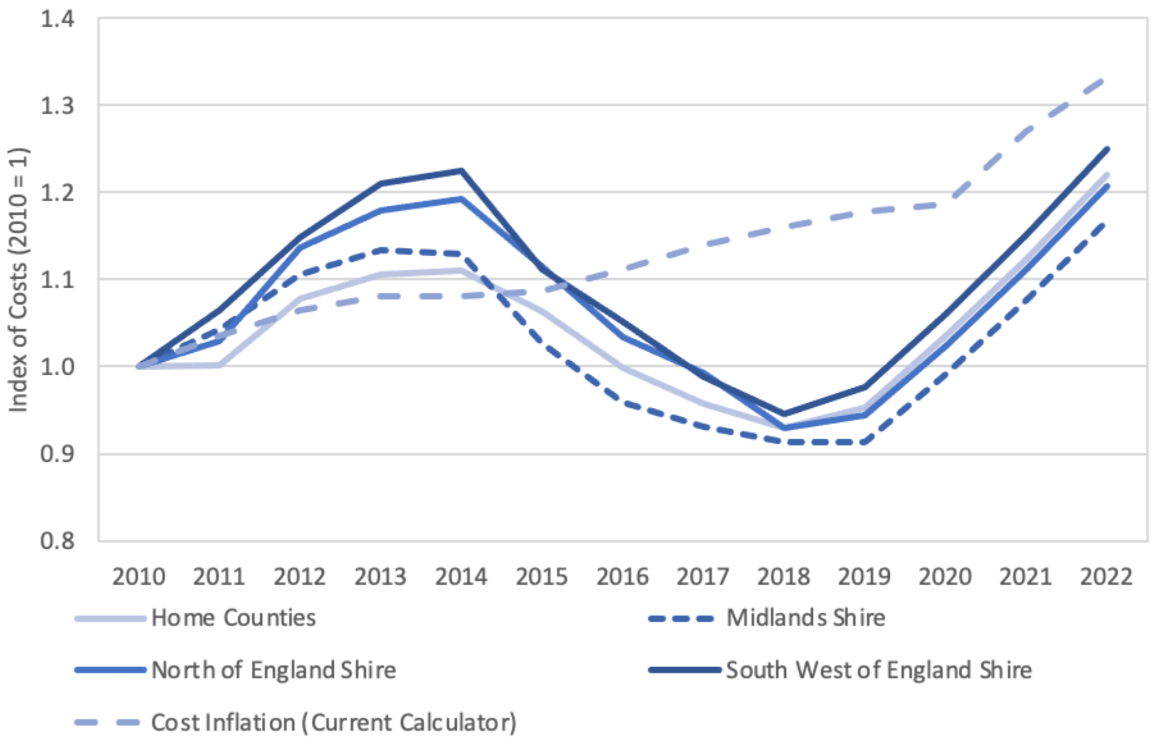
5.3.5 CPT data suggests fuel costs increased by 15 percentage points less than the inflation assumption in the current calculator in metropolitan areas; this compares with 12 percentage points lower than inflation in Shire Areas (in total from 2010 to 2022). CPT note that hedging, congestion, fleet replacement and driver training programmes affect when and how these are incurred.[25] Figure 12 and Figure 13 show the index growth in fuel costs by area type.

Figure 12. Index Growth in Fuel Costs - Metropolitan Areas



25 Hedging fuel refers to the process of buying fuel at a fixed price for delivery at a later date

Figure 13. Index Growth in Fuel Costs - Shire Areas



5.3.6 CPT data also suggests that insurance costs increased by 24 percentage points less than the inflation assumption in the current calculator in metropolitan areas, and by 17 percentage points lower than inflation in shire areas (in total from 2010 to 2022). As with the cost of parts, graphs are shown in Annex E for this cost item but not here as the contribution to operating costs is again small (less than 5%).

5.3.7 Across all of the above cost components, the CPT data suggests that operators' costs have increased by 5 percentage points higher than the inflation assumption in the current calculator in the Metropolitan Areas, and by 9 percentage points higher in Shire Areas (in total from 2010 to 2022). This reflects that labour and fuel costs contribute the majority of operating costs and, therefore, there is a weight in the average to these items. The growth is shown in the two area types in Figure 14 and Figure 15.

Figure 14. **Index Growth in Total Costs (Marginal Items Only) - Metropolitan Areas**

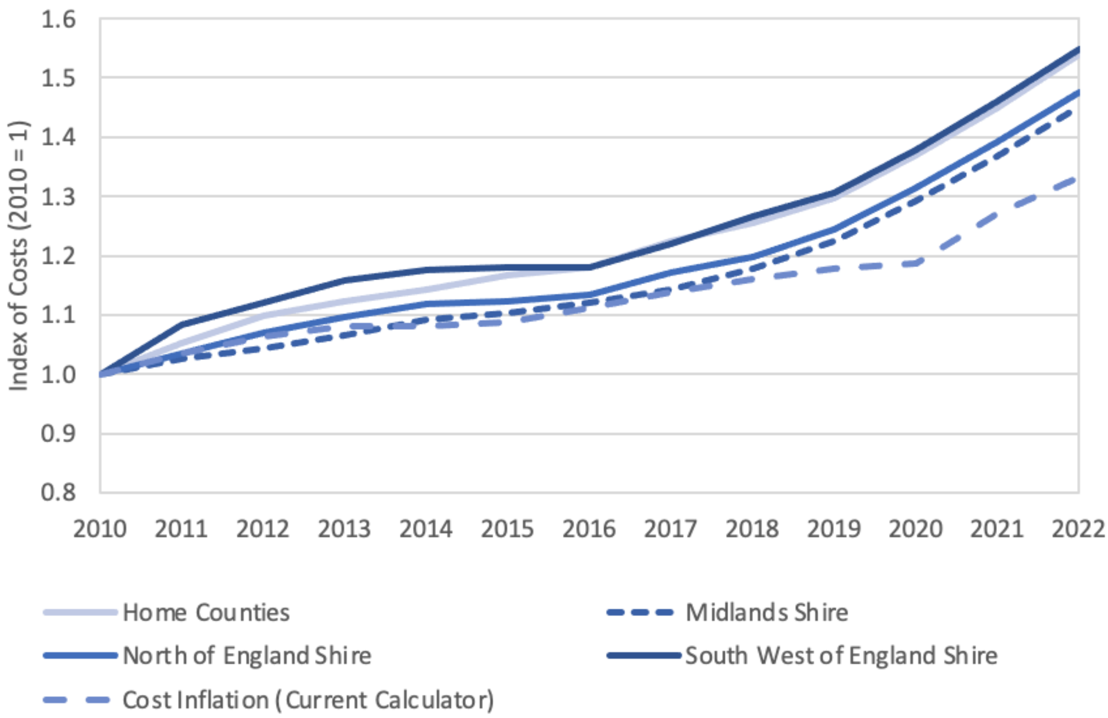
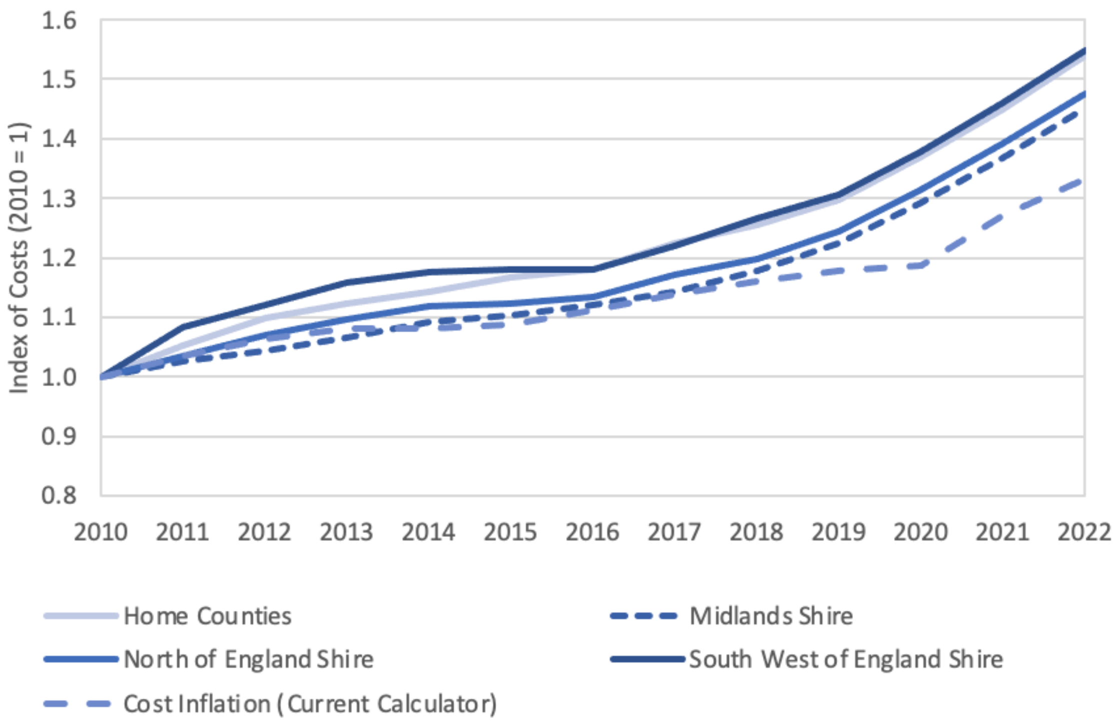


Figure 15. **Index Growth in Total Costs (Marginal Items Only) - Shire Areas**



5.3.8 This study has looked at two aspects of Marginal Capacity Costs: the unit values to use in calculating Marginal Capacity Costs (costs per vehicle mile and costs per vehicle hour); and the service frequency elasticity.

5.3.9 The change in the unit values is based on the same analysis as outlined above for the MOCs.

5.3.10 The current service frequency elasticity (the percentage change in passenger journeys in response to a percentage change in bus service frequency) used in the calculator is based on econometric analysis conducted in the late 1990s and 2000. The analysis conducted for this study uses much more recent data provided by operators. We are grateful to the operators who provided their data: for confidentiality, we do not identify those operators.

5.3.11 This analysis used route-level data from 6 different bus operators, from the North West, North East, South East, South West and East of England. The analysis estimated the relationship between passengers and total mileage (a proxy for service frequency), controlling for yield and local area characteristics. Local area characteristics were added to each bus route by a geocoding exercise, for which we relied on publicly available data (Traveline). We estimated the service frequency elasticity using a range of regression specifications.

5.3.12 We estimated a number of econometric specifications. “Dynamic” elasticity (allowing passengers a period of adjustment to a change in bus services) is conceptually appropriate for use in the calculator (and is what is currently used). A “static” elasticity model is estimated as a sense-check.

5.3.13 Our base specification estimated an elasticity of 0.59-0.70, which is consistent with the elasticity in the current calculator of 0.66. This was the lowest elasticity estimate among the sensitivities.

5.3.14 The pre-COVID model produced a higher elasticity estimate than the base model. As the pre-COVID-19 model did not attempt to fit a single model across structural breaks in public transport demand, the higher elasticity estimate may reflect a better model fit. It may also indicate that there has been a decrease in service frequency elasticity over time. Bus users with more discretionary and elastic demand likely have reduced bus usage post-pandemic relative to pre-pandemic, although the evidence examined elsewhere in this report is inclusive on this point.

5.3.15 The static model estimated a service frequency elasticity which was substantially higher than the base specification, although the reason for this is not clear, and due to time constraints it was not possible to investigate this further.

5.3.16 The model adjusting for local route competition also produced a relatively high elasticity estimate. By estimating a stronger relationship between mileage and passengers, this model seems to have been successful at reducing some of the noise due to correlations in the route-level errors in the base model. However, this model groups together bus routes across operators within local areas. As the calculator inputs an individual operator's data, there is a conceptual mismatch between this estimate and the calculator data.

5.3.17 The estimate from the full route sample produced an estimate towards the centre of our sensitivity range and is consistent with the current service frequency elasticity.

5.3.18 On the evidence available, this analysis has provided a series of model specifications which are robust and stable. As the dynamic model is conceptually appropriate for the calculator, we recommend using an average of the dynamic models, which is [(0.64+0.72+0.79+0.70)/4] = 0.71.

5.3.19 Our elasticity estimates are broadly consistent with the values currently used in the calculator, and the sensitivity analyses suggest that the estimates are moderately sensitive to assumptions around COVID-19-related structural breaks, different passenger response lengths, and competition from other local routes. All the models have high predictive power, and the coefficients of interest are statistically significant.

5.3.20 We are confident that this analysis is a significant improvement on the evidence base underpinning the current service frequency elasticity contained within the guidance.

5.3.21 On the evidence available, this analysis has provided a series of model specifications which are robust and stable. The dynamic model is most appropriate for estimating this elasticity, therefore we recommend using an average of the dynamic model estimates, and this average is 0.71. This is close to the current value in the calculator of 0.66.

5.3.22 All else being equal, a higher service frequency elasticity reflects that commercial passengers are more responsive to changes in service frequency. Therefore, where service frequencies are increased because of the ENCTS, a higher service frequency elasticity will result in a greater modelled increase in commercial passengers arising from that frequency increase: and therefore a reduction in the level of reimbursement required to leave bus operators no better and no worse off.

5.3.23 The full details of this analysis are set out in Annex F.

5.4 Implications for the calculator

5.4.1 Based on the analysis of costs described above, we propose that fixed and variable elements of the Marginal Operating Cost (MOC in pence per passenger, in 2009/10 prices) below are updated as follows – and the 6.1p central assumption of MOCs is also updated. The updates are to reflect that operating costs appear to have grown by more than the inflation assumption in the current calculator.

MOC = 5.5 + 0.6 . [Average concessionary journey length (in miles)/3.9]

5.4.2 A single adjustment is proposed based on an average adjustment across the metropolitan and shire areas analysed from the CPT data, extrapolated from 2010 to 2022 (CPT data) to 2009/10 to 2023/24 (to reflect the range in current calculator).

5.4.3 The adjustment is presented in Table 12, by average distance. All values are presented in pence per generated journey.

Table 11. MOC adjustment

Average Distance of Concessionary Passenger (Miles)	1	2	3	4	5	6	7	8	9	10
Base (2023/24 prices)	8.08p	8.30p	8.52p	8.74p	8.96p	9.18p	9.40p	9.62p	9.84p	10.06p
Metropolitan (51% - 2023/24 prices)	8.21p	8.43p	8.66p	8.88p	9.10p	9.33p	9.55p	9.78p	10.00p	10.22p
Shire (45% - 2023/24 prices)	8.49p	8.72p	8.95p	9.18p	9.41p	9.64p	9.87p	10.11p	10.34p	10.57p
Updated (47.5% - 2023/24 prices)	8.35p	8.58p	8.80p	9.03p	9.26p	9.49p	9.71p	9.94p	10.17p	10.39p

5.4.4 Similarly, the cost item-specific Marginal Operating Costs that were produced by ITS Leeds in 2009/10 were updated to 2023/24, using the average adjustment factors. These are shown in Table 13, along with the average adjustment.

Table 12. Cost item specific MOCs

Item	Base (2009/10)	Current Calculator Adjustment (2023/24)	Metropolitan Areas (2023/24)	Shire Areas (2023/24)	Average (Metropolitan and Shire Areas)
Fuel	0.3p/mile	0.4p/mile	0.4p/mile	0.4p/mile	0.4p/mile
Tyres and Oil	0.1p/mile	0.1p/mile	0.3p/mile	0.3p/mile	0.3p/mile
Maintenance and Cleaning	0.1p/mile	0.1p/mile	0.1p/mile	0.2p/mile	0.2p/mile
Insurance	2.7p/mile	3.9p/mile	3.0p/mile	3.2p/mile	3.1p/mile
Information	0.5p/mile	0.7p/mile	1.3p/mile	1.4p/mile	1.4p/mile
Additional Time Costs	1.3p/mile	1.9p/mile	1.9p/mile	2.0p/mile	1.9p/mile
Total	5.0p/mile	7.1p/mile	7.0p/mile	7.4p/mile	7.2p/mile

5.4.5 In addition to the above calculations relevant to MOCs, we have assessed the increases in costs relevant to MCCs: a cost per vehicle hour; and a cost per vehicle mile. Adopting the same approach as for the MOCs, these are uplifted to reflect changes in drivers' hourly wages (which is estimated as 49.0%, on average, from 2009/10 to 2023/24 from the CPT data) and fuel costs (which is estimated as 23.3%, on average, from 2009/10 to 2023/24 from the CPT data). This compares against a single adjustment of 42.9% in the current calculator for both items.

5.4.6 The analysis of the service frequency elasticity is set out in detail in Annex F. Data has been received from operators, combined with data on other factors expected to influence passenger demand, and analysed using a regression model to derive a new service frequency elasticity.

5.4.7 Based on this analysis, we propose updating the service frequency elasticity used in the guidance to 0.71.

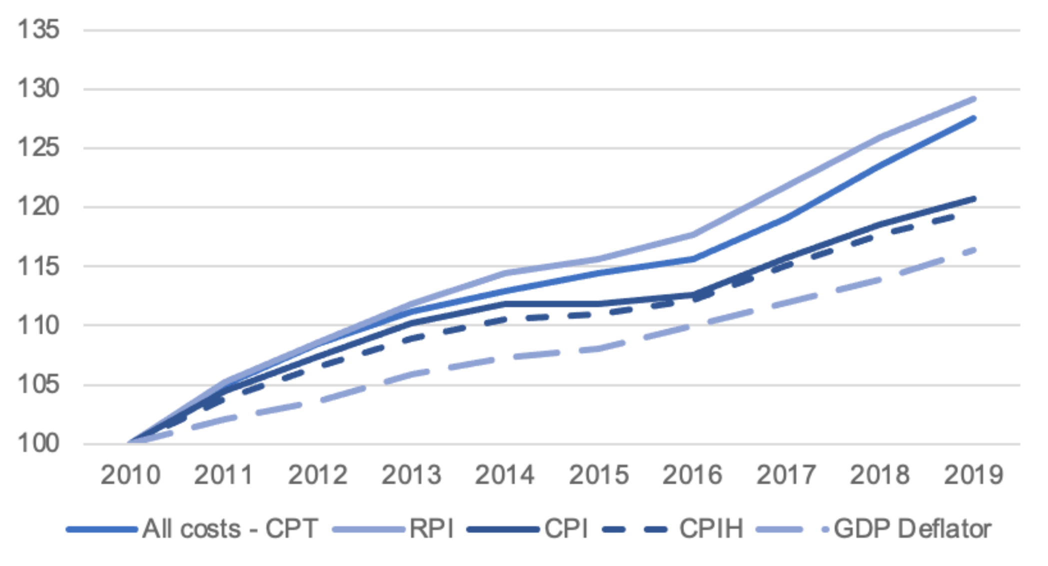
5.5 Cost inflation

5.5.1 It is noted that the existing calculator uses a mix of CPI and GDP deflator. The discussion in the preceding sections that is based on data from the CPT shows that these indices have not performed well in terms of tracking historical operators' costs.

5.5.2 The same was observed when using standard measures of inflation such as the CPI, Consumer Prices Index including owner occupiers' housing costs (CPIH), RPI and GDP deflator; they did not track operators' costs well. The RPI, which performed better than the other indices, is discouraged by the Office for National Statistics. [26]

26 https://blog.ons.gov.uk/2017/03/20/measuring-inflation-whats-changed-and-why/

Figure 16. **Comparison of the changes in total operators' costs from CPT (2010 to 2019) with different inflation indices**

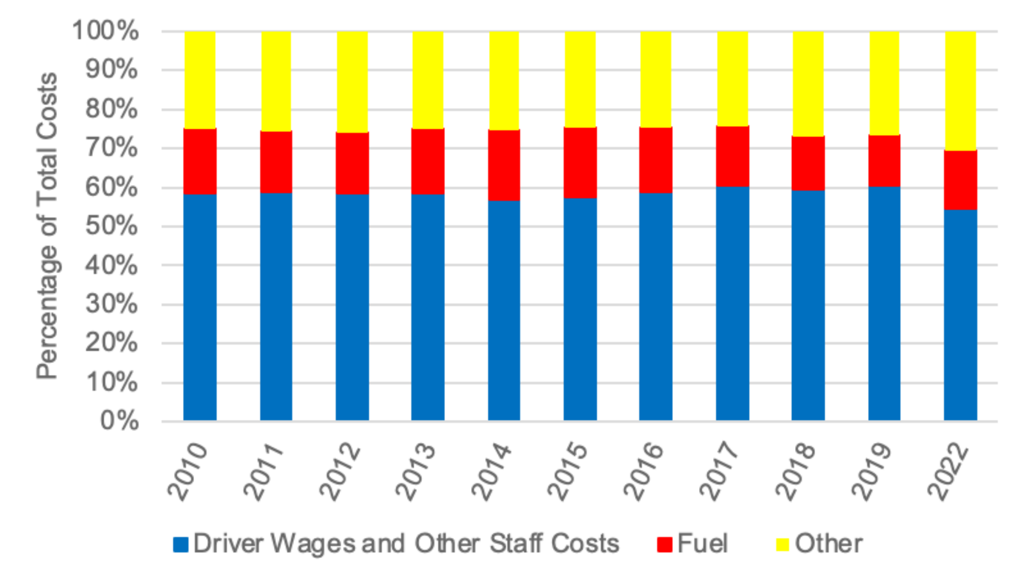


5.5.3 Therefore, we propose a bespoke inflation metric that is based on independently gathered inflation data concentrating on the main components of operators' costs:

- Driver wages and other staff costs,
- Fuel costs, and
- Other costs.

5.5.4 Based on historical analysis of CPT data, the composition of operators' costs is shown in Figure 17.

Figure 17. **Composition of Operators' Costs**



5.5.5 These show that composition of operators' costs have remained largely stable over the last 12 years, with:

- driver wages and other staff costs making up 55% - 61% of the total costs;

- fuel costs making up 14% - 18%;
- other costs, including insurance and claims, maintenance materials, vehicle depreciation and other operating costs making up 25% - 27%.

5.5.6 Based on the above, we propose weights of 60%, 15% and 25% for the three components. These weights were validated against data that was provided by a local authority and used in adjusting for inflation in that authority's bus contracts.

5.5.7 ONS provide an independent dataset on Average Weekly Earnings for the Transport and Storage sector for the former, and for diesel costs which should track operators costs more closely than generic indices such as the CPI.

5.5.8 For the other costs, we propose that CPI is used as the independent inflation index.

5.5.9 In summary, the bespoke inflation index is calculated as follows:

$$inflation = 0.6 * AWE\_TS + 0.15 * Diesel + 0.25 * CPI$$

5.5.10 The calculator would need to provide inflation data for the future too. For that purpose, we propose that the following forecasts are used using the same weights as in para 5.5.6 (60%, 15% and 25%):

- Drivers wages and other staff costs - Earnings[27] time series from the Office of Budget Responsibility (OBR)[28] (Medium Term Forecasts);
- Fuel costs - the TAG Databook;[29]
- CPI - CPI forecasts from the OBR's Medium-Term Forecasts.

5.5.11 OBR and ONS provide these forecasts twice a year, and it is recommended that DfT update the calculator yearly, with the historical and forecasted cost indices. This would avoid duplication of effort across TCAs

5.6 Conclusion

5.6.1 This chapter presented the recommendations for the base Marginal Costs as well as inflation.

5.6.2 We recommend an uplift of 47.5% for MOCs from 2009/10 to 2023/24, which is a slight increase from the inflation assumption in the current calculator (43%).

27 It is noted that these forecasts are not specifically for the Transport and Storage sector.
28 https://obr.uk/publications/
29 https://www.gov.uk/government/publications/tag-data-book

5.6.3 For inflating these costs into future years, we recommend a bespoke cost index that is based on independently sourced historical datasets from the ONS, and forecasts sourced from the OBR and TAG.

5.6.4 We recommend an uplift of 49.0% to the MCC per hour from 2009/10 to 2023/24 and 23.3% from 2009/10 to 2023/24 for the MCC per mile. The inflation adjustment in the current calculator is 43%, which means that:

- MCC per hour: 6 percentage points higher than in the current assumption
- MCC per mile: 20 percentage points lower than in the current assumption

5.6.5 We recommend an update to the service frequency elasticity to 0.71.

6 Case studies

6.1 Introduction

6.1.1 To illustrate how changes to the DfT reimbursement calculator may impact upon operator reimbursement in different area types, a series of case studies were produced. These area types were defined as urban, rural, and urban-rural mixed, which was split into 2 case studies, one for each of the urban and rural parts of such an area. As discussed in Section 3 of this report, urban areas replace PTE-like areas in the calculator, thus the urban area demand curve is used to derive the reimbursement factor, while the non-urban demand curve was used instead of the non-PTE demand curve.

6.1.2 The case studies were formulated using the professional experience of the team to reflect the inputs to the DfT calculator which might typically be expected of a bus operation in each of the defined areas and were discussed with the Technical Advisory Group. Recommendations made in sections 3-5 above were then applied separately to modify versions of the DfT calculator to create comparable scenarios through which to assess the effects of these recommendations.

6.1.3 The case studies cover all changes to the calculator other than the new lookup tables and the most recent forecast inputs to inflation for Average Weekly Earnings and CPI. Lookup tables were not included as average fare forgone was input directly for each case study rather than calculated using either of the calculator methods.

6.2 Methodology

6.2.1 Inputs to the calculator for each case study, as informed by professional experience, were as below.

Table 13. Case study inputs

Input	Urban	Rural	Urban-Rural Mixed - Urban	Urban-Rural Mixed - Rural
AF – Average Fare Forgone	£2.48	£2.40	£2.00	£2.75
RF - Percentage change in nominal fares between 2005/6 and the current reimbursement period	108%	78%	95%	40%
AC - Average Journey Length	3.6 miles	4 miles	3 miles	7.5 miles
MCC - Cost/Vehicle Hour	£30	£18.17	£30	£27.50
MCC – Cost/Vehicle Mile	£0.70	£0.96	£0.70	£0.60
MCC - Speed	9 mph	13 mph	9 mph	16 mph
MCC - Mean Vehicle Occupancy	16.5	3.5	12.25	10
MCC - Mean Journey Length	3 miles	4 miles	3.25 miles	7.5 miles

Input	Urban	Rural	Urban-Rural Mixed - Urban	Urban-Rural Mixed - Rural
MCC - Mean Route Length	6 miles	8 miles	6.5 miles	15 miles
MCC - Average Commercial Fare	£1.61	£1.50	£1.75	£2.50
MCC – Commercial Journeys % of Total	55%	60%	80%	75%

6.2.2 These inputs were used in a standard, unmodified version of the 2023/24 DfT calculator to act as a baseline for each area type. Modifications were then made to those calculators in line with the recommendations outlined from this commission.

6.2.3 In order to model the effects of changing the demand curve in line with section 3 of this report, lambda values for the demand curve were altered to be 0.7 for urban areas and 0.9 for non-urban areas, from ~0.72 and ~0.64 respectively. Beta values were changed from -0.668 to -0.5963 for urban areas, and from -0.836 to -0.7226 for non-urban areas.

6.2.4 Since the values used to derive this demand curve were themselves derived from 2019 data, the percentage change in fares was overridden to represent the change in fares between 2019/20 and 2023/24 to match the curve. This fares increase was represented as calculated from the same data used to derive the curve.

6.2.5 Where a TCA is using the changes in local fares since 2005/06, the impact of changing to using 2019 fares as a baseline along with the new demand curve parameters will likely vary from the impact set out in these case studies. Where local fares have increased since 2005/06 by a larger amount, then the impact of this change to the baseline will be correspondingly larger.

6.2.6 Analysis of cost inflation indices from this commission lead to three separate cost inflation figures, 47.5% for MOCs, 49% for MCC per vehicle hour and 23.3% for MCC per vehicle mile. These changes are applied incrementally in the case studies, first for MOC changes and then for MCC changes. The MCC changes are grouped together with the change in service frequency elasticity from 0.66 to 0.71, which also affects MCCs. In the calculator, the cost inflation figures were applied by changing formulae that looked up the previous inflation to table to refer directly to the component specific inflation figure.

6.2.7 Changes to inflation indices in the calculator, as recommended in section 5 of this report, required overwriting the inflation tables in the 'RF Workings' tab of the calculator. CPI was overwritten with the composite cost inflation index developed. Deflation factors for fare deflation have been altered to be derived from CPI only, as opposed to the combination of CPI and GDP deflator used previously.

6.3 Summary of findings

6.3.1 Testing the demand curve adjustments for reimbursement factor calculation results in fixed reimbursement rates changes for urban areas and for non-urban areas. This is because the inputs provided for the rate of fares increase between 2019/20 and 2023/24 were fixed figures for urban and non-urban areas, therefore the fare increases do not differ across the non-urban case studies. For urban areas, this increases the reimbursement factor from 43.44% to 54.53%. In rural and both mixed urban and rural areas, the resultant reimbursement factor increases from 39.92%, 37.77% and 45.50% respectively to 46.09%

6.3.2 Results for each case study under each test are recorded in the tables below, split by case study.

6.3.3 For urban areas, a typical operator as represented in this case study would receive £1.18 per concessionary passenger under the current DfT calculator for 2023/24. This would rise 19.3% to £1.41 if the demand change were adjusted as recommended. Changes to MOC and MCC are relatively minor, increasing reimbursement by 0.4% and decreasing it by 1.2% respectively. Introducing the composite inflation index and CPI-based deflation would see the operators' per passenger reimbursement rise 3.8% to £1.23. When all updates are combined, the resultant per passenger reimbursement is £1.43, a 20.8% increase from the 2023/24 calculator.

Table 14. Urban Case Study Key Outputs

Parameter	Base	Demand Curve Adjustment	MOC	MCC	Inflation Adjustment	Combined
Classification	**Urban**	**Urban**	**Urban**	**Urban**	**Urban**	**Urban**
Average Fare Forgone	£2.48	£2.48	£2.48	£2.48	£2.48	£2.48
Reimbursement Factor	43.44%	53.51%	43.44%	43.44%	45.27%	54.53%
MOC per generated journey	£0.08	£0.08	£0.09	£0.08	£0.09	£0.09
MCC per generated journey	£0.11	£0.11	£0.11	£0.08	£0.11	£0.08
Total Reimbursement per Passenger	£1.18	£1.41	£1.19	£1.17	£1.23	£1.43

6.3.4 A typical operator in a purely rural area might expect to receive £1.77 using the current reimbursement calculator, rising and falling less than 0.5% for each of the MOC and MCC changes. The changes to inflation and deflation increases reimbursement per concessionary passenger 4.3%, while adjusting the demand curve parameters results in a 2.8% increase in reimbursement at £1.82. The combined effect of all recommendations increases the reimbursement per passenger by 3.8% to a total of £1.84.

Table 15. Rural Case Study Key Outputs

Parameter	**Base**	**Demand Curve Adjustment**	**MOC**	**MCC**	**Inflation Adjustment**	**Combined**
Classification	**Non-urban**	**Non-urban**	**Non-urban**	**Non-urban**	**Non-urban**	**Non-urban**
Average Fare Forgone	£2.40	£2.40	£2.40	£2.40	£2.40	£2.40
Reimbursement Factor	39.92%	44.67%	39.92%	39.92%	41.56%	46.09%
MOC per generated journey	£0.08	£0.08	£0.09	£0.08	£0.09	£0.09
MCC per generated journey	£1.27	£1.27	£1.27	£1.27	£1.37	£1.27
Total Reimbursement per Passenger	£1.77	£1.82	£1.78	£1.77	£1.85	£1.84

6.3.5 In the urban part of a mixed urban and rural area, the operator modelled in this case study would receive £0.88 per concessionary passenger using the input parameters and the 2023/24 calculator. If the demand curve parameters of the calculator were altered as recommended, this would increase by 14.2% to £1.00. Operating cost changes results in only a 0.6% increase, while the changes to MCC, driven by the new service elasticity, decreases reimbursement by 2.8%. Changing the inflation and deflation indices used in DfT's calculator leads to a 3.8% increase, or £0.91 per concessionary journey. When combined, these changes result in a final expected reimbursement per passenger of £1.00.

Table 16. **Urban-Rural Mixed - Urban Key Outputs**

Parameter	Base	Demand Curve Adjustment	MOC	MCC	Inflation Adjustment	Combined
Classification	**Non-urban**	**Non-urban**	**Non-urban**	**Non-urban**	**Non-urban**	**Non-urban**
Average Fare Forgone	£2.00	£2.00	£2.00	£2.00	£2.00	£2.00
Reimbursement Factor	37.77%	44.67%	37.77%	37.77%	39.42%	46.09%
MOC per generated journey	£0.08	£0.08	£0.09	£0.08	£0.09	£0.09
MCC per generated journey	£0.11	£0.11	£0.12	£0.07	£0.11	£0.06
Total Reimbursement per Passenger	£0.88	£1.00	£0.88	£0.85	£0.91	£1.00

6.3.6 For operators claiming concessionary reimbursement in the rural part of a mixed area, the 2023/24 DfT calculator outputs £1.48 reimbursement per passenger for a typical operator. Adjusting the demand curve results in a 1.3% decrease in this reimbursement, at £1.46. Adjusting MOC parameters has negligible effect on reimbursement, while adjusting MCC parameters results in a 2% decrease. Altering the inflation and deflation indices in the calculator to include the composite index increases reimbursement by 2.8%, to £1.52 per concessionary passenger. The combination of all recommended calculator alterations leads to an estimated 0.7% decrease to per passenger reimbursement, at £1.47.

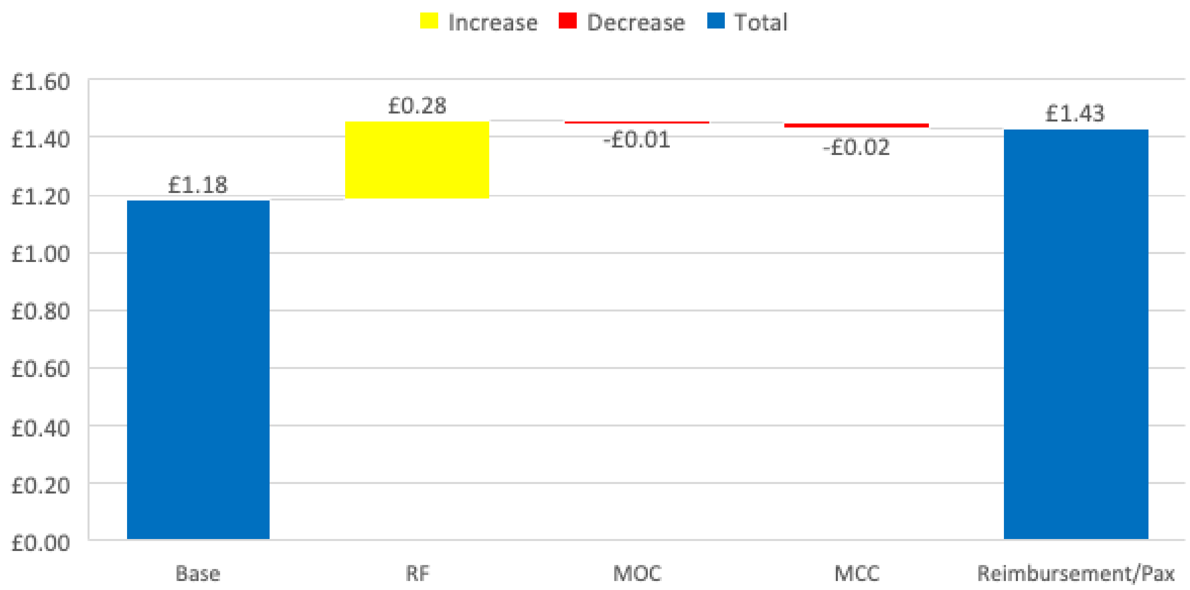
Table 17. **Urban-Rural Mixed - Rural Key Outputs**

Parameter	Base	Demand Curve Adjustment	MOC	MCC	Inflation Adjustment	Combined
Classification	**Non-urban**	**Non-urban**	**Non-urban**	**Non-urban**	**Non-urban**	**Non-urban**
Average Fare Forgone	£2.75	£2.75	£2.75	£2.75	£2.75	£2.75
Reimbursement Factor	45.50%	44.67%	45.50%	45.50%	47.10%	46.09%
MOC per generated journey	£0.09	£0.09	£0.10	£0.09	£0.10	£0.10
MCC per generated journey	£0.33	£0.33	£0.33	£0.27	£0.33	£0.28
Total Reimbursement per Passenger	£1.48	£1.46	£1.48	£1.45	£1.52	£1.47

6.4 Key conclusions

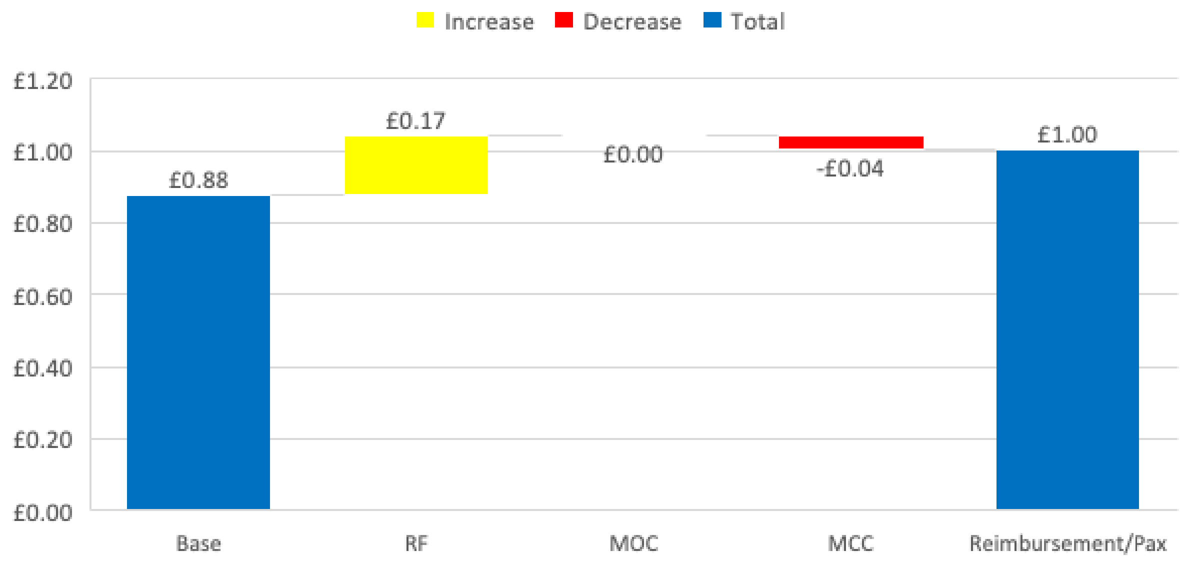
6.4.1 The test with the largest effect upon its case study was the combination of all recommended calculator changes being applied to the urban case study. The resultant 20.8% increase is driven by the change to the demand curve, with urban being the only case study to utilise the PTE demand curve and the updated urban demand curve. The below waterfall chart illustrates these changes, with the first bar representing per passenger reimbursement for the base case (i.e. the 2023/24 DfT calculator), the rightmost bar representing per passenger reimbursement for the test case, and the middle bars showing the effect to each reimbursement component in the test case.

Figure 18. Urban Combined



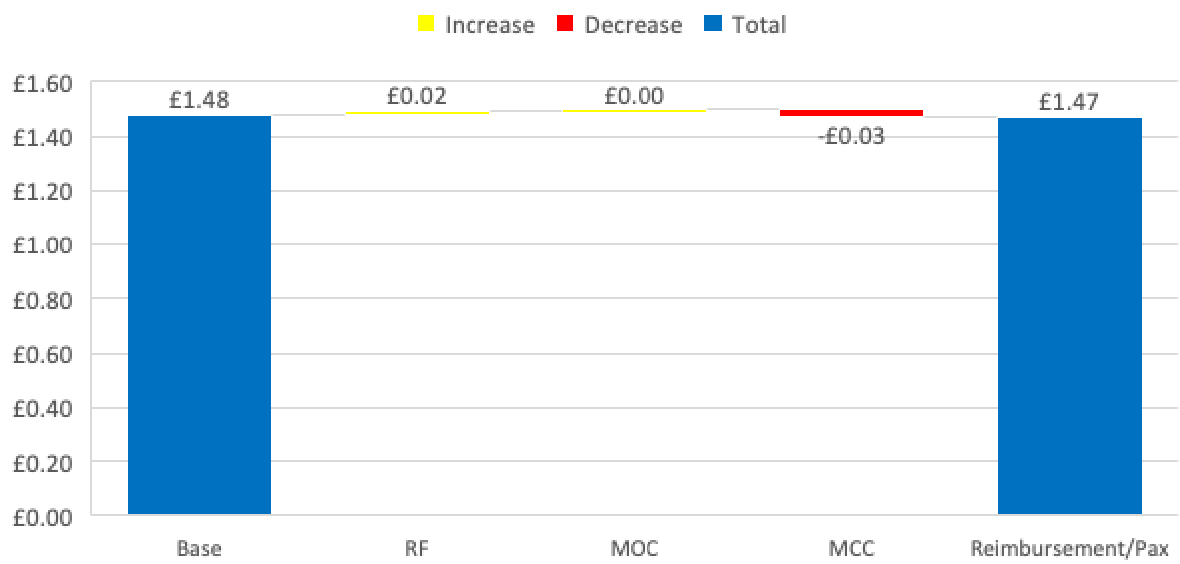
6.4.2 The next largest increase to reimbursement per passenger comes from applying the full suite of alterations to the mixed urban case study, causing a 14.4% increase in reimbursement. As with the urban case study, this is driven by the higher reimbursement factor, which in turn is caused by the demand curve changes. While this case study uses the non-urban parameters, and the new reimbursement factor itself represents an interaction between derived demand curve parameters and fares growth not relating to the case study, as discussed earlier in this section, this case study had a much lower reimbursement factor in the 2023/24 calculator than other studies using the same demand curve so experiences a larger increase.

Figure 19. **Mixed Urban Combined**



6.4.3 Unlike the other area types, applying all of the recommended updates to the calculator for mixed rural areas results in a small decrease to reimbursement on a per passenger journey basis. This is caused by a relatively high reimbursement factor in the 2023/24 calculator base case, which is only marginally increased in the new calculator. The decrease is caused by a lower rate of MCCs being compounded by a slightly lower generation factor.

Figure 20. **Mixed Rural Combined**



6.4.4 In all case studies, the MCC adjustments resulted in a decrease to reimbursement. This is because the higher service frequency elasticity drives a higher revenue gain for carrying extra passengers in the MCC calculations, reducing the net capacity cost. Adjustments to MOC calculations resulted in the smallest changes to per passenger reimbursement for all case studies apart from rural, increasing reimbursement by less than 0.6% for all case studies.

7 Recommendations and conclusions

7.1 Intoduction

7.1.1 A study has been conducted to review the processes and tools established to assist bus operators and Travel Concession Authorities (TCAs) in calculating reimbursement for carrying passengers eligible for the English National Concessionary Travel Scheme (ENCTS). This study has been informed by engagement with industry stakeholders, notably TCAs and bus operators, and a detailed review of the latest relevant literature available. New data about the use of the scheme has been obtained and processed to inform our recommendations.

7.1.2 The provisions of the ENCTS remain enshrined in law and unchanged – this requires that bus operators are left financially "no better and no worse off" as a result of carrying ENCTS passholders. To achieve this, operators are reimbursed for:

- the bus fares that would have been paid by passholders, for journeys that would have been made by bus even if payment of that fare would have been required (non-generated journeys); and
- the additional operating costs accrued by carrying passholders, for journeys that are only being made because no fare is charged (generated journeys).

7.1.3 This review has confirmed that the core processes established in 2009 to underpin the calculation of bus operator reimbursement remain fit for purpose. However, a number of changes are recommended for adoption, guided by the industry engagement described in Section 2, namely:

- Inputs and assumptions have been updated, supported by analysis of a wide range of data, including newer and more comprehensive datasets provided by TCAs and bus operators. This includes updated information on the generation factor to be applied to account for journeys only made because no fare is payable;
- The calculator provided to TCAs and bus operators has been refreshed to ensure it (i) includes all updated inputs and assumptions, (ii) is in accordance with modelling best practice, and (iii) operates more clearly and intuitively;
- New guidance has been developed hand-in-hand with the new calculator, aimed at improving the clarity and useability for all users.

7.1.4 In combination, these recommendations will mean the reimbursement process can be more easily understood by experienced practitioners and new users alike, providing tools for calculating reimbursement that are up-to-date, fit-for-purpose and easier to understand and follow.

7.1.5 The table below summarises which aspects of the current guidance are recommended for change, and which are recommended to retain in their current form.

7.1.6 The table below summarises the aspects of the approach to reimbursing operators that are, and are not, recommended for change following the analysis in this study. Further details are provided after the table.

Table 18. Recommendations

Aspect of reimbursement	Recommended for change or not
Operators reimbursed on NBNW basis	No (set in legislation)
"Shape" of the demand curve	No, but the distinction between "old" and "new" passholders should be removed which would simplify the calculations considerably
Number of demand curves	No, but recommend changing from PTE/non-PTE to urban/non-urban
Parameters of demand curves	Yes, to reflect latest evidence but building on the research conducted by ITS.
Methods to calculate AFF	No
Available lookup tables	Yes, to reflect latest evidence on concessionary passenger travel patterns
Inflation adjustments	Yes, by using CPI for deflating fares; and introduce bespoke cost index for increasing operator costs
Marginal Operating Costs	Yes, to reflect cost inflation
Marginal Capacity Costs and service frequency elasticity	Yes, to reflect cost inflation
Mohring factor	No

Annex A Literature review

A.1 Introduction

A.1.1 An evidence review was undertaken as part of the research. This was firstly to assess stakeholder views on concessionary reimbursement guidance and tools, and parts of these that needed to be reviewed and updated. A literature review was also undertaken looking at the available literature on elasticities, the findings of this review were considered as part of the economic analysis.

A.1.2 This annex summarises the available literature on elasticities, as of August 2023.The review included demand and vehicle-kilometres elasticities with respect to various relevant drivers (fares, income, journey time, and others). All of the studies identified used pre-pandemic data as there is inevitably a lag between an event occurring (such as the pandemic) and literature on the response to that being available, and we did not find evidence related to disabled people specifically. Both of these factors were key limitations of this review.

A.1.3 There is significant variation in estimated elasticities, due to differences in methods, data, and market segments between studies. Key drivers of variation are included in the table below.

Table 19. Drivers of variation between fare elasticity estimates

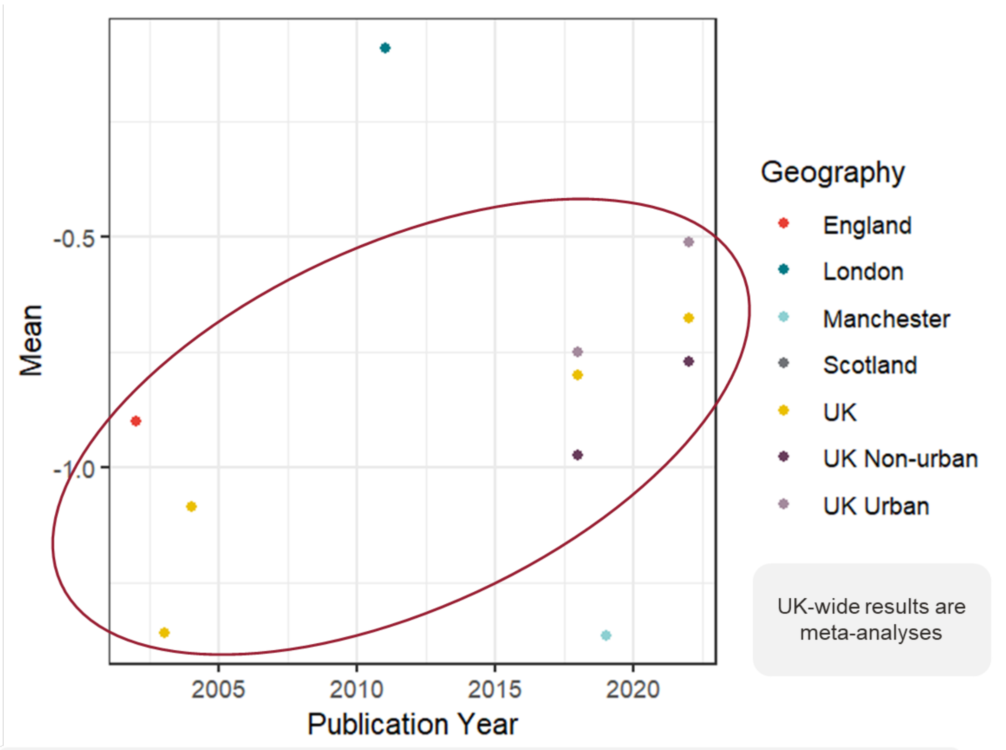
Driver of variation	Variation
Revealed preference vs. stated preference	Stated preference data tends to overestimate willingness-to-pay for services, and overstate the valuation of publicly-funded goods
Exogenous vs. endogenous source of fare variation; Macroeconomic conditions	Without an exogenous source of fare variation, there can be omitted variable bias. The direction of the bias depends on the situation, but typically endogeneity biases the elasticity toward 0. Upward shifts in real income tend to reduce fare elasticity
Short-run vs. long-run	A short-run elasticity may not include the entirety of the consumer reaction to a fare change, biasing the elasticity estimate toward 0.
National/regional/ district/ route level data	National data obscures fares variation, reducing precision Local data may not be nationally representative
Geographic area	Lower population density areas may have higher bus fare sensitivity, e.g. due to high car access
Journey purpose	Typically, leisure fare elasticity < commuting fare elasticity < business fare elasticity
Ticket types covered	Peak fare elasticity tends to be lower (in absolute magnitude) than off-peak fare elasticity; the elasticity for season tickets tends to be lower (in absolute magnitude) than for non-season tickets
Market segment (e.g. elderly or other concessionary groups)	Journey purpose and income effects introduce variation in elasticity between different market segments

Driver of variation	Variation
The set of other factors on which the elasticity is conditioned (factors that are held constant)	If the change in bus fares was a result of a driver that impacted other aspects of bus service and other mode changes, conditioning on those other transport service factors would affect the estimated elasticity
Sample size	All else equal, larger sample sizes will increase precision

A.1.4 Most of the available literature focused on fare elasticities, including several meta-analyses (e.g. Wardman 2022).[30] The literature has produced a very wide range of fare elasticity estimates. This is likely both due to (1) the difficulty of controlling for all factors affecting bus demand, leading to omitted variable and endogeneity biases, and (2) that demand elasticities tend to be highly sensitive to the parametric assumptions used in the study.

A.1.5 There is some evidence that UK-wide meta-analytic estimates of fare elasticities trended toward zero between 2005/6 and 2019. This is shown in the figure below. However different studies use different methods, and cross-study comparisons should be interpreted with caution.

Figure 21. Long run bus fare elasticity estimates



Due to differences between studies in methods and data, cross-study comparisons should be viewed as indicative

30 Wardman, M. Meta-analysis of price elasticities of travel demand in Great Britain: Update and extension. Transportation Research Part A: Policy and Practice, 158, 1-18 (2022).

A.1.6 Stephens (2022) points out that historical estimates of price sensitivity may overstate the sensitivity of passengers to price changes, as passengers today may have no other choice than paying higher prices, due to less choice of transport.[31] Evidence from a Cornwall pilot found that significant fare reductions (~40%) have so far generated less than 10% increase in demand, despite demand increasing as society emerged from Omicron.[32]

A.1.7 The literature on generalised journey time elasticity also has produced a wide range of estimates (-0.58 to -1.1). RAND/SYSTRA (2018) note that there is very little up-to-date evidence in terms of bus journey time elasticities, with little or no distinction by key factors such as journey purpose or type of area.

A.1.8 There was very limited evidence on service frequency elasticity.

31 Stephens, P. (2022) 'Proposals for ENCTS revision' [PowerPoint presentation].

32 Cornwall Council (2022) 'Minister praises Cornwall's bus fares pilot for cutting residents' travel costs'. Available at: www.cornwall.gov.uk/council-news/transport-streets-and-waste/minister-praises-cornwall-s-bus-fares-pilot-for-cutting-residents-travel-costs/

Table 20. Summary of fare elasticity sources

Parameter	Source	Source (short)	Interpretation of the parameter that is estimated	Numeric estimate	Lower/upper bounds for the estimate	Short / long run	Data used to estimate the parameter	Time period of the data used	Geographic scope of the data used	Passenger mix	
Fare	Balcombe, R., Mackett, R., Paulley, N., Preston, J., Shires, J., Titheridge, H., ... & White, P. The demand for public transport: a practical guide (2004).	Balcombe et al. (2004)	Price elasticity of bus travel demand: responsiveness of the quantity demanded of a good or service to a change in its own price	(0.42) short run (0.56) medium run (1) long run	(0.86) - (0.07) short run (0.61) - (0.51) medium run (1.32) - (0.85) long run	Short and long run	Operator ticket sales and surveys such as National Travel Survey (NTS)	Studies between 1980 and 2004	UK	Whole population	Meta-analysis of price elasticities
Fare	Dargay, J. M., & Hanly, M. (2002). The demand for local bus services in England. Journal of Transport Economics and Policy (JTEP), 36(1), 73-91.	Dargay (2002)	The change in bus patronage nationally as a result of a given "average" fare change	-0.4	NA	Short-run	Actual data on bus patronage (STATS100A database provided by the DETR) and preference surveys	1986 - 1996	England	All	Dynamic econometric model using time series and cross-section data
Fare	Dargay, J. M., & Hanly, M. (2002). The demand for local bus services in England. Journal of Transport Economics and Policy (JTEP), 36(1), 73-91.	Dargay (2002)	The change in bus patronage nationally as a result of a given "average" fare change	-0.9	NA	Long-run	Actual data on bus patronage (STATS100A database provided by the DETR) and preference surveys	1986 - 1996	England	All	Dynamic econometric model using time series and cross-section data
Generalised cost elasticity of demand	Department for Transport (2009) The Role of Soft Measures in Influencing Patronage Growth and Modal Split in the Bus Market in England, available at: http://assets.dft.gov.uk/publications/role-of-soft-factors-in-the-bus-market-in-england/report.pdf	DfT (2009)	Generalised cost elasticity of demand, used in the previous appraisal	-0.9	N/A	N/A	DfT data	N/A	GB	N/A	N/A
Journey time	DfT. TAG Unit M2: Variable Demand Modeling (2017). https://www.gov.uk/government/publications/webtag-tag-unit-m2-variable-demand-modellingmarch-2017	DfT. TAG Unit M2 (2017). https://www.gov.uk/government/publications/webtag-tag-unit-m2-variable-demand-modellingmarch-2017	Generalised journey time elasticity	-0.58	N/A	N/A	N/A	N/A	United Kingdom	N/A	N/A

Parameter	Source	Source (short)	Interpretation of the parameter that is estimated	Numeric estimate	Lower/upper bounds for the estimate	Short / long run	Data used to estimate the parameter	Time period of the data used	Geographic scope of the data used	Passenger mix	
Mohring effect	DfT. Evaluation of concessionary bus travel: the impacts of the free bus pass (2016)	DfT. Evaluation of concessionary bus travel (2016)	We use the assumption that new demand for bus travel from concessionary passengers leads to extra bus frequency supply at 60% of the new demand (known as the Mohring factor). https://www.gov.uk/government/publications/guidance-on-reimbursing-bus-operators-forconcessionary-travel	0.6	N/A	N/A	DfT data	N/A	England excl. London	N/A	N/A
Fare	GMCA (2019). Bus Franchising in Greater Manchester: Assessment September 2019	GMCA (2019)	How sensitive demand is to the price of a competing ticket, as well as how sensitive that demand is to the price of its own ticket	N/A	Commute: -0.65 Child school: -0.85 Leisure singles: -2.08 for own elasticity, 1.20 for cross elasticity Leisure periods: -0.98 for own elasticity, 0.21 for cross elasticity	Long-term	NA	NA	Manchester	All	Mark Wardman (SYSTRA) carried out a review of available evidence and recommended a set of elasticities to use.
Vehicle-km to passenger demand	Greener Journeys. The costs and benefits of concessionary bus travel for older and disabled people in Britain (2014)	Greener Journeys. The costs and benefits of concessionary bus travel for older and disabled people in Britain (2014) (2014)	Elasticity of vehicle kilometres to passenger demand	0.6	N/A	N/A	DfT data	N/A	GB	N/A	N/A
Fare	Jain, N. (2011). Assessing the impact of recent fare policy changes on public transport demand in London (Doctoral dissertation, Massachusetts Institute of Technology).	Jain (2011)	Own Fare Impact Elasticity: short term (or immediate change) in demand from an increase in own model fares.	-0.26	From -0.29 to -0.24	Short-term	Different kinds of data (Travelcards, Oyster, Oyster PayG)	2008-2010	London	All	Annual difference semi- logarithmic models,

Parameter	Source	Source (short)	Interpretation of the parameter that is estimated	Numeric estimate	Lower/upper bounds for the estimate	Short / long run	Data used to estimate the parameter	Time period of the data used	Geographic scope of the data used	Passenger mix	
Fare	Jain, N. (2011). Assessing the impact of recent fare policy changes on public transport demand in London (Doctoral dissertation, Massachusetts Institute of Technology).	Jain (2011)	Own Fare Smoothed Elasticity - The medium term change in demand due to an increase in own mode fares, where medium term represents the approximate change in demand happening within one year of a fare change, irrespective of change in other mode fares. In the model, smoothed earnings deflated fare indices were used for bus and underground.	-0.04	From -0.13 to -0.05	Medium-term (1 y)	Different kinds of data (Travelcards, Oyster, Oyster PayG)	2008-2010	London	All	Annual difference semi- logarithmic models
Fare	Kholodov et al.: Public transport fare elasticities from smartcard data: Evidence from a natural experiment (2021)	Kholodov et al. (2021)	Fare elasticity is defined as the percentage change in public transport demand after a one percent change in the fare, under the assumption that all other factors are kept constant.	− 0.46	Overall: -0.86 to -0.07 Regular users are more sensitive than sporadic users to the fare policy (elasticity − 0.46 versus − 0.29)	Short-term	Public transport smartcard data	2016-2017	Stockholm	Stockholm County population	We extract direct fare elasticities from disaggregate smartcard data. The process consists of two main steps: extracting a travel diary of journeys for each individual card (the card id is persistent in the dataset throughout the analysis period) and associating each card with sociodemographic information collected for small census zones.
Income elasticity	Paulley et al: The demand for public transport: the effects of fares, quality of service, income and car ownership. Transport Policy, Volume 13, (2006)	Paulley et al (2006)	Elasticity of bus demand with respect to income	-0.35	(0,-0.7) is range found among different studies	Short run (long run information also available in same study	Summary of UK studies	N/A	UK	All	Various

Parameter	Source	Source (short)	Interpretation of the parameter that is estimated	Numeric estimate	Lower/upper bounds for the estimate	Short / long run	Data used to estimate the parameter	Time period of the data used	Geographic scope of the data used	Passenger mix	
Fare	Mackie, P: Concessionary Fares Project. Report 2: Issues Relating to Average Fare. University of Leeds/ Institute for Transport Studies (2014)	Mackie et al. (2014)	Elasticity not estimated	N/A	N/A	N/A	Now Card data; ticket prices; 912 interviews	June-July 2013	England (Edinburgh, Cardiff, Norwich, Manchester and Leeds)	Unemployed population	N/A
Fare	RAND/SYSTRA: Bus fare and journey time elasticities and diversion factors for all modes. A rapid evidence assessment (2018)	RAND/Systra (2018)	Fare price elasticity	(0.7) - (0.9)	Depends on type of journey (communite, leisure) and urban / london and rural	Short and long run	Results of various studies (1999 - 2014)	Since 1999	Mostly UK, also Europe, USA, Canada, Australia, New Zealand	All	Rapid-evidence review process (systematic literature search and use of existing databases and networks)
Generalised journey time	RAND/Systra: Bus fare and journey time elasticities and diversion factors for all modes. A rapid evidence assessment (2018)	RAND/ Systra:	Generalised journey time elasticity (The journey time might be the overall journey time, in-vehicle time (IVT), walk time or wait time, or indeed some weighted aggregation of the three components of overall journey time into a composite term commonly referred to as Generalised Journey Time (GJT))	-1.1	Commute -1.15 Leisure -1.05	There is some uncertainty as to whether the elasticity is short run, long run or is essentially indeterminate	based on a small amount of evidence largely from the 1990s	based on a small amount of evidence largely from the 1990s	Mostly UK, also Europe, USA, Canada, Australia, New Zealand	All	Rapid-evidence review process (systematic literature search and use of existing databases and networks)
Journey time (in-vehicle time)	RAND/Systra: Bus fare and journey time elasticities and diversion factors for all modes. A rapid evidence assessment (2018)	RAND/Systra: Bus f (D.ourney time (in-vehicle tim.)	Change in demand from change in time in vehicle IVT elasticity = fare elasticity * value of time *(IVT/fare)	–0.60	(0.55) and (0.65) based on a meta-analysis	Long run	based on a small amount of evidence largely from the 1990s	based on a small amount of evidence largely from the 1990s	Mostly UK, also Europe, USA, Canada, Australia, New Zealand	All	Rapid-evidence review process (systematic literature search and use of existing databases and networks)
Fare	Review of fare elasticities in Great Britain (2003)	Wardman et al. (2003)	Fare elasticities	UK, short run: -0.36 UK, long run: -0.70 UK, off peak, sr: -0.40 UK, peak, sr: -0.30	UK, short run: -0.36 UK, long run: -0.70 UK, off peak, sr: -0.40 UK, peak, sr: -0.30	Long and short run	41 studies and 305 values	Studies between 1951 to 2002	United Kingdom	N/A	Meta-analysis

Parameter	Source	Source (short)	Interpretation of the parameter that is estimated	Numeric estimate	Lower/upper bounds for the estimate	Short / long run	Data used to estimate the parameter	Time period of the data used	Geographic scope of the data used	Passenger mix	
Income elasticity	The income elasticity of the value of travel time savings: A meta-analysis		Elasticity of (value of travel time savings) with respect to income	0.259	Standard deviation of estimates: 0.199	Stated Preference surveys	Summary of 85 UK studies	1968-2019	UK	All	Meta-analysis of Stated Preference surveys
Fare	Transport Scotland: Scotland-wide Older and Disabled Persons Concessionary Bus Scheme - Further Reimbursement Research	Transport Scotland (n.a.)	The sensitivity of demand to fares	(0.29) compromise value	(0.318) MVA/ Minnerva Preferred values (0.267) CPT	Long run	Confederation of Passenger Transport - Scotland (CPT) data	Pre and post Oct 2002, when the policy was introduced	Scotland	All	N/A
General	Victoria Transport Policy Institute: Understanding Transport Demands and Elasticities (2022)	Victoria Transport Policy Institute (2022)	Price sensitivity is the percentage change in a good's consumption caused by each one-percent change in its price or other characteristics such as travel speed or transit service.	Many, but non UK specific	Many, but non UK specific	N/A	More of an introduction to what the concepts mean, various data sources	N/A	Global	N/A	Demand model
Generalised journey time	Wardman, M. Meta-analysis of British time-related demand elasticity evidence: An update. Transportation Research Part A: Policy and Practice, 157, 198-214 (2022)	Weneralised journey tineralised journey timdmeneralised journey tin et al. (2022)	Mean time and headway elasticities implied by the GJT elasticity.	(0.40) - (0.84) Bus time Trips (0.36) - (0.28) Bus Headway trips	Bus time trips: Urban Commute: -0.50 Urban Leisure: -0.40 Inter-Urban Leisure: -0.84 Bus Headway trips: Urban Commute: -0.34 Urban Leisure: -0.28 Inter-Urban Leisure: -0.36	Long run implied elasticities	102 British studies published between 1977 and 2020	102 British studies published between 1977 and 2020	United Kingdom	N/A	Meta-analysis of British elasticity evidence
Fare	Wardman, M. Meta-analysis of price elasticities of travel demand in great britain: Update and extension. Transportation Research Part A: Policy and Practice, 158, 1-18 (2022).	Wardman et al. (2022)	Price elasticity of bus travel demand: responsiveness of the quantity demanded of a good or service to a change in its own price	(0.28) - (0.91), depending on the type of passanger	(0.63) rural (0.44) urban (0.74) on cencession urban (0.28) concession urban (0.91) all	Long run implied elasticities	204 British studies	Data from studies published between 1968 and 2020	United Kingdom	Bus passangers	Meta-analysis of price elasticities

Parameter	Source	Source (short)	Interpretation of the parameter that is estimated	Numeric estimate	Lower/upper bounds for the estimate	Short / long run	Data used to estimate the parameter	Time period of the data used	Geographic scope of the data used	Passenger mix	
Journey time	Wheat & Toner: Concessionary Fares Project - Research Report 8 Whole market demand elasticity variation. Institute for Transport Studies	Wheat & Toner (udies	Wheat, P and Toner, J.P (2010) Whole market demand elasticity variation, Concessionary Fares Project, Research Report 8. Institute for Transport Studies, University of Leeds.	N/A	N/A	N/A	STTA100A (DfT database)	N/A	England	N/A	N/A
Fare	WSP Parsons Brinckerhoff: Youth Concessions Research. Price Elasticity of Bus Travel Demand (2016)	WSP Parson (2016)	Price elasticity of bus travel demand: responsiveness of the quantity demanded of a good or service to a change in its own price with all other factors remaining constant	N/A	(3.2) to (0.7) Difference by age group (3.35) to 1.44 Difference by age group	Long run elasticities	Analysis of National Travel Survey data; ticket/ pass data (ticket price, passes on issue, number of journeys made)	2011-2016 (implied)	England (minus South West, East of England, East Midlands, Yorkshire and the Humber, North West)	16-25 people	Seasonal differences model as used by Kennedy (2013), long term elasticity
Journey time	WYCA/Steer: WY Stated Preference Research Final Report (2017)	WCYA/Steer (2017)	Willingness to pay (minutes per passenger for concessionary passangers)	12.4 (min per passenger)	14.1 - 12.4 min range by operator 10.7 - 18.5 min by boarding point	No elasticities computed	Survey (including online panel, postcard and face to face)	14th January and 30th January 2017	West Yorkshire	850 fare paying passengers + 292 concessionary passangers (over 16 and who used a bus to travel within the region in the last month)	Stated Preferences
Fare	WYCA/Steer: WY Stated Preference Research Final Report (2017)	WYCA/Steer (2017)	Willingness to pay (pounds per paying passengers, and minutes per passenger for concessionary passangers)	0.26 (pounds per passanger)	£0.25 - 0.27 by journey purpose: people WTP more for leisure purposes vs non-leisure £0.21 - 0.29 by frequency: frequent users WTP is higher than infrequent users £0.22 - 0.239 by boarding point: with passengers boarding in Calderdale WTP more £0.24 - 0.28 by operator	No elasticities computed	Survey (including online panel, postcard and face to face)	14th January and 30th January 2017	West Yorkshire	850 fare paying passengers + 292 concessionary passangers (over 16 and who used a bus to travel within the region in the last month)	Stated Preferences

Annex B NTS econometrics and Derivation of Demand Curves

B.1 Introduction

B.1.1 Reimbursement of bus operators is divided into two elements: revenue forgone and net additional costs.

B.1.2 Revenue forgone is the reimbursement of fares that operators would have received from concessionary journeys that would have been made in the absence of a scheme.

B.1.3 The proportion of observed concessionary journeys that are made purely because of the concession are referred to as ‘generated journeys’. Calculating concessionary travel reimbursement is predicated on determining what would have happened in the absence of the concessionary scheme.

B.1.4 One of the tasks in this project is to estimate the effect of ENCTS eligibility on bus journey making. This task contributes to the analysis of the concessionary reimbursement, and the value for money of the statutory scheme. In essence, we are tasked with estimating the number of ‘generated journeys’ which have occurred purely because of the concession.

B.1.5 The generation factor is the proportion of the observed concessionary journeys that would not have been made at the prevailing commercial fares in the absence of the ENCTS. This definition involves a counterfactual scenario (no ENCTS exists) that has not been (and cannot be) observed.

$$\text{Generation factor} = \frac{[(\text{Observed concessionary journeys}) - (\text{Estimated journeys that would have been made at commercial fares})]}{(\text{Observed concessionary journeys})}$$

B.1.6 The demand for travel in the current calculator is currently based on fares from 2005/06 or studies from 2008/09. COVID-19 has affected bus usage, particularly amongst older people, and there has been a substantial length of time since the previous research was conducted. This is in addition to wider societal factors that may have had an impact on bus usage. Additionally, the demand curves are unobservable and so if there is a data-based way of assessing the generation factor, then this is desirable in – at a minimum – adding another point of evidence and, potentially, reducing the complexity of the calculator.

B.2 Objectives and approach

B.2.1 In this annex, we present a theoretical model which can be used for such a calculation, explore the relevant data which is needed to empirically run this model, and assess the accuracy of the results this model generates. We also present, in our conclusion, the limitations any interpretations drawn from our work.

B.2.2 We consider the data available in the National Travel Survey (NTS) to provide a useful level of information to understand how the bus journey rate varies by:

B.2.3 Possession of a concessionary pass (i.e. older people and disabled users); and

B.2.4 Other demographic and personal characteristics that are thought to drive bus usage (e.g. income, region, etc).

B.2.5 We seek to estimate the effect that the ENCTS has on the number of bus stage-level journeys taken by eligible persons. While this may initially seem like a simple exercise of counting journeys taken by people with a concession pass, this is not an accurate approximation.

B.2.6 To find the effect that the concession has on bus journeys for eligible persons, we need to find the expected number of journeys that the concessionary group would have taken if the concession did not exist.

B.2.7 Inversely this also means the effect of the concession can be found by removing from the total number of concessionary journeys, the expected number of those journeys which would have taken place without the concession, leaving only those that took place because those passengers had a concession available.

B.2.8 This approach relies on the following assumptions:

- The NTS contains demographic/household/personal characteristics about users that predict bus usage well.[33] If the concession did not exist, the concession criteria (age, disability) would not add any predictive power about bus usage to the predictive power of these other characteristics;
- The travel behaviour of passengers who are not eligible for a concession is not dependent on the existence of the concession. This means that the passengers who are not eligible for a concessionary pass do not change their travel behaviour due to the existence of the pass or the trends in the use of the pass;

33 In the sample used for the econometric analysis, only data for people over 50 is used to reduce the differences between the concessionary and non-concessionary groups.

B.2.9 The sample of NTS data available to us are representative of all bus passengers in England, and the results of analysis of these data can be generalised to the population.

B.3 Theory behind our model

B.3.1 We know that there is a concession for a particular demographic group, $c(D^{+})$. The concession we are looking into is applicable for elderly and disabled persons, who are thus the demographic group in the term above.

B.3.2 From the NTS data, we know the number of concessionary journeys (per week, as they are recorded in the NTS data) that occurred with the concession in place $J_{c(D+)=1}$. We do not observe $J_{c(D+)=0}$, which represents the number of journeys of the concessionary group that would have taken place in absence of the concession.

B.3.3 The generation factor can be estimated as:

$$g_{c(D+)} = 1 - \frac{E(j_{D+}|c(D^{+}) = 0)}{E(j_{D+}|c(D^{+}) = 1)}$$

B.3.4 Or to put it into words, the generation factor is one minus the ratio of the expected number of journeys among the concessionary group if the concession does not occur, to the expected number of journeys among the concessionary group if the concession does occur.

B.3.5 We need to estimate the function $E(j_{D+}|c(D^{+}))$: the expected number of journeys conditional on whether the concession occurs.

B.3.6 The first identifying assumption is that there exists a separate set of demographic information h such that, if the concession does not exist, then journeys are independent of the concession criteria d conditional on h:

$$p(j|c(D^{+}) = 0, h) \perp\!\!\!\perp d$$

B.3.7 In other words, if we know other personal characteristics (employment status, education status, income, car ownership, health status, geographic location, other household occupants, active journey rates) then the concession group eligibility criteria (age, disability status) do not add information about the passenger’s travel behaviour in the case that the concession does not exist.

B.3.8 Under this assumption,
$E(j_{D+}|c(D^{+}) = 0, d) = E(j_{D+}|c(D^{+}) = 0,h)p(h|d)$

And also, for a given socio-demographic group h':

$E(j_{D+}|c(D^+) = 0, h')p(h'|d') = E(j_{D+}|c(D^+) = 0, h')p(h'|d'')$,
$d' \in D^+$ and $d'' \in D^-)$, [A]

B.3.9 The second identifying assumption is that if the passenger is not eligible for the concession, their travel behaviour is the same regardless of whether the concession did not exist or did exist:
$E(j_{D+}|c(D^+) = 0,d) = E(j_{D+}|c(D^+) = 1,d) = \forall\ d \in D^-$ [B]

B.3.10 Combining [A] and [B]: The expected number of journeys for an individual who is eligible for the concession, in the unobserved case where the concession did not exist is equal to the expected number of journeys of an individual with the same socio-demographic characteristics h′ who is not eligible for the concession, in the observed case where the concession does exist.

$$E(j_{D+}|c(D^+) = 0, d')$$
$$= E(j_{D+}|c(D^+) = 0, h' \notin D^+)\, p(h'|d')$$
$$= E(j_{D+}|c(D^+) = 1, h' \notin D^+)\, p(h'|d'),\ d' \in D^+$$

B.3.11 In order to pool data across years, we must make an additional assumption that journey-making behaviour is the same across years among people in our sample with characteristics such as age, health, income, employment status, etc. This essentially means that we are assuming that, for example, an individual aged 58 with no disabilities and an income between £25,000 - £50,000 would have the same journey-making behaviour in 2012 as another person with those same characteristics would have in 2017.

B.3.12 The generation factor can then be estimated in two ways:

- Approach 1: Subset the data to the group D^- that were not eligible for the concession, and estimate a regression of journeys on demographic characteristics h that do not include the eligibility criteria variables (vector of personal characteristics). Subset the data to the concessionary population of interest D^+.
  Use the regression to perform an out-of-sample prediction of the number of journeys that the concessionary population would have taken in absence of the concession, $E(j_{D+}|c(D^+) = 0)$.
  The factual journeys $E(j_{D+}|c(D^+) = 1)$ are observable, so we can estimate
  $$g_{c(D+)} = 1 - \frac{E(j_{D+}|c(D^+) = 0)}{E(j_{D+}|c(D^+) = 1)}$$
  .
- Approach 2: Conduct a regression $\ln(j_i) = \beta_0 + \beta_1 D_i^+ + \beta_{2:k} x_{2:k,i} + \epsilon_i$, where j is the number of bus journeys, D^+ is an indicator for disability eligibility, and $x_{2:k}$ is a vector of other personal characteristics and β_1 is the percentage increase in bus journeys due to the concession $\frac{E(j_{D+}|c(D^+) = 1)}{E(j_{D+}|c(D^+) = 0)}$, so $g_{c(D+)} = 1 - \frac{1}{\beta_1}$.

B.4 Data

B.4.1 As mentioned above, we rely on data from the National Travel Survey (NTS) for our analysis.

B.4.2 The National Travel Survey (NTS) is a household survey of personal travel by residents of England travelling within Great Britain, from data collected via interviews and a seven-day travel diary, which enables analysis of patterns and trends. The survey also collects information on how, why, when and where people travel as well as factors affecting travel (for example, car availability).

B.4.3 The NTS is designed to provide a representative sample of households in England and is based on a stratified two-stage random probability sample of private households. The sample design employs postcode sectors as Primary Sampling Units (PSUs), and then by selecting addresses within PSUs.

B.4.4 We have divided this section into a summary of the data source used, and a description of some of the key variables in the data which we use in our analysis below.

Summary of data available

B.4.5 NTS data are collected at the level of the PSU, household and the individual. But data are also collection on topics such as attitudes, long distance journeys, the days of journeys, vehicles, trips, stage of a journey, and tickets. All categories/cuts of the data can be linked back to the PSU, household, and individuals.

B.4.6 The NTS is conducted annually, and we use Special Access data from 2010-2021, covering England to build our sample. There was an average of 33,300 individuals surveyed annually in 2010-2019. In 2020 and 2021 the sample was substantially smaller (13,800 and 21,600 respectively). Not all of these individuals are bus users, and the sample of older users is significantly smaller. After restricting the data to individuals aged over 50, we are left with a sample size of 75,391 individuals over the years 2010-2021. At the time this analysis was being conducted, 2022 data was not available.

B.4.7 The NTS is designed to provide a representative sample of households in England and was based on a stratified two-stage random probability sample of private households. The sampling frame was the ‘small user’ Postcode Address File (PAF) – a list of all addresses (delivery points) in the country, grouped into postcode sectors (the primary sampling unit). Since NTS2015, the first stage of the sample stratifies by a regional variable (30 NUTS2-based regions), an urban/rural indicator, car ownership, and since 2021 a working from home indicator. The sampling design supports analysis at the NUTS2 level.

B.4.8 The NTS includes a weighting of the data to account for non-response bias. In our regressions, we use a combination of two of the six weights available in the data: the weights for household-level non-participation (w2), and the weights for exclusion of participating households at which not every individual completed the survey (w3).

B.4.9 The type of concessionary pass held can be identified in the data (we only consider individuals with a concessionary pass as a result of age or disability as members of the concessionary group relevant to our analysis).

B.4.10 Responding households are asked to record their travel history during a specific week, and thus all the travel data in the NTS in on a weekly basis. Analysis of travel data is based on the diary sample. This comprises all 'fully cooperating households', defined as households for which the following information is available: a household interview, an individual interview for each household member, a 7-day travel diary for each individual and, where applicable, at least one completed vehicle section. Analyses at household, individual and vehicle level presented in this publication are based on the interview sample.

B.4.11 In the NTS, the basic unit of travel is a trip, which is defined as a one-way course of travel with a single main purpose. Outward and return halves of a return trip are treated as two separate trips. A trip consists of one or more stages. A new stage is defined when there is a change in the form of transport or when there is a change of vehicle requiring a separate ticket.

B.4.12 Since a trip can consist of multiple stages with multiple modes of transport, we conduct our analysis at the 'stage' level so as to focus on all bus journeys made by respondents.

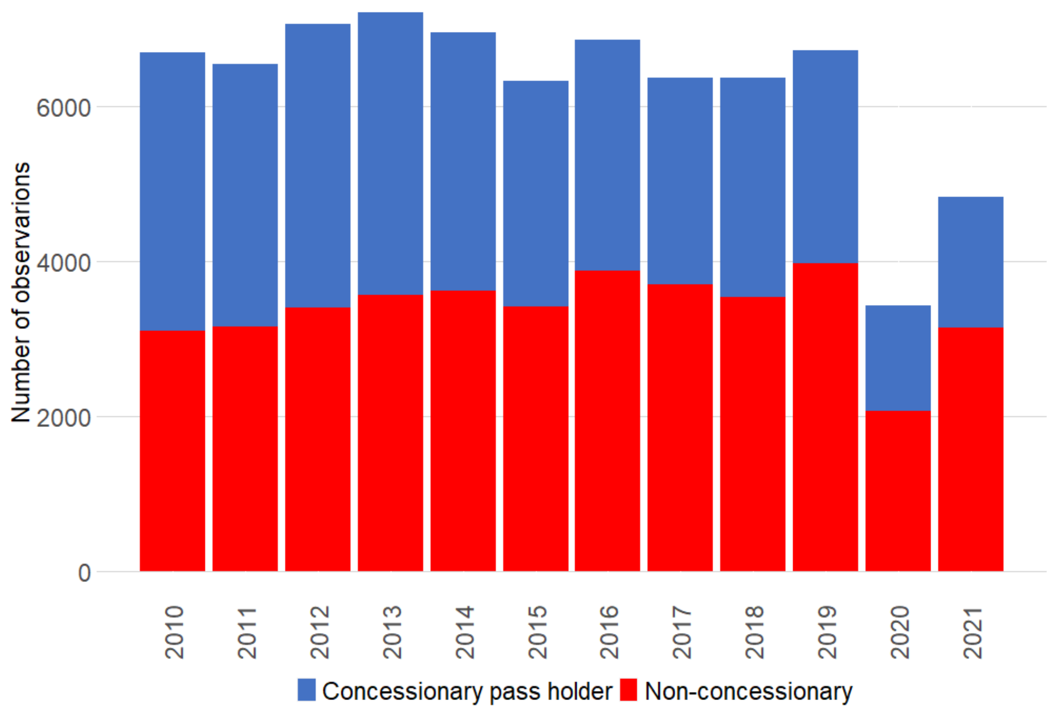
B.4.13 The length of any trip stage is the distance actually covered, as reported by the traveller, and not the straight-line distance.

Summary of key variables which we control for in the regression analysis

B.4.14 We limit the sample to respondents who reside in England. We further limit the sample to individuals aged over 50, to reduce the differences between the concessionary and non-concessionary population. In the chart below we present the distribution of the sample across years, divided into their concessionary pass status.

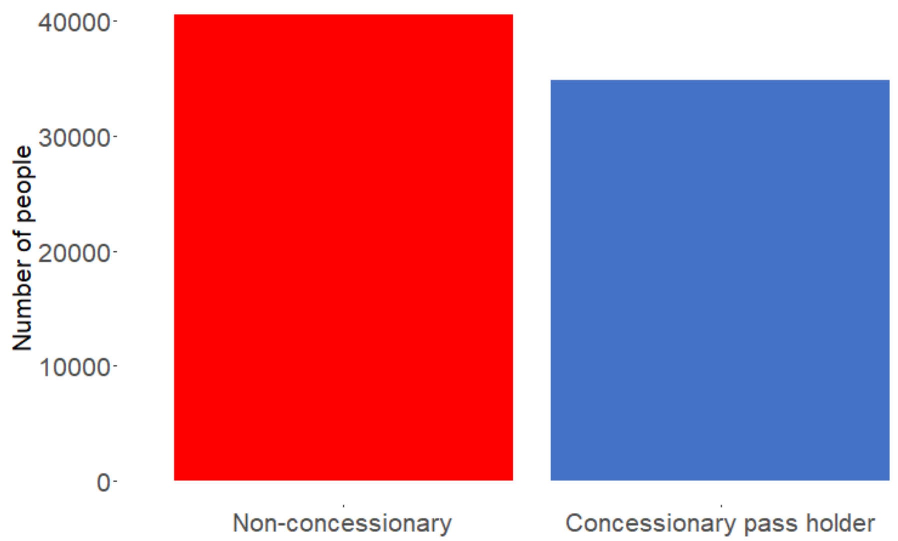
B.4.15 The smaller sample sizes in 2020 and 2021 are due to the coronavirus (COVID-19) pandemic from March 2020. The sample size after data cleaning (more than 75,000 observations as stated above) is large enough for econometric analysis.

Figure 22. Observation of concessionary/non-concessionary groups



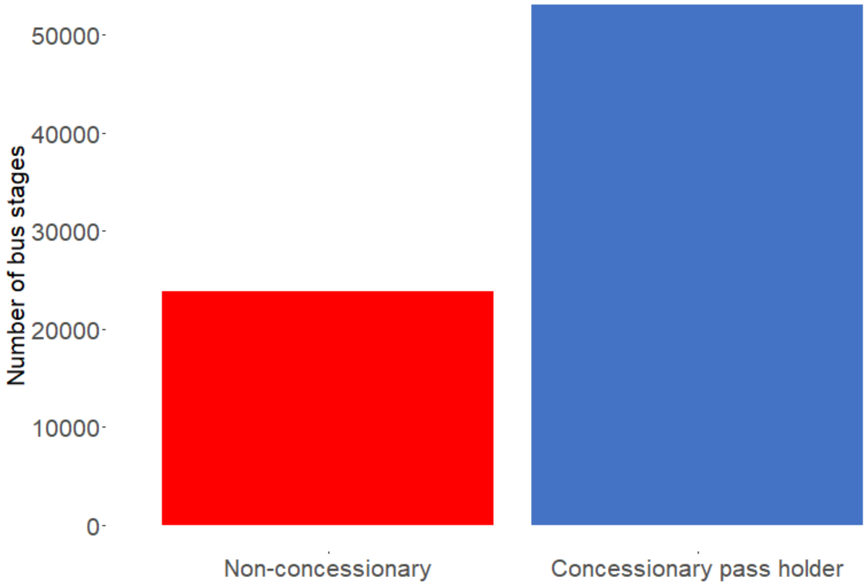
B.4.16 Breaking down the data into the total number of people in the concessionary and non-concessionary groups informs us that the treatment and control groups in our sample are broadly of the same size.

Figure 23. Number of concessionary/non-concessionary users



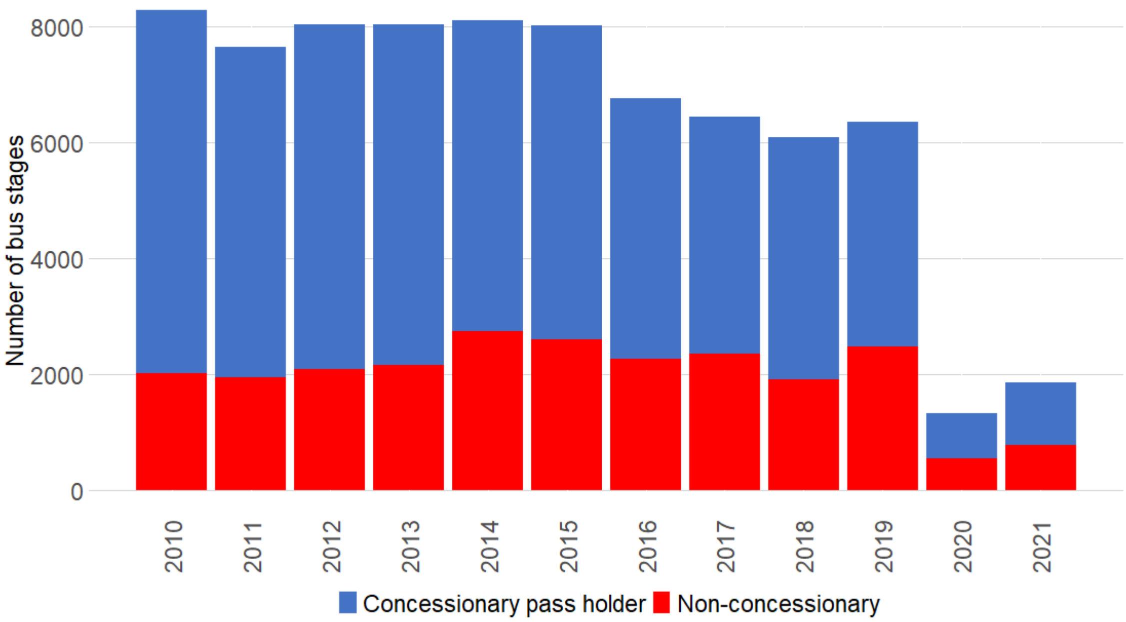
B.4.17 While the number of people in the non-concessionary and concessionary groups are broadly similar, the total number of bus stage-level journeys taken by individuals in these groups are different. Individuals in the concessionary group take far more bus stage-level journeys than those in the non-concessionary group. Note that this is after individuals under the age of 50 and living outside of England are removed from the data.

Figure 24. Number of bus stages for non-concessionary/concessionary users



B.4.18 The distribution of the total bus stage-level journeys for the two groups across years highlights these differences in more detail. It also better represents the drop off in travel that took place in 2020 and 2021 within our data due to the COVID-19 pandemic.

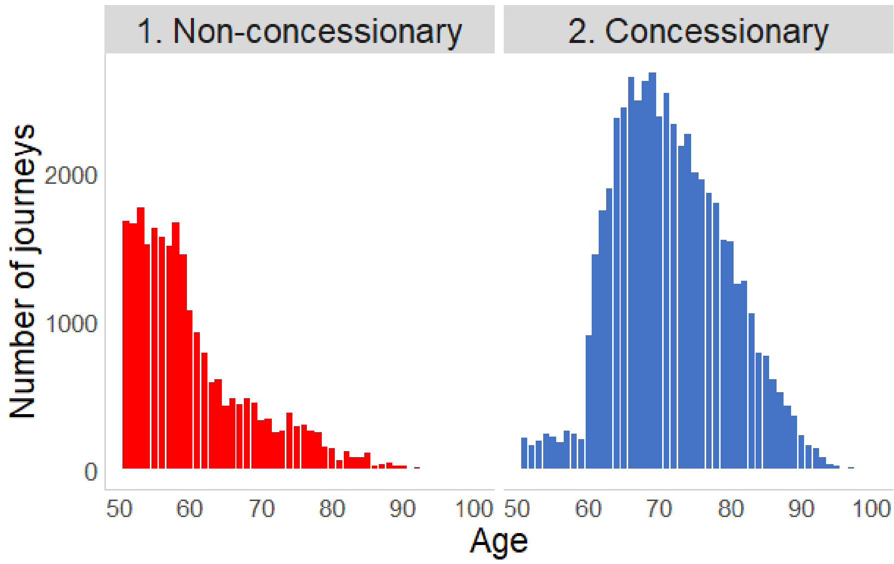
Figure 25. Number of bus stages for non-concessionary/concessionary users by year



B.4.19 Note that especially in the years 2020 and 2021 the total number of bus stages will be lower than the number of individuals in the survey for those years in our data because many of those individuals would have taken zero bus journeys. As a result of the pandemic, the number of people taking zero bus journeys would have been higher in these years.

B.4.20 The distribution of bus usage by age and concessionary pass status shows that the total number of bus stage-level journeys are different on the basis of concessionary pass status. Older people are more likely to have a concessionary pass and thus have a higher number of total journey.

Figure 26. Number of journeys made by non-concessionary/concessionary users



B.4.21 To explore the extent of the similarities between the concessionary and non-concessionary group, we focussed on variables that could have high explanatory power in a regression of concessionary pass status and personal characteristics on the number of bus stage-level journeys.

B.4.22 While there are slightly more people in the non-concessionary group than in the concessionary group, breaking down these data further by economic activity status shows that while the share of inactive and active individuals in the non-concessionary group are similar, that is not the case in the concessionary group. Aggregating the total number of weekly bus stages by economic activity status and concessionary pass status also reveals the inactive individuals in the concessionary group using buses far more frequently. These results are intuitive on account of there being older people in the concessionary group, who are more likely to be economically inactive. The average bus stages per person are always higher for the concessionary group than the non-concessionary group, with the former number around three times larger than the latter. The average person in the concessionary group are thus more likely to take bus stage-level journeys than the average person in the non-concessionary group. The average economically inactive concessionary passholder takes slightly more bus stage-level journeys than the economically active person.

Figure 27. Number of people in the data by economic activity status

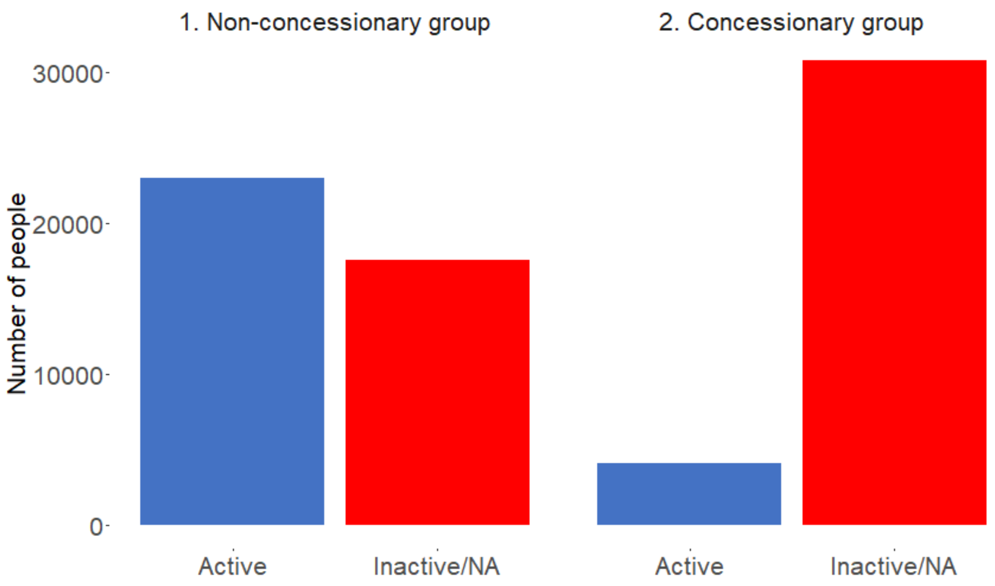


Figure 28. Number of bus stages by economic activity status

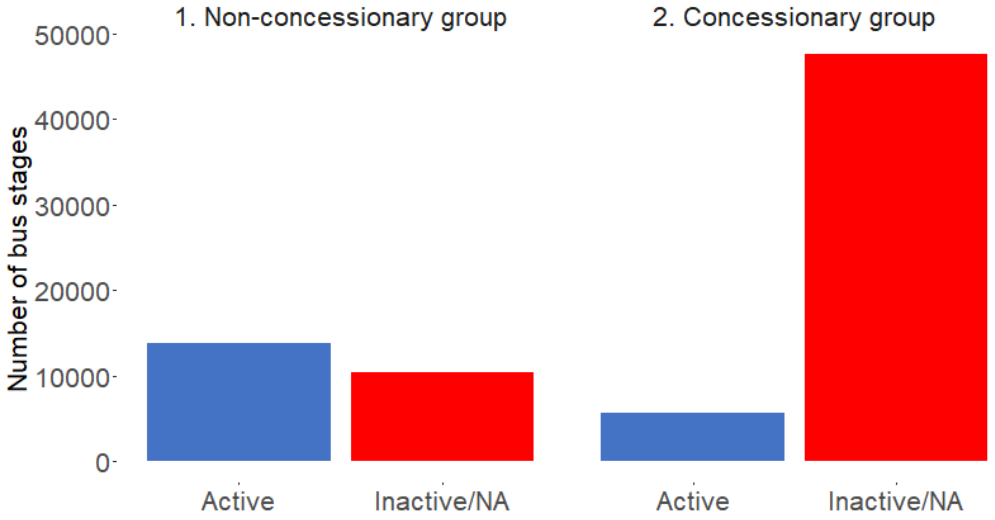
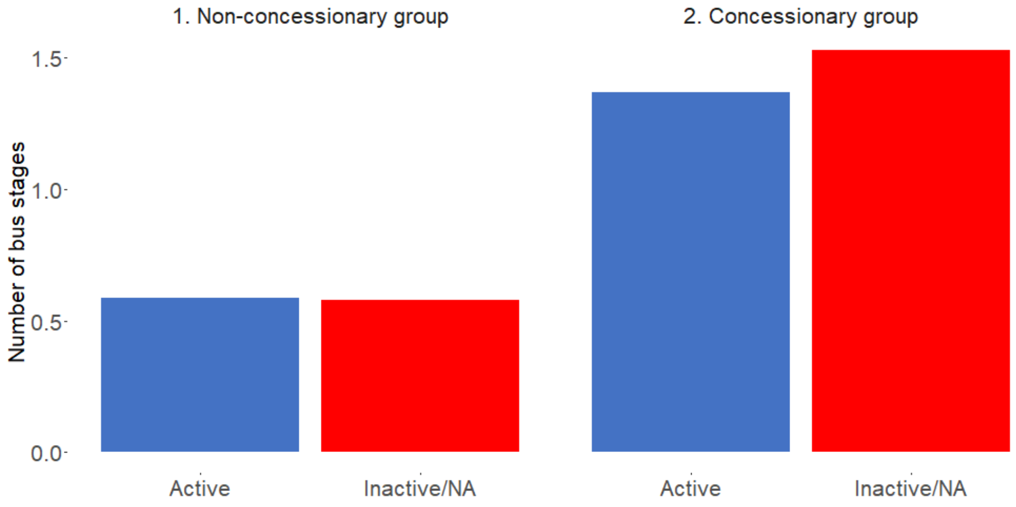


Figure 29. Average bus stages per person by economic activity status



B.4.23 Breaking down the number of people in the concessionary and non-concessionary groups by income bands reveals a broadly similar pattern within the two groups - a large number of people with individual incomes below £25,000 and fewer people with higher incomes. While there are more people with incomes above £25,000 in the non-concessionary group, the distribution is largely similar between the two groups - especially with respect to people with incomes below £25,000. When these data are re-aggregated to show the total weekly bus stages for these groupings, a different pattern emerges. We see that lower income people in the concessionary group take far more bus stage journeys than any other sub-group. Since concessionary status is not dependent on income level, these results help us confirm the intuition that income may be a powerful determinant of bus usage. When we look at the average number of bus stages taken across concessionary status and income groups, we see that the average person in the concessionary population across all income groups takes more bus stage-level journeys than the average person in the non-concessionary group.

Figure 30. Number of bus stages taken by income group

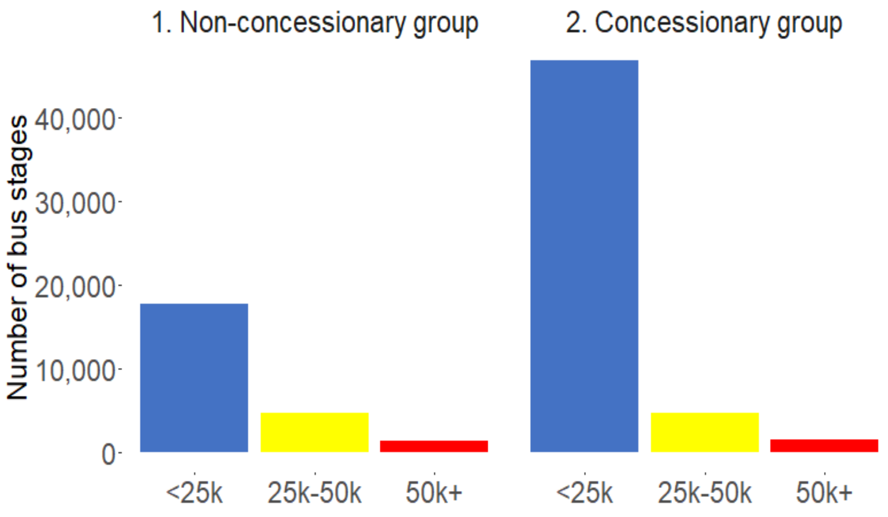


Figure 31. Number of people by income group

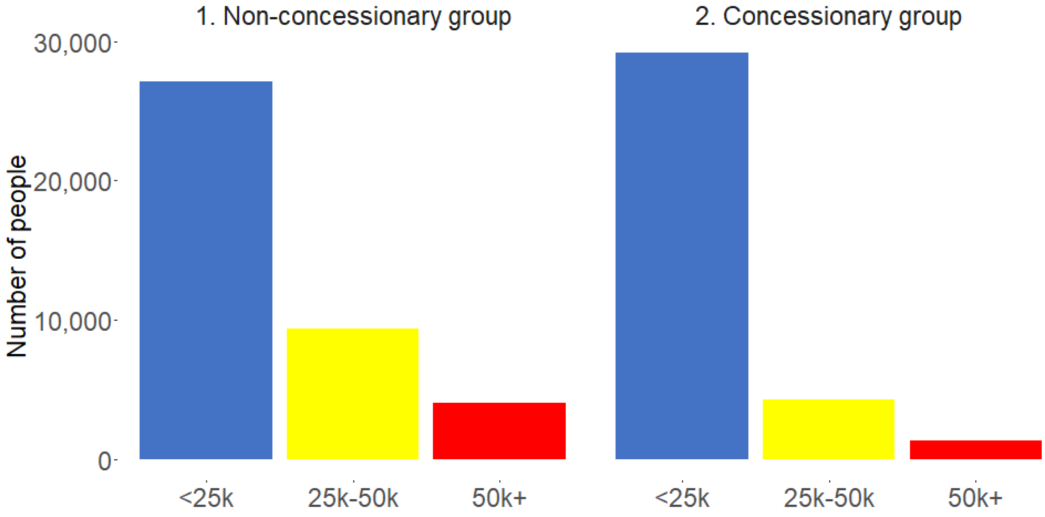
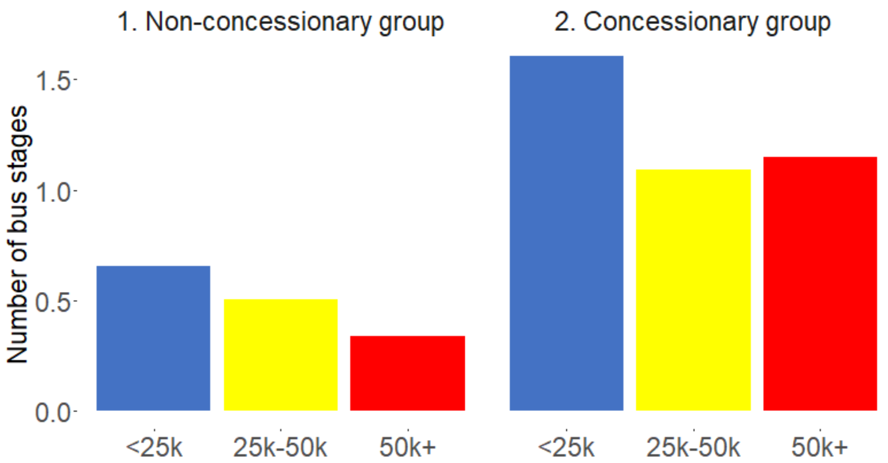


Figure 32. Average bus stages per person taken by income group



B.4.24 The pattern described above changes slightly when looking at household income rather than individual income. The number of people in the concessionary group are distributed across household income categories similarly to how they are for individual income categories (with the most people in the lowest income category). But for the non-concessionary group we observe no significant differences in the number of people across groups. Slightly surprisingly, the pattern in total number of weekly bus stages remains the same as what is observed in the case of individual income groups - that the individuals in lower income households in the concessionary group take more bus stage journeys than other subgroups.

Figure 33. Number of bus stages taken by household income group

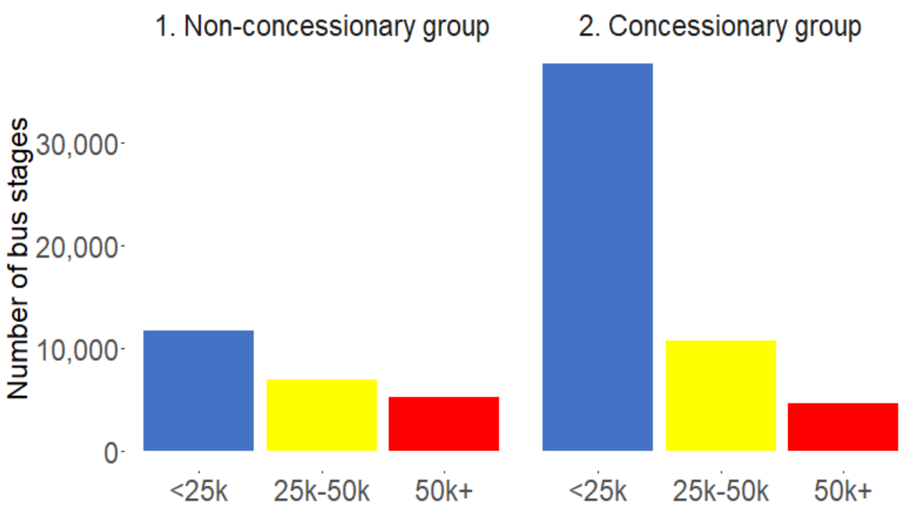


Figure 34. Number of people by household income group

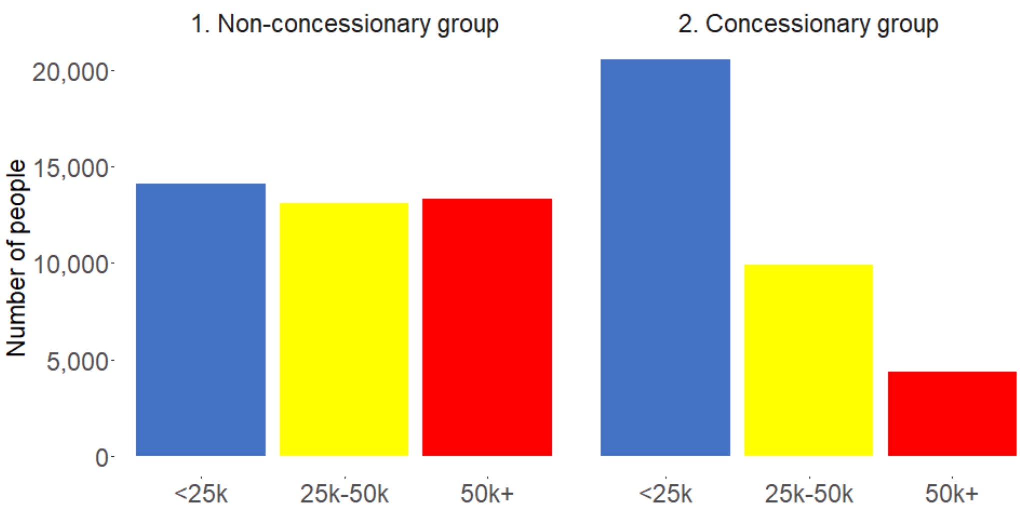
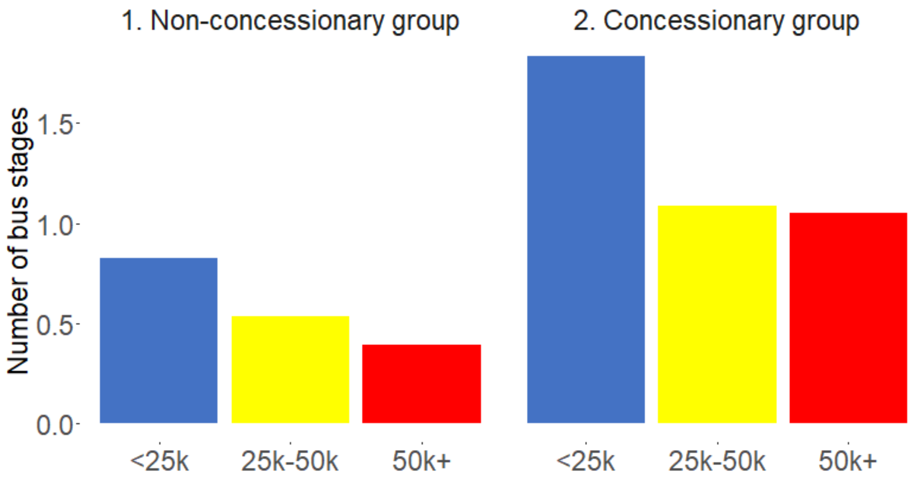


Figure 35. Average bus stages per person taken by household income group



B.4.25 When exploring differences in different levels of urbanisation, we see that the concessionary group in more urban areas takes more bus stage journeys than the concessionary group in less urban areas, but in general the concessionary group takes more bus stage journeys than the non-concessionary group. This holds true both in aggregate and in terms of average bus stages per person. This implies that the degree of urbanity is likely an important factor in determining the bus travel behaviour of individuals in our sample. Further, the generation factor might be different for urban and non-urban areas given the extent of these differences.

Figure 36. Number of bus stages taken by type of location

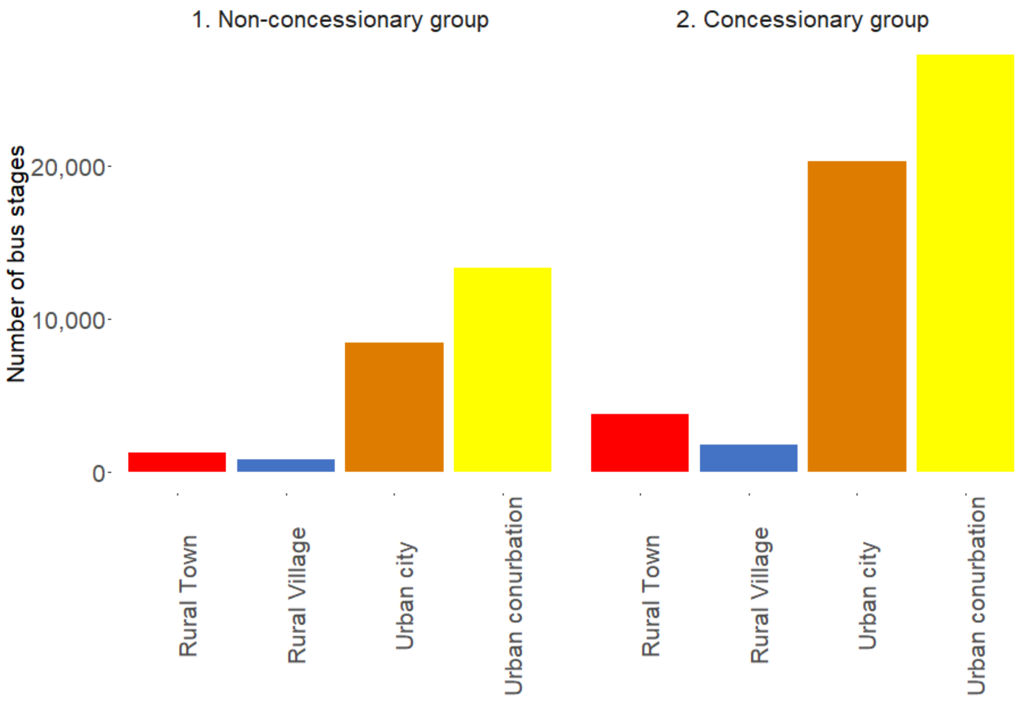


Figure 37. Average number of bus stages taken by type of location, per person

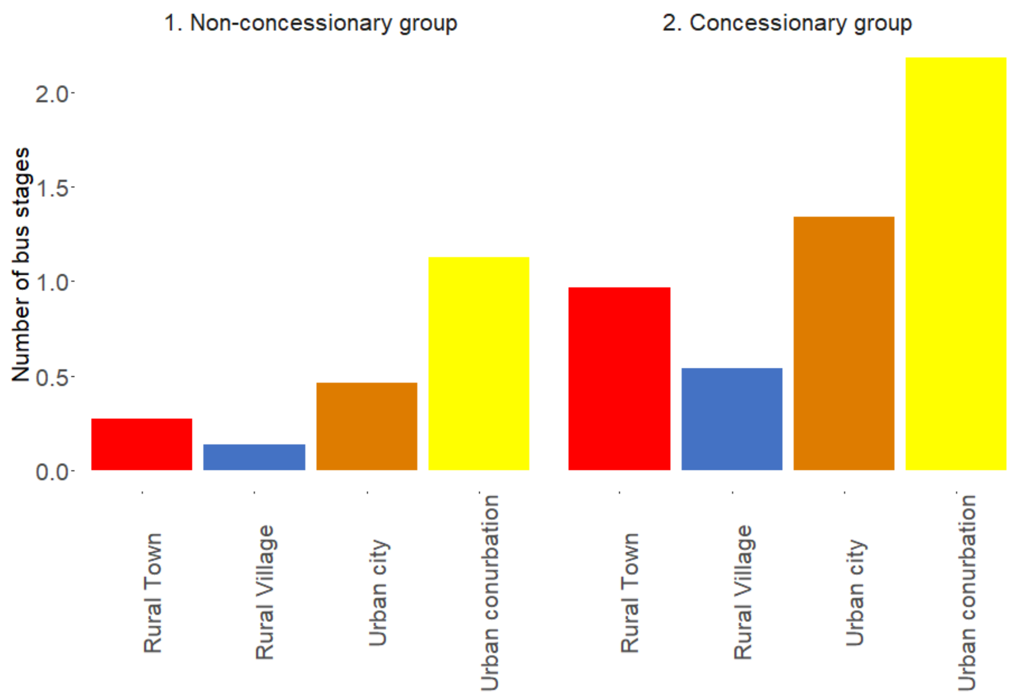
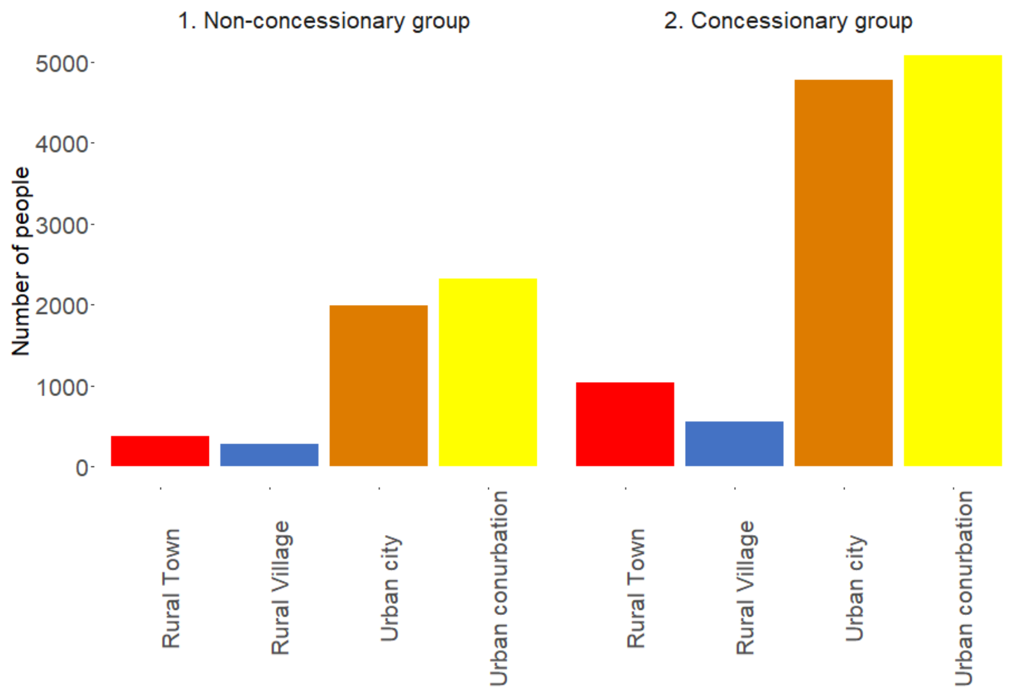


Figure 38. Number of people by type of location



B.4.26 From our review of the data, we see that there are differences between the concessionary and non-concessionary groups that could be explained better using regression analysis, so that we can understand the level of correlation between concessionary status and bus use, controlling for other factors.

B.4.27 We have found from our analysis that income and urbanity of area seem to be important factors in determining bus journey behaviour. Superficially it seems that the average person in the concessionary group makes two to three times more bus stage-level journeys as compared to the average person in the non-concessionary group, and that some demographic characteristics that are found in the NTS data can help explain the differences between groups. We explore this further in the next section.

B.5 Baseline regression specification

B.5.1 The baseline specification used is a regression where the dependent variable is the total number of bus stage-level journeys taken by an individual in a week. A regression model can be used to assess whether changes observed in the 'dependent variable' (in this case, the number of bus stages per person per week) are associated with changes in one or more of the 'explanatory variables' (in this case, whether or not an individual possesses a concessionary pass and a series of other personal characteristics). The coefficient on the variable of interest thus helps us understand the change in the dependent variable that results from a unit increase in that regressor.[34]

B.5.2 In essence, we want to test whether the count of weekly bus stage-level journeys per person changes based on whether or not individuals possess a concessionary pass, controlling for personal characteristics.

B.5.3 The personal characteristics controlled for in the regression analysis are described in the following table.

Table 21.

Personal characteristics in regression analysis

Variable	Name in NTS	Definition and transformation
Number of weekly bus stages per person	bus_stage_count	
Concessionary pass	SpecialTicket_B01ID	Season ticket or travel pass held by individual, split into 11 numerical categories. We categorise this variable into a binomial which is 1 if SpecialTicket_B01ID takes the value of 'Concessionary: Passes for older people' (numerical value of 7 in the data) or 'Concessionary: Disabled person's pass' (numerical value of 9 in the data).

34 Another key concept is that of statistical significance - which at a high level is the claim that a given set of observed results are not a result of chance but can be attributed to a correlation between the variables in question. Statistical significance can be considered strong or weak, and is interpreted using the p-value associated with a variable in a regression result. If a p-value is small, the result is considered more reliable. A p-value of 0.05 is considered the standard benchmark of reliable results in most scientific literature, but the 'smallness' of a p-value can depend highly on the context (the more precise or hard to find a result is within the data, the smaller the acceptable level of the p-value).

Variable	Name in NTS	Definition and transformation
Age	Age	Age of person - actual age
Sex	Sex_B01ID	Sex of person
Whether the individual has walking difficulties	FootDiffSum_B01ID	Difficulties when travelling by foot
Whether the individual is of pension age	OfPenAge_B01ID	Is the individual of state pension age
Ownership of home	Ten1_B01ID	Type of tenancy - 6 categories (Own outright, Buying with the help of mortgage or loan, Part own and part rent, renting, rent-free, squatting)
Educational qualifications	EdAttn1_B01ID	Any certificated educational qualifications
Professional qualifications	EdAttn2_B01ID	Any certificated professional qualifications
Working status	EcoStat_B01ID	Working status of individual (split into 11 categories but recategorised into a binomial based on whether or not the individual is economically active)
Employment status	Stat_B01ID	Employee or self-employed
Individual income group	IndIncome2002_B02ID	Individual Income bands, split into 'Less than £25,000', '£25,000-£50,000', and '£50,000 and over'
Household income group	HHIncome2002_B02ID	Household Income bands, split into 'Less than £25,000', '£25,000-£50,000', and '£50,000 and over'
Count of all earners in the household		Generated variable
Count of earners in the household who are in the same income group as the individual		Generated variable
More than one earner in the household		Generated variable
Driver's license	DrivLic_B02ID	Type of drivers license held, split into 'Full car licence', 'Provisional car', and 'Other or none'
Disabled driver	DrivDisable_B01ID	Whether or not the individual is a disabled driver

Variable	Name in NTS	Definition and transformation
Access to a car	CarAccess_B01ID	Type of access of a car, split into whether the individual is the 'Main driver of a company car', 'Other main driver', 'not the main driver of a household car', 'has a household car but is not the main driver', 'has a household car but non-driver', 'is a driver but has no car', and 'non driver and has no car'
Average trip distance covered by the individual per week		Generated variable
Settlement type	Settlement2011EW_B04ID	ONS Rural-Urban Classification of residence- 2011 Census, split into 'Urban conurbation', 'Urban City and Town', 'Rural Town and Fringe' and 'Rural Village, Hamlet, and Isolated Dwelling'
Region	HHoldGOR_B01ID	14 categories of regions in England split into metropolitan and non-metropolitan, including North East, North West & Merseyside, Yorkshire & Humberside, East Midlands, West Midlands, East of England, Greater London, South East, and South West
Year	survey_year_indiv	

B.5.4 The regression described above can also be expressed as the below formula:

$$\sum(bus\ stages)_{i,week} = \alpha + \beta_1(concessionary\ pass)_i + \Omega_i(vector\ of\ personal\ characteristics)_i + \varepsilon_i \ .$$

Where Ω represents a vector of coefficients for each of the personal characteristics controlled for in the regression. The ε represents the error term (i.e. the portion of the variation in the independent variable which cannot be explained by the regressors).

B.5.5 To construct propensity score weights, we used a standard logistic regression methodology, with the same regressors as our baseline specification, to predict the probability of having a concessionary pass.

B.5.6 The distribution of the predicted probabilities of having a concessionary pass are shown in the charts below. The predicted probabilities of receiving the concession are substantially different between the groups, indicating that the propensity score weighting was needed to improve balance in the modelling.

Figure 39. Predicted probability of having non-concessionary pass

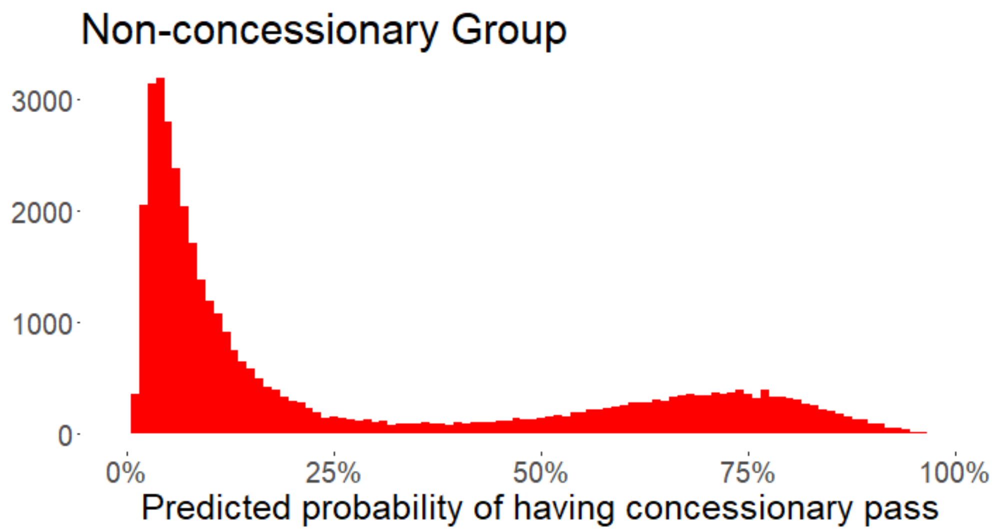
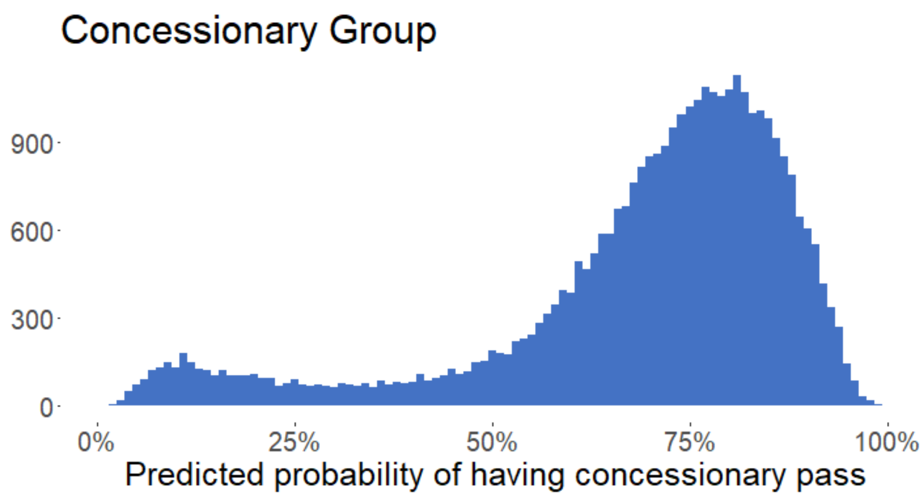


Figure 40. Predicted probability of having concessionary pass



B.5.7 The outputs for the baseline specification are detailed in the table below. The concessionary pass variable has a positive coefficient that is significant at 1% level. The specification has an adjusted R-squared of 21%. The coefficients on the control variables allow for a sensible interpretation:

- the coefficient for Age is negative, implying that as age increases, the number of bus stage-level journeys reduces;
- people in higher income brackets take fewer bus stage-level journeys;
- people with higher household incomes take fewer bus stage-level journeys;
- as the area that a respondent resides in becomes less urban, the number of bus stage-level journeys they take reduces.

Table 22. Outputs for baseline specification

Variable	Coefficient	Standard error	T-statistic	p-value
(Intercept)	12.17099	0.451337	26.96651	2.1E-159
concessionary_pass_1	0.636803	0.017558	36.26854	1.5E-285
log10(Age)	-5.24613	0.234624	-22.3597	2.2E-110
factor(Sex_B01ID)2	-0.17579	0.019392	-9.06509	1.27E-19
factor(walking_difficulties)No difficulties	1.502374	0.031559	47.60571	0
factor(OfPenAge_B01ID)2	-0.36021	0.031136	-11.5689	6.29E-31
factor(educational_qual)1	0.255085	0.021962	11.61477	3.69E-31
factor(professional_qual)1	0.229539	0.036997	6.204219	5.53E-10
factor(work_status)Inactive/NA	0.052938	0.025084	2.110438	0.034824
indiv_income25k-50k	-0.036	0.028917	-1.24509	0.213104
indiv_income50k+	-0.14359	0.044191	-3.24943	0.001157
hh_income25k-50k	-0.02809	0.024737	-1.13555	0.256148
hh_income50k+	-0.08371	0.036116	-2.31782	0.020462
count_all_earners	-0.10958	0.025744	-4.25633	2.08E-05
count_similar_earners	0.069914	0.023942	2.920101	0.0035
factor(more_than_one_earner)1	-0.21645	0.029801	-7.26333	3.81E-13
factor(drivers_licence)2	3.858174	0.550374	7.010095	2.4E-12
factor(drivers_licence)3	3.078554	0.546037	5.637996	1.73E-08
factor(disabled_driver)1	0.822075	0.040762	20.1678	3.25E-90
factor(car_access)Main driver and has car	-2.63401	0.043131	-61.0698	0
factor(car_access)Non driver and has car	-4.40058	0.548651	-8.02073	1.07E-15
factor(car_access)Non driver and no car	-3.06994	0.546869	-5.61366	1.99E-08
factor(car_access)Not Main driver and has car	-2.2133	0.049748	-44.4901	0
avg_trip_distance	0.010655	0.000315	33.80697	1.1E-248
factor(Settlement2011EW_B04ID)2	-0.20459	0.03517	-5.81724	6.01E-09
factor(Settlement2011EW_B04ID)3	-0.34555	0.041401	-8.34642	7.15E-17
factor(Settlement2011EW_B04ID)4	-0.45713	0.041405	-11.0404	2.56E-28
factor(HHoldGOR_B01ID)2	-0.584	0.082338	-7.09276	1.33E-12
factor(HHoldGOR_B01ID)3	-0.78948	0.067232	-11.7425	8.22E-32
factor(HHoldGOR_B01ID)4	-0.90836	0.074209	-12.2405	2.04E-34
factor(HHoldGOR_B01ID)5	-0.65039	0.068811	-9.45182	3.42E-21
factor(HHoldGOR_B01ID)6	-0.7513	0.080696	-9.31024	1.31E-20
factor(HHoldGOR_B01ID)7	-0.7712	0.071298	-10.8165	3.01E-27
factor(HHoldGOR_B01ID)8	-0.65103	0.07505	-8.67457	4.23E-18
factor(HHoldGOR_B01ID)9	-0.96286	0.075161	-12.8106	1.56E-37
factor(HHoldGOR_B01ID)10	-0.7789	0.070463	-11.0539	2.21E-28
factor(HHoldGOR_B01ID)11	-0.01267	0.064093	-0.19767	0.843301

Variable	Coefficient	Standard error	T-statistic	p-value
factor(HHoldGOR_B01ID)12	-0.73451	0.069191	-10.6157	2.63E-26
factor(HHoldGOR_B01ID)13	-0.66566	0.071902	-9.2579	2.14E-20
factor(survey_year_indiv)2011	0.019968	0.0398	0.501715	0.615869
factor(survey_year_indiv)2012	-0.1114	0.039255	-2.83779	0.004544
factor(survey_year_indiv)2013	-0.04249	0.039251	-1.0824	0.279079
factor(survey_year_indiv)2014	-0.09803	0.039632	-2.47354	0.01338
factor(survey_year_indiv)2015	0.128656	0.040982	3.139344	0.001694
factor(survey_year_indiv)2016	-0.12999	0.040248	-3.22975	0.00124
factor(survey_year_indiv)2017	-0.14735	0.041218	-3.575	0.00035
factor(survey_year_indiv)2018	-0.11788	0.041775	-2.8219	0.004775
factor(survey_year_indiv)2019	-0.07448	0.04077	-1.82688	0.067722
factor(survey_year_indiv)2020	-0.61265	0.05064	-12.0982	1.16E-33
factor(survey_year_indiv)2021	-0.6515	0.045612	-14.2835	3.19E-46

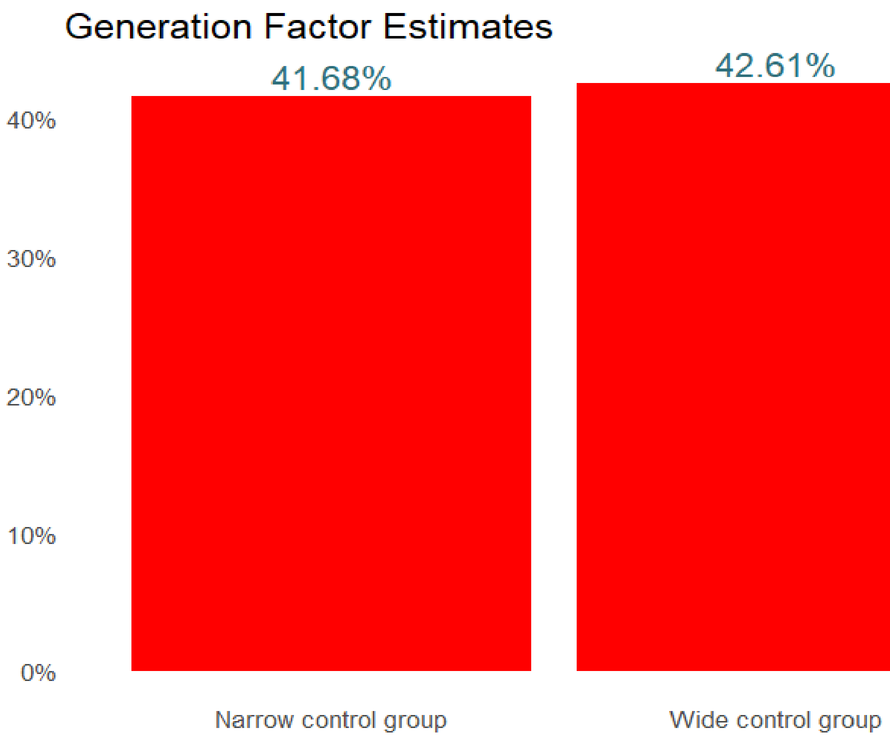
B.5.8 This model underwent robustness tests to confirm the direction of the results. We did this by running a more stripped down version of the model (with fewer control variables), by running the model separately for each year of survey data, and also by running each of these sensitivities both with and without the propensity score based weighting.

B.6 Generation factor estimation

B.6.1 We estimate the generation factor using 2 methods:

- Narrow control group: using the non-concessionary population to estimate the counterfactual, which results in a generation factor of 41.7%; and
- Wide control group: using both the concessionary and non-concessionary population, which results in a generation factor of 42.6%.

Figure 41. Generation factor estimates



B.6.2 We describe these methods in more detail below.

B.6.3 Narrow control group: we estimate a model with the same regressors as the baseline but without the concessionary pass variable, limiting the sample to only the non-concessionary population. This model was then used to predict the weekly total bus stages of each individual in the concessionary population. This is done so as to see how well a model with these regressors limited to the non-concessionary population can predict the behaviour of the concessionary passholders. The generation factor is then calculated as:

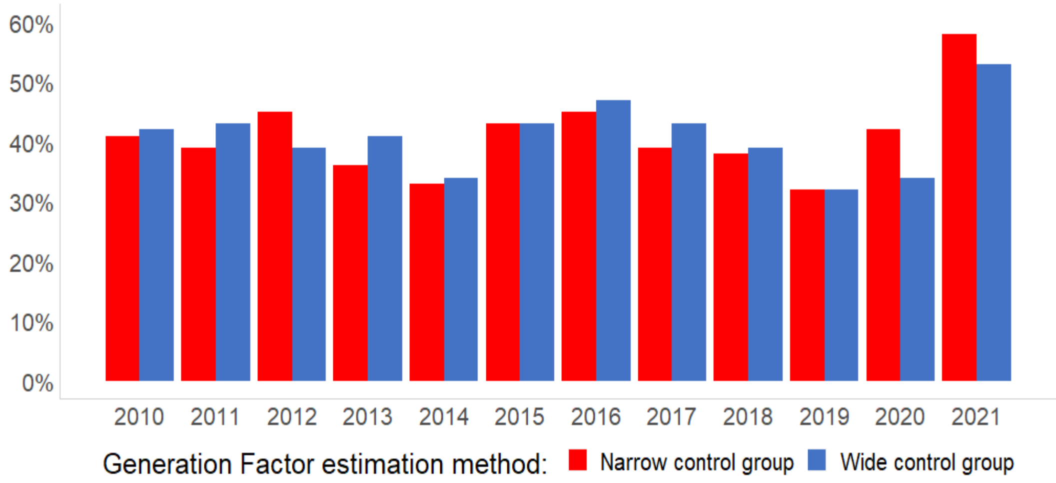
$$generation\ factor = 1 - \left(\frac{\Sigma(predicted\ bus\ stages)}{\Sigma(actual\ bus\ stages)}\right).$$

B.6.4 Wide control group: the same model as the baseline specification is used to predict the number of bus stages for the concessionary group. This is then repeated with the additional assumption that all individuals have non-concessionary status. This is done so as to see how well the model predicts the behaviour of the concessionary group if these individuals had not possessed a concessionary pass. The generation factor is then calculated as:

$$generation\ factor = 1 - \left(\frac{\Sigma(predicted\ bus\ stages,\ modified\ concessionary\ group)}{\Sigma(predicted\ bus\ stages,\ actual\ concessionary\ group)}\right).$$

B.6.5 To investigate how this effect changes in each year of data in our sample, we calculate the generation factor for each year individually. The generation factors thus produced are presented in the chart below. Our results in 2020/2021 are likely subject to omitted variable bias due to the pandemic. These years include reduced public transport use particularly by vulnerable passengers, and evolving patterns in commuting. These biases could contribute either to over- or under-estimating the generation factor in these years.

Figure 42. Generation factor estimate



B.6.6 We also run the generation factor estimation by our categories of urban and rural areas, over the variable 'Settlement2011EW_B04ID' described above. We find evidence that the generation factor is slightly lower in urban areas. This is directionally consistent with the non-PTE/ PTE distinction in the current calculator, which uses a higher-magnitude elasticity for non-PTE (i.e. higher generation). The results are below.

Table 23. Estimated generation factor by area type

Area type	Narrow control group	Wide control group
Urban conurbation	0.43	0.46
Urban city or town	0.45	0.5
Rural town and fringe	0.51	0.51
Rural village, hamlet and isolated dwelling	0.56	0.5

B.7 Conclusion

B.7.1 We find evidence that the generation factor is in the range of approximately 43%-56%. These results are, on average, not materially different across the two methods we use to calculate the generation factor (i.e. the wide and narrow control groups lead to similar results). The table above provides the results of the estimated generation factor used to create the demand curves as set out in section 3.

B.7.2 When segmented into subgroups based on the survey year, the generation factor is in the range of 30%-50% between the years 2010 - 2020, and much higher at between 50%-60% for the year 2021. The results for 2021 are most likely attributable to the lingering effects of the COVID-19 pandemic, which cannot accurately be accounted for due to lack of data for the years after the pandemic. As previously stated, the NTS 2022 data were not publicly available at the time this research was being conducted.

B.7.3 When segmented into subgroups based on the type of region in which respondents live, the generation factor is in the range of 40% - 55%, and is generally higher for more rural areas.

B.7.4 These generation factor estimates are slightly lower than those used in the current calculator (where values of around 45%-65% are typical). While some of the sub-groups within our sample do lead to generation factor estimates closer to the middle of the range produced by the current calculator, this is not the case in most of our sample. Especially in these cases it is also observed that there is a difference in the generation factor estimates produced by the two methods.

B.7.5 We cannot robustly estimate pandemic (2020/2021) generation, as we cannot fully control for the effects of the pandemic. The results for the pandemic years would not robustly extrapolate to later years.

B.7.6 This analysis could be usefully updated with post-pandemic NTS data in the future, this would require updating both the data and - potentially - the model specification to account for the impact of the pandemic.

B.7.7 Future research could assess the impact of bus fares on the generation factor. This would require adding in additional data from other datasets.

B.7.8 There are limitations to our analysis, specifically when it comes to the data availability and model specifications. While the NTS data is comprehensive, the survey methodology might not be reflective of all concessionary passholders in the country. Due to the data used, we may not be able to control for all factors that determine travel behaviour beyond those in the NTS.

B.7.9 But nevertheless, these results provide a direct estimate of the level of generation, and the results from the analysis appear broadly consistent across a range of model specifications and over time, giving confidence in the findings.

Annex C HOPS trends summary

C.1 Introduction

C.1.1 HOPS data has been requested across the following six anonymised TCAs for the years 2019/20 and 2022/23. A range of area types has been examined to reflect different geographies of England, including urban, rural and mixed urban/rural areas.

- TCA 1: a mixed urban/rural TCA
- TCA 2: a medium-sized urban TCA
- TCA 3: a large urban TCA and former PTE area
- TCA 4: a rural TCA
- TCA 5: a large urban TCA and former PTE area
- TCA 6: a rural TCA

C.1.2 HOPS data provides a record of ENCTS smartcard usage within a specific TCA for a given period of time. The primary purpose of the HOPS data is to develop a series of Lookup Tables (for use in the Discounted Fare Method) that are suitable for different types of TCAs, based on the six TCAs for which data has been received.

C.1.3 Analysis of the HOPS data will also prove useful to validate or corroborate the trends in pass-usage and journey-making.

C.1.4 In this Annex, summary trends from the HOPS data have been produced for each of the six TCAs. This analysis was used to seek to understand whether there is evidence that would further support a change in the reimbursement factor post-Covid. In addition, it was used as preliminary analysis which could be drawn upon to understand the scale of changes in other workstreams, i.e. do the scale of changes in AFFs look reasonable given how journey frequencies have evolved? In order to efficiently process tens of millions of data records, Python has been used to read and parse each dataset.

C.1.5 The process involved counting the unique number of concessionary passes and the total number of journeys undertaken by each passholder over an average week across each year:

C.1.6 The annual average weekly journey total was then rounded to the nearest integer to create journey frequency bands, which group passholders based on the rounded total number of journeys undertaken per week.

- A list of unique ENCTS cards which appeared in both 2019/20 and 2022/23 (existing passes) was identified, as was a list of passes which only appeared in 2022/23 (new passes).
- Differences in the journey frequencies may suggest changes in

behaviour pre- and post-pandemic

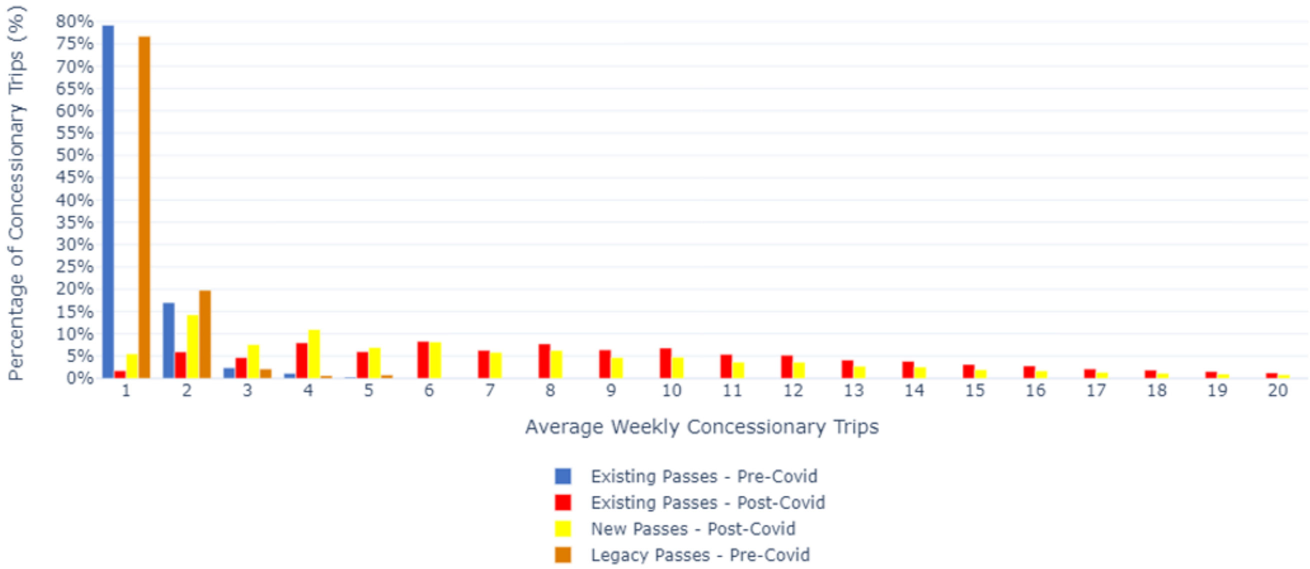
C.1.7 In the HOPS analysis which follows, and based on the above summary of other data sources, it was anticipated that there will be a decline in journeys made by passholders pre- and post-pandemic.

TCA 1: mixed urban/rural area

C.1.8 A comparison of journey frequencies by pass pre- and post-pandemic is shown in the graph below. This data does not show much meaningful comparison because the 2019/20 HOPS data is only a very small sample (incomplete) compared to post-pandemic. Therefore, it is not possible to state by how much concessionary travel declined by from 2019/20 to 2022/23 for this TCA.

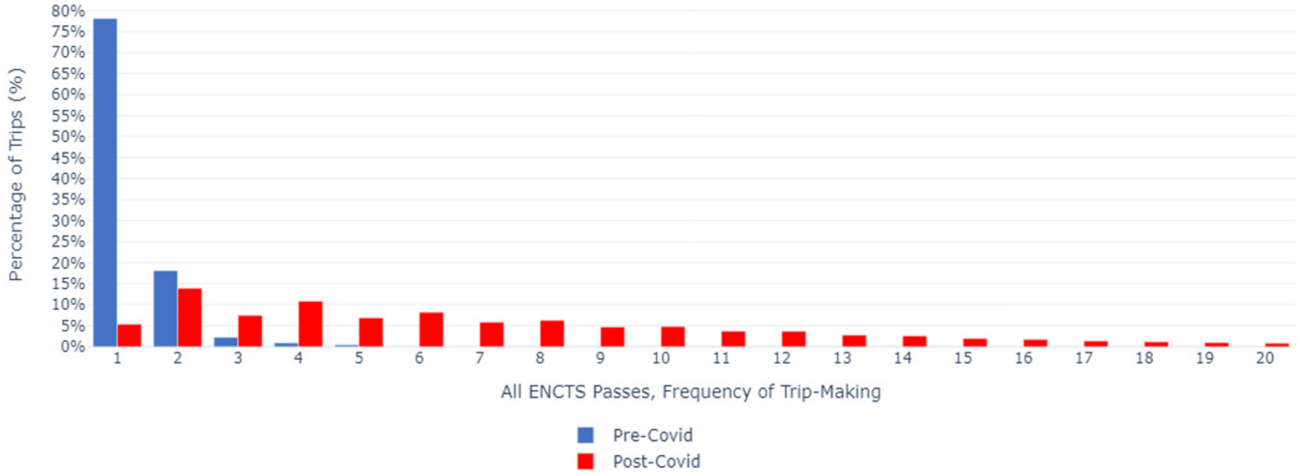
C.1.9 However, the analysis is shown for completeness across all TCAs which have been analysed and to explain that any significant differences for TCA 1 would be due to the data for 2019/20. It would not be possible to isolate any other impacts as a result.

Figure 43. **Comparison of Journey Frequencies (New and Existing Passes) – TCA 1: mixed urban/rural area**



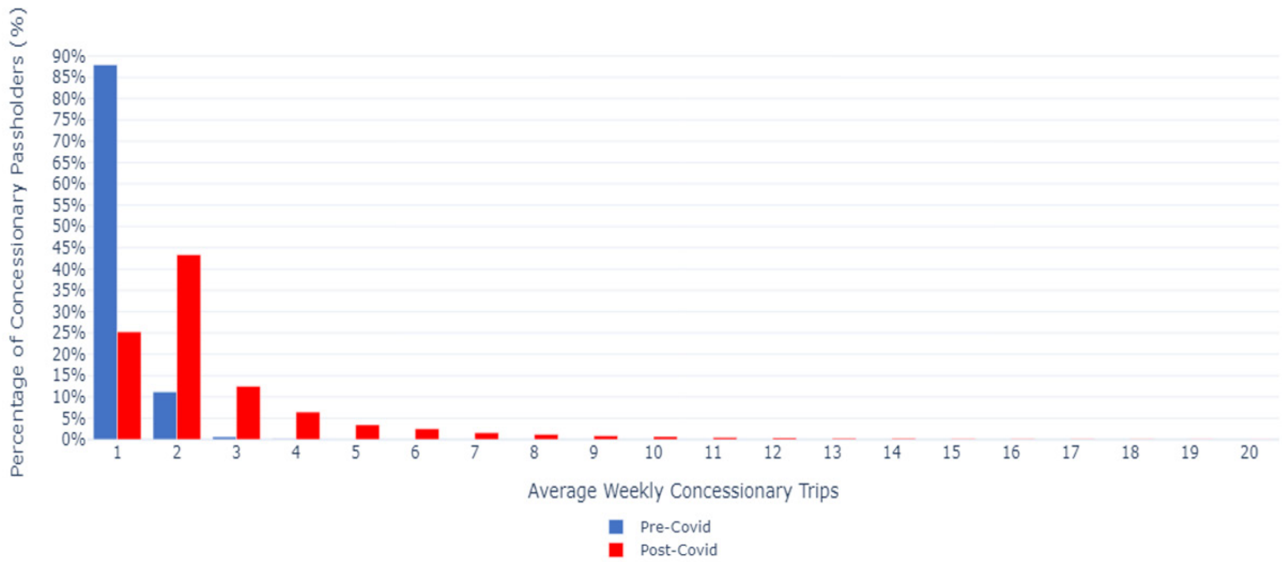
C.1.10 The graph below shows a comparison of the proportion of journeys made across passholders by frequency per week (pre- and post-pandemic). As with the previous graph, there is no meaningful comparison to be extracted because the data for 2019/20 from HOPS is incomplete.

Figure 44. Percentages of Journeys by Frequency (All Passes) – TCA 1: mixed urban/rural area



C.1.11 In the final graph for TCA 1 below, the percentage of passholders is shown by journey frequency per week pre- and post-pandemic for all passholders. Once more, this does not provide a meaningful comparison as the 2019/20 HOPS data is incomplete.

Figure 45. Percentages of Passholders by Average Journey Frequency (All Passes) – TCA 1: mixed urban/rural area

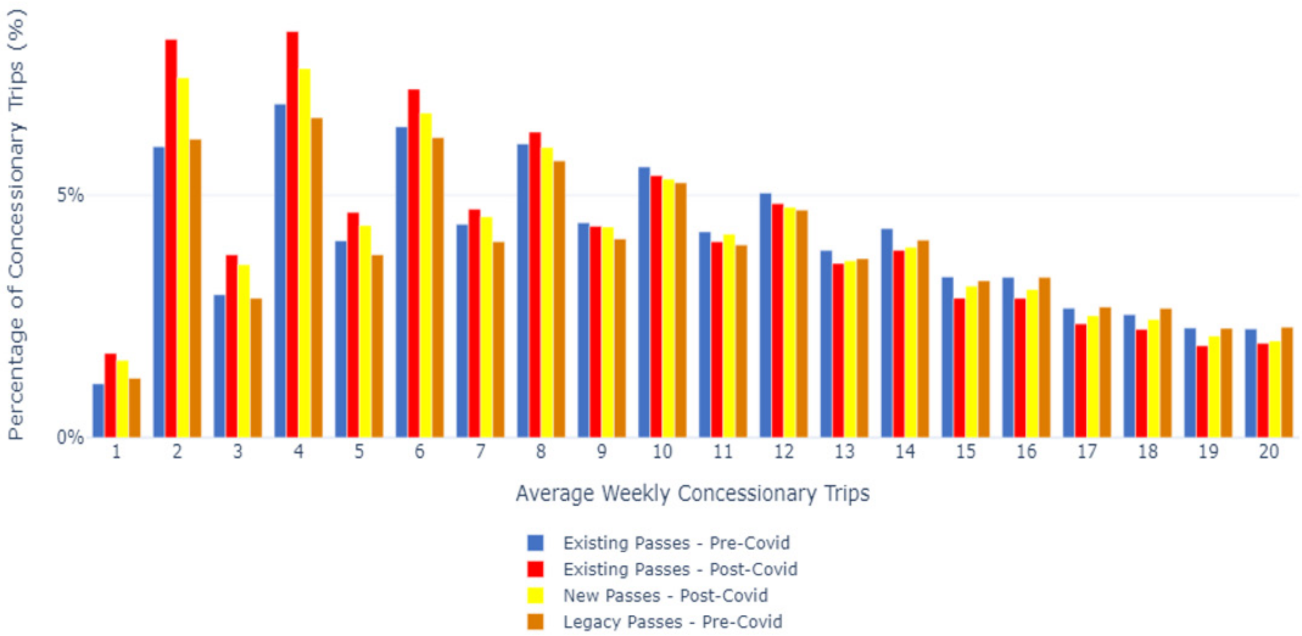


TCA 2: medium-sized urban area

C.1.12 For this TCA, the overall number of concessionary journeys declined by 33% between 2019/20 and 2022/23.

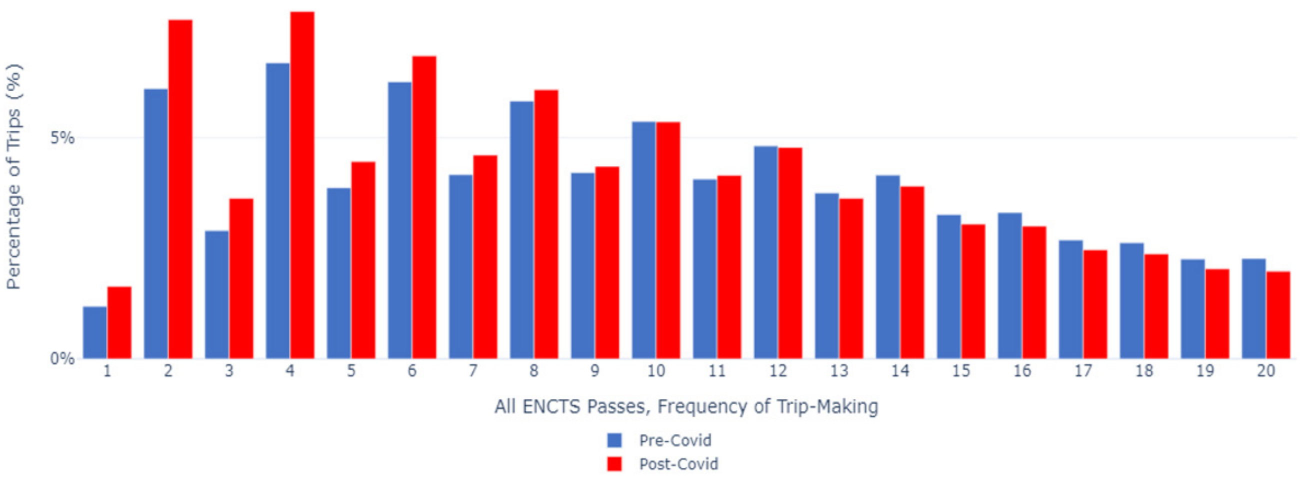
C.1.13 In the graph below, the proportion of passholders by journeys per week pre- and post-pandemic is shown for TCA 2. The graph demonstrates that the profile of journeys per week follows a similar pattern over the range regardless of card type. What is noticeable is that there is a slight increase in the lower end of the range of journeys per week for existing and new passes post-pandemic in comparison to existing passes pre-pandemic. There is also a slight decrease in the higher end of the range of journeys per week for existing and new passes post-pandemic in comparison to existing passes pre-pandemic. However, the differences are small.

Figure 46. Comparison of Journey Frequencies (New and Existing Passes) – TCA 2: medium-sized urban area



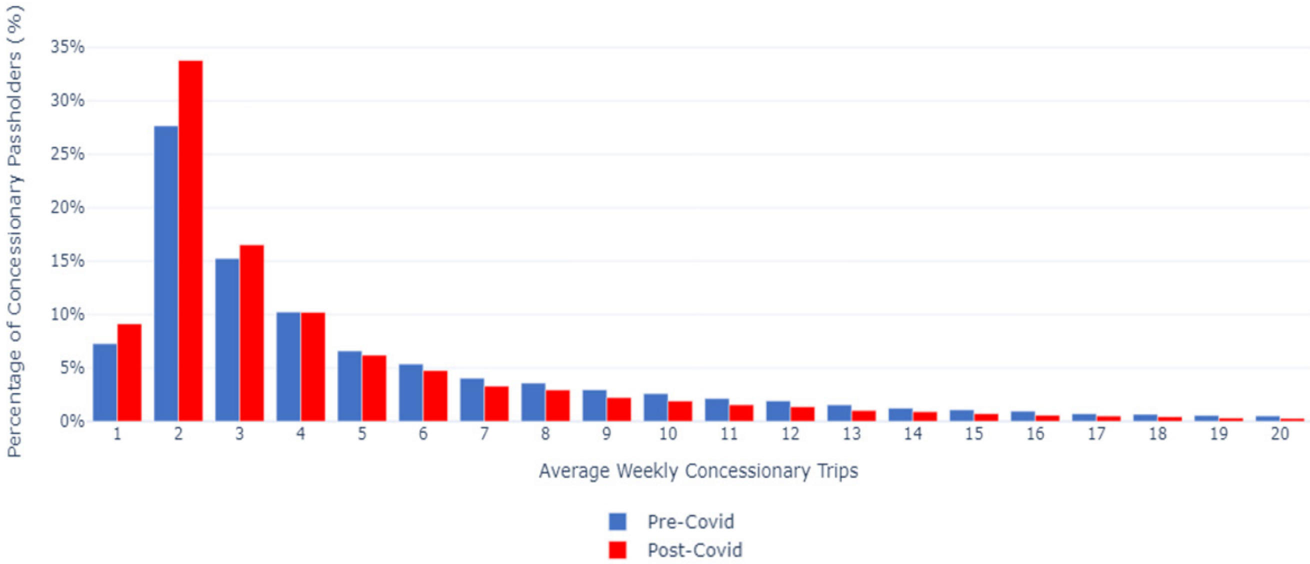
C.1.14 The proportion of journeys made per week pre- and post-pandemic is shown in the graph below for TCA 2. In general, there is very little difference in the distributions pre- and post-pandemic, although there is a slight increase in the proportion of journeys made towards the lower end of the range and a slight decrease at the higher end of the range.

Figure 47. Percentages of Journeys by Frequency (All Passes) – TCA 2: medium-sized urban area



C.1.15 The graph below summarises the proportion of passholders by average journey frequency per week pre- and post-pandemic. This graph shows that a greater proportion of passholders undertake fewer journeys per week where just a single or two journeys were formerly made per week. However, in general there is again very little change across the distribution.

Figure 48. Percentages of Passholders by Average Journey Frequency (All Passes) – TCA 2: medium-sized urban area



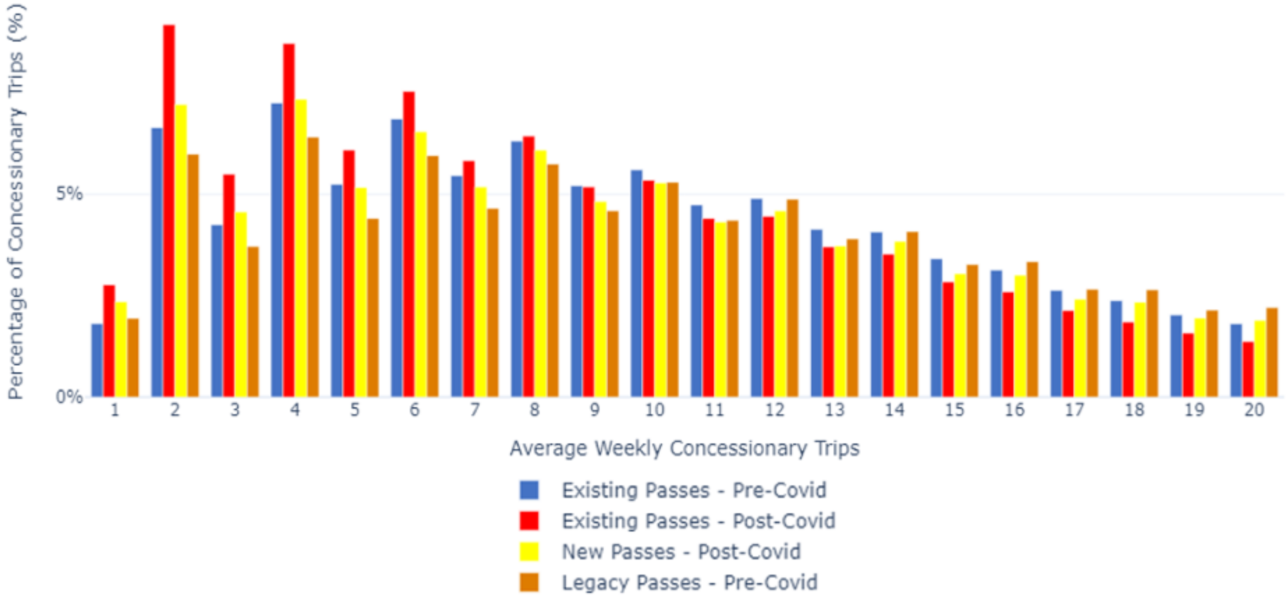
C.1.16 Across all passholders, the mean journey frequency has decreased from 7.11 to 6.28 journeys per week (2019/20 to 2022/23), which is a decrease of 12%.

TCA 3: large urban area

C.1.17 For TCA 3, the amount of concessionary journeys undertaken declined by 30% from 2019/20 to 2022/23.

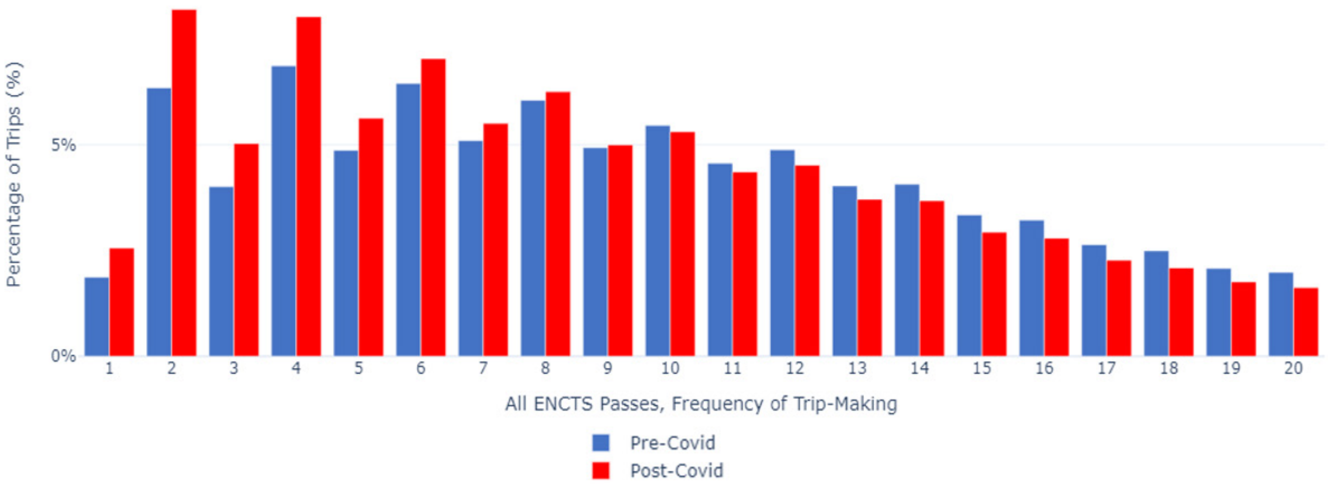
C.1.18 In the graph below, the proportion of passholders by journeys per week pre- and post-pandemic is shown for TCA 3. The graph demonstrates that the profile of journeys per week follows a similar pattern over the range regardless of card type. What is noticeable is that there is a slight increase in the lower end of the range of journeys per week for existing and new passes post-pandemic in comparison to existing passes pre-pandemic. There is also a slight decrease in the higher end of the range of journeys per week for existing and new passes post-pandemic in comparison to existing passes pre-pandemic. However, the differences are small.

Figure 49. Comparison of Journey Frequencies (New and Existing Passes) – TCA 3: large urban area



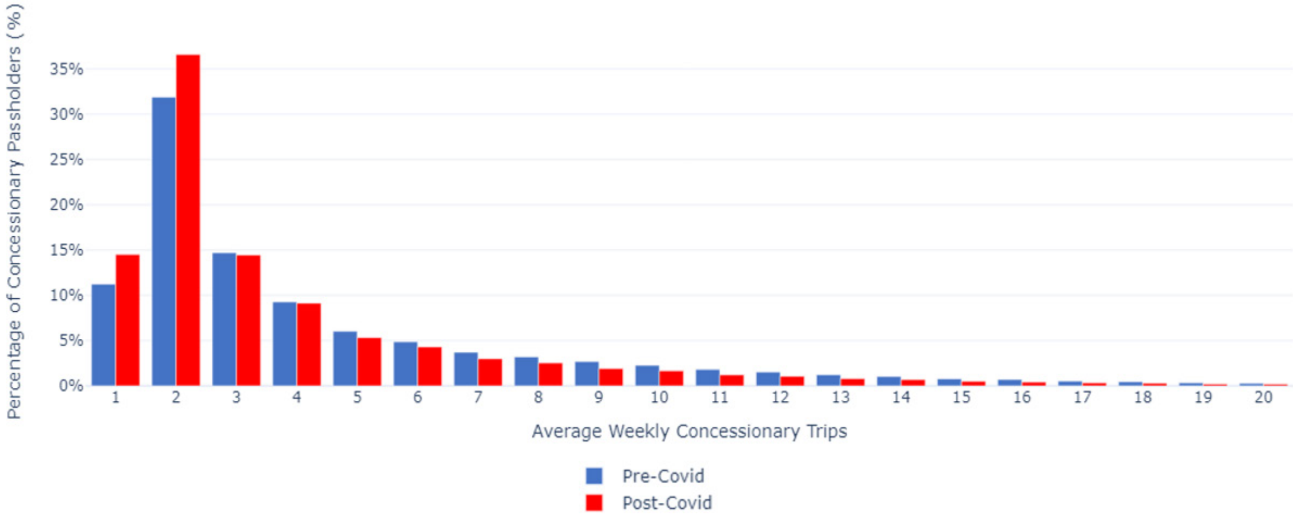
C.1.19 The proportion of journeys made per week pre- and post-pandemic is shown in the graph below for TCA 3. In general there is very little difference in the distributions pre- and post-pandemic, although there is a slight increase in the proportion of journeys made towards the lower end of the range and a slight decrease at the higher end of the range.

Figure 50. Percentages of Journeys by Frequency (All Passes) – TCA 3: large urban area



C.1.20 The graph below summarises the proportion of passholders by average journey frequency per week pre- and post-pandemic. This graph shows that a greater proportion of passholders undertake fewer journeys per week where just a single or two journeys were formerly made per week. However, in general there is again very little change across the distribution.

Figure 51. **Percentages of Passholders by Average Journey Frequency (All Passes) – TCA 3: large urban area**



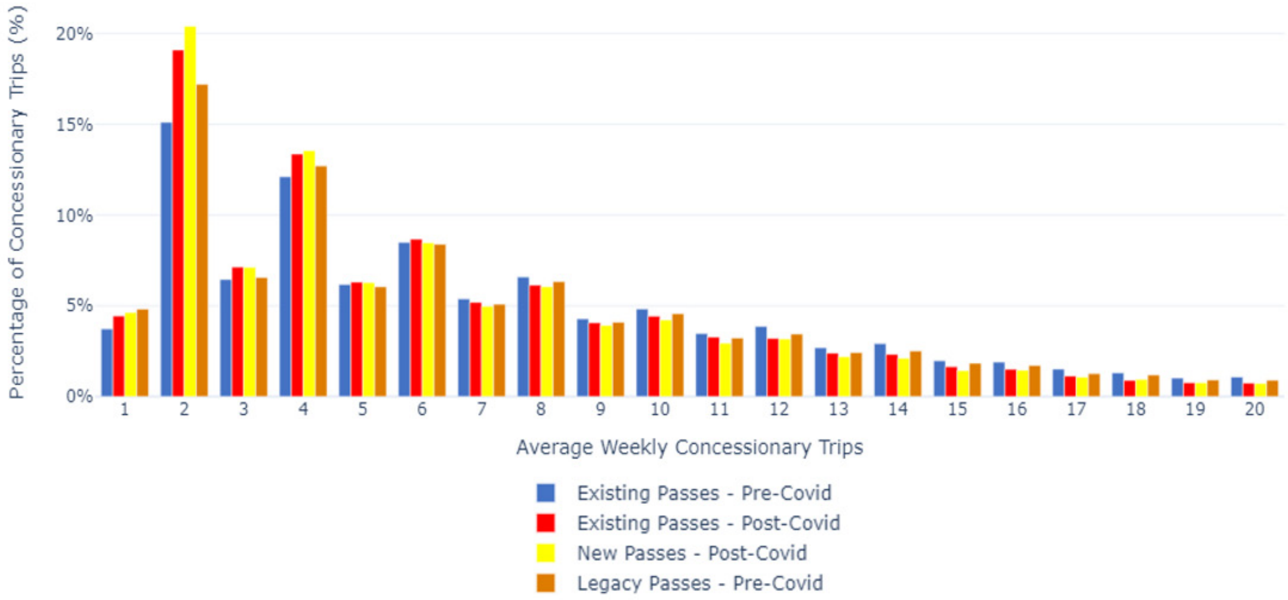
C.1.21 Across all passholders, the journey frequency per passholder has decreased from 6.41 to 5.6 journeys per week (2019/20 to 2022/23), which is a decrease of 13%.

TCA 4: rural area

C.1.22 For this TCA, the decline in concessionary travel between 2019/20 and 2022/23 was 35%.

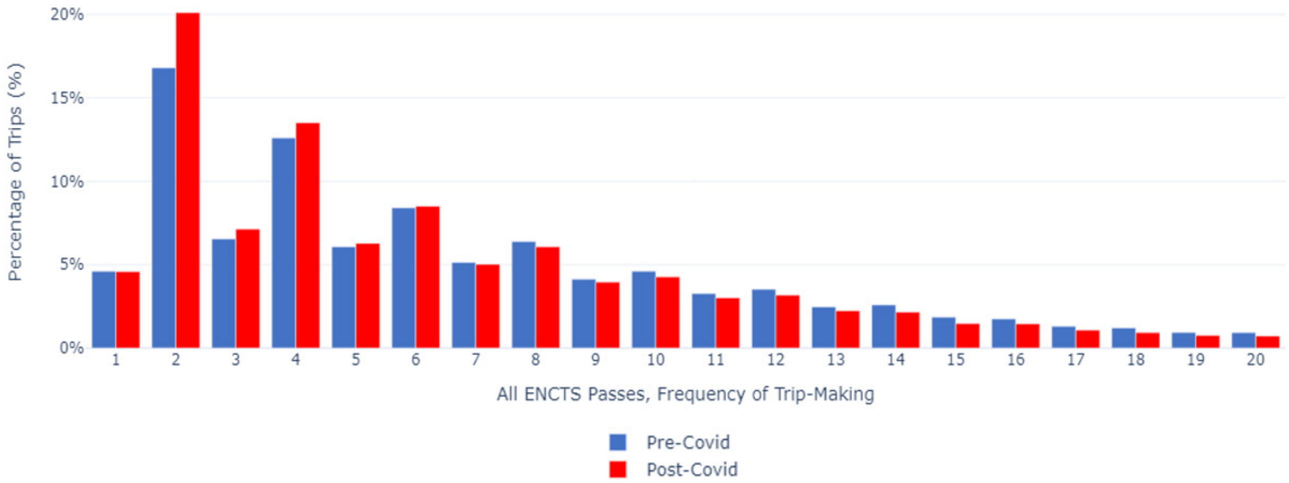
C.1.23 In the graph below, the proportion of passholders by journeys per week pre- and post-pandemic is shown for TCA 4. The graph demonstrates that the profile of journeys per week follows a similar pattern over the range regardless of card type. What is noticeable is that there is a slight increase in the lower end of the range of journeys per week for existing and new passes post-pandemic in comparison to existing passes pre-pandemic. There is also a slight decrease in the higher end of the range of journeys per week for existing and new passes post-pandemic in comparison to existing passes pre-pandemic. However, the differences are small.

Figure 52. **Comparison of Journey Frequencies (New and Existing Passes) – TCA 4: rural area**



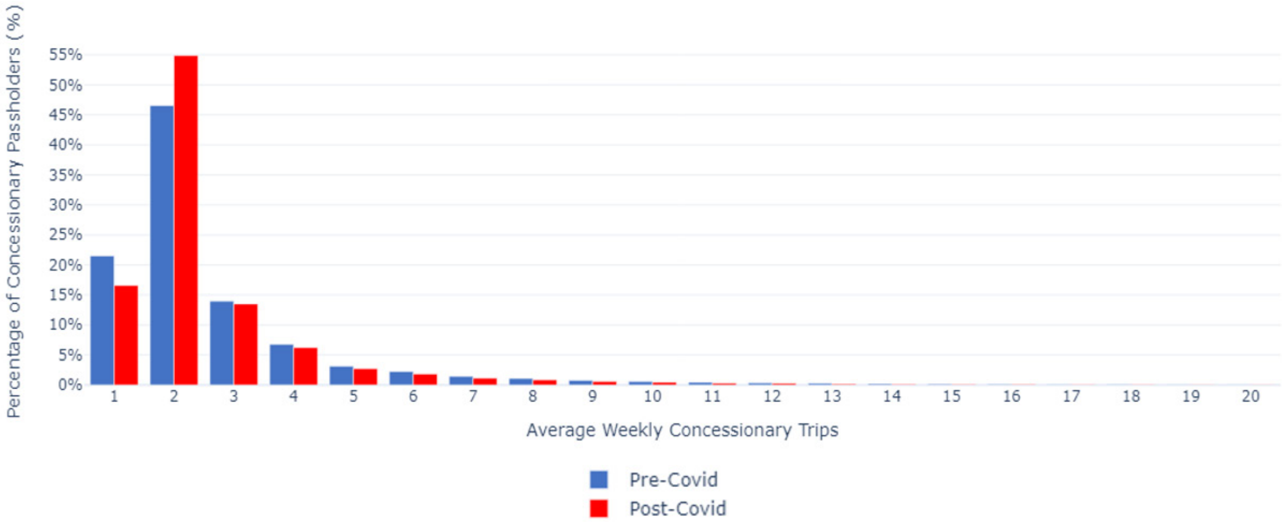
C.1.24 The proportion of journeys made per week pre- and post-pandemic is shown in the graph below for TCA 4. In general there is very little difference in the distributions pre- and post-pandemic, although there is a slight increase in the proportion of journeys made towards the lower end of the range and a slight decrease at the higher end of the range.

Figure 53. **Percentages of Journeys by Frequency (All Passes) – TCA 4: rural area**



C.1.25 The graph below summarises the proportion of passholders by average journey frequency per week pre- and post-pandemic. This graph shows that a greater proportion of passholders undertake just two journeys per week, whilst fewer undertake just a single journey per week. However, in general there is again very little change across the distribution.

Figure 54. Percentages of Passholders by Average Journey Frequency (All Passes) – TCA 4 rural area



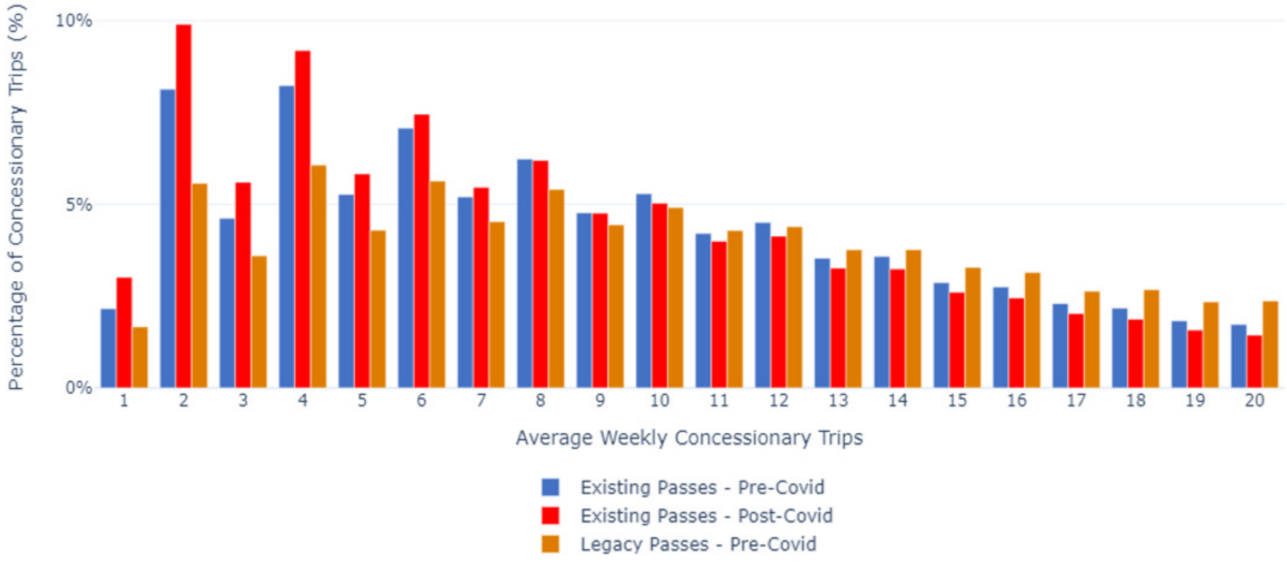
C.1.26 Across all passholders, the journey frequency per passholder has decreased from 3.99 to 3.73 journeys per week (2019/20 to 2022/23), which is a decrease of 7%.

TCA 5: large urban area

C.1.27 For this TCA, there has been a 37% decline in concessionary travel between 2019/20 and 2022/23.

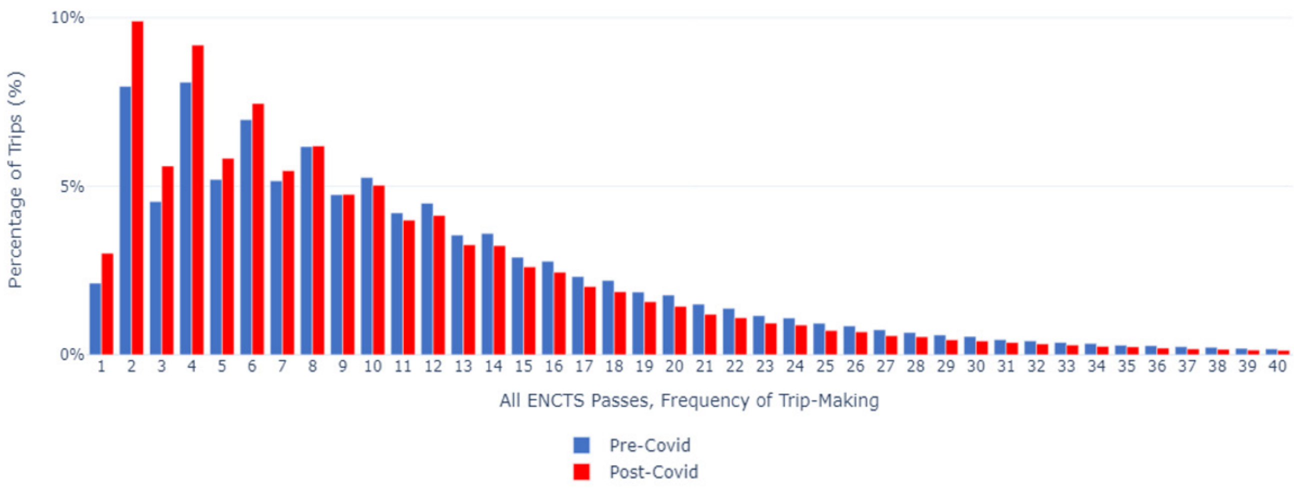
C.1.28 In the graph below, the proportion of passholders by journeys per week pre- and post-pandemic is shown for TCA 5. The graph demonstrates that the profile of journeys per week follows a similar pattern over the range regardless of card type. What is noticeable is that there is a slight increase in the lower end of the range of journeys per week for existing passes post-pandemic in comparison to existing passes pre-pandemic. There is also a slight decrease in the higher end of the range of journeys per week for existing passes post-pandemic in comparison to existing passes pre-pandemic. However, the differences are small.

Figure 55. **Comparison of Journey Frequencies (New and Existing Passes) – TCA 5: large urban area**



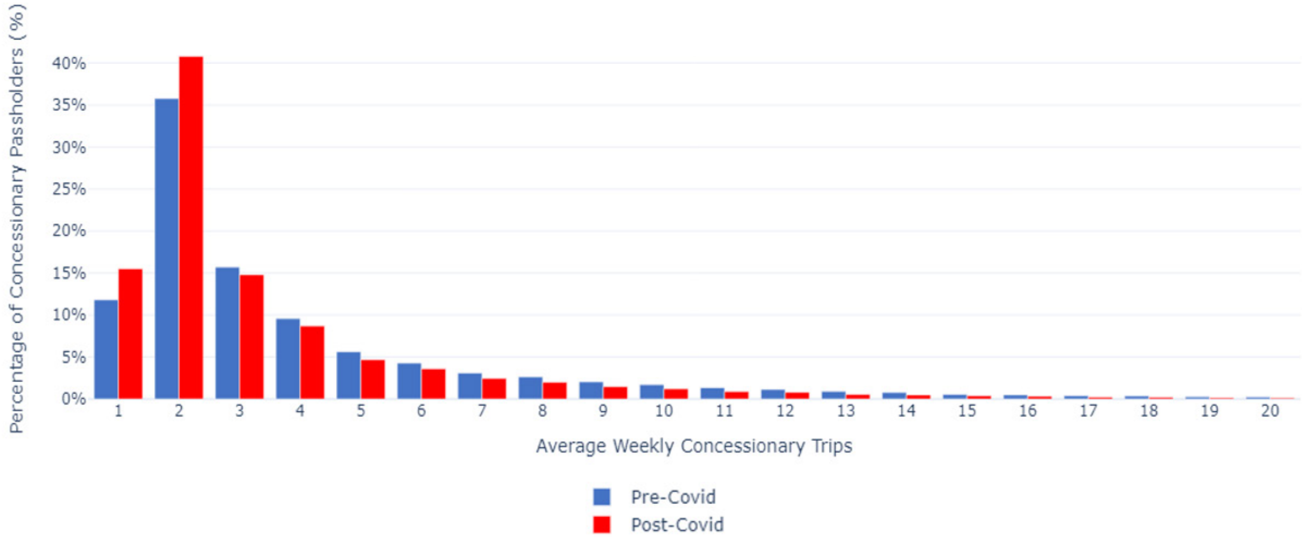
C.1.29 The proportion of journeys made per week pre- and post-pandemic is shown in the graph below for TCA 5. In general there is very little difference in the distributions pre- and post-pandemic, although there is a slight increase in the proportion of journeys made towards the lower end of the range and a slight decrease at the higher end of the range.

Figure 56. **Percentages of Journeys by Frequency (All Passes) – TCA 5: large urban area**



C.1.30 The graph below summarises the proportion of passholders by average journey frequency per week pre- and post-pandemic. This graph shows that a greater proportion of passholders undertake fewer journeys per week where just a single or two journeys were formerly made per week. However, in general there is again very little change across the distribution.

Figure 57. **Percentages of Passholders by Average Journey Frequency (All Passes) – TCA 5: large urban area**



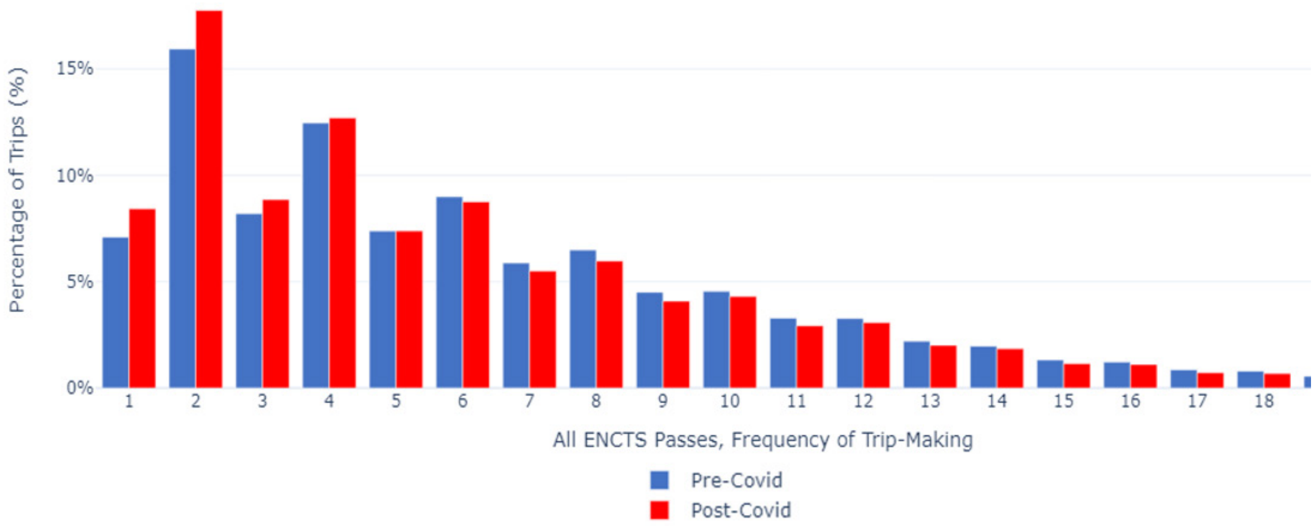
C.1.31 Across all passholders, the journey frequency per passholder has decreased from 3.99 to 3.73 journeys per week (2019/20 to 2022/23), which is a decrease of 12%.

TCA 6: rural area

C.1.32 For this TCA, there has been a total decline in concessionary travel of 33% from 2019/20 to 2022/23.

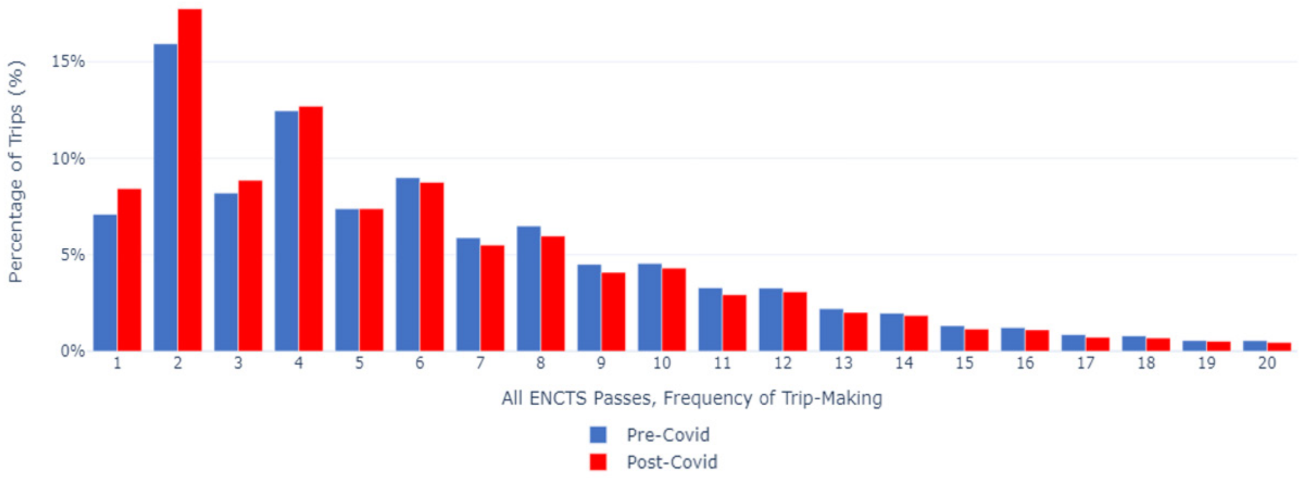
C.1.33 In the graph below, the proportion of passholders by journeys per week pre- and post-pandemic is shown for TCA 6. The graph demonstrates that the profile of journeys per week follows a similar pattern over the range regardless of card type. What is noticeable is that there is a slight increase in the lower end of the range of journeys per week for existing and new passes post-pandemic in comparison to existing passes pre-pandemic. There is also a slight decrease in the higher end of the range of journeys per week for existing and new passes post-pandemic in comparison to existing passes pre-pandemic. However, the differences are small.

Figure 58. **Comparison of Journey Frequencies (New and Existing Passes) – TCA 6: rural area**



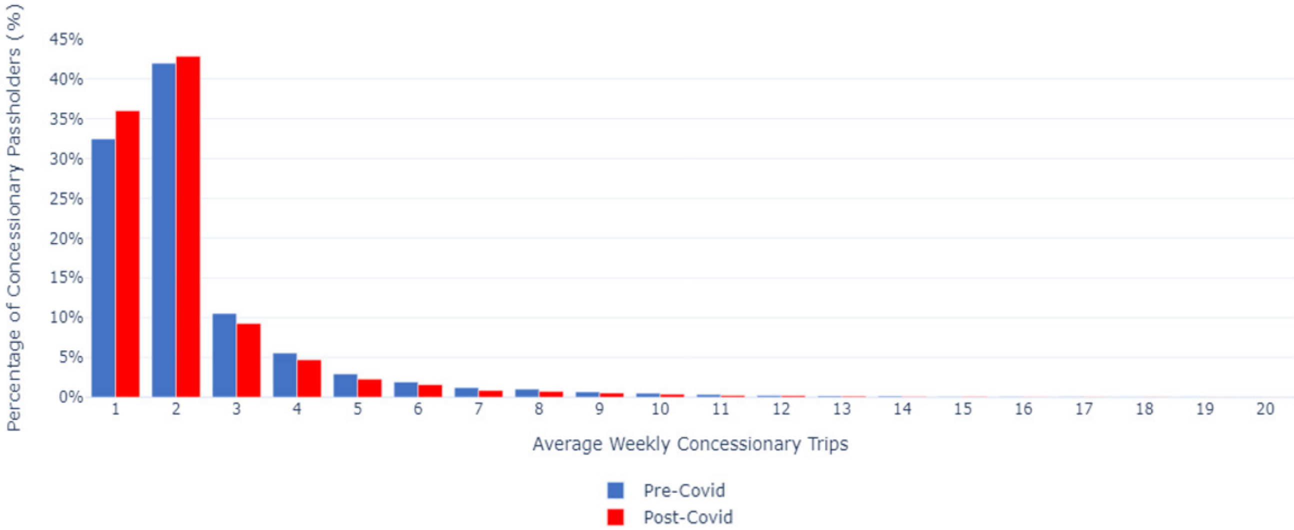
C.1.34 The proportion of journeys made per week pre- and post-pandemic is shown in the graph below for TCA 6. In general there is very little difference in the distributions pre- and post-pandemic, although there is a slight increase in the proportion of journeys made towards the lower end of the range and a slight decrease at the higher end of the range.

Figure 59. **Percentages of Journeys by Frequency (All Passes) – TCA 6: rural area**



C.1.35 The graph below summarises the proportion of passholders by average journey frequency per week pre- and post-pandemic. This graph shows that a greater proportion of passholders undertake fewer journeys per week where just a single or two journeys were formerly made per week. However, in general there is again very little change across the distribution.

Figure 60. **Percentages of Passholders by Average Journey Frequency (All Passes) – TCA 6: rural area**



C.1.36 Across all passholders, the journey frequency per passholder has decreased from 3.60 to 3.34 journeys per week (2019/20 to 2022/23), which is a decrease of 7%.

C.2 Summary

C.2.1 Across the range of TCAs presented in the preceding graphs there are some key findings which leads to an overall conclusion:

- total concessionary journeys have fallen by between 30% and 37% between 2019/20
- overall, passholders are making fewer journeys per week on average. However, the reduction in journeys per week is small, varying between 7% and 13% (from 2019/20 to 2022/23) across the TCAs presented;
- the profile of journeys made per week is also similar pre- and post-pandemic. There is a skew to the left in the graphs showing the percentage of journeys by frequency in both time periods. Therefore the majority of journeys made pre- and post-pandemic are relatively low frequency and the proportions are progressively lower at higher frequencies;
- however, it can generally be seen that the proportions of lower journey frequencies (i.e. 1 to 2 journeys) have increased post-pandemic, whilst the proportions of higher journey frequencies (i.e. more than 7 journeys) have slightly decreased;
- this similarity of profile and skew is also present in the graphs showing the percentage of passholders by average journey frequency per week. The majority of passholders are undertaking less than 4 journeys per week and this is the case pre- and post-pandemic.
- in these graphs it can be seen that the percentage of passholders undertaking lower frequency journeys (i.e. 1 to 2 journeys) is higher

post-pandemic, with a decline in the proportion of passholders making higher frequency journeys (i.e. more than 3 journeys);

C.2.2 In the summary above it is explained that passholders are generally undertaking fewer journeys per week on average post-pandemic than they were pre-pandemic. Whilst the general profile of journey-making appears to be similar between time periods, there has been a reduction in more frequent journey-making in proportionate terms and an increase in infrequent journey-making.

C.2.3 This has implications for the reimbursement calculator. The reduction in average journey frequency is small at between 7% and 13% across TCAs post-pandemic. It is important to note that average journey frequencies only apply to passholders who have undertaken concessionary travel. Therefore, the impact of passholders undertaking zero trips in a financial year will not be accounted for in the reduction. However, this reduction in demand could impact on the scale of the reimbursement across a few different aspects:

- passholders making fewer journeys on average would indicate fewer Daily and Weekly tickets would have been purchased under commercial rather than concessionary operations. These tickets typically have a discount relative to the Average Cash Fare which means the AFF will be affected. The AFF per person might be higher as a result but the total revenue forgone is likely to be lower in the reimbursement;
- lower demand will also impact on the operating costs of operators, as the need for additional capacity and service frequencies to accommodate concessionary demand is reduced. This will impact on the MOCs, MCCs and PVRs of operators and potentially reduce the reimbursement.

Annex D Lookup tables and the Average Fare Forgone

D.1 Introduction

D.1.1 Under the ENCTS, passengers eligible for a pass can travel for free on buses off-peak. This travel consists of:

- Passenger journeys which would have been made regardless of whether or not a commercial fare was required (non-generated);
- Passenger journeys which are only made because travel is free to the passholder (generated).

D.1.2 For journeys which would have been made regardless of the ENCTS pass, there is a loss of commercial revenue received by the operators. The reimbursement rate for these non-generated journeys is based on the Average Fare Forgone (AFF). The AFF describes the average fare that passengers would have paid for a non-generated journey were this journey not free under ENCTS. Identifying the AFF is more complex than simply taking the cost of an average single fare. This is because passengers typically have available to them a wide range of ticket options. In the absence of ENCTS passengers would have selected the ticket type most appropriate to their travel patterns, this would likely be the ticket that would have provided the lowest cost per journey (in the absence of any journey restrictions which might mean a higher value fare is required). While the actual cost of other tickets will be higher than the cost of a single fare, the cost per journey will typically be lower given multiple journeys are allowed under different ticket types (this assumes that passengers choose the cost-efficient ticket available to them, dependent on their travel patterns). Therefore, to simply take the average single fare would overestimate the value of the AFF.

D.1.3 There are four approaches to empirically estimate AFFs set out in the current guidance, of which three are directly included in the current calculator. These methods are as summarised in the table below. Local Methods are not included in the current calculator because these are bespoke and it would be unfeasible to account for all possibilities of estimation.

Table 24. Suitability of Methods from the Current Guidance

Method	Approach	Recommended for Use
Average Cash Fare	A weighted average (by passenger journeys) across all tickets which have a fixed limit on the numbers of journeys which can be made on it (i.e. Single, Return and Carnet)	For operators with cash fares only
Basket of Fares Method	The weighted average (by passenger journeys) across a range of ticket types for all fixed limit (i.e. Single, Return and Carnet) and periodic tickets (i.e. Daily and Weekly) available	For operators with: ▪ At least 60% of concessionary boardings on services where average weekday daytime frequency is no greater than 1 bus per hour ▪ No cash fares (as the Discounted Fare Method will not work with such fares) ▪ A ratio of the Daily ticket to cash fare price greater than 5 ▪ Concessionary demand using a much higher proportion of daily or period tickets than the commercial demand
Discounted Fare Method	A discount rate is applied to the Average Cash Fare. The discount rate is applied to adjust the AFF to reflect that some passengers will buy periodic tickets which are typically priced cheaper per journey than the Average Cash Fare. The discount rate is based on the price multipliers for each periodic ticket type (i.e. Daily and Weekly) relative to the Cash Fare (i.e. Single and Return). The relative price multipliers are applied to ticket sales for each ticket type to estimate a factor (discount) relative to total journeys undertaken. An degeneration adjustment is applied to the factor to reflect that fewer trips would be undertaken by bus if travel were commercial rather than concessionary. This avoids overstating the discount factor. The degeneration-adjusted discount factor is then applied to the Average Cash Fare to derive the AFF.	The preferred method in most circumstances
Local Methods	Any other approach which can be justified as appropriate	For operators in large urban areas such as PTEs where journey patterns are significantly different (than outside of PTE areas)

D.1.4 It is important to note that the Discounted Fare Method uses a Lookup Table to estimate the AFF. There is a single Lookup Table in the current reimbursement calculator which is based on NoWcard data for Lancashire from 2009. The Lookup Table represents a distribution of journeys by different combinations of pricing ratios. The ratios are for the relative prices of Weekly and Daily tickets to the Average Cash Fare (i.e. 10:2:1 for Weekly:Daily:Average Cash Fare prices). The distribution of journeys is used to estimate the discount factor applied to the Average Cash Fare.

D.1.5 In this research area, the overall aim is to consider the suitability of the above methods in the current calculator and recommend potential revisions as part of the update to the calculator and guidance. Under this research aim, the objectives are to:

- re-evaluate the strengths and weaknesses of each of the main approaches to estimate the AFF;
- evaluate the AFF pre- and post-pandemic using empirical examples for each of the main approaches;
- determine any impact that the COVID-19 pandemic might have had on the estimates of AFF;
- provide recommendations as to the preferred method, whilst considering the:
  - Theoretical strengths and weaknesses of the different methods
  - Size of the empirical estimations and differences between the values using different methods
  - Impact of the pandemic on the different approaches
  - Practicality of estimation

D.1.6 A summary of this report can be found in Section 4.

D.2 Strengths and Weaknesses

D.2.1 The first objective investigated for the research area involved examining the theoretical strengths and weaknesses of each approach. In considering such strengths and weaknesses, a set of criteria has been defined as listed below. The criteria are based on a review of the current guidance and with consideration of the practicality of use by operators and the TCAs. Each criterion is listed in terms of how a strength to the approach is demonstrated:

- data requirements are low: the more data that is required, the more likely it is that data processing is disproportionate to the scale of the claim for smaller operators in particular;
- estimation is simple: the method should be accessible across a range of users in the industry for ease of use and understanding of the processes involved;
- auditing is simple: it would be preferable if inputs and assumptions to the method, and also the representativeness of the method to concessionary journey frequency, can be checked quickly;

- comparisons can be made across TCAs and/or operators: it would be preferable if the reasons behind differences across TCAs and/or operators can be explained through comparative underlying data inputs and assumptions;
- representative of a range of ticket types: the method should reflect the different options passengers would have and the distribution of prices to pay if they were undertaking commercial travel;
- representative of the concessionary journey frequency distributions: the method should reflect the frequency of concessionary journeys to ensure the prices passengers would pay are consistent with their demand for bus services. Using commercial journey data is unlikely to accurately reflect concessionary travel decisions.

D.2.2 It should be noted that there have been several changes to tickets since 2010, as summarised below. These changes might impact on the method chosen by the operator and TCA in the calculation of AFF. This would be on the basis of potential trade-offs between which method is theoretically stronger and practicalities of information available:

- Off-bus sales of tickets have become more prevalent, which impacts on how to allocate ticket sales and revenues to a particular service, route and network. This could result in average ticket prices being calculated inaccurately, thereby distorting the estimated AFF when the average fare per ticket type is included in the calculator;
- Capping of fares on contactless EMV or ITSO cards has become more widespread. This means that the charge to each passenger is applied post-travel using the most cost-effective product, rather than through a pre-purchased ticket and then travelling. This means the most appropriate product is applied to customers but might impact on revenues and the estimation of AFF;
- There has also been a shift towards more multi-operator ticketing products. When calculating an average fare for reimbursement purposes, all such product sales need to be taken into account when calculating an average fare. This isn’t always straightforward, particularly when capping is in place. This point means that a Lookup Table across all operators within a TCA would be preferable to one that is specific to each operator;
- A current, short-term issue is the introduction of the £2 flat fare from 2023, which has been extended several times and now runs until at least December 2024. This has encouraged customers to purchase more single tickets rather than season products which distorts the ticketing market. This has an impact on how to calculate an average fare using the basket of fares method in particular. The choices passengers would make without the £2 flat fare would likely be very different than the weighted average of sales data. Annex J has been

included in the concessionary reimbursement guidance[35] to address the impacts of the fare cap in calculating AFF.

Discounted Fare Method

D.2.3 In the Table below, the strengths and weaknesses of the Discounted Fare Method are summarised:

Table 25. Strengths & Weaknesses of the Discounted Fare Method

Criteria	Strength/ Weakness	Discussion
Data requirements are low	Strength	The inputs to the current calculator are simple: sales and revenue by ticket type, plus journey multipliers for tickets which form the Average Cash Fare to be discounted (i.e. Single and Return tickets)
Estimation is simple	Strength	The process in the current calculator is automated and based on simple data inputs described above
Auditing is simple	Weakness	Revenue/sales data is held by the operators which will make it more difficult for the TCA to audit
Comparisons can be made across TCAs and/or Operators	Strength	The process will be consistent and use the same grouped ticket types of Single, Return, Daily and Weekly to represent ticket choices had one been required
Representative of a range of ticket types	Strength	Can account for many ticket types which may have been used should the travel have been commercial rather than conce ssionary
Representative of the concessionary journey frequency distributions	Strength	This is embedded in the process through Lookup Tables which captures the ticket types which would have been used had the travel been commercial and not concessionary. The fares Lookup Tables are built on concessionary journey data meaning that the average fare reflects concessionary travel decisions.

Basket of Fares Method

D.2.4 In the Table below, the strengths and weaknesses of the Basket of Fares Method are summarised:

35 https://www.gov.uk/government/publications/guidance-on-reimbursing-bus-operators-for-concessionary-travel

Table 26. Strengths & Weaknesses of the Basket of Fares Method

Criteria	Strength/ Weakness	Discussion
Data requirements are low	Strength	Data can be as simple as commercial revenue and sales data by ticket type across each service operated
Estimation is simple	Strength	The estimation is a weighted average across the revenue and sales data
Auditing is simple	Weakness	Revenue/sales data is held by the operators which will make it more difficult for the TCA to audit
Comparisons can be made across TCAs and/or Operators	Strength	The process will be consistent using weights on groups of ticket types had one been required
Representative of a range of ticket types	Strength	Can account for many ticket types which may have been used should the travel have been commercial rather than concessionary
Representative of the concessionary journey frequency distributions	Weakness	It is possible to use commercial sales and journey data

Average Cash Fare Method

D.2.5 In the Table below, the strengths and weaknesses of the Average Cash Fare Method are summarised:

Table 27. Strengths & Weaknesses of the Average Cash Fare Method

Criteria	Strength/ Weakness	Discussion
Data requirements are low	Strength	Data can be as simple as commercial revenue and sales data across any ticket type with a fixed limit on journeys undertaken (i.e. Single, Return and Carnet)
Estimation is simple	Strength	The estimation is a weighted average across the revenue and sales data
Auditing is simple	Weakness	Revenue/sales data is held by the operators which will make it difficult for the TCAs to audit
Comparisons can be made across TCAs and/or Operators	Weakness	This can potentially only be compared for operators and TCAs which don't offer period tickets (i.e. Daily and Weekly)
Representative of a range of ticket types	Weakness	Can only account for fixed journey tickets (i.e. Single, Return and Carnet)
Representative of the concessionary journey frequency distributions	Weakness	It is possible to use commercial sales and journey data

Local Methods

D.2.6 In the Table below, the strengths and weaknesses of the Local Methods are summarised:

D.2.7 One additional element which is not summarised in this table is that Local Methods might enable flexibility in that the operators and the TCA could find a common approach to agree on – although it might take a long period of negotiation to arrive at such a point.

Table 28. Strengths & Weaknesses of Local Methods

Criteria	Strength/ Weakness	Discussion
Data requirements are low	Unknown	As these are bespoke methods it isn't possible to know how complex the data requirements are
Estimation is simple	Unknown	As these are bespoke methods it isn't possible to know how complex the estimation is
Auditing is simple	Weakness	The use of bespoke methods is likely to make auditing more complicated as the process will need to be understood before it can be evaluated for accuracy
Comparisons can be made across TCAs and/or Operators	Weakness	The use of bespoke methods is likely to make comparisons harder to undertake
Representative of a range of ticket types	Unknown	As these are bespoke methods it isn't possible to know how representative of concessionary travel the methods will be
Representative of the concessionary journey frequency distributions	Unknown	As these are bespoke methods it isn't possible to know how representative of concessionary travel the methods will be

Summary

D.2.8 The table below provides an overall summary of the assessment of the strengths and weaknesses of each method.

Table 29. Summary of the Strengths & Weaknesses of AFF Methods

Criteria	Discounted Fare Method	Basket of Fares	Average Cash Fare	Methods
Data requirements are low	Strength	Strength	Strength	Unknown
Estimation is simple	Strength	Strength	Strength	Unknown
Auditing is simple	Weakness	Weakness	Weakness	Weakness
Comparisons can be made across TCAs and/or operators	Strength	Strength	Weakness	Weakness
Representative of a range of ticket types	Strength	Strength	Weakness	Unknown
Representative of the concessionary journey frequency distributions	Strength	Weakness	Weakness	Unknown

D.2.9 Based on the above table, the following summary is provided:

- the Discounted Fare Method appears to be the strongest method overall. It has similar strengths to the other methods but with the advantage of reflecting concessionary journey frequency distribution and implied ticket choices;
- the Basket of Fares Method carries the risk that commercial data is used rather than the journey frequency distribution and implied ticket choices in the calculations;
- Average Cash Fare is very straightforward but it is not representative unless the operator only offers fixed tickets and ignores the concessionary travel distribution;
- Local Methods carry a lot of risk as it isn't clear what the method will be and what the relative strengths and weaknesses are. This also has the potential to make auditing more difficult as the method will be bespoke. To reiterate, the current guidance states that such methods might only be appropriate for operators in large urban areas such as PTEs (replaced by transport authorities within Combined Authorities – such as Nexus or SYMCA) where journey patterns are significantly different (than outside of the former PTE areas).

D.2.10 The authors of this report have not come across any practical examples of where Local Methods have been applied to estimate the AFF as part of this commission. However, the authors are aware that TCAs ad operators can often negotiate around different products types to be included or excluded from Discounted Fare Method and Basket of Fare calculations.

D.2.11 From the above summary, it is recommended that the Discounted Fare Method remains the preferred approach but other methods should be allowed, given that the Discounted Fare Method may not be the most appropriate in all circumstances. The Basket of Fares Method may be more appropriate where:

- the use of the default Lookup Table in the calculator is not representative of concessionary journey frequencies but the data processing required to produce bespoke Lookup Tables would not be a simple task for the operator;
- only a small percentage of concessionary journeys would be on Daily or Weekly tickets as it is likely that the Discounted Fare Method and Basket of Fares Method will produce very similar outputs;
- operators run predominantly low frequency services. In the current guidance these are defined as operators who have at least 60% of concessionary boardings (on services within a TCA) on buses where the average weekday daytime (09:30 to 18:00) frequency is less than or equal to 1 bus per hour. There has not been any reason found in this update to disagree with this position;
- the operator does not sell Single/Returns/Carnets because the Discounted Fare Method will not work (it relies on a discount rate applied to the Average Cash Fare, which would be zero if the aforementioned tickers are not sold);
- similarly, if Daily and Weekly tickets are not sold the Discounted Fare Method will not work as the discount factor on the Average Cash Fare would also be zero.

D.2.12 It is also recommended that the Average Cash Fare Method only remains for use when operators sell fixed journey tickets (i.e. Single, Return, Carnet) and do not offer periodic tickets (i.e. Daily and Weekly) and that Local Methods are strongly discouraged and avoided unless the operator can give justification for using a bespoke method. For example, where the operator can demonstrate the other methods are not representative of concessionary travel on their services.

D.2.13 The justification for using a bespoke method would need to demonstrate that the AFFs using the Discounted Fare and Basket of Fares Method produce an AFF which is not representative of the journey distribution of the operator within the given TCA. This would involve comparing the implied journey distribution from the Lookup Tables in the calculator against the actual journey distribution of the operator and demonstrating that the differences are significant enough to result in an unrepresentative AFF.

D.3 The impact of COVID-19 & empirical estimation

D.3.1 A series of AFFs have been estimated using the three principal methods in the calculator and guidance (Average Cash Fare, Basket of Fares and Discounted Fare Methods). Local Methods have not been applied because there is no single method of estimation and comparison.

D.3.2 One of the purposes of the estimation is to consider any impact which COVID-19 might have had on the frequency of journeys being undertaken, as this could influence which method is most appropriate. For example, reduced journey frequencies would imply Daily and Weekly tickets are much less likely to be used and might mean the Discounted Fare Method is no longer as appropriate.

D.3.3 A second purpose is to consider whether the default Lookup Table is suitable in the current calculator as it is based on journey frequencies for Lancashire using NoWcard data from 2009, which is nearly fifteen years old and unlikely to be representative.

Data

D.3.4 Two sets of data were requested from TCAs and operators to estimate the AFFs. The first is HOPS data which was requested from TCAs. This data contains information on concessionary boarding numbers (i.e. journeys by date, operator and pass type – i.e. elderly, disabled etc.). This data was requested for both 2019/20 and 2022/23 in order to understand how journey frequencies have changed pre- and post-pandemic. The following TCAs supplied data:

- TCA 1: a mixed urban/rural area;
- TCA 2: a medium-sized urban area;
- TCA 3: a large urban area (former PTE);
- TCA 4: a rural area;
- TCA 5: a large urban area (former PTE);
- TCA 6: a rural area.

D.3.5 For each TCA, fares data has been requested from operators for 2022. The TCAs which the operators run services in vary. This means that AFFs cannot be estimated for each operator in all TCAs. The data was requested for 2022 to reflect that it is the distribution of concessionary journey frequency pre- and post-pandemic that is of interest for comparison on a consistent basis (i.e. the price per ticket remains constant across the years of analysis). Furthermore, from 2023 onwards, fares were temporarily capped at £2, which is a distortion best isolated from the impacts of the pandemic for this analysis.

D.3.6 The fares data provided by three operators contains information on average fares for the following groups of ticket types (as yields per passenger across all routes and individual ticket types):

- Single (including Carnet);
- Return;
- Daily;
- Weekly.

Methodology

D.3.7 Empirical estimations of AFFs were produced using the data summarised in the previous sub-section for the following approaches – Local Methods were not analysed as these would be bespoke and difficult to compare on a like-for-like basis:

- Average Cash Fare
- Basket of Fares Method
- Discounted Fare Method

D.3.8 A four-stage process to estimating the AFFs was applied:

- Stage One: The HOPS data was analysed for each TCA to determine total journeys per week across all cardholders – this allowed the exclusion of any weeks from the data which appear to have unusually high or low journeys compared to general trends. Any cardholders which do not have a unique, anonymised reference number associated with them are removed from the data too as this will aggregate multiple cards and overstate journeys per person. Within the retained data, journeys per day were aggregated by cardholder. The number of rows removed by TCA is summarised in Table 23 and demonstrates between 15% and 27% of the records have been removed through the cleaning process;

Table 30. HOPS Records Removed in Data Cleaning Process

TCA	Pre-Cleaning	Post-Cleaning	Removed	% Difference
1	8.6m	6.5m	2.1m	24%
2	11.8m	9.6m	2.2m	19%
3	54.0m	45.8m	8.2m	15%
4	13.4m	10.2m	3.2m	24%
5	38.7m	31.6m	7.1m	18%
6	5.2m	3.8m	1.4m	27%

- Stage Two: The HOPS data was analysed using average yields per ticket across each TCA and operator available for the following ticket types:
  - Single;
  - Return;

  - Daily;
  - Weekly;
- Stage Three: The HOPS data on journey frequencies from Stage One and the average yields from Stage Two were combined to understand the fares choices which concessionary passengers would have made had they been required to pay a fare. The choices were aggregated to understand:
  - Journeys per sale (by ticket type);
  - Total journeys per ticket type;
  - Sales (by ticket type);
- Stage Four: AFFs were estimated and compared against output from the current calculator for each of the three methods listed above across the range of TCAs and operators for which data is available.

D.3.9 In Stage Four, the degeneration factor from the current calculator was applied to empirically estimate AFFs using the Discounted Fare Method. The degeneration factor adjusts the AFF under the Discounted Fare Method to reflect that if commercial fares were paid rather than concessionary travel being undertaken, the journeys per person would likely be lower. Therefore, fewer Daily and Weekly tickets would be purchased than under concessionary travel and the discount factor on the Average Cash Fare would be lower.

D.3.10 It is recognised that the Degeneration Factor might be unrepresentative of generated demand today. However, this aspect of the calculator was updated concurrently in a separate area of analysis which has been discussed in Section 3 of this report to update the demand generation factor.

D.3.11 This is unlikely to cause any issues to the analysis as it only affects the Discounted Fare Method and the empirical estimations are mainly used to compare the effect of the pandemic between 2019/20 and 2022/23. The difference in AFFs driven by potentially different journey distributions pre- and post-pandemic regardless of the inclusion of a historic or an updated degeneration factor being applied.

Output

D.3.12 The estimates of AFF are presented in the table below for 2019/20 and 2022/23 for each method. This output shows a lot of variation by method and combination of TCA and operator. However, the change from 2019/20 to 2022/23 is very low. This suggests that choosing the appropriate method of estimation is important to avoid over or understating the AFF, whereas the impacts of COVID-19 have been less than 5%:

- in 2019/20, the minimum AFF is £1.13 under the Basket of Fares Method, in comparison to a maximum of £2.71 under the Average Cash Fares Method;

- in 2022/23, the minimum AFF is £1.17 under the Basket of Fares Method, in comparison to a maximum of £2.71 under the Average Cash Fares Method;
- on average, the change from 2019/20 to 2022/23 under each method is:
  - Average Cash Fare: £0.01 (0.2%);
  - Basket of Fares: £0.08 (4.4%);
  - Discounted Fare Method: £0.07 (3.8%).

Table 31. Estimated AFF by Method

TCA & operator		2019/20			2022/23		
TCA	Operator	Average Cash Price	Basket of Fares	Discounted Fare	Average Cash Price	Basket of Fares	Discounted Fare
1	A	-	-	-	£2.12	£1.80	£1.95
1	C	-	-	-	£2.02	£1.78	£1.89
2	A	£1.72	£1.28	£1.34	£1.73	£1.32	£1.39
3	B	£1.94	£1.44	£1.55	£1.96	£1.50	£1.61
3	C	£2.18	£1.39	£1.63	£2.18	£1.47	£1.72
4	A	£2.42	£1.97	£2.24	£2.42	£2.03	£2.29
5	A	£1.28	£1.13	£1.18	£1.30	£1.17	£1.23
5	C	£1.79	£1.37	£1.47	£1.80	£1.43	£1.54
6	A	£2.52	£2.33	£2.42	£2.52	£2.35	£2.45
6	C	£2.71	£2.16	£2.59	£2.71	£2.20	£2.64

D.3.13 In the table below, the output of the Discounted Fare Method is compared for the updated outputs against the current calculator for each year, TCA and operator analysed. These outputs show that there are reasonably large differences in using the NoWcard default Lookup Table, in comparison to estimating AFFs using journey frequencies from the HOPS data. There is again little difference between years. This implies that the NoWcard data is not representative of current concessionary travel and there is likely to be variation by Rural and Urban area types which should be accounted for.

Table 32. Comparison of AFF: Current Calculator & Updated Outputs (Discounted Fare Method)

TCA & operator		2019/20			2022/23		
TCA	Operator	Current Calculator	Updated Outputs	Difference	Current Calculator	Updated Outputs	Difference
1	A	-	-	-	£1.96	£1.95	-£0.01
1	C	-	-	-	£1.90	£1.89	-£0.01
2	A	£1.63	£1.34	-£0.29	£1.64	£1.39	-£0.25
3	B	£1.83	£1.55	-£0.28	£1.83	£1.61	-£0.22
3	C	£1.92	£1.63	-£0.29	£1.92	£1.72	-£0.20
4	A	£2.22	£2.24	£0.02	£2.22	£2.29	£0.07
5	A	£1.26	£1.18	-£0.08	£1.28	£1.23	-£0.05
5	C	£1.68	£1.47	-£0.21	£1.69	£1.54	-£0.15
6	A	£2.39	£2.42	£0.03	£2.39	£2.45	£0.06
6	C	£2.42	£2.59	£0.17	£2.42	£2.64	£0.22

D.3.14 Based on the above, the recommendation is that the Lookup Table in the calculator is updated to reflect more recent data and area type.

D.4 Discussion & recommendations

D.4.1 The aim of this research was to investigate the suitability of the AFF in the current calculator and recommend potential revisions as part of a package of updates to the calculator and guidance. The following objectives were pursued:

- Re-evaluate the strengths and weaknesses of each of the main approaches to estimate the AFF;
- Estimate the AFF pre- and post-pandemic using empirical examples for each of the main approaches;
- Determine any impact that COVID-19 might have had on the estimates of AFF;
- Provide recommendations as to the preferred method.

D.4.2 There are four methods to estimate AFF in the current guidance, of which three are directly included in the current calculator:

- Average Cash Fare (included);
- Basket of Fares (included);
- Discounted Fare (included);
- Local Methods – any other approach which is not included in the template calculator.

D.4.3 In the current guidance, the recommendation is for the Discounted Fare Method to be the preferred approach (unless services are infrequent – in which case the Basket of Fares Method is preferred because Daily and Weekly tickets are much less likely to be used if the ENCTS were not in place, and fares paid).

D.4.4 Recommendation One: It is recommended that the Discounted Fare Method remains the preferred approach. From this research, there has been no reason to disagree with when the method might not be appropriate based on current guidance. The strengths appear to be greater than the other methods – in particular that concessionary journey frequency distributions and implied ticket choices under commercial travel are reflected in the Discounted Fare Method.

D.4.5 The Basket of Fares Method must be recognised as having most of the other strengths and weaknesses of the Discounted Fare Method with one key exception. The exception is that it doesn't account for the journey frequency distribution of concessionary travel, whereas the Discounted Fare Method does, via the Lookup Tables in the calculator. Hence, the Basket of Fares Method does not account for the adjustment to the AFF via the degeneration factor (which accounts for the ENCTS generating additional journeys per person due to travel being free rather than having to pay commercial fare).

D.4.6 Nevertheless, when journey frequencies indicate that a very low proportion of journeys per person would be undertaken using Daily or Weekly tickets, there is likely to be little difference empirically between the Discounted Fare and Basket of Fares Methods.

D.4.7 Unless operators only offer fixed journey tickets, the Average Cash Fare does not seem appropriate to use – it will likely overstate the value of concessionary journeys unless very few journeys per passholder are undertaken each week and Single or Return tickets would have made sense to use under commercial travel.

D.4.8 The use of Local Methods should also be discouraged unless there is strong argument for using them – it makes auditing and comparisons potentially difficult and time consuming. Where it could be relevant is where:

- The commercial ticket choices and/or pricing structures are bespoke to the TCA and/or operator; or
- The journey frequency distribution is very different to other TCAs or operators; or
- The above might combine to mean the other methods in the guidance could be argued as potentially producing unrepresentative results (but this would need justified by the operator)

D.4.9 Nevertheless, Recommendation Two is that the other two methods which are included in the current calculator (Average Cash and Basket of Fares) are also retained in the updated calculator.

D.4.10 The advantages of this are:

- The inclusion of the different methods allows for TCAs and operators to select a method which is suitable for their ticketing structure (some operators might not offer periodic tickets such as Daily and Weekly);
- It also allows for TCAs and operators to select a method suitable for their concessionary journey frequency distribution (low numbers of journeys per person might mean it is unlikely periodic tickets would be used if passengers were required to pay a fare);
- There are known weaknesses of the Discounted Fare Method stated in the guidance at present, where these conditions are met it is reasonable to offer TCAs and operators other options.

D.4.11 The disadvantages are:

- Offering multiple methods might mean that TCAs and operators are uncertain over which is the most appropriate method to apply. Although clear guidance should mitigate this potential problem;
- The calculator needs to account for more inputs, assumptions and calculations – though this is a feature of the current calculator anyway and can be re-organised to improve the presentation;
- The Average Cash Fare is only really relevant for operators which offer Single and Return tickets;
- The Basket of Fares Method does not directly account for the journey frequency distribution of concessionary travel, whereas the Discounted Fare Method does and could be based on Lookup Tables bespoke to the region.

D.4.12 Beyond the theoretical considerations, the empirical estimations serve to demonstrate that the Average Cash Fare approach should not be used unless the operator only offers fixed tickets (i.e. Single and Return) – for operators which offer Daily and Weekly tickets, the Average Cash Fare is likely to overstate the AFF owing to the discount on periodic tickets. Recommendation Three is that that the Average Cash Fare approach is discouraged from use for operators offering Daily and Weekly tickets.

D.4.13 The differences between the estimation of AFFs using the current calculator and the bespoke Lookup Tables (using the Discounted Fare Method) demonstrate that the HOPS data is more representative of the current journey frequency distribution of concessionary travel than the NoWcard data. This is unsurprising as the NoWcard data is from 2009, whereas the HOPS data is from 2019/20 and 2022/23. It is Recommendation Four that the default Table is updated to more recent data. However, it should remain in the guidance that operators/TCAs can collaboratively produce their own Lookup Tables in place of the default

Table – the Tables from this research are intended to be made available subject to agreement by TCAs. This approach might also mean that Local Methods become irrelevant for use because atypical journey frequency distributions and bespoke pricing structures can be accounted for in the bespoke Lookup Tables.

D.4.14 The impact of COVID-19 on average between 2019/20 and 2022/23 has been estimated as follows across each method:

- 0.2% under the Average Cash Fare Method;
- 4.4% under the Basket of Fares Method;
- 3.8% under the Discounted Fare Method.

D.4.15 These changes in AFF on average are only slight (in proportionate terms) and are driven by a reasonably stable distribution of journey frequencies pre- and post-pandemic. Therefore, the impact of the pandemic on AFFs on which method might be preferable and/or the scale of AFFs seems minimal. That the impact of the pandemic appears low serves to reinforce that the changes in AFFs estimated in relation to the current calculator are driven more by improved data (HOPS) in comparison to the NoWcard data which informs the Lookup Tables in the current calculator.

D.4.16 For Recommendation Five, the default Lookup Table in the calculator (which is based on NoWcard data for Lancashire from 2009) should be updated. The data is nearly fifteen years old and is unlikely to be representative of current concessionary travel patterns across the range of geographies of England – which is reinforced by differences in the AFFs estimated in this research.

D.4.17 It has been agreed (Recommendation Six) that the following four Lookup Tables are developed for inclusion, which should reflect a range of journey distributions driven by differences in service frequencies/population densities (which will impact on journey frequencies per concessionary passenger and ultimately AFF estimated):

- Large Urban Area: the options here are TCA 3 and TCA 5. to reflect former PTE areas. There is little to choose between the areas but it is recommended that TCA 3 is used on the basis of the processing being easier due to the absence of multi-modal journeys.
- Medium-Sized Urban Area: it is recommended that TCA 2 is used as it offers a reasonable balance between a large settlement and complexity in data.
- Mixed Urban/Rural Area: it is recommended that TCA 1 is used as the current Lookup Table is also based on a mixed urban/rural area. It enables closer comparison to be made pre- and post -implementation of changes to the Lookup Tables which could be beneficial to understand;

- Rural Area: the options here are TCA 4 and TCA 6. There is relatively little basis on which to choose between these, as the data quality appears to be similar. It is recommended that TCA 4 is used.

D.4.18 The advantage of the update to include four Lookup Tables rather than the single default Lookup Table in the original calculator is that it allows a wider reflection of the different journey frequency distributions across a range of geographies. This will enable the user to select the most appropriate Lookup Table for their TCA and improve the accuracy of their reimbursement estimates.

D.4.19 While the impact of the update to the lookup tables included within the new calculator is not covered by the case studies in Section 6, owing to the use of directly input AFF for each case study, the effects of each new lookup tables compared to the old NoWcard data have been investigated. The discount factors from the Large Urban Lookup table and Medium Urban lookup table are higher than the discount factor from the lookup table in the current calculator (assuming the same combination of fare inputs), which would lead to a lower AFF for non-generated journeys. In contrast the discount factors from the Mixed rural/urban and Rural lookup tables are lower than the discount factor from the lookup table in the current calculator (assuming the same combination of fare inputs), leading to a higher AFF as compared to the previous calculator.

D.4.20 TCAs can also use custom lookup tables, however, as there will be variation in the discount factor applied by these it is not possible to assess how this factor compares to the discount factors from the other lookup tables. It is understood that some TCAs already use their own custom lookup tables based on local data, in these instances little impact is expected as a result of the update to the default lookup tables within the calculator.

D.4.21 This leads to Recommendation Seven that the guidance and updated calculator should note that whilst there are four default Lookup Tables, it is also possible for bespoke Lookup Tables to be produced for a TCA – this is a practice that occurs already and it is not perceived that using more local data (provided it can be shown to be robust and representative of concessionary travel) is of any issue. It will arguably be more representative of local conditions and more accurate.

D.4.22 The guidance should recommend that the TCA and operator agree prior to use of the calculator in any submission on whether they use one of the default Lookup Tables or a bespoke version.

D.4.23 It is not recommended that Lookup Tables are developed for each operator as this might disadvantage smaller operators. Lookup Tables by TCA, as recommended, could benefit smaller operators who could use more local data but not incur the resources required to develop them.

D.4.24 To conclude this section of the report, a summary of the recommendations is provided below:

- Recommendation One: The Discounted Fares Method remains the preferred approach;
- Recommendation Two: The Average Cash Fares and Basket of Fares Methods are retained where the Discounted Fares Method might not be appropriate. Local methods are allowed but discouraged from use unless there is strong justification for why the other methods are inappropriate;
- Recommendation Three: The Average Cash Fare is discouraged from use unless the operator only offers Single and Return tickets;
- Recommendation Four: It remains feasible for operators/TCAs seek to collaboratively produce their own Lookup Tables using local data;
- Recommendation Five: The default Lookup Table is also updated from 2009 NoWcard data to 2022/23 HOPS data;
- Recommendation Six: A set of four Lookup Tables using the HOPS data are included in the updated calculator to ensure operators/TCAs which do not have their own Lookup can use more appropriate data. The revised Lookup Tables will reflect: Large Urban, Medium-Sized Urban Mixed Urban/Rural and Rural Areas;
- Recommendation Seven: The guidance and calculator should be clear that whilst there are four Lookup Tables for different geographies, operators and TCAs are permitted to develop their own bespoke Lookup Tables using local and robust data.

D.5 Derivation of Lookup Tables

D.5.1 To conclude this Annex, the process followed to produce a set of Lookup Tables is summarised.

D.5.2 The HOPS data that the Lookup Tables have been constructed from included all concessionary journeys starting in the local area on smartcard-enabled buses for the year 2022/23. Data from non-residents was excluded to avoid any potential incompleteness of data and to avoid undermining the strength of the data.

D.5.3 The HOPS data included a record for each journey made by concessionary passholders within 2022/23. Together with the suppliers of the data, we removed:

- Records with missing passholder ID information
- Passholders ineligible to hold the pass
- Passholders who were issued a pass after the data extraction start date
- Duplicate cardholders
- Outliers in terms of journeys per passholder

D.5.4 The cleaned data was summarised into the total number of concessionary journeys made by each passholder on each day of 2022/23. It was then further summarised into the total number of journeys in each week of the year. Both these aggregations used an SQL coding process.

D.5.5 This data is then aggregated for each combination of weekly to cash fares and daily to cash fares price ratios to derive the Lookup Table:

- For each value of the weekly ticket price to cash fare ratio (1:1, 2:1, 3:1,…,40:1) the total number of passholders who had weekly journey totals at or above that value are counted and the number of journeys made are calculated. For instance, for a weekly ticket priced at three times the cash fare, it is assumed that all passengers who make three or more journeys per week would purchase a weekly ticket. Summing across all passholders would then yield the number of weekly tickets, and summing their journeys would yield the total number of weekly journeys at that price ratio;
- The process is repeated for the remaining journeys (the journeys not assigned to weekly tickets) for each value of the daily ticket price ratio (1:1, 2:1,…,10:1);
- The journeys not categorised as weekly or daily tickets are assigned to the cash fare category.

D.5.6 The process resulted in Lookup Tables summarised as in the table below.

Table 33. Properties of lookup tables areas

Lookup Table	Description	Population	Density (population/ sq. km)	Population (Over 65s)	Lookup Table Characteristics
Large Urban Area	Combined authority area	1.15m	2,100	0.20m	Journeys = 19,449,708 Unique Passes Used = 193,271 Number of days a pass is used (pass days) = 8,794,372 Average journeys made each day a pass is seen = 2.21
Medium Urban Area	Medium sized city	0.35m	5,000	0.05m	Journeys = 4,453,481 Unique Passes Used = 38,758 Number of days a pass is used (pass days) = 1,837,200 Average journeys made each day a pass is seen = 2.42

Lookup Table	Description	Population	Density (population/ sq. km)	Population (Over 65s)	Lookup Table Characteristics
Mixed Urban/ Rural	Large county area of mixed urban and rural settlements	1.25m	400	0.25m	Journeys = 6,661,511 Unique Passes Used = 127,485 Number of days a pass is used (pass days) = 3,505,073 Average journeys made each day a pass is seen = 1.90
Rural	County area of mostly rural settlements	0.90m	200	0.20m	Journeys = 4,390,618 Unique Passes Used = 92,390 Number of days a pass is used (pass days) = 2,194,713 Average journeys made each day a pass is seen = 2.00

D.5.7 The average number of journeys made per card provides a comparable metric with which to compare the four datasets used to derive the Lookup Tables. The medium-sized urban area saw 2.42 journeys per pass per day which is greater than the large urban area (2.21) and significantly greater than the mixed urban/rural (1.90) and rural areas (2.00). Typically, the higher the number of journeys made per pass per day, the more likely that, in absence of a scheme, a greater proportion of passholders would have purchased day and week tickets compared to cash tickets. This would likely result in a higher discount factor and lower average fare, all things remaining equal.

D.5.8 The medium-sized urban area is reflective of cities that have dense urban populations – as reflected by the population densities in the previous table – and frequent bus services serving urban and suburban areas.

D.5.9 The large urban area Lookup Table is more representative of Mayoral Combined Authorities, whereas the rural Lookup Table is representative of a large, predominantly rural shire authority area with a small city and a small number of small urban settlements. The mixed urban/rural Lookup Table is broadly comparable to the NoWcard Lookup Table from previously published guidance and calculators given the mix of urban settlements and rural areas in the area on which it was developed.

Annex E Costs: Inflation and Marginal Operating Costs

E.1 Introduction

E.1.1 The ENCTS enables passengers who are eligible for a travel pass to undertake off-peak bus journeys for free in England. A proportion of journeys under the scheme would be made even if the pass was not provided – these journeys are simply converted from fare-paying to free travel. However, because the travel is free, there is also a proportion of journeys only made because travel is free.

E.1.2 This increase in journeys by bus due to the scheme puts a financial burden on the operator because they:

- carry more passengers which impacts on costs including fuel consumption and wear and tear;
- might have to run more services or run existing services more intensively to meet demand.

E.1.3 The financial burden could be experienced through increased Capital Costs and also Operating & Maintenance Costs. In this Annex it is the increase in Operating & Maintenance Costs which is considered. Some of these Operating & Maintenance costs are, however, relevant to the Marginal Capital Cost and Peak Vehicle Requirement elements of the calculator as discussed in Section 5.4. The cost of providing additional capacity through operating more services is informed by drivers' hourly wages and fuel costs.

E.1.4 In the current calculator and guidance, operators are allowed to claim for the increase in Operating & Maintenance costs incurred from carrying concessionary passengers who would not have travelled in the absence of the ENCTS.

E.1.5 The increase is reflected through Marginal Operating Costs (MOCs). The general concept of Marginal Cost is that it reflects the additional cost of providing one more unit of output. Therefore, in the calculator MOC reflects the additional Operating & Maintenance cost incurred for each additional passenger served by an operator.

E.1.6 This can be considered against Average Costs, which reflects the cost per unit across the entire range of output served, or the cost per passenger (existing and additional/generated together).

E.1.7 There is an existing relationship in the calculator and guidance to estimate MOCs. The relationship is based on research by ITS as part of the development of the reimbursement calculator from the introduction of the 2010 ENCTS.

MOC = 0.055 + 0.006
** Average distance in miles travelled per generated concession)/3.9*

E.1.8 For the above equation:

- The first parameter reflects a fixed element to MOCs, which means that for every additional journey an additional 5.5p is incurred by Operators
- The second term reflects a variable element to Marginal Operating Costs which increases with the average distance travelled for each generated concessionary passenger. For every 3.9 miles travelled, an additional 0.6p per passenger will be incurred.

E.1.9 In this research, the above functional form of MOCs will be maintained and it is only the cost parameters which are to be updated based on the supporting evidence – i.e. the 5.5p fixed parameter and the 0.6p per passenger mile variable element. There is some risk to maintaining this relationship as it is possible that this estimate of MOCs is no longer accurate after nearly fifteen years – due to technological change, congestion, bus priority etc. However, the data requirements and timescales to investigate this relationship are beyond the scope of this study.

E.1.10 To update the relationship would require econometric analysis of Operating Cost functions, which would require comprehensive and consistent data on the following across multiple operators, regions and years to be robust:

- Operating Costs;
- Drivers of Operating Costs;
- Outputs – i.e. passenger and vehicle kilometres.

E.1.11 The parameters in the above relationship are in 2009/10 prices which means that for each year a reimbursement claim is made, the MOCs estimated are adjusted to reflect the price base of that year. The adjustments are based on an inflationary index which uses CPI until 2021/22. Beyond this year, the percentage change in the GDP Deflator each year is applied– which means that the inflationary adjustments are based on an index which sources data from two separate measures of inflation. The rationale for this is unclear.

E.1.12 In this research area, the aim is to review the suitability of the current reimbursement calculator and guidance in terms of estimating MOCs. Under this research aim are the following objectives:

- To analyse how bus operating costs have changed since 2009/10;
- To compare operating costs against the inflation assumptions in the current calculator;
- To cross-check any differences in operating cost growth with the

inflation assumptions (where possible);

- To provide recommendations for future cost inflation, also considering a bespoke measure of inflation that is more aligned with the drivers' of changes in operators costs;
- To provide recommendations for adjustments to the MOCs for the new calculator.

E.2 Data

E.2.1 In order to understand how bus operating costs have changed since 2009/10, a series of datasets has been provided and sourced, which is discussed in this section.

E.2.2 The first set of data is named as 'CPT Cost Indices', which the Confederation of Passenger Transport (CPT) has provided and contains a set of cost indices from 2010 to 2019. The data breaks down annual cost changes by category for the following English Regions:

- Greater London;
- Home Counties;
- Midlands;
- Northern England;
- South West England.

E.2.3 The second set of data is the 'Changes in Bus Industry Costs 2019-2022' Report which the CPT has also provided (hereafter referred to as the CPT Report). It contains extracts from their bus industry cost report which summarises annual cost changes by category from 2015 to 2022 for Great Britain (outside of London), and also overall operating cost changes for the following regions:

- English Metropolitan Areas;
- English Shire Areas;
- England Outside of London.

E.2.4 The third set of data is 'Bus4i: Costs, fares and revenue for local bus services'. This data is publicly available on the DfT's Statistics at DfT website.[36] The data summarises overall operating cost changes between 2004/05 and 2021/22 for the following regions:

- London;
- English Metropolitan;
- English Non-Metropolitan Areas;
- England Outside London.

36 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1132924/bus04i.ods

E.2.5 The final dataset is extracted from the 'Concessionary travel for older and disabled people: guidance on reimbursing bus operators (England) – Annex E: Research and Summary of Evidence' report. This report is part of the guidance for the current calculator and provides evidence on the breakdown of MOC by component from a bottom-up estimate.

E.2.6 It is believed that the CPT data is the most comprehensive available with respect to comparing trends in costs over time by component and geography. There has not been any other data (robust or otherwise) supplied or mentioned by any stakeholder to the study. It would have been feasible to ask operators for their data. However, this might lead to the following problems:

- A lack of representativeness across the range of responding operators on average.
- Issues with commercial sensitivity in publishing the outputs and using it in any updates to the calculator and guidance.

E.2.7 Nevertheless, various stakeholders have raised concerns about the robustness of the CPT data due to the inclusion of coach operators within the data and the potential incentive for operators to overstate increases in costs. For this reason, we have contrasted the data provided by CPT with other sources of data where feasible. We do not find evidence of material overstatement of cost changes and believe that the CPT data is the most consistent and comprehensive data available on bus operating costs.

E.3 Methodology

E.3.1 The methodology to analyse how MOCs have changed since 2009/10 has focussed on analysing the two sets of cost data provided by the CPT:

- CPT Report;
- CPT Cost Indices.

E.3.2 This data is used because this data breaks down the main drivers of Operating Costs from 2010 to 2022 across different geographies, whereas the other data from the DfT is much more aggregated. The disaggregation is useful to consider as it might demonstrate different trends by driver and region.

E.3.3 In general, the methodology for the analysis was straightforward. It involved analysing the trends in different operating costs from the CPT datasets and benchmarking them against the DfT data and the bottom-up estimate in the current guidance (Annex E). The outputs were then compared against the inflation assumption in the current calculator to understand whether or not an update to the MOCs would be required.

E.3.4 However, the data from the CPT index is separated into two datasets which are not quite consistent in terms of geography, aggregation of cost components or time horizons. Therefore, these two datasets required a process to combine the data, which is summarised below.

E.3.5 The CPT Cost Indices which provide data from 2010 to 2019 were analysed by region and year to produce a set of indices by operating cost type. The indices were then expanded to 2022 by joining the data with extracts from the CPT Report.

E.3.6 The CPT Report only provided index changes in Operating Costs aggregated for Outside of London, rather than the geographical breakdown the CPT Indices provided. The cost components were also slightly different between the report and indices. As a starting point in the combination of the datasets, Operating Cost components were matched between the two sets as shown in the table below:

Table 34. Mapping of Cost Categories between CPT Report and Indices

CPT Report	CPT Cost Index
Drivers	Driver Wages and On Costs
Maintenance	Other Labour and Staff Costs
Admin	Other Labour and Staff Costs
Parts	Maintenance Materials
Fuel	Fuel
Overheads	Other Operating Costs
Insurance	Insurance and Claims
Depreciation & Leasing	Vehicle Depreciation

E.3.7 The CPT Report provides the above components in absolute monetary values for Outside of London but does not break these down any further by geographical region. However, it does provide overall Operating Costs by Metropolitan and Shire Areas. Hence, each cost component was factored to reflect the overall cost per km as follows:

Table 35. Cost Adjustments by Area

Area	2019	2022
Outside London (CPT Report)	£2.153	£2.497
Metropolitan Areas (CPT Index)	£2.497	£2.899
Shire Areas (CPT Index)	£2.067	£2.452
Factor Metropolitan Areas (CPT Index/CPT Report)	1.16	1.16
Factor Shire Areas (CPT Index/CPT Report)	0.96	0.98

E.3.8 This produced two initial sets of outputs for 2019 to 2022:

- Costs by component for Metropolitan Areas in monetary values;
- Costs by component for Shire Areas in monetary values.

E.3.9 In the CPT Indices the Operating Cost data is available for four geographical regions outside of London. The areas in the CPT Indices could cover both Metropolitan/Urban and Shire Areas. Therefore, these indices were applied to the above Cost Outputs from 2019 to 2022 to extend the time horizon to 2010, with the mapping between datasets as shown in the Table below.

Table 36. Mapping of Geographies between CPT Report and Indices

Area	CPT Index (2010 to 2019)	CPT Report (2019 to 2022)
Home Counties	Home Counties	Shire Areas
Midland Metropolitan	Midlands	Metropolitan Areas
Midland Shire	Midlands	Shire Areas
North of England Metropolitan	North of England	Metropolitan Areas
North of England Shire	North of England	Shire Areas
South West Urban	South West England	Metropolitan Areas
South West Shire	South West England	Shire Areas

E.3.10 A set of indices was then constructed for each Cost Category in each Area by calculating the index change from a 2010 base (from the time series of monetary values).

E.3.11 It is possible to demonstrate the above using a hypothetical example and values. First, assume that Driver Costs are £1 per km Outside of London from the CPT Report but the analysis of interest is the Midlands from the CPT Index. The £1 per km can be adjusted by a factor of 1.16 for 2019 so that the costs reflect the Midland Metropolitan Area. Therefore, Driver Costs are £1.16 per km in this area. The same method would then also be applied to the costs for 2022 and interpolation applied between these years as 2020 and 2021 are unavailable.

E.3.12 The CPT Index for the Midlands would then be applied to derive all monetary values back to 2010. If Driver Costs in the Midlands in 2010 were 75% of the Driver Costs in 2019, then the estimated cost for Midland Metropolitan would be £0.87 per km. Therefore, the index would start at 1.00 for 2010 (first year of data), and by 2019 the index would have reached 1.33 (£1.16 per km/£0.87 per km).

E.3.13 By considering the range of potential values when joining the two datasets together and analysing the changes, it helps to demonstrate the potential range of growth in Operating Costs which might have been experienced across England. If this range is narrow, it provides confidence that a single adjustment can be applied to update MOCs (as is currently applied in the calculator), whereas a large range provides the risk that operators might be over or under-compensated because geographical differences are not represented.

Average and Marginal Costs

E.3.14 An important clarification to note from the methodology is that Average Costs from the CPT data are being used to inform potential changes in Marginal Costs – the current calculator reimburses for changes in Operating Costs based on Marginal Costs rather than Average Costs because the reimbursement reflects the cost of additional passengers through Concessionary travel.

E.3.15 It is unlikely that there is data available to benchmark the Marginal Cost relationship in the current calculator against actual Marginal Costs experienced by operators across the range of geographies and years for which Average Costs are available. This would require a further econometric study to estimate cost functions and derive Marginal Costs from across a range of operators and over a reasonably representative time horizon. This is because company accounts and finances will tend to focus on accounting costs rather than economic costs, which need to be estimated.

E.3.16 Therefore, the analysis is presented under the assumption that the MOC relationship in the current calculator (summarised in the introduction to this report) is maintained and does not require updating. It is only the adjustment by inflation to the MOCs which is used to adjust to today's prices which requires investigating and potentially updating if it is not representative. However, this does assume that changes in Average Cost will be representative of the changes in Marginal Cost to update the calculator.

E.3.17 It is not considered that assuming MOCs grow in line with Average Costs will produce any particular bias. This is as long as any adjustment to reflect actual Operating Cost inflation only accounts for cost changes to items which are marginal (affected by additional output) and not the full range of Operating Costs which might not be marginal.

E.4 Costs

E.4.1 A series of graphs of the index changes in Operating Costs have been produced and presented in this section of the report. Each Operating Cost is separated into a sub-section as follows:

- Breakdown of Costs;
- Driver Costs;
- Maintenance Costs;
- Other Labour and Staff Costs;

- Labour Sub-Total Costs;
- Cost of Parts;
- Fuel Costs;
- Insurance Costs;
- Overhead Costs;
- Depreciation & Leasing;
- Total Costs (All Items);
- Total Costs (Marginal Items Only).

E.4.2 The geography analysed is consistent with the breakdown in the CPT Index and Reports, and the possible mappings of the data pre-2019 and post-2019 between the two data sources. This means that the different areas analysed are:

- Home Counties;
- Midland Metropolitan & Shire;
- North of England Metropolitan & Shire;
- South West Urban & Shire;

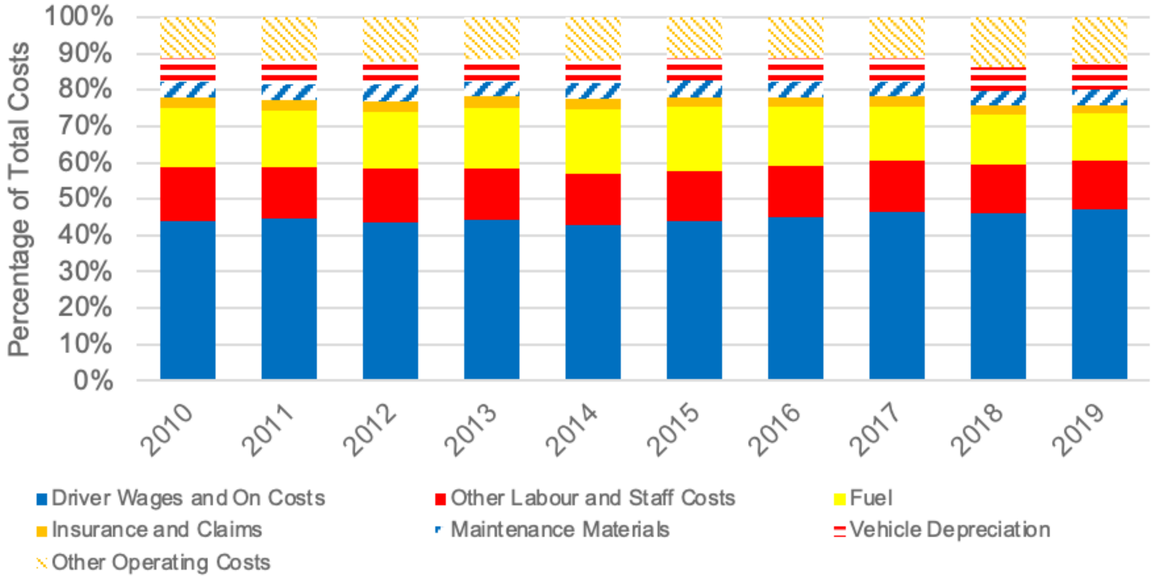
E.4.3 The rationale for analysing and presenting the different geographies is twofold. Firstly, it allows for potential regional variations to be considered with respect to how much any required update to the calculator might vary. Secondly, the CPT Report provides changes by Metropolitan and Shire Areas. In the CPT Index, it is feasible that the Midlands, North of England and South West England contains both Metropolitan or Large Urban areas and also Shire Counties. Therefore, it allows for such differences to be accounted for.

E.5 Breakdown of Costs

E.5.1 The CPT Indices data provides the proportion of overall operating costs which each category contributes to operators between 2010 and 2019. The data shows that three costs contribute approximately 75% of costs and each cost item appears to contribute a similar proportion each year:

- Driver Wages and On Costs (on costs reflect contributions beyond wages/salaries such as pension contributions);
- Fuel;
- Other Labour and Staff Costs.

Figure 61. **Breakdown of Operating Costs (CPT Indices)**



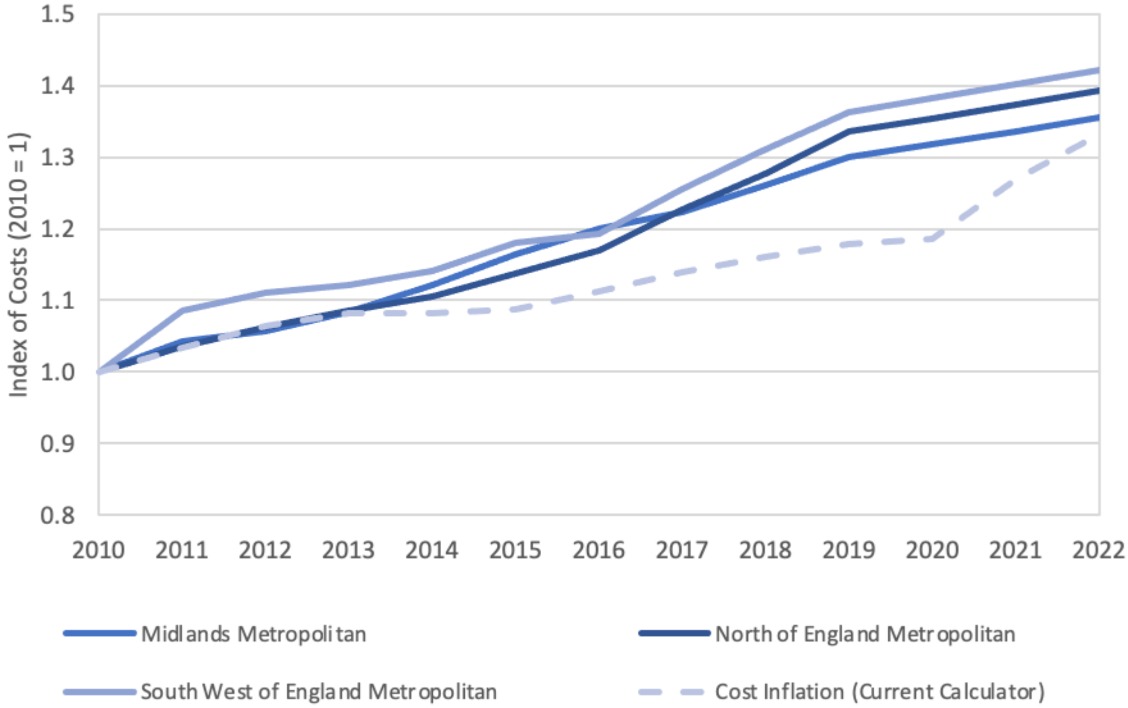
E.6 Driver Costs

E.6.1 In this section, the index change in Driver Costs from 2010 to 2022 is summarised by Metropolitan and Shire Area analysed. The CPT data describes Driver Costs as consisting of wages and on costs (on costs refer to the costs paid by an employer on top of salary such as national insurance contributions, pensions etc.).

Metropolitan Areas

E.6.2 The graph below demonstrates a general trend of Driver Costs increasing at a rate similar to the inflation assumption in the current calculator, with the exception of the period 2016 to 2021, where costs rose above inflation.

Figure 62. Index Changes in Driver Costs – Metropolitan Areas (2010 to 2022)



E.6.3 In the table below, a comparison of the growth in Driver Costs against the inflation adjustment assumptions in the current calculator are summarised overall and as an annual average growth rate. This demonstrates that the growth in Driver Costs is slightly higher than inflation.

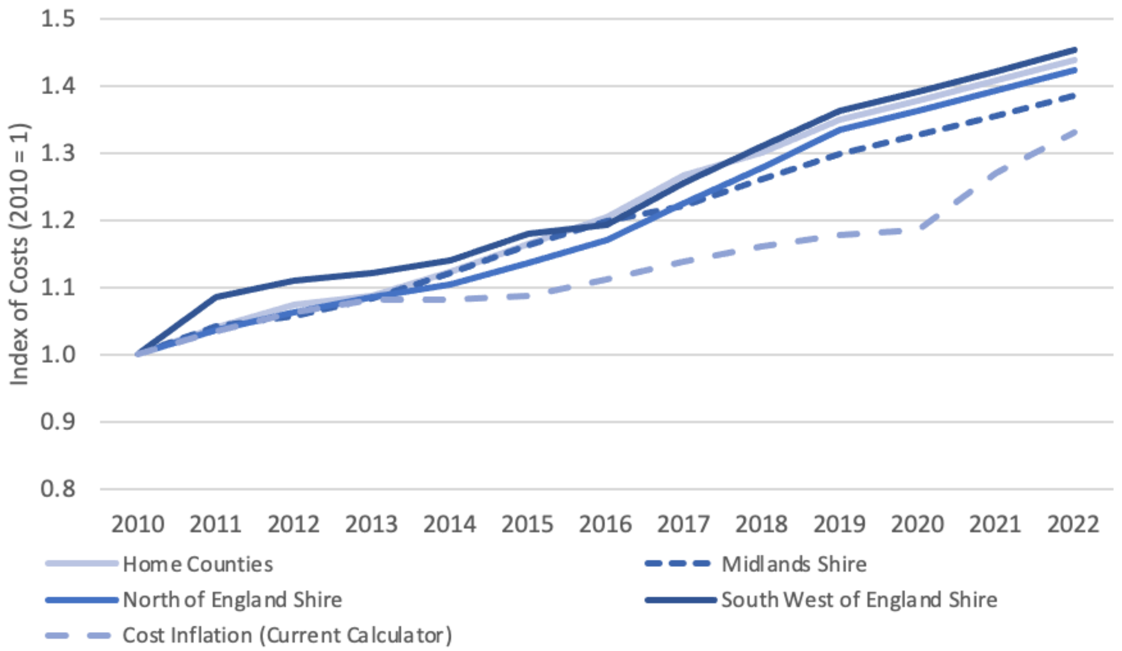
Table 37. Summary of Driver Cost Growth – Metropolitan Areas (2010 to 2022)

Area	Total Growth (2010 to 2022)		Average Annual Growth		Difference	
	Cost Growth	Inflation (Calculator)	Cost Growth	Inflation (Calculator)	Total Growth	Average Annual Growth
Midlands	36%	33%	2.57%	2.42%	3%	0.15%
North of England	39%	33%	2.80%	2.42%	6%	0.38%
South West of England	42%	33%	2.98%	2.42%	9%	0.56%
Average	39%	33%	2.78%	2.42%	6%	0.36%

Shire Areas

E.6.4 The trends in Driver Costs are also presented for Shire Areas in the graph below. In general, these costs are also rising slightly above the inflation assumption in the current calculator, with the exception of post-2018 where costs appear to be growing at a faster rate than inflation.

Figure 63. **Index Changes in Driver Costs – Shire Areas (2010 to 2022)**



E.6.5 The growth in Driver Costs for Shire Areas is presented in comparison to Inflation assumptions in the current calculator in the table below. This summary shows that Driver Costs have risen faster than inflation.

Table 38. **Summary of Driver Cost Growth. – Shire Areas (2010 to 2022)**

	Total Growth (2010 to 2022)		Average Annual Growth			Difference
Area	**Cost Growth**	**Inflation (Calculator)**	**Cost Growth**	**Inflation (Calculator)**	**Total Growth**	**Average Annual Growth**
Home Counties	44%	33%	3.08%	2.42%	9%	0.66%
Midlands	39%	33%	2.75%	2.42%	6%	0.33%
North of England	42%	33%	2.98%	2.42%	9%	0.56%
South West of England	45%	33%	3.16%	2.42%	12%	0.74%
Average	42%	33%	2.99%	2.42%	9%	0.57%

Summary

E.6.6 Driver costs account for about 43% to 47% of overall operating costs. Therefore, any change in these costs will have a proportionately large impact on MOCs.

E.6.7 Over the period analysed, the costs appear to have growth slightly faster in Shire Areas than in Metropolitan Areas by 2022:

- Metropolitan Areas: 6 percentage points higher on average than the inflation adjustment
- Shire Areas: 9 percentage points higher on average than the inflation adjustment

E.6.8 Driver Costs will vary with increased volume of concessionary patronage. Hence, the analysis suggests that the adjustment for inflation in the current calculator is insufficient and implies a slight upward revision is needed to reflect the changes in costs being incurred by the industry.

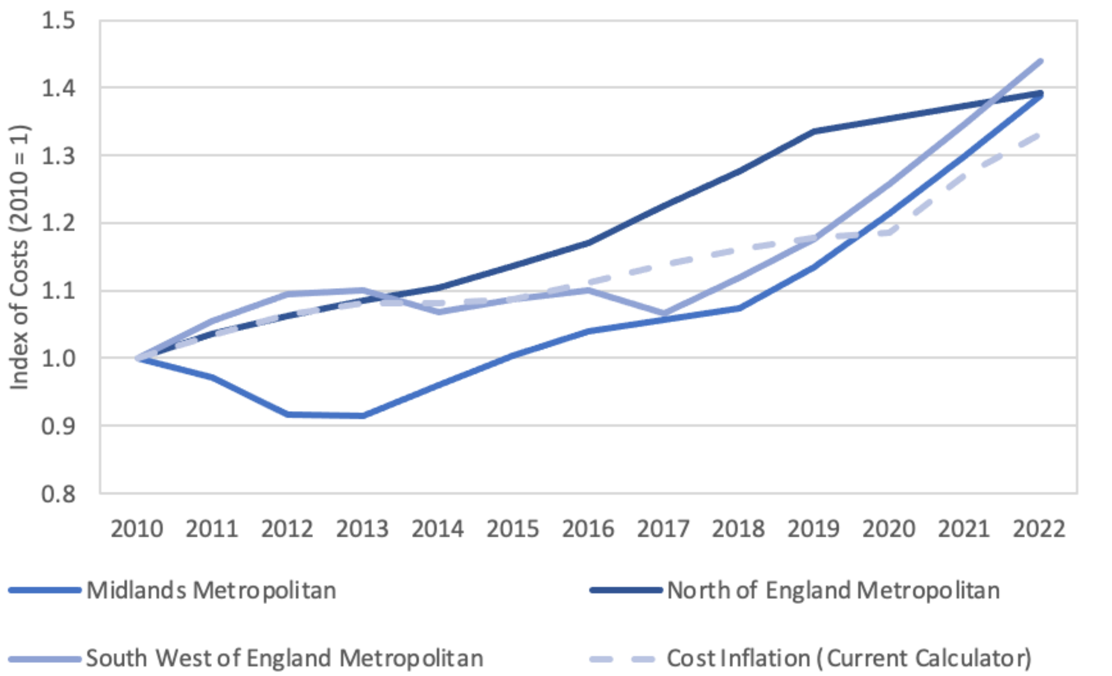
E.7 Maintenance Costs

E.7.1 In this section maintenance Costs are summarised as index changes from 2010 to 2022 by Metropolitan and Shire Area analysed. These costs consist of the labour costs of performing maintenance – with the cost of materials covered under Parts, which are analysed later in this report.

Metropolitan Areas

E.7.2 There is variation in the growth trends for Maintenance Costs across Metropolitan Area shown in the graph below. However, by 2022 Maintenance Costs have grown faster than the inflation assumptions in the current calculator.

Figure 64. Index Changes in Maintenance Costs – Metropolitan Areas (2010 to 2022)



E.7.3 In comparison to the inflation assumptions in the current calculator, the table below demonstrates that Maintenance Costs have grown slightly higher on average per annum.

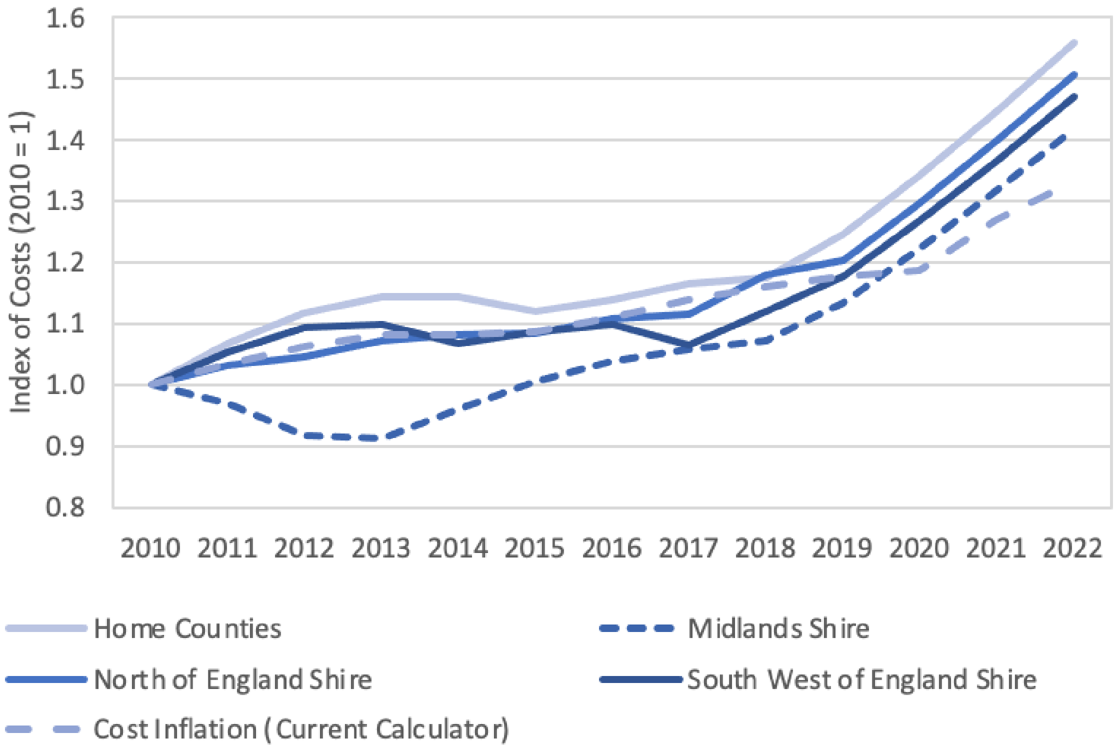
Table 39. Summary of Maintenance Cost Growth – Metropolitan Areas (2010 to 2022)

Area	Total Growth (2010 to 2022)		Average Annual Growth		Difference	
	Cost Growth	Inflation (Calculator)	Cost Growth	Inflation (Calculator)	Total Growth	Average Annual Growth
Midlands	39%	33%	2.78%	2.42%	6%	0.36%
North of England	39%	33%	2.80%	2.42%	6%	0.38%
South West of England	44%	33%	3.08%	2.42%	11%	0.66%
Average	41%	33%	2.89%	2.42%	8%	0.47%

Shire Areas

E.7.4 The growth in Maintenance Costs for Shire Areas also shows a variation in growth trends over the period analysed. However, by 2022 these costs have grown by more than the inflation assumption in the current calculator overall.

Figure 65. Index Changes in Maintenance Costs – Shire Areas (2010 to 2022)



E.7.5 In summary in the table below, the growth in Maintenance Costs is higher on average per annum than in comparison to the inflation assumptions in the calculator.

Table 40. Summary of Maintenance Cost Growth – Shire Areas (2010 to 2022)

Area	Total Growth (2010 to 2022)		Average Annual Growth		Difference	
	Cost Growth	Inflation (Calculator)	Cost Growth	Inflation (Calculator)	Total Growth	Average Annual Growth
Home Counties	56%	33%	3.77%	2.42%	23%	1.35%
Midlands	42%	33%	2.96%	2.42%	9%	0.54%
North of England	51%	33%	3.47%	2.42%	18%	1.05%
South West of England	47%	33%	3.27%	2.42%	14%	0.85%
Average	49%	33%	3.37%	2.42%	16%	0.75%

Summary

E.7.6 In the CPT breakdown of operating costs, Maintenance Costs contribute between 4% and 5% of the overall expenditure. A change in these costs will have around 10% of the impact that Driver Costs have on MOCs.

E.7.7 Over the period analysed, the costs appear to have grown faster in Shire Areas than in Metropolitan Areas as follows:

- Metropolitan Areas: 8 percentage points higher on average than the inflation adjustment;
- Shire Areas: 16 percentage points higher on average than the inflation adjustment.

E.7.8 Maintenance Costs will increase as more vehicle kilometres and passenger kilometres are operated, due to additional wear and tear from longer distances run and additional weight carried. Hence, the analysis suggests that the adjustment for inflation in the current calculator is insufficient to reflect the changes in Maintenance Costs which have been incurred and an upward revision is required.

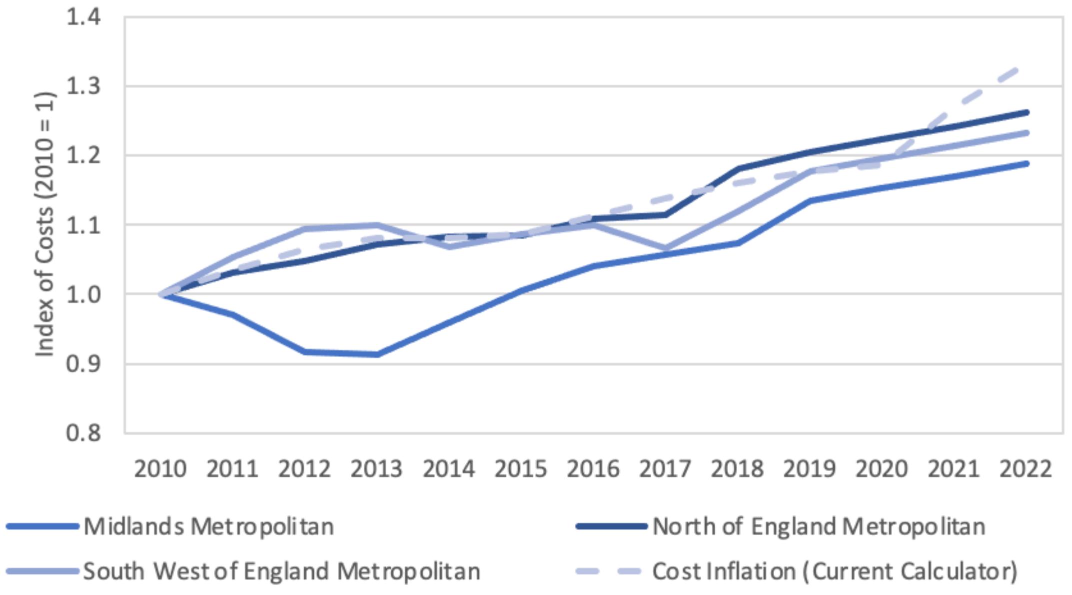
E.8 Other Labour & Staff Costs

E.8.1 In this section the other costs of Labour and Staff are summarised as index changes between 2010 and 2022 by Metropolitan and Shire Area. These Other Costs reflect costs beyond Driver and Maintenance Staff Costs, which would include items such as Administration.

Metropolitan Areas

E.8.2 Other Labour and Staff Costs are summarised by Metropolitan Area in the graph below. Over most of the period analysed, these costs rise in line with the inflation assumption in the current calculator, though since 2020 the rate appears to have been slower than the growth in inflation.

Figure 66. Index Changes in Other Labour and Staff Costs – Metropolitan Areas (2010 to 2022)



E.8.3 The table below summarises the rate of growth in Other Labour and Staff Costs by Metropolitan Area in comparison to inflation. It can be seen that overall, these costs have grown by less than inflation between 2010 and 2022.

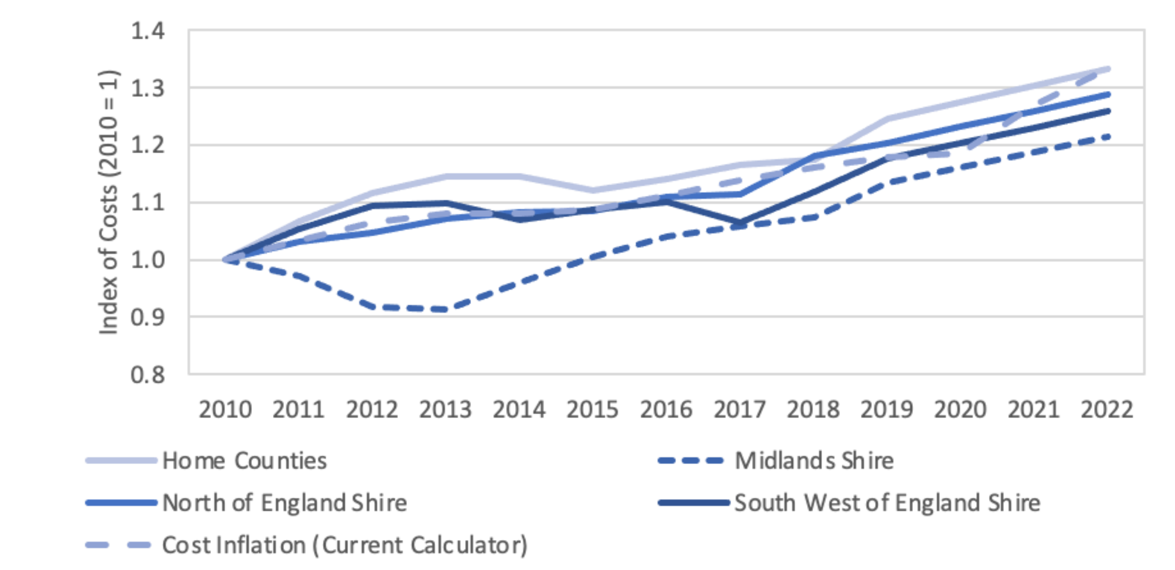
Table 41. Summary of Growth in Other Labour and Staff Costs – Metropolitan Areas (2010 to 2022)

Area	Total Growth (2010 to 2022)		Average Annual Growth		Difference	
	Cost Growth	Inflation (Calculator)	Cost Growth	Inflation (Calculator)	Total Growth	Average Annual Growth
Midlands	19%	33%	1.45%	2.42%	-14%	-0.77%
North of England	26%	33%	1.96%	2.42%	-7%	-0.46%
South West of England	23%	33%	1.76%	2.42%	-10%	-0.66%
Average	23%	33%	1.72%	2.42%	-10%	-0.70%

Shire Areas

E.8.4 The growth in Other Labour and Staff Costs is summarised in the graph below for Shire Areas. The changes in costs are shown as index changes from 2010 to 2022. For these areas the costs have grown generally in line or below the inflation assumption in the current calculator, with the main exception of the Home Counties which has generally grown above inflation until 2020.

Figure 67. Index Changes in Other Labour & Staff Costs – Shire Areas (2010 to 2022)



E.8.5 The table below summarises the rate of growth of Other Labour and Staff Costs in comparison to inflation. On average, the Home Counties has experienced growth consistent with inflation, whereas all other Shire Areas have experienced growth lower than inflation.

Table 42. Summary of Growth in Other Labour & Staff Costs – Shire Areas (2010 to 2022)

Area	Total Growth (2010 to 2022)		Average Annual Growth		Difference	
	Cost Growth	Inflation (Calculator)	Cost Growth	Inflation (Calculator)	Total Growth	Average Annual Growth
Home Counties	33%	33%	2.43%	2.42%	0%	0.01%
Midlands	21%	33%	1.63%	2.42%	-12%	-0.79%
North of England	29%	33%	2.14%	2.42%	-4%	-0.28%
South West of England	26%	33%	1.94%	2.42%	-7%	-0.48%
Average	27%	33%	2.04%	2.42%	-6%	-0.40%

Summary

E.8.6 The breakdown of contribution to Operating Costs summarised by CPT suggests that between 2010 and 2019, Other Labour and Staff Costs contribute 13% to 15% of overall Operating Costs. Therefore, any change in these costs will have a reasonable impact on Operating Costs.

E.8.7 Over the period analysed, the costs have grown faster in Shire Areas than Metropolitan Areas, yet the growth is at or below inflation:

- Metropolitan Areas: 10 percentage points lower on average than inflation;
- Shire Areas: 6 percentage points lower on average than inflation.

E.8.8 Other Labour and Staff Costs are likely to increase as more passenger and vehicle kilometres are run to support the generation of Concessionary Passengers. Therefore, these costs suggest that the inflation adjustment in the current calculator is overstated in terms of Other Labour and Staff Costs. Therefore, a downward revision to the inflation adjustment would be supported by such costs.

E.9 Labour Sub-total Costs

E.9.1 The total change in Labour Costs is summarised in this section. The total consists of the three elements below which have been analysed separately in the three previous sections of the report:

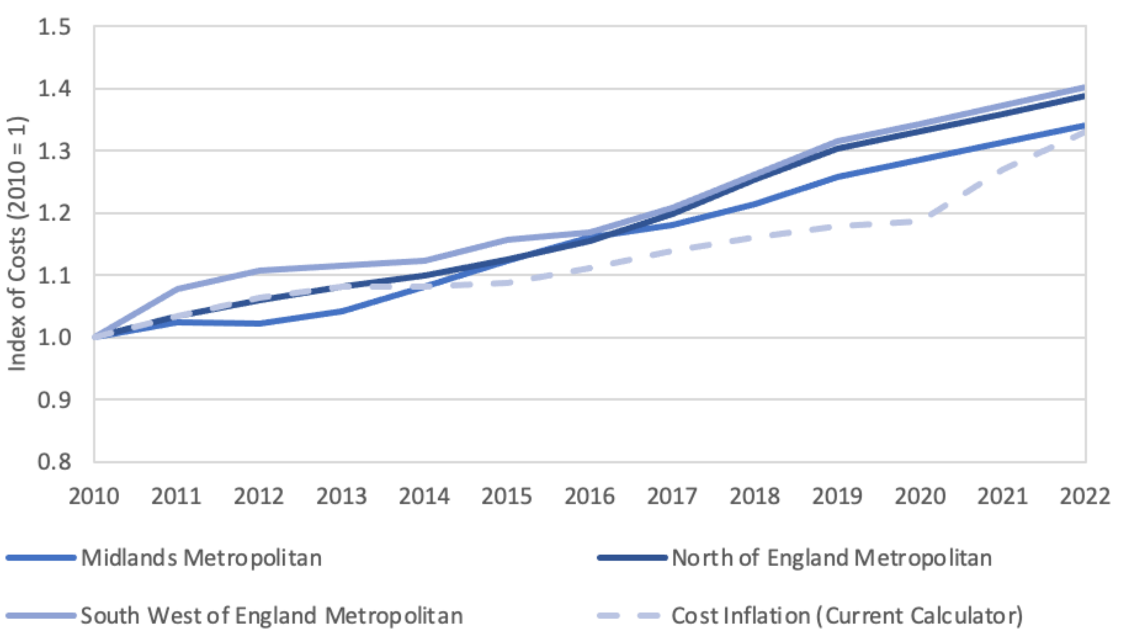
- Driver Costs;
- Maintenance Costs;
- Other Labour and Staff Costs.

E.9.2 The costs are summarised for Metropolitan and Shire Areas as index changes over the period from 2010 to 2022.

Metropolitan Areas

E.9.3 The graph below summarises the index change in Total Labour Costs in comparison to the inflation assumption in the current calculator. Over the period analysed, these costs have risen by just above inflation in general.

Figure 68. Index Changes in Total Labour Costs – Metropolitan Areas (2010 to 2022)



E.9.4 The table below presents a comparison of the growth in Total Labour Costs and inflation assumptions in the current calculator by Metropolitan Area. On average across each area, these costs have growth slightly faster than inflation.

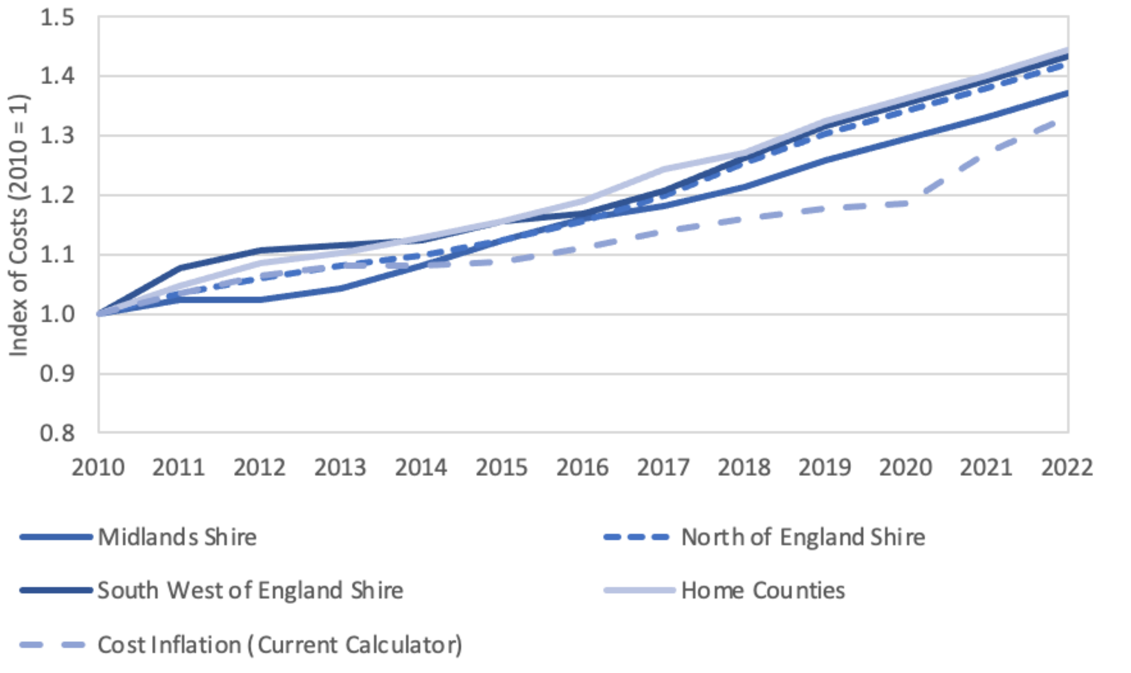
Table 43. Summary of Growth in Total Labour Costs – Metropolitan Areas (2010 to 2022)

Area	Total Growth (2010 to 2022)		Average Annual Growth		Difference	
	Cost Growth	Inflation (Calculator)	Cost Growth	Inflation (Calculator)	Total Growth	Average Annual Growth
Midlands	34%	33%	2.48%	2.42%	1%	0.06%
North of England	39%	33%	2.78%	2.42%	6%	0.36%
South West of England	40%	33%	2.86%	2.42%	7%	0.44%
Average	38%	33%	2.71%	2.42%	5%	0.29%

Shire Areas

E.9.5 In the graph below it can be seen that across each Shire Area, in general Total Labour Costs have grown faster than the inflation assumptions in the current calculator.

Figure 69. **Index Changes in Total Labour Costs – Shire Areas (2010 to 2022)**



E.9.6 The table below summarises that in comparison to inflation in the current calculator, across each Shire Area Total Labour Costs have risen slightly faster on average per annum.

Table 44. **Summary of Growth in Total Labour Costs – Shire Areas (2010 to 2022)**

Area	Total Growth (2010 to 2022)		Average Annual Growth		Difference	
	Cost Growth	Inflation (Calculator)	Cost Growth	Inflation (Calculator)	Total Growth	Average Annual Growth
Home Counties	44%	33%	3.10%	2.42%	11%	0.68%
Midlands	37%	33%	2.66%	2.42%	4%	0.24%
North of England	42%	33%	2.96%	2.42%	9%	0.54%
South West of England	43%	33%	3.05%	2.42%	10%	0.63%
Average	42%	33%	2.94%	2.42%	9%	0.52%

Summary

E.9.7 In the CPT indices, it is summarised that Total Labour Costs contribute to between 60% and 67% of overall Operating Costs. Therefore, growth in these costs will have the largest combined impact on Operating Costs compared to any other category.

E.9.8 Over the period analysed, the costs have grown faster in Shire Areas than in Metropolitan Areas:

- Metropolitan Areas: 5 percentage points higher on average than inflation;
- Shire Areas: 9 percentage points higher on average than inflation.

E.9.9 It has already been discussed in earlier labour cost sections that these reflect MOCs. Therefore, as costs have risen slightly faster than the inflation assumption in the current calculator, this would imply an upward revision to MOCs with respect to Total Labour Costs.

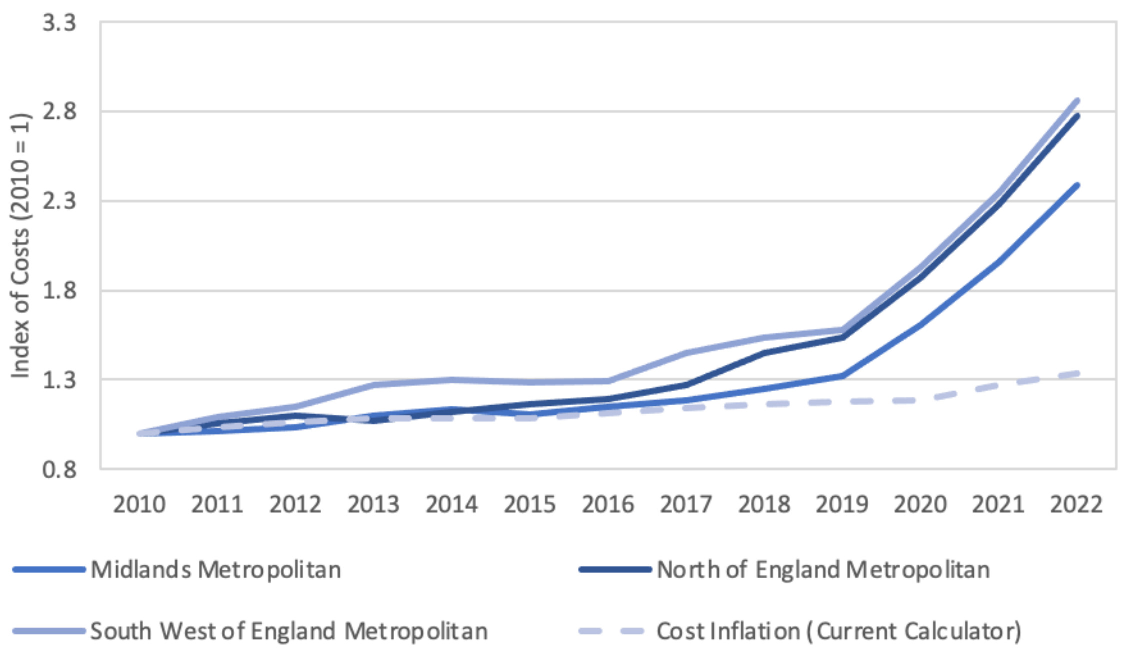
E.10 Cost of Parts

E.10.1 In this section the index change in the Cost of Parts is summarised between 2010 and 2022 for both Metropolitan and Shire Areas. The Cost of Parts reflects expenditure on materials used in maintaining vehicles.

Metropolitan Areas

E.10.2 In the graph below, it can be seen that the Cost of Parts has risen far higher than the inflation assumption in the current calculator across all Metropolitan Areas, with most of the growth appearing to have occurred between 2020 and 2022, which coincides with the COVID-19 pandemic.

Figure 70. Index Changes in Cost of Parts – Metropolitan Areas (2010 to 2022)



E.10.3 The scale of growth above inflation for each Metropolitan Area is shown in the table below.

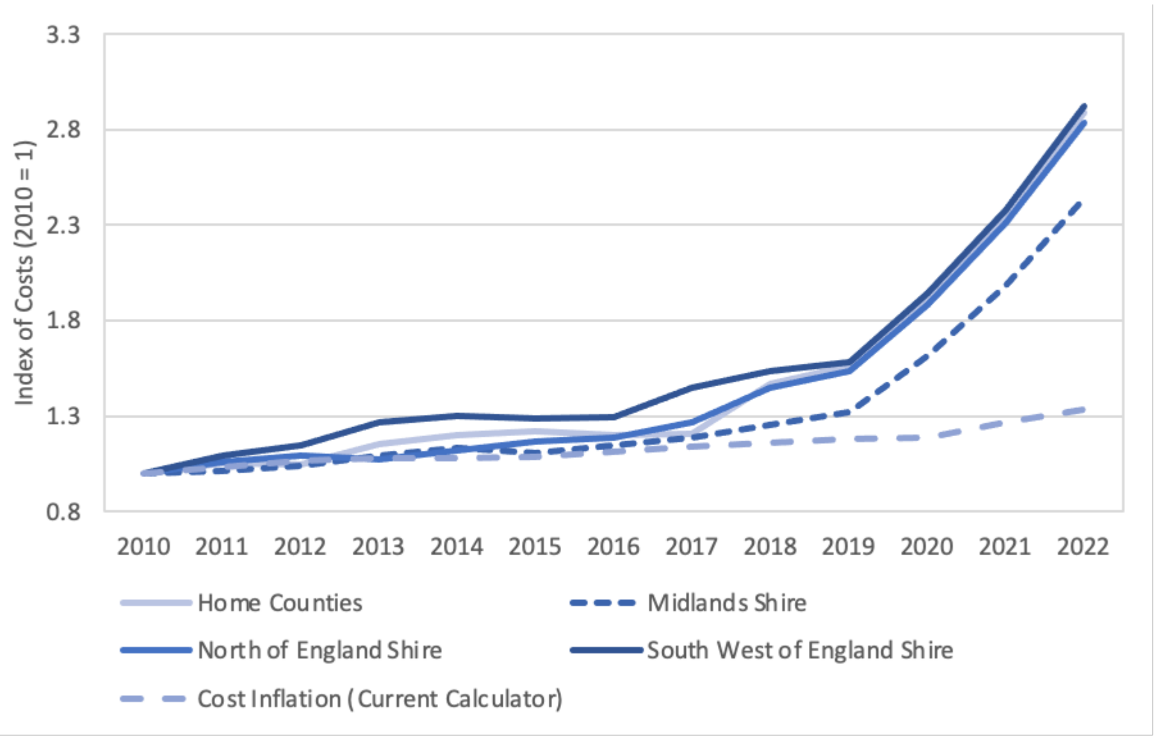
Table 45. Summary of Growth in the Cost of Parts – Metropolitan Areas (2010 to 2022)

Area	Total Growth (2010 to 2022)		Average Annual Growth		Difference	
	Cost Growth	Inflation (Calculator)	Cost Growth	Inflation (Calculator)	Total Growth	Average Annual Growth
Midlands	139%	33%	7.52%	2.42%	106%	5.10%
North of England	178%	33%	8.88%	2.42%	145%	6.46%
South West of England	186%	33%	9.15%	2.42%	153%	6.73%
Average	167%	33%	8.54%	2.42%	134%	6.12%

Shire Areas

E.10.4 Across Shire Areas, it is also seen that the Costs of Parts has risen much faster than the inflation assumption in the current calculator, with most of the growth occurring since the pandemic began in 2020.

Figure 71. Index Changes in the Cost of Parts – Shire Areas (2010 to 2022)



E.10.5 The table below shows the extent to which the Cost of Parts has risen above inflation.

Table 46. Summary of Growth in the Cost of Parts – Shire Areas (2010 to 2022)

Area	Total Growth (2010 to 2022)		Average Annual Growth		Difference	
	Cost Growth	Inflation (Calculator)	Cost Growth	Inflation (Calculator)	Total Growth	Average Annual Growth
Home Counties	189%	33%	9.23%	2.42%	156%	6.81%
Midlands	144%	33%	7.71%	2.42%	111%	5.29%
North of England	184%	33%	9.08%	2.42%	151%	5.66%
South West of England	192%	33%	9.35%	2.42%	159%	6.93%
Average	177%	33%	8.86%	2.42%	144%	6.44%

Summary

E.10.6 The CPT index summarises that the Cost of Parts contributes between 4% and 5% of overall Operating Costs. This means that despite the Costs of Parts having almost tripled since 2010, the total impact on Operating Costs is around 10% and will have less than half of the overall impact which Total Labour Costs have.

E.10.7 Over the period analysed costs have grown faster in Shire Areas than in Metropolitan Areas:

- Metropolitan Areas: 134 percentage points higher on average than the inflation adjustment
- Shire Areas: Between 144 percentage points higher on average than the inflation adjustment

E.10.8 As the Cost of Parts will vary with both passenger and vehicle kilometres operated, this category will impact on MOCs. Therefore, the current assumption to adjust for inflations appears to be too low in comparison to the Cost of Parts and an upward revision would be required to MOCs.

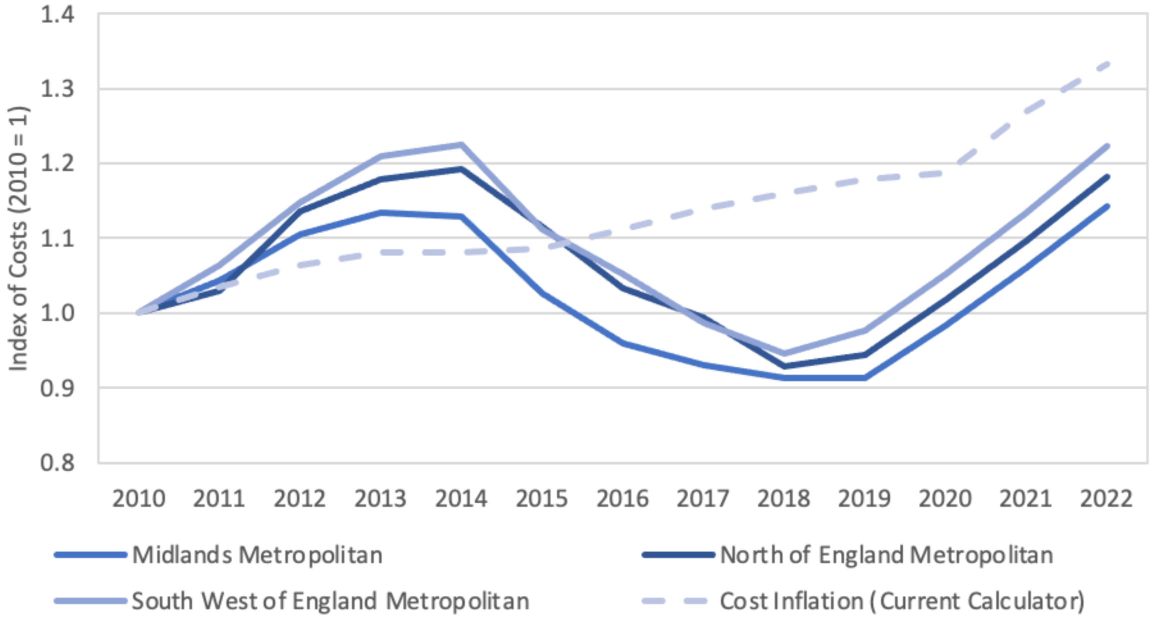
E.11 Fuel Costs

E.11.1 Fuel costs across both Metropolitan and Shire Areas are summarised in this section, with the costs presented as index changes between 2010 and 2022.

Metropolitan Areas

E.11.2 The graph below summarises the growth in Fuel Costs by Metropolitan Area. These costs can be shown to be very cyclical, having grown and fallen over the period analysed. Overall, Fuel Costs have risen slower than the inflation assumption in the current calculator between 2010 and 2022.

Figure 72. **Index Changes in Fuel Costs – Metropolitan Areas (2010 to 2022)**



E.11.3 A comparison of growth in Fuel Costs relative to inflation within the calculator is shown in the table below. On average Fuel Costs have risen by 0.73 to 1.30 percentage points less per annum than inflation within the calculator.

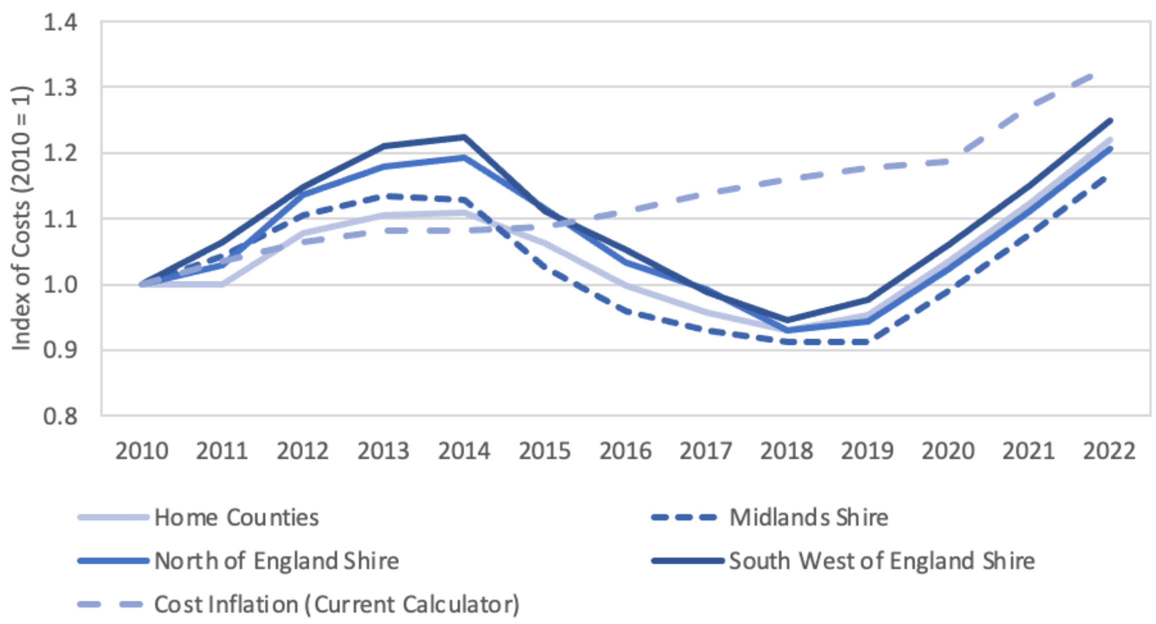
Table 47. **Summary of Fuel Cost Growth – Metropolitan Areas (2010 to 2022)**

Area	Total Growth (2010 to 2022)		Average Annual Growth		Difference	
	Cost Growth	Inflation (Calculator)	Cost Growth	Inflation (Calculator)	Total Growth	Average Annual Growth
Midlands	14%	33%	1.12%	2.42%	-19%	-1.30%
North of England	18%	33%	1.40%	2.42%	-15%	-1.02%
South West of England	22%	33%	1.69%	2.42%	-11%	-0.73%
Average	18%	33%	1.41%	2.42%	-15%	-1.01%

Shire Areas

E.11.4 The findings are similar for Shire Areas, in which growth in Fuel Costs is cyclical and has risen by less than the inflation assumption in the current calculator over the period analysed.

Figure 73. Index Changes in Fuel Cost Growth – Shire Areas (2010 to 2022)



E.11.5 In the table below, it can be seen that Fuel Costs have grown by 0.55 to 1.12 percentage points less than inflation within the calculator on average per annum.

Table 48. Summary of Fuel Cost Growth – Shire Areas (2010 to 2022)

	Total Growth (2010 to 2022)		Average Annual Growth		Difference	
Area	**Cost Growth**	**Inflation (Calculator)**	**Cost Growth**	**Inflation (Calculator)**	**Total Growth**	**Average Annual Growth**
Home Counties	22%	33%	1.67%	2.42%	-11%	-0.75%
Midlands	17%	33%	1.30%	2.42%	-16%	-1.12%
North of England	21%	33%	1.58%	2.42%	-12%	-0.84%
South West of England	25%	33%	1.87%	2.42%	-8%	-0.55%
Average	21%	33%	1.61%	2.42%	-12%	-0.81%

Summary

E.11.6 Fuel Costs are shown in the CPT Index data to be the second largest component of Operating Costs after Labour Costs, contributing between 13% and 18% each year to Operating Costs. By 2022, these costs had grown by less than inflation across Metropolitan and Shire Areas:

- Metropolitan Areas: 15 percentage points lower on average than the inflation adjustment
- Shire Areas: 12 percentage points lower on average than the inflation adjustment

E.11.7 The cost of living crisis which is prominent in the news at present and partly driven by energy prices might mean that it is surprising to see that Fuel Costs have risen by less than inflation since 2010. The latest year of data is not available to analyse (2023) and so it is possible that costs have risen more in the past year. However, if Crude Oil prices are examined, the findings above are reinforced, with the index of prices in key years of peaks and troughs as follows (source: The World Bank Pink Sheet):

- 2010: $79.64 per barrel
- 2014: $98.94 per barrel
- 2019: $64.03 per barrel
- 2022: $99.82 per barrel
- 2023: $82.14 per barrel

E.11.8 The above demonstrates that like petrol prices analysed, the price of oil has also fluctuated over the same time period. The price per barrel is only a little bit higher in 2022 in comparison to 2014 and is lower in 2023.

E.11.9 There is also the issue that some Operators can hedge the price of oil and potentially reduce their exposure to increases in prices. Fuel price rises might also be offset through:

- Improved engine technologies such as hybrid and fleet replacement with more efficient engines
- Driver training programmes to improve efficiency
- Congestion which could worsen or improve.

E.11.10 The above also helps to explain the regional variation as congestion will differ, the mix of fleet and engine types will also. There is also the potential for distribution costs to differ meaning that prices can vary by region.

E.11.11 As Fuel Costs will vary with both passenger and vehicle kilometres, any changes in such costs will impact on MOCs. The above findings suggest that the current adjustment for inflation in the calculator is too high and a downward revision would be required with respect to Fuel Costs.

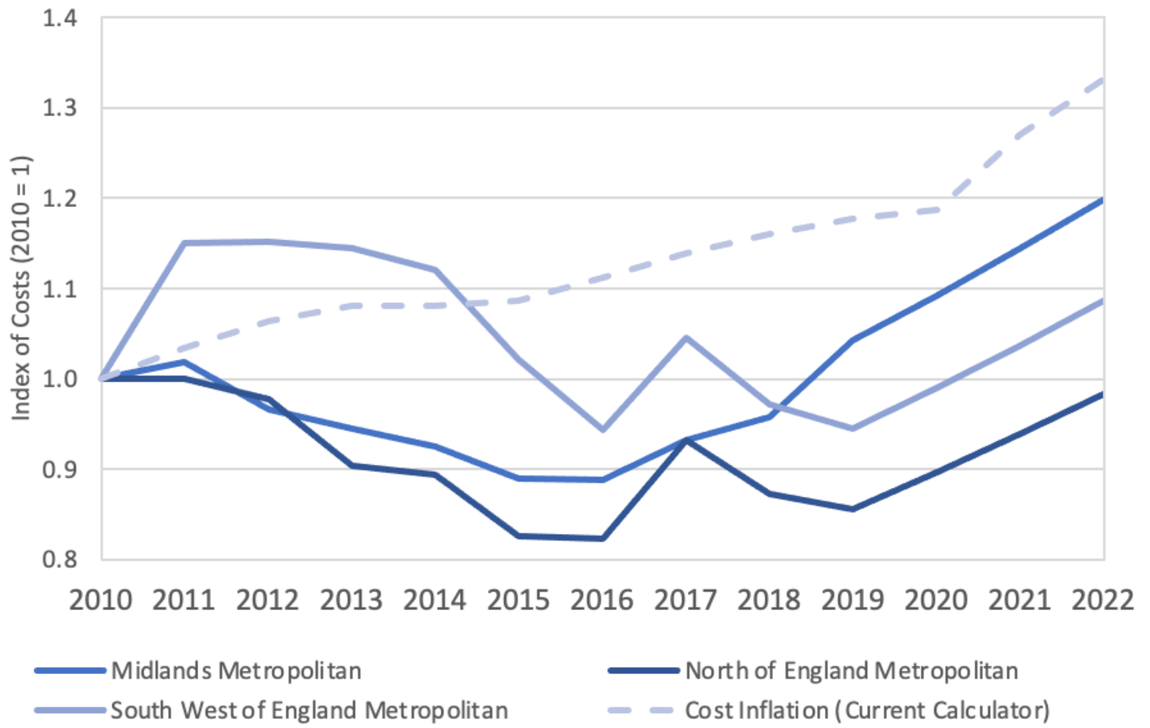
E.12 Insurance Costs

E.12.1 In this section of the report, the insurance costs are summarised by Metropolitan and Shire Area over the period from 2010 to 2022.

Metropolitan Areas

E.12.2 In the graph below, the index changes in Insurance Costs are summarised over the period analysed. This demonstrates that Insurance Costs have risen by less than the inflation assumption in the current calculator between 2010 and 2022.

Figure 74. Index Changes in Insurance Costs – Metropolitan Areas (2010 to 2022)



E.12.3 A summary of the growth in Insurance Costs in comparison to the current Inflation adjustment summarised in the table below, overall and as averages per annum.

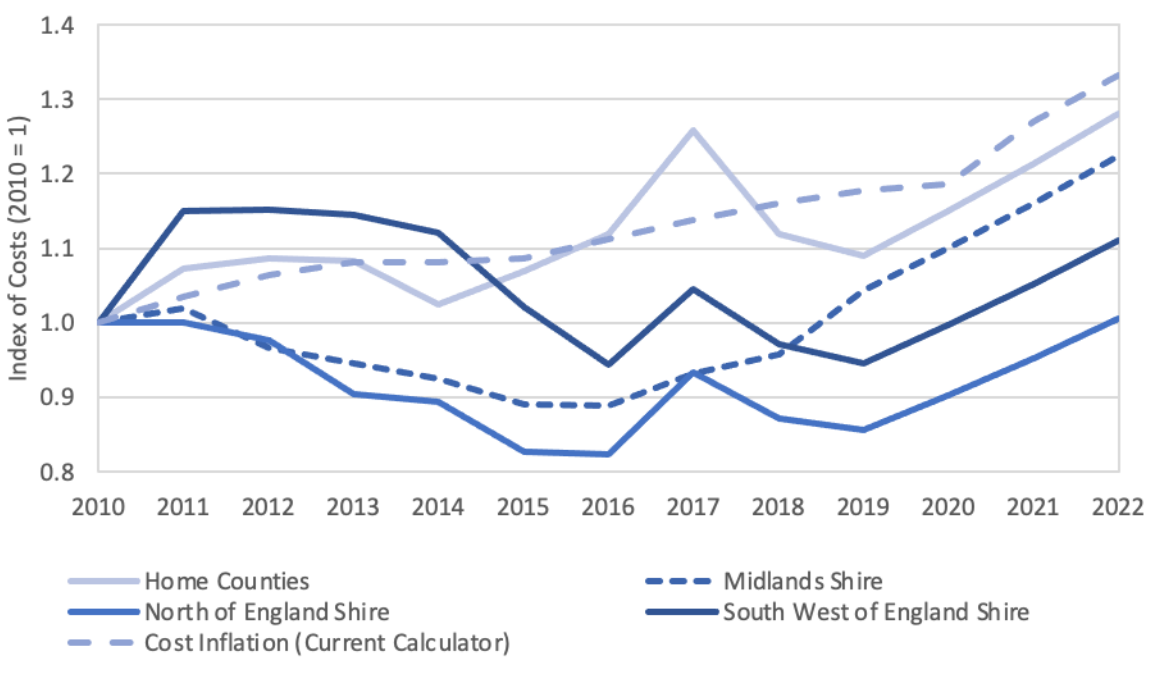
Table 49. Summary of Insurance Costs Growth – Metropolitan Areas (2010 to 2022)

Area	Total Growth (2010 to 2022)		Average Annual Growth		Difference	
	Cost Growth	Inflation (Calculator)	Cost Growth	Inflation (Calculator)	Total Growth	Average Annual Growth
Midlands	20%	33%	1.52%	2.42%	-13%	-0.90%
North of England	-2%	33%	-0.14%	2.42%	-35%	2.56%
South West of England	9%	33%	0.70%	2.42%	-24%	-1.72%
Average	9%	33%	0.72%	2.42%	-24%	-1.70%

Shire Areas

E.12.4 In the graph below, the index changes in Insurance Costs are summarised by Shire Area from 2010 to 2022. As with Metropolitan Areas, the growth in Insurance Costs has been lower than the inflation assumption in the current calculator over the period analysed.

Figure 75. Index Changes in Insurance Costs – Shire Areas (2010 to 2022)



E.12.5 A comparison of overall growth and the average growth per annum is summarised for Insurance Costs in relation to the inflation adjustment in the Table below (2010 to 2022) for Shire Areas. This demonstrates that Insurance Costs have risen slower than inflation.

Table 50. Summary of Growth in Insurance Costs – Shire Areas (2010 to 2022)

Area	Total Growth (2010 to 2022)		Average Annual Growth		Difference	
	Cost Growth	Inflation (Calculator)	Cost Growth	Inflation (Calculator)	Total Growth	Average Annual Growth
Home Counties	28%	33%	-2.08%	2.42%	-5%	-4.50%
Midlands	22%	33%	-1.70%	2.42%	-11%	-4.12%
North of England	0%	33%	0.04%	2.42%	-33%	-2.38%
South West of England	11%	33%	0.88%	2.42%	-22%	-1.54%
Average	16%	33%	1.21%	2.42%	-17%	-1.21%

Summary

E.12.6 In the CPT Indices it is shown that Insurance Costs contribute to just 3% of overall Operating Costs over the period analysed.

- Metropolitan Areas: 24 percentage points lower on average than the current inflation adjustment.
- Shire Areas: 17 percentage points lower on average than the current inflation adjustment.

E.12.7 Over the period analyses, the costs have grown faster in Shire Areas than in Metropolitan Areas as follows:

E.13 Overheads

E.13.1 Overheads reflect ongoing expenses with running a business which do not vary with producing the output of a product or service. Hence, such costs will not impact on MOCs as they will not vary with passenger or vehicle kilometres operated.

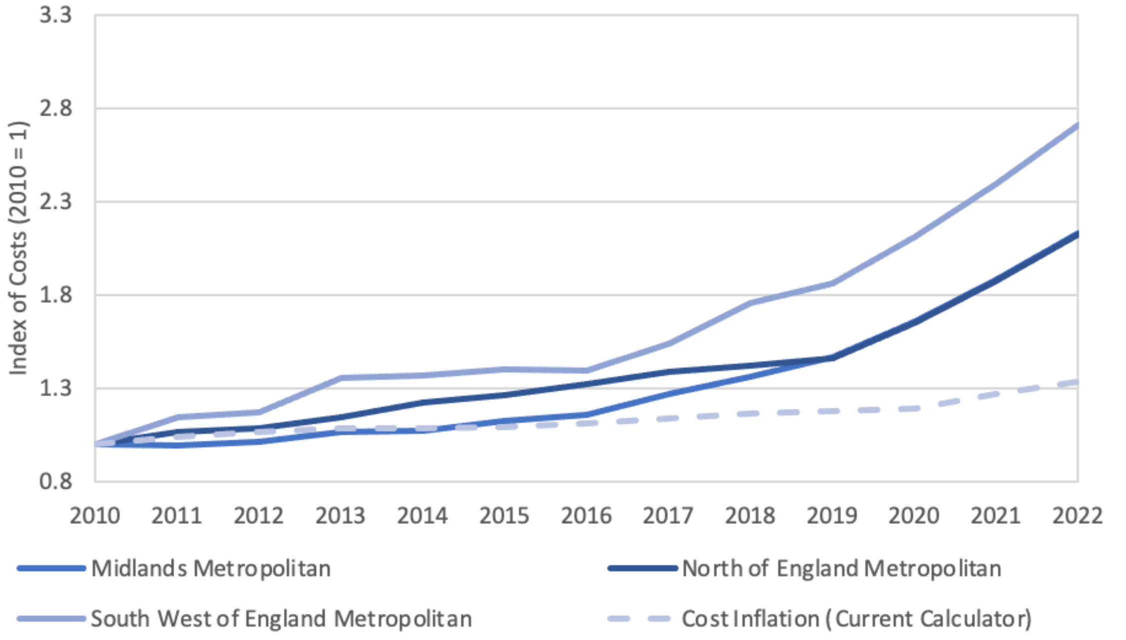
E.13.2 The costs are presented because it is important that these are excluded from the overall estimate of how MOCs have changed over time. Overheads are shown to reflect between 11% and 14% of overall Operating Costs, which reinforces the importance of excluding these items from the overall summary of MOC changes.

E.13.3 In this section the index changes in Overhead Costs are shown for both Metropolitan Areas and Shire Areas between 2010 and 2022.

Metropolitan Areas

E.13.4 The index change in Overhead Costs is summarised in the graph below by Metropolitan Area. Over the period analysed it can be shown that Overheads have increased significantly faster than the inflation assumption in the current calculator.

Figure 76. Index Changes in Overheads – Metropolitan Areas (2010 to 2022)



E.13.5 The table below summarises that across each Metropolitan Area, Overhead Costs have increased faster than inflation on average per annum.

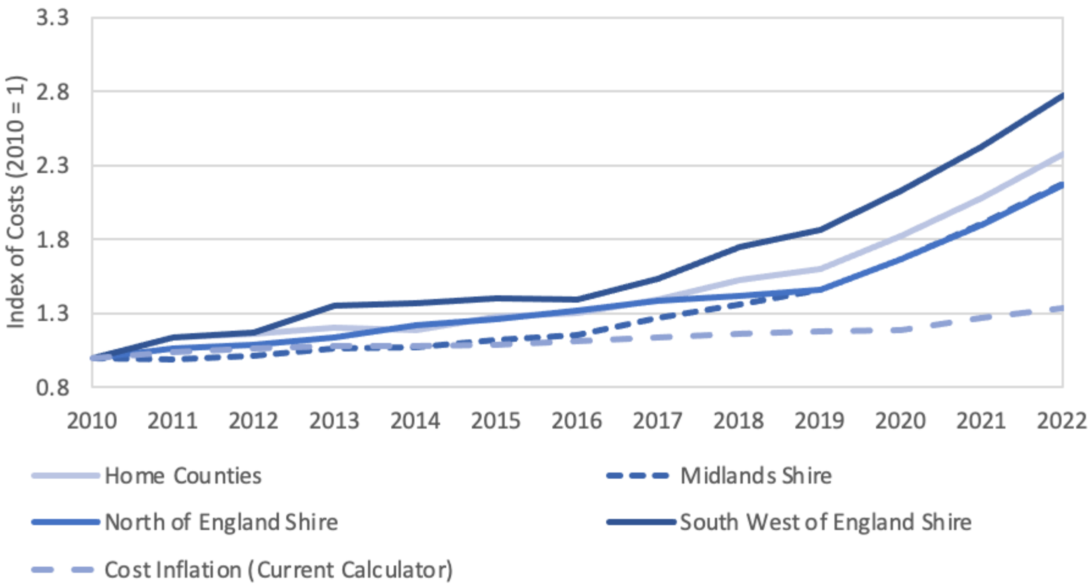
Table 51. Summary of Growth in Overheads – Metropolitan Areas (2010 to 2022)

Area	Total Growth (2010 to 2022)		Average Annual Growth		Difference	
	Cost Growth	Inflation (Calculator)	Cost Growth	Inflation (Calculator)	Total Growth	Average Annual Growth
Midlands	113%	33%	6.51%	2.42%	80%	4.09%
North of England	112%	33%	6.46%	2.42%	79%	4.04%
South West of England	171%	33%	8.67%	2.42%	138%	6.25%
Average	132%	33%	7.27%	2.42%	99%	4.85%

Shire Areas

E.13.6 The analysis of Shire Areas is consistent with the analysis of Metropolitan Areas in which Overhead Costs have risen much higher than the inflation assumption in the current calculator.

Figure 77. Index Changes in Overheads – Shire Areas (2010 to 2022)



E.13.7 The table below demonstrates that on average per annum, the growth in Overhead Costs is higher than inflation.

Table 52. Summary of Growth in Overheads – Shire Areas (2010 to 2022)

Area	Total Growth (2010 to 2022)		Average Annual Growth		Difference	
	Cost Growth	Inflation (Calculator)	Cost Growth	Inflation (Calculator)	Total Growth	Average Annual Growth
Home Counties	138%	33%	7.48%	2.42%	105%	5.06%
Midlands	118%	33%	6.70%	2.42%	115%	4.28%
North of England	117%	33%	6.65%	2.42%	84%	4.23%
South West of England	177%	33%	8.87%	2.42%	144%	6.45%
Average	137%	33%	7.47%	2.42%	104%	5.05%

Summary

E.13.8 Overhead Costs contribute 11% to 14% of overall Operating Costs according to CPT data. These costs have risen by a large amount over the period from 2010 to 2022 as follows:

- Metropolitan Areas: Between 80 and 138 percentage points higher than inflation
- Shire Areas: Between 84 and 144 percentage points higher than inflation

E.13.9 Due to these costs contributing a large proportion of Operating Costs and rising by such a large amount, it is important that these costs are removed from the overall summary to avoid overstating the impacts on MOCs.

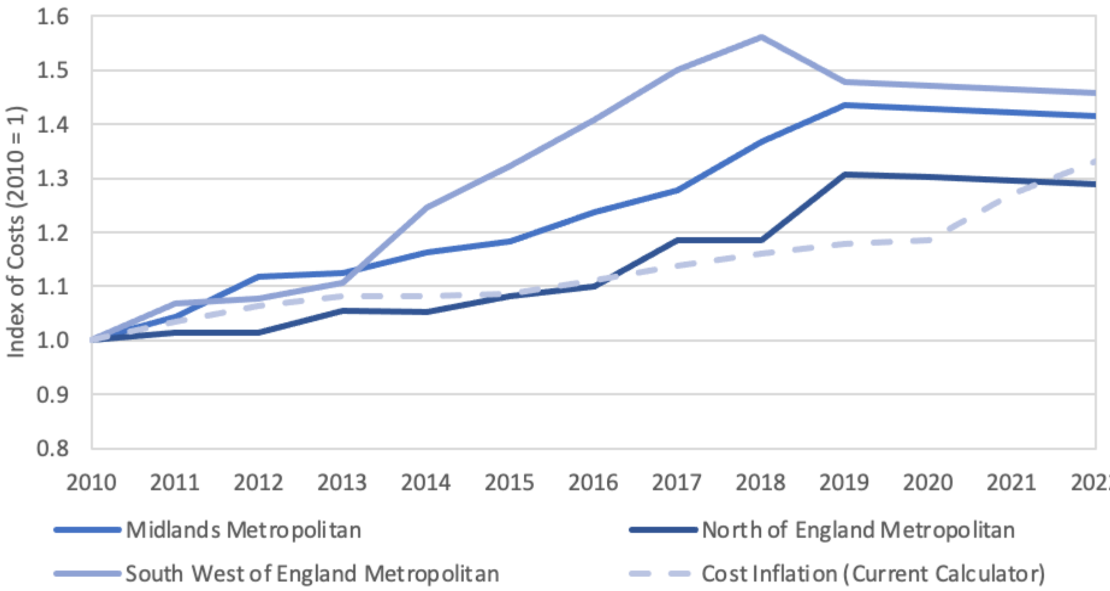
E.14 Depreciation & Leasing Costs

E.14.1 Depreciation & Leasing Costs are summarised in this section of the report and reflect another item which will need to be excluded from the overall summary of MOC changes. The cost of leasing is unlikely to be affected by passenger and vehicle kilometres. Whilst it is feasible that depreciation occurs quicker for assets which are owned by the operator as they run more passenger and vehicle kilometres, assets such as buses are more likely to have fixed asset lives and depreciation will be assumed as a fixed or proportionate amount of purchase cost until the end of life.

Metropolitan Areas

E.14.2 Over the period analysed, all Metropolitan Areas except for North of England demonstrate growth in Depreciation & Leasing Costs above the inflation assumption in the current calculator.

Figure 78. Index Changes in Depreciation & Leasing Costs – Metropolitan Areas (2010 to 2022)



E.14.3 The table below summarises the growth in Depreciation & Leasing Costs in comparison to inflation. For all areas but North of England there has been growth higher than inflation.

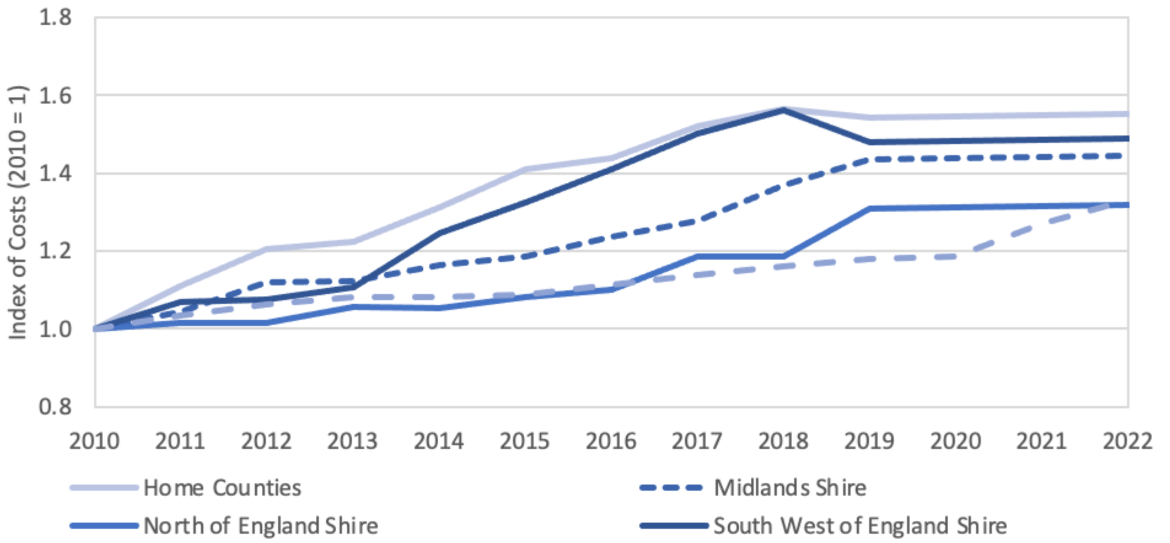
Table 53. Summary of Growth in Depreciation & Leasing Costs – Metropolitan Areas (2010 to 2022)

Area	Total Growth (2010 to 2022)		Average Annual Growth		Difference	
	Cost Growth	Inflation (Calculator)	Cost Growth	Inflation (Calculator)	Total Growth	Average Annual Growth
Midlands	41%	33%	2.93%	2.42%	8%	0.51%
North of England	29%	33%	2.14%	2.42%	-4%	-0.28%
South West of England	46%	33%	3.19%	2.42%	13%	0.77%
Average	39%	33%	2.76%	2.42%	6%	0.34%

Shire Areas

E.14.4 Across the Shire Areas, the trends are consistent with the Metropolitan Areas, as shown in the graph below. Depreciation & Leasing Costs have grown faster than the inflation assumption in the current calculator for all areas except for the North of England.

Figure 79. Index Changes in Depreciation & Leasing Costs – Shire Areas (2010 to 2022)



E.14.5 In the table below, the comparison demonstrates that on average the growth in Depreciation & Leasing Costs is just below or slightly higher than the inflation adjustment in the calculator on average per annum.

Table 54. Summary of Growth in Depreciation & Leasing Costs – Shire Areas (2010 to 2022)

Area	Total Growth (2010 to 2022)		Average Annual Growth		Difference	
	Cost Growth	Inflation (Calculator)	Cost Growth	Inflation (Calculator)	Total Growth	Average Annual Growth
Home Counties	55%	33%	3.73%	2.42%	22%	1.31%
Midlands	45%	33%	3.12%	2.42%	12%	0.70%
North of England	32%	33%	2.32%	2.42%	-1%	-0.10%
South West of England	49%	33%	3.37%	2.42%	16%	0.75%
Average	45%	33%	3.15%	2.42%	12%	0.73%

Summary

E.14.6 Over the period analysed, Depreciation & Leasing Costs are shown by the CPT to contribute between 6% and 7% of overall Operating Costs. These costs have risen just below or slightly above inflation over the period analysed depending on Area:

- Metropolitan Areas: Between 4 percentage points lower and 13 percentage points higher than the inflation adjustment
- Shire Areas: Between 1 percentage point lower and 22 percentage points higher than the inflation adjustment

E.14.7 These items only contribute a small amount to Operating Costs and in general only risen by a small amount. Nevertheless, as Depreciation & Leasing Costs are not considered to impact on MOCs because they do not change with the number of passengers, these costs should not be included in any adjustment to MOCs.

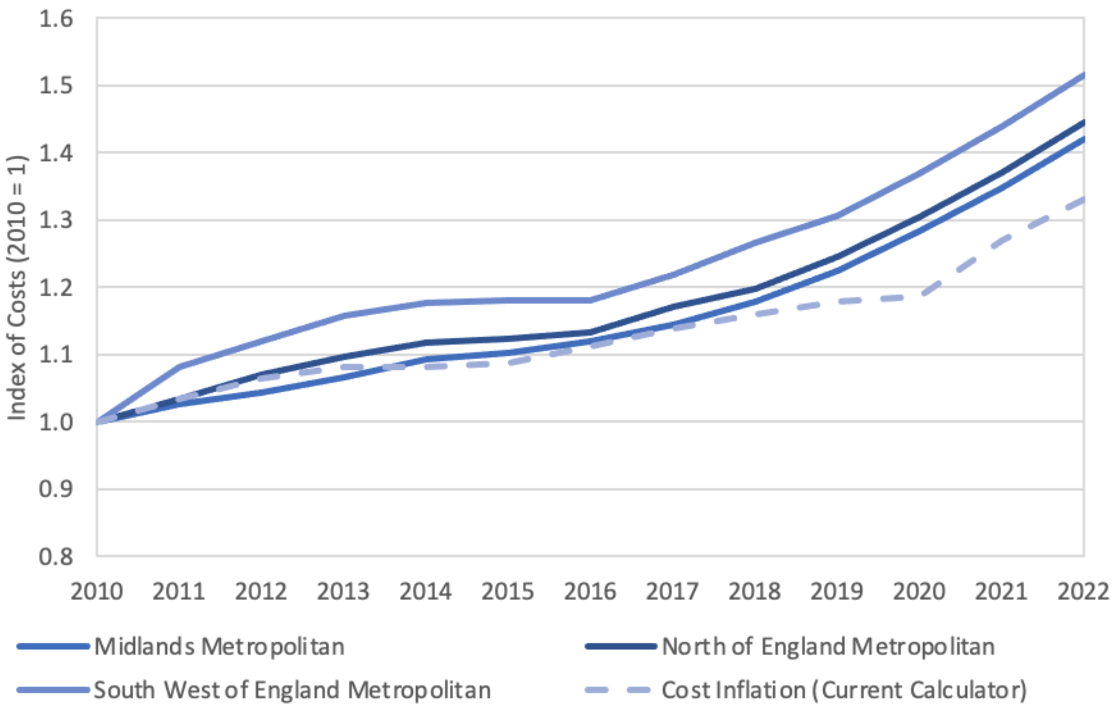
E.15 Total Costs (All Items)

E.15.1 In this section of the report, Total Costs are presented by Metropolitan and Shire Area over the period 2010 to 2022. These costs include all items summarised in previous sections of the report, with a further section below included to exclude items which are not considered to contribute to MOCs.

Metropolitan Areas

E.15.2 The growth in Total Costs (All Items) is summarised in the graph below. Across each Metropolitan Area these costs have growth at or above the inflation assumption in the current calculator, with an increase in the rate following the emergence of the pandemic in 2020.

Figure 80. Index Changes in Total Costs (All Items) – Metropolitan Areas (2010 to 2022)



E.15.3 On average, the growth in Total Costs is slightly higher than inflation per annum across each Metropolitan Area.

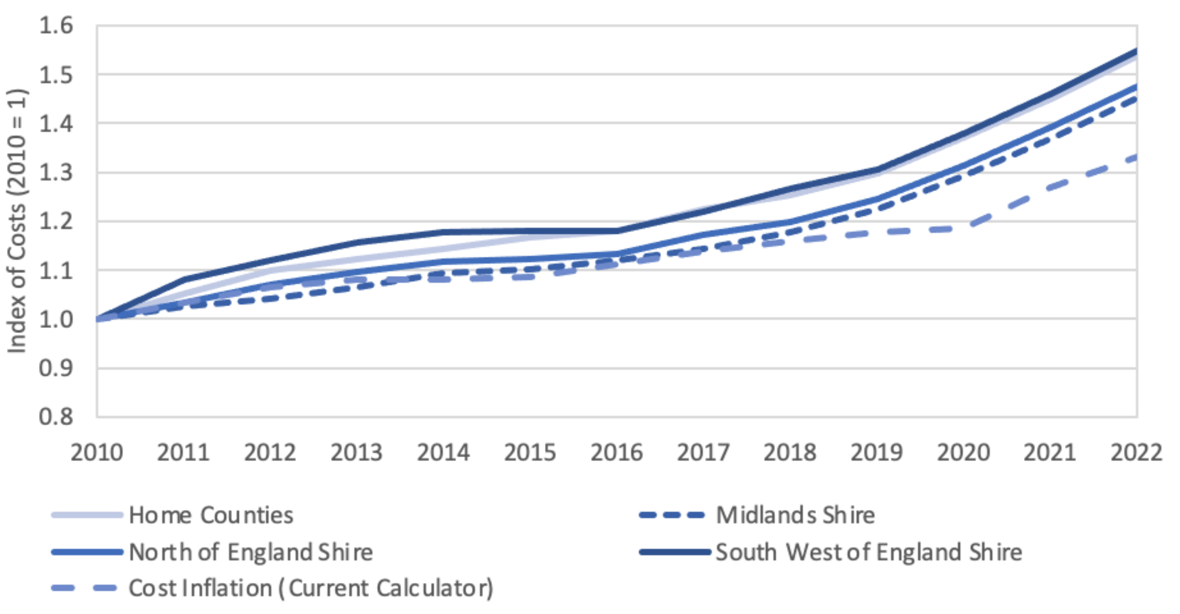
Table 55. Summary of Growth in Total Costs (All Items) – Metropolitan Areas (2010 to 2022)

Area	Total Growth (2010 to 2022)		Average Annual Growth		Difference	
	Cost Growth	Inflation (Calculator)	Cost Growth	Inflation (Calculator)	Total Growth	Average Annual Growth
Midlands	42%	33%	2.97%	2.42%	9%	0.55%
North of England	45%	33%	3.12%	2.42%	12%	0.70%
South West of England	52%	33%	3.53%	2.42%	19%	1.11%
Average	46%	33%	3.21%	2.42%	13%	0.69%

Shire Areas

E.15.4 The analysis of Shire Areas shown in the graph below is consistent with Metropolitan Areas. Growth is in line or above the inflation assumption in the current calculator over the period analysed, with a noticeable increase in the difference following the emergence of the pandemic in 2020.

Figure 81. Index Changes in Total Costs (All Items) – Shire Areas (2010 to 2022)



E.15.5 In the table below, the average growth per annum in Total Costs is shown to be slightly higher than the inflation assumption in the current calculator.

Table 56. Summary of Growth in Total Costs (All Items) – Shire Areas (2010 to 2022)

Area	Total Growth (2010 to 2022)		Average Annual Growth		Difference	
	Cost Growth	Inflation (Calculator)	Cost Growth	Inflation (Calculator)	Total Growth	Average Annual Growth
Home Counties	54%	33%	3.66%	2.42%	21%	1.24%
Midlands	45%	33%	3.16%	2.42%	12%	0.74%
North of England	48%	33%	3.30%	2.42%	15%	0.88%
South West of England	55%	33%	3.72%	2.42%	22%	1.30%
Average	50%	33%	3.46%	2.42%	17%	1.04%

Summary

E.15.6 Total Costs appear to have grown faster in Shire Areas than Metropolitan Areas over the period analysed, as summarised below:

- Metropolitan Areas: Between 9 and 19 percentage points higher than the inflation adjustment
- Shire Areas: Between 12 and 22 percentage points higher than the inflation adjustment

E.15.7 However, this reflects items discussed in earlier sections of this report as not contributing to MOCs. Therefore, the impact of the following items is removed from the next section of the report.

E.16 Total Costs (Marginal Items Only)

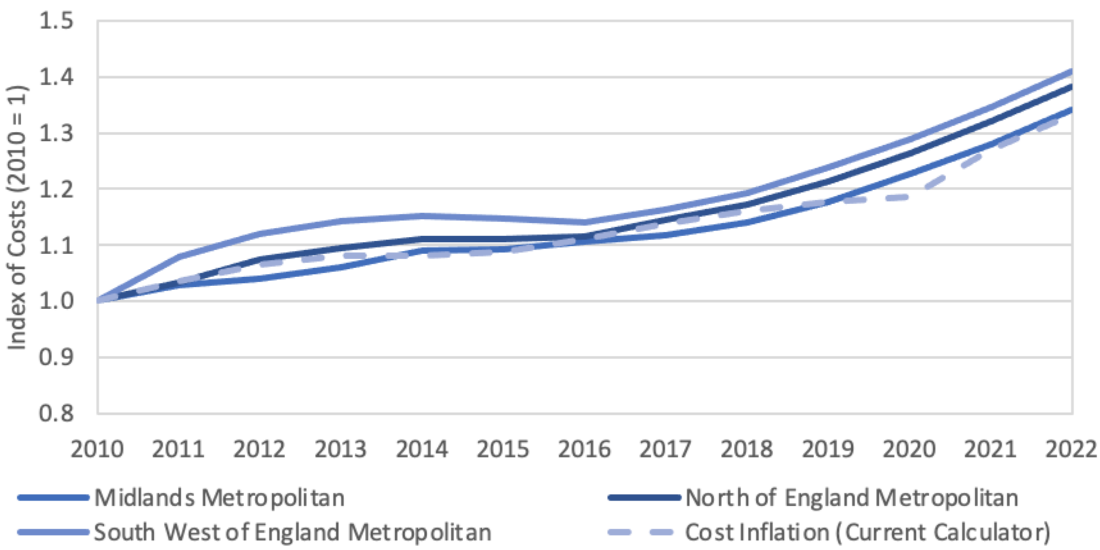
E.16.1 In this section, Total Costs are again compared for both Metropolitan and Shire Areas but with the following items removed:

- Overhead Costs
- Depreciation & Leasing Costs

Metropolitan Areas

E.16.2 In the graph below, Total Costs (Marginal Items Only) are presented in comparison to inflation. For each Metropolitan Area it can be seen that these costs have grown at or slightly above the inflation assumption in the current calculator between 2010 and 2022.

Figure 82. Index Changes in Total Costs (Marginal Items Only) – Metropolitan Areas (2010 to 2022)



E.16.3 In the table below it can be seen that on average per annum, the growth in Total Costs (Marginal Items only) is only just higher than the inflation assumptions in the current calculator. On average, the rate is just 0.28 percentage points higher than inflation.

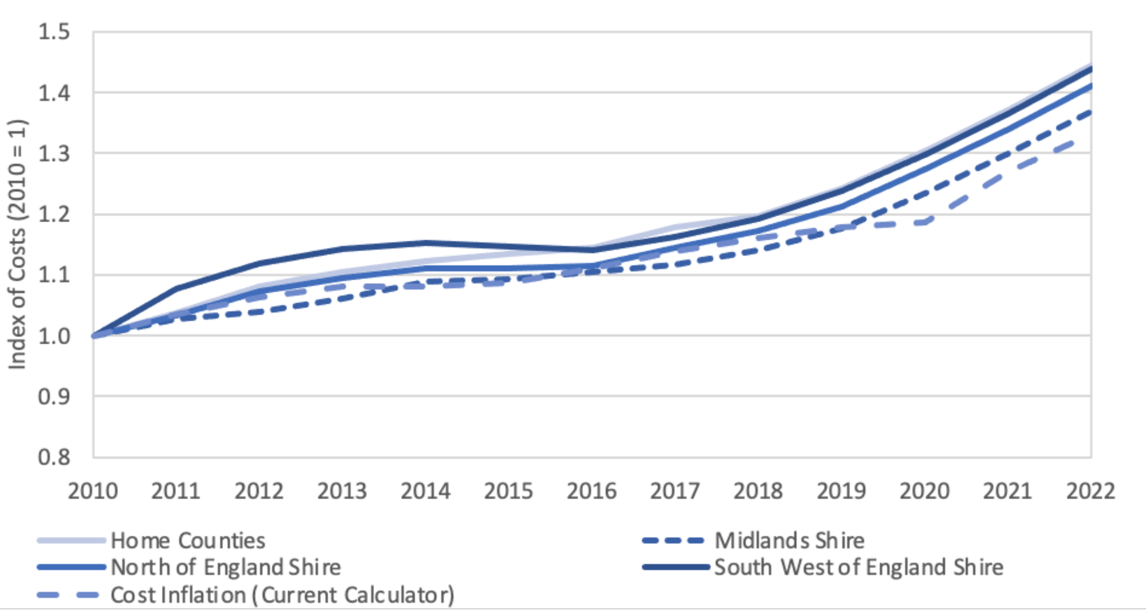
Table 57. Summary of Total Cost Growth (Marginal Items Only) – Metropolitan Areas (2010 to 2022)

Area	Total Growth (2010 to 2022)		Average Annual Growth		Difference	
	Cost Growth	Inflation (Calculator)	Cost Growth	Inflation (Calculator)	Total Growth	Average Annual Growth
Midlands	34%	33%	2.47%	2.42%	1%	0.05%
North of England	38%	33%	2.73%	2.42%	5%	0.31%
South West of England	41%	33%	2.90%	2.42%	8%	0.48%
Average	38%	33%	2.70%	2.42%	5%	0.28%

Shire Areas

E.16.4 For Shire Areas, the growth in Total Costs (Marginal Items Only) is slightly higher than the inflation assumption in the current calculator between 2010 and 2022 across all Metropolitan Areas.

Figure 83. Index Changes in Total Costs (Marginal Items Only) – Shire Areas (2010 to 2022)



E.16.5 In the table below, the growth per annum can be shown to be slightly higher for Total Costs in comparison to the inflation assumption in the current calculator. On average, this is just 0.52 percentage points higher.

Table 58. **Summary of Growth in Total Costs (Marginal Items Only) – Shire Areas (2010 to 2022)**

Area	Total Growth (2010 to 2022)		Average Annual Growth		Difference	
	Cost Growth	Inflation (Calculator)	Cost Growth	Inflation (Calculator)	Total Growth	Average Annual Growth
Home Counties	45%	33%	3.12%	2.42%	12%	0.70%
Midlands	37%	33%	2.65%	2.42%	4%	0.23%
North of England	41%	33%	2.91%	2.42%	8%	0.49%
South West of England	44%	33%	3.08%	2.42%	11%	0.66%
Average	42%	33%	2.94%	2.42%	9%	0.52%

Summary

E.16.6 Over the period analysed, Total Costs (Marginal Items Only) have grown slightly faster in Shire Areas then in Metropolitan Areas:

- Metropolitan Areas: Between 9 and 19 percentage points higher than the inflation adjustment
- Shire Areas: Between 12 and 22 percentage points higher than the inflation adjustment

E.16.7 The above suggests that the adjustment for inflation in the current calculator is lower than the growth in Total Costs. Therefore, an upward revision would be required to fully account for the growth in MOCs.

E.17 Discussion & Recommendations

E.17.1 The current calculator estimates MOCs using the following relationship between distance and cost:

MOC = 0.055 + 0.006
** Average distance in miles travelled per generated concession)/3.9*

E.17.2 In the above relationship, it is summarised that MOCs are estimated as the sum of:

- A fixed component of 5.5p per passenger (2009/10 prices)
- A variable component which means that for every 3.9 miles travelled, 0.6p is incurred per passenger

E.17.3 The above is summarised in the Table below across a range of distances from 1 to 10 miles, with the following summarised:

- Base (2009/10 Prices) – this demonstrates base MOCs in the current calculator without any adjustment by inflation of actual cost growth.

- Current Adjustment (2023/24 Prices) – this demonstrates MOCs in the current calculator adjusted by the inflation assumption in the current calculator.
- Average Metropolitan Adjustment (2023/24 Prices) – this demonstrates MOCs in the current calculator adjusted by Total Cost Growth as an average across Metropolitan Areas (2.70% per annum).
- Average Shire Adjustment (2023/24 Prices) – this demonstrates MOCs in the current calculator adjusted by Total Cost Growth as an average across Shire Areas (2.94% per annum).

Table 59. Comparison of Marginal Costs per Passenger by Distance and Scenario

Growth	Average Distance of Concessionary Passenger (Miles)									
	1	2	3	4	5	6	7	8	9	10
Base (0%)	5.65	5.81	5.96	6.12	6.27	6.42	6.58	6.73	6.88	7.04
Current Adjustment (43%)	8.08	8.30	8.52	8.74	8.96	9.18	9.40	9.62	9.84	10.06
Metropolitan Areas (45%)	8.21	8.43	8.66	8.88	9.10	9.33	9.55	9.78	10.00	10.22
Shire Areas (50%)	8.49	8.72	8.95	9.18	9.41	9.64	9.87	10.11	10.34	10.57

Comparison with ITS Marginal Costs

E.17.4 The DfT's guidance for the current calculator is the 'Concessionary travel for older and disabled people: guidance on reimbursing bus operators (England)' report. Within this report is Annex E: Research and Summary of Evidence, which presents a bottom-up review of MOCs produced by ITS.

E.17.5 The costs included in the bottom-up estimate by ITS are not entirely consistent with the data from the CPT which has been analysed, with ITS estimating MOCs based on:

- Fuel;
- Tyres;
- Oil;
- Maintenance and Cleaning;
- Insurance;
- Information;
- Additional Time Costs.

E.17.6 The majority of these can be mapped as shown in the second column of the Table overleaf. However, the CPT data does not disaggregate Tyres and Oil and there is not a direct comparison of Information. However, the analysis is only for benchmarking purposes to check that an entirely different answer does not result from analysing growth rates in a different manner using different datasets.

E.17.7 The review by ITS is included in this report simply to cross-check the average uplifts across Metropolitan and Shire Areas which have been identified in the 'Total Costs – Marginal Items Only' section of this report. In the current calculator, the MOC equation is based on distance and the individual component costs are aggregated such that the contribution of staff, fuel costs etc. cannot be seen.

E.17.8 However, the ITS data gives an alternative view of MOCs which is broken down by cost item. By adjusting the bottom-up estimate by individual cost component using the average values in each comparative section in this report, a different overall uplift can be estimated. This can then be compared against the uplifts across Total Costs (Marginal Items Only) to see if there is any risk with using the CPT data as an overall factor uplift to MOCs in the calculator.

E.17.9 In the table below, the MOCs are presented by scenario for each cost item:

- Base: These are the unadjusted values from Annex E (2009/10 Prices);
- Current Adjustment: The values from Annex E adjusted using the inflation assumption in the current calculator (2023/24 Prices);
- Metropolitan Areas: The values from Annex E adjusted using extrapolated growth rates from the corresponding section in this report to the Uplift Applied column – Metropolitan Areas (2023/24 Prices);
- Shire Areas: The values from Annex E adjusted using extrapolate growth rates from the corresponding section in this report to the Uplift Applied column – Shire Areas (2023/24 Prices).

E.17.10 The table shows that the current adjustment in the calculator would mean that the MOCs increase from 5.0p/mile in 2009/10 prices, to 7.5p/mile in 2023/24 prices. This compares against slightly lower values of 7.0p/mile using the growth in costs for Metropolitan Areas from the analysis in this report and 7.4p/mile for Shire Areas.

Table 60. ITS Bottom-Up Estimate & Updates by Scenario of MOCs

Item	Uplift Applied	Base (2009/10 Prices)	Current Adjustment (Calculator) (2023/24 Prices)	Metropolitan Areas (2023/24 Prices)	Shire Areas (2023/24 Prices)
Fuel	Fuel	0.3p/mile	0.5p/mile	0.4p/mile	0.4p/mile
Tyres and Oil	Parts	0.1p/mile	0.2p/mile	0.3p/mile	0.3p/mile
Maintenance and Cleaning	Maintenance	0.1p/mile	0.2p/mile	0.1p/mile	0.2p/mile
Insurance	Insurance	2.7p/mile	4.1p/mile	3.0p/mile	3.2p/mile
Information	Overheads	0.5p/mile	0.8p/mile	1.3p/mile	1.4p/mile
Additional Time Costs	Labour Sub-Total	1.3p/mile	2.0p/mile	1.9p/mile	2.0p/mile
Total		5.0p/mile	7.5p/mile	7.0p/mile	7.4p/mile

E.17.11 For the above MOCs, a breakdown of the components by contribution is shown for each category and scenario in the Table below. There is little change across most items with the exceptions of Insurance and Information Costs. Insurance has grown by less than inflation whereas Fuel, Parts and Staff Costs (Maintenance and Additional Time Costs) have grown by slightly higher than inflation.

E.17.12 Furthermore, for Information, from the CPT data there is not a good comparison for Information Costs. Overheads have been used but these are considered not to be a Marginal Cost, so there is a limitation with this analysis. It does reinforce that using an overall factor is more appropriate than breaking down MOCs and re-constructing using individual growth rates for each cost item owing to data availability.

Table 61. Contribution of Item to MOCs in ITS Estimate & Updates by Scenario

Item	Uplift Applied	Base	Current Adjustment	Metropolitan Areas	Shire Areas
Fuel	Fuel	6%	6%	5%	5%
Tyres and Oil	Parts	2%	2%	4%	4%
Maintenance and Cleaning	Maintenance	2%	2%	2%	2%
Insurance	Insurance	54%	54%	42%	43%
Information	Overheads	10%	10%	19%	19%
Additional Time Costs	Labour Sub-Total	26%	26%	27%	26%
Total		100%	100%	100%	100%

E.17.13 A comparison of the overall growth in MOCs is summarised in the Table below using the adjustment in the current calculator, the single growth rate across all items (Total Costs – Marginal Items Only) and an uplift aggregated from individually adjusting the items shown in the bottom-up adjustment in the tables in this section.

E.17.14 The analysis demonstrates that a lower uplift is estimated for Metropolitan Areas than Shire Areas which is consistent with the prior analysis. However, whereas the inflation adjustment in the current calculator is lower than the estimate of Operating Cost growth from earlier analysis in this report, this latest analysis shows the contrary – the inflation adjustment is slightly higher.

E.17.15 However, the estimate by ITS has 54% of MOCs relating to insurance costs, in comparison to just 6% for fuel costs, whereas the CPT analysis suggests Operating Costs consist of Fuel and Staff Costs to around 75%. Therefore, whilst this analysis is a useful cross-check that the growth rates aren't too dissimilar, it is not recommended that it is used to influence an adjustment to MOCs in the calculator.

Table 62. Comparison of Uplift Estimates

	ITS Comparison			Comparison against Current Calculator	
Area	**Current Calculator Uplift**	**Single Uplift**	**Uplift by Item**	**Single Uplift**	**Uplift by Item**
Metropolitan	50%	45%	41%	-5%	-9%
Shire	50%	50%	48%	0%	-2%

E.17.16 A further benchmarking exercise is presented in the Table below. This compares the following estimates:

- Current Calculator: The extrapolated inflationary adjustment from 2009/10 to 2023/24 prices is summarised.
- DfT Data: The growth in Operating Costs per mile from the DfT's 'bus04i' dataset extrapolated from 2009/10 to 2023/24 is summarised.
- Study (Average): The growth trends analysed from the CPT data in the Total Costs (Marginal Items Only) section of this report is extrapolated for 2009/10 to 2023/24.

E.17.17 The summary demonstrates that both the inflationary adjustment in the current calculator and the growth rates estimated from the CPT data in this research are lower than the growth rates estimated from the DfT's data, particularly for Shire Areas. The DfT's dataset does not explain why the range is so high or why Shire Areas have grown so much in comparison to the CPT data.

Table 63. **Comparison of Growth Assumptions against DfT Cost Data**

Area	Current Calculator	DfT Data	Study (Average)
Metropolitan	43%	49%	45%
Shire	43%	73%	50%

Summary & Recommendations

E.17.18 The aim of this research was to review the suitability of the current reimbursement calculator and guidance in terms of estimating MOCs. Within this aim are the following objectives:

- To analyse how bus operating costs have changed since 2009/10;
- To compare operating costs against the inflation assumptions in the current calculator;
- To cross-check any differences in operating cost growth with the inflation assumptions (where possible);
- To provide recommendations for adjustments to the MOCs for the new calculator.

E.17.19 Data has been provided by the CPT which has been used to understand how different Operating Cost components have evolved since the current calculator was introduced as part of the 2010 ENCTS. The overall change in items which are considered to reflect Marginal Cost changes rather than just Average Cost changes has been compared against the current inflation assumption.

E.17.20 The change has been slightly higher for Shire Areas than Metropolitan Areas over the period analysed from 2010 to 2022. For both areas, the growth has been slightly higher than the inflation assumption in the calculator. Therefore, Recommendation One is that the MOCs are uplifted in the calculator to reflect the growth in Operating Costs analysed.

E.17.21 The growth rates are higher for Shire Areas than Metropolitan Areas, as summarised below for an adjustment for 2009/10 to 2023/24 prices:

- Metropolitan Areas: 45%;
- Shire Areas: 50%.

E.17.22 However, these values are not too dissimilar and are only a little bit higher than the current adjustment of 43%. Recommendation Two is that a central value is used as an uplift which would mean 47.5%. This single adjustment is proposed based on an average adjustment across the metropolitan and shire areas analysed from the CPT data, extrapolated from 2010 to 2022 (CPT data) to 2009/10 to 2023/24 (to reflect the range in current calculator).

E.17.23 Two cross-checks have been undertaken against these uplifts as follows:

- Uplifts by Cost Category against ITS Bottom-up Estimates of MOCs;
- Comparisons against DfT Operating Costs per Mile.

E.17.24 The above checks have demonstrated that the uplifts estimated in this research are lower but not dissimilar than comparisons against other benchmarks. It is also broadly consistent with the inflation adjustment calculated using a Composite Index from the Inflation work, which is 45% (consisting of weighted Fuel Costs, Labour Costs and CPI). Therefore, it is believed that the recommended uplift is reasonable and robust.

E.17.25 A set of QA checks has also been undertaken against the supporting analytical workbooks to ensure that input data and calculations are reliable.

E.17.26 Nevertheless, there are some caveats and limitations to the analysis which are important to summarise. The average annual growth in Total Costs (Marginal Items Only) pre- and post-pandemic is as follows:

- 2010 to 2019: 2.18% per annum;
- 2019 to 2022: 4.85% per annum.

E.17.27 The above means that 47% of the growth in Operating Costs has occurred in the final three years of the CPT data. It is possible that the higher rate of growth is due to short-term shocks from:

- The COVID-19 pandemic: due to potential shortages in parts and problems with distribution/labour, and which might explain why Parts Costs have almost tripled since 2010;
- The Cost-of-Living crisis and Supply Chain issues : driven by high inflation, particularly in 2022, which is impacting across the UK economy.

E.17.28 Therefore, Recommendation Three is that the analysis is revisited in 2-3 years time when the impacts of the above are likely to have settled down and to ensure that the recommended adjustments are still relevant.

E.17.29 Finally, the analysis has been based on Average Costs rather than Marginal Costs. The relationship developed by ITS which consists of Fixed and Variable components has not been tested as this would require an extensive econometric exercise beyond the scope of this study. Recommendation Four is that at some point in the future an Operating Cost function is estimated using econometric analysis and MOCs are directly estimated from the function for comparison against the relationship in the current calculator.

E.17.30 To conclude this report, the recommendations are summarised as follows:

- Recommendation One: The MOCs in the current calculator are uplifted to reflect the growth in Operating Costs analysed;

- Recommendation Two: The uplift applied to MOCs is 47.5% to reflect a central value across Metropolitan and Shire Areas analysed;
- Recommendation Three: The analysis is revisited in 2-3 years time to consider the longer term impact of the pandemic and the Cost-of-Living crisis;
- Recommendation Four: MOCs are directly estimated from econometric analysis of Operating Costs to re-evaluate the relationship established by ITS.

Annex F Costs: service frequency elasticity

F.1 Introduction

F.1.1 The current service frequency elasticity (the percentage change in passenger journeys in response to a percentage change in bus service frequency) used in the calculator is based on econometric analysis conducted in the late 1990s and 2000.[37] The analysis conducted for this study uses much more recent data provided by operators. We are grateful to the operators who provided their data: for confidentiality, we do not identify those operators.

F.1.2 This annex outlines the approach to estimating the service frequency elasticity. This elasticity is used to adjust reimbursement for changes in revenue that may result from patronage that is induced by operators increasing service frequency in response to passenger journeys generated by the ENCTS.

F.1.3 The analysis was conducted under significant time constraints. Given additional time, it would also have been possible to run a greater volume of sensitivities, and examine the behaviour of the models in greater detail, which would have allowed us to explain the results in greater depth. Additionally, with more time we could have improved the bus route geocoding, to more precisely control for local competition between routes. This could potentially have increased the precision of the results (less random noise in the estimates). We have aimed to control for this imprecision by running multiple sensitivities that over- and under-adjust for route competition and taking an average.

F.1.4 In this section we summarise:

- Data sources used
- Method for elasticity estimation
- Findings
- Discussion of findings

F.2 Data

F.2.1 This analysis used the data sources outlined in the table below.

F.2.2 As the operator data is commercially sensitive, we have removed any identifiable commercially sensitive figures in reporting the results in this annex.

37 Sourced from TRL593, Table A7.2; available from https://trl.co.uk/uploads/trl/documents/TRL593%20-%20The%20Demand%20for%20Public%20Transport.pdf

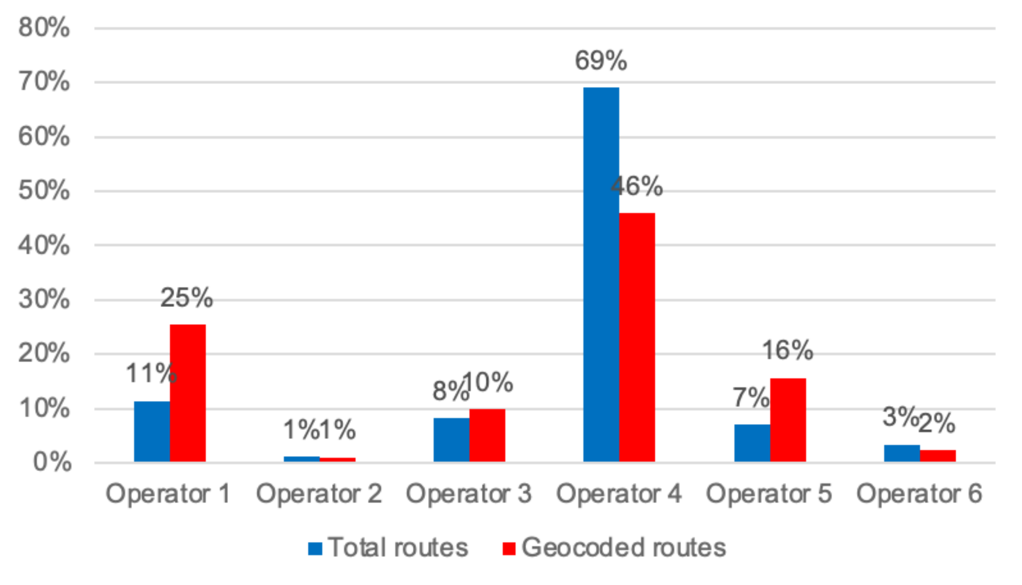
Table 64. Data sources for service frequency elasticity analysis

Data	Description	Source
Operator data	Mileage, passengers, PVR, revenue; by operator; by route; monthly for 2017-present	Operators provided data for a variety of routes in the North East, North West, South West and East of England, covering a range of urban and rural routes.
Public statistics on local areas	Local authority population, average income, % unemployed, % households with car ownership, population density	2021 Census
Geocoding information	Geocoded bus stop locations by route number and operator	Traveline

F.2.3 In order to account for variation in the characteristics of local passengers, we link operator data with public statistics on local areas. This requires geocoding bus routes, which we have done using 2023 Traveline data. However, bus route geocoding is not straightforward. Bus route numbers or bus stop locations may change over time, and route numbers are reused in different local areas and by different operators. In addition, there are multiple route identifiers in Traveline, and it is not always clear which ones match the codes provided by the operators. After matching with Traveline data, we then also restrict our data to the corresponding geographic region, to account for the fact that route identifier codes might be re-used by the same operator in different areas.

F.2.4 For this reason, out of the sample of 1,095 distinct bus routes provided by the operators, we are able to rigorously match and geocode 307 (c. 30%) distinct routes. This sample is well-represented across different operators, and is referred to below as the high-confidence scenario. To check robustness of this approach, we perform a sensitivity analysis by considering the full sample (low confidence scenario) where the local area statistics are matched to the Government Office Region average.

Figure 84. Operator share of routes (total and geocoded)



F.2.5 The geocoding provided a sample that is well distributed across operators and geographies. The total number of routes is the % of all routes in the raw data from each operator. Geocoded routes is the % of all geocoded routes from each operator.

F.2.6 More precisely, approximately 50% (509) of routes can be perfectly matched to at least one Traveline entry by using the route identifier code and the operator name. This share is, on average, 63% by operator, but the number of matches is significantly lower for one operator's services. Out of these, 40% (223) are perfectly matched, 14% (84) have multiple Traveline matches and the remaining 46% fall outside of the corresponding geographic area. The result is 307 distinct routes well-represented across the different operators. The match quality and final number of routes is summarised in the table below.

Table 65. Match quality and number of routes

	Inclusion in the 'high confidence match' sensitivity	Inclusion in the 'low confidence match' sensitivity	Final number of routes
The route and operator matched precisely to one entry in Traveline location data	Included after restricting to geographic area	Included after restricting to geographic area	223 routes
The route and operator matched multiple entries in Traveline location data	Included	Matched to the route that was located closest to the geographic centre of the operator's other bus stops	84 routes
The route and operator matched no entries in Traveline location data	Not included	Matched to the Government Office Region average	788 routes

F.3 Method

F.3.1 We estimated two regression specifications. The "dynamic" elasticity (allowing passengers a period of adjustment to a change in bus services) is conceptually appropriate for use in the calculator (and is what is currently used). The "static" elasticity is estimated as a sense-check.

F.3.2 We use two approaches to control for COVID-19 pandemic effects: (1) include month fixed effects and use the entire sample 2017-present; or (2) include month fixed effects and remove March 2020-July 2021 from the sample.

F.3.3 The specification for the static elasticity is:

$$log(passengers_{i,t}) = \beta_0 + \beta_1 log(mileage_{i,t}) + \beta_3 log(yield_{i,t}) + \beta_{4,i} + \beta_{5,t} + \beta_{2:k}(local\ area\ characterisitics) + \epsilon_{i,t}$$

where i is the route, and t is the month, and $yield$ is (revenue/passengers). The term of interest is β_1, which is interpretable as the percentage change in passengers for a percentage change in mileage.

F.3.4 The specification for the dynamic elasticity is:

$$log(passengers_{i,t}) = \beta_0 + \beta_1 log(passengers_{i,t\text{-}12}) + \beta_2 log(mileage_{i,t}) + \beta_3 log(yield_{i,t}) + \beta_{4,i} + \beta_{5,t} + \beta_{2:k}(local\ area\ characterisitics) + \epsilon_{i,t}$$

F.3.5 Where the long-run elasticity is estimated as[38]

38 See W. Greene, *Econometric analysis*, fifth edition, section 19.4.2.

$$\frac{\beta_2}{1-\beta_1}$$

F.3.6 In order to estimate the long-run elasticity with a confidence interval, we rearrange the regression equation:

$$\log(passengers_{i,t-12}) - \log(passengers_{i,t}) = -\beta_0 + (1-\beta_1)\log(passengers_{i,t-12}) - \beta_2 \log(mileage_{i,t}) - \beta 3 \log(yield_{i,t}) - \beta 4,i - \beta_{5,t} - \beta_{2:k}(local\ area\ characteristics) - \epsilon_{i,t}$$

$$\frac{1}{1-\beta_1}(\log(passengers_{i,t-12}) - \log(passengers_{i,t})) \frac{-\beta_0}{(1-\beta_1)} + \log(passengers_{i,t-12}) - \frac{\beta_2}{(1-\beta_1)}\log(mileage_{i,t}) - \frac{\beta_3}{(1-\beta_1)}\log(yield_{i,t}) - \frac{\beta_{4i}}{(1-\beta_1)} - \frac{\beta_{5,t}}{(1-\beta_1)} - \frac{\beta_{2:k}}{(1-\beta_1)}(local\ area\ characteristics) - \frac{\epsilon_{i,t}}{(1-\beta_1)}$$

$$\begin{aligned}\log(passengers_{i,t-12}) &= \frac{-\beta_0}{(1-\beta_1)} \\ &+ \frac{1}{(1-\beta_1)}(\log(passengers_{i,t-12}) - \log(passengers_{i,t})) \\ &+ \frac{\beta_2}{(1-\beta_1)}\log(mileage_{i,t}) + \frac{\beta_3}{(1-\beta_1)}\log(yield_{i,t}) \\ &+ \frac{\beta_{4i}}{(1-\beta_1)} + \frac{\beta_{5,t}}{(1-\beta_1)} \\ &+ \frac{\beta_{2:k}}{(1-\beta_1)}(local\ area\ characteristics) + \frac{\epsilon_{i,t}}{(1-\beta_1)}\end{aligned}$$

F.3.7 The term of interest is the coefficient on mileage.

F.3.8 The main specification is at a route level. However, we included a sensitivity that accounts for potential competition between routes in a local area (which may or may not be run by multiple operators). This sensitivity groups together all routes in a local area into one observational unit. This accounts for the possibility that increases in passengers on one route are related to decreases in mileage on another route, which would violate the regression specification assumption of independent errors.

F.3.9 To determine which bus routes to group together into areas of local competition, we:

F.3.10 Calculated the average distance between the bus stops on Route A and the bus stops on Route B, for all pairwise combinations of routes in the dataset.

F.3.11 This dataset formed a network, where the nodes are routes and the edges are the inverse squared distance between the pair of routes (gravity model of distance).

F.3.12 We applied a community detection algorithm to this network data (Louvain algorithm). A perfect community detection would contain all edges within communities and no edges would cross communities, but in practice this is typically not achievable due to the network structure. For the algorithm, the user specifies the penalty for edges crossing communities relative to the benefit for edges being contained within communities (these benefits/ penalties enter into a score function). This algorithm starts with each node in its own community, and searches over possible groupings of communities, and then repeats the stepwise process to search for larger groupings of communities that improve the score.

F.3.13 From our dataset of 307 routes, we produced 70 local areas using this approach. We expect that this method overestimates the extent to which routes are in competition. Our base model underestimates the extent to which routes are in competition. Therefore the 'base' and 'adjustment for route competition' sensitivities should provide bounds on the elasticity estimate.

F.3.14 We estimated the following sensitivity analyses:

Table 66. Sensitivity analyses

Sensitivity	Years	Subset of routes	Specification
Base	2017-2023, COVID-19 dummy from March 2020 to July 2021	High-confidence geocoded routes	Dynamic
Pre-COVID-19	Exclude period after March 2020	High-confidence geocoded routes	Dynamic
Static model	2017-2023, COVID-19 dummy from March 2020 to July 2021	High-confidence geocoded routes	Static
Adjustment for route competition	2017-2023, COVID-19 dummy from March 2020 to July 2021	High-confidence geocoded routes grouped by local area	Dynamic
Full route sample	2017-2023, COVID-19 dummy from March 2020 to July 2021	Include full sample of routes (including those with bus stops that were difficult to geocode)	Dynamic

F.3.15 We assessed model fit by examining coefficient sign and magnitude to adjust functional form (logged and squared polynomial terms), adjusted R2 for predictive power, residual plots for model specification and heteroskedasticity, Cooke's distance plots to remove points with high leverage, and QQ plots to assess normality. We found that the residuals violated normality (their distribution had heavy tails), and so we used robust standard errors.

F.4 Results

F.4.1 The elasticity estimates are:

Table 67. Elasticity estimates

Model	Estimate (95% Confidence interval)
Base	0.64 (0.59, 0.70)
Pre-COVID period	0.72 (0.66, 0.79)
Static model	0.80 (0.74, 0.86)
Adjustment for route competition	0.79 (0.69, 0.88)
Full route sample	0.70 (0.67, 0.74)

F.4.2 The regression coefficients are shown below. Below each point estimate, we show (standard error, p-value) in parentheses. The models have high R2 because there is a strong level relationship between passengers and mileage, and because of the route-level fixed effects.

Table 68. Regression coefficients

Coefficient (se, p-value)	Base	Pre-covid--19	Short-run	Adjustment for local competition	Full sample
Intercept	-0.29 (0.51, 0.57)	0.76 (0.67, 0.26)	-1.24 (0.57, 0.03)	1.46 (0.93, 0.11)	-14.19 (8.68, 0.1)
log(lagged pax) – log(pax)	0.73 (0.01, <0.01)	<0.01.86 (0.01, <0.01)	NA	0.8 (0.02, <0.01)	0.78 (0.01, <0.01)
log(mileage)	0.64 (0.03, <0.01)	0.72 (0.03, <0.01)	0.8 (0.03, <0.01)	0.79 (0.05, <0.01)	0.7 (0.02, <0.01)
log(yield)	-0.38 (0.03, <0.01)	-0.61 (0.03, <0.01)	-0.47 (0.03, <0.01)	-0.23 (0.08, 0.01)	-0.31 (0.02, <0.01)
COVID-19 dummy	-0.37 (0.1, <0.01)	NA	-0.33 (0.12, 0.01)	-0.74 (0.19, <0.01)	-0.45 (0.09, <0.01)
Population density	<0.01 (<0.01, 0.1)	<0.01 (<0.01, 0.02)	<0.01 (<0.01, <0.01)	<0.01 (<0.01, 0.55)	<0.01 (<0.01, 0.01)
Income per person	<0.01 (<0.01, <0.01)	<0.01 (<0.01, 0.12)	<0.01 (<0.01, <0.01)	<0.01 (<0.01, 0.02)	<0.01 (<0.01, 0.08)
Income per person squared	<0.01 (<0.01, <0.01)	<0.01 (<0.01, 0.15)	<0.01 (<0.01, <0.01)	<0.01 (<0.01, 0.06)	<0.01 (0, 0.04)
Unemployment rate	-3.01 (0.63, <0.01)	-0.3 (0.84, 0.72)	-2.78 (0.66, <0.01)	-9.64 (1.35, <0.01)	-3.08 (0.44, <0.01)
Cars per person	0.58 (0.11, <0.01)	0.19 (0.14, 0.17)	0.57 (0.12, <0.01)	0.09 (0.18, 0.59)	0.22 (0.07, <0.01)
log(yield) * COVID-19 dummy	0.01 (0.02, 0.64)	NA	0.01 (0.02, 0.55)	-0.03 (0.06, 0.66)	0.02 (0.01, 0.11)
Population density * COVID dummy	<0.01 (<0.01, <0.01)	NA	<0.01 (<0.01, <0.01)	<0.01 (<0.01, 0.04)	<0.01 (<0.01, <0.01)
Income per person * COVID-19 dummy	<0.01 (<0.01, <0.01)	NA	<0.01 (<0.01, 0.01)	<0.01 (<0.01, 0.05)	<0.01 (<0.01, 0.38)
Income per person squared * COVID-19 dummy	<0.01 (<0.01, <0.01)	NA	<0.01 (<0.01, <0.01)	<0.01 (<0.01, 0.05)	<0.01 (<0.01, 0.32)
Unemployment rate * COVID-19 dummy	2.53 (0.72, <0.01)	NA	3.18 (0.85, <0.01)	8.47 (1.76, <0.01)	3.82 (0.53, <0.01)
Cars per person * COVID dummy	-0.08 (0.01, <0.01)	NA	-0.1 (0.02, <0.01)	0.03 (0.03, 0.38)	-0.06 (0.01, <0.01)
R^2	0.99	0.99	0.98	0.99	0.98
N	8100	4693	8100	2815	15189

F.4.3 Our base specification estimated an elasticity of 0.59-0.70, which is consistent with the elasticity in the current calculator of 0.66. This was the lowest elasticity estimate among the sensitivities.

F.4.4 The pre-COVID model produced a higher elasticity estimate than the base model. As the pre-COVID-19 model did not attempt to fit a single model across structural breaks in public transport demand, the higher elasticity estimate may reflect a better model fit. It may also indicate that there has been a decrease in service frequency elasticity over time. Bus users with more discretionary and elastic demand likely have reduced bus usage post-pandemic relative to pre-pandemic, although the evidence examined elsewhere in this report is inclusive on this point.

F.4.5 The static model estimated a service frequency elasticity which was substantially higher than the base specification, although the reason for this is not clear, and due to time constraints it was not possible to investigate this further.

F.4.6 The model adjusting for local route competition also produced a relatively high elasticity estimate. By estimating a stronger relationship between mileage and passengers, this model seems to have been successful at reducing some of the noise due to correlations in the route-level errors in the base model. However, this model groups together bus routes across operators within local areas. As the calculator inputs an individual operator’s data, there is a conceptual mismatch between this estimate and the calculator data.

F.4.7 The estimate from the full route sample produced an estimate towards the centre of our sensitivity range and is consistent with the current service frequency elasticity.

F.4.8 On the evidence available, this analysis has provided a series of model specifications which are robust and stable. As the dynamic model is conceptually appropriate for the calculator, we recommend using an average of the dynamic models, which is [(0.64+0.72+0.79+0.70)/4] = 0.71. This is very close to the current value in the calculator of 0.66 .

F.5 Conclusions

F.5.1 This analysis used route-level data from 6 different bus operators, from the North West, North East, South East, South West and East of England. The analysis estimated the relationship between passengers and total mileage (a proxy for service frequency), controlling for yield and local area characteristics. Local area characteristics were added to each bus route by a geocoding exercise, for which we relied on publicly available data (Traveline). We estimated the service frequency elasticity using a range of regression specifications.

F.5.2 Our elasticity estimates are consistent with the values currently used in the calculator, and the sensitivity analyses suggest that the estimates are moderately sensitive to assumptions around COVID-19-related structural breaks, different passenger response lengths, and competition from other local routes. All the models have high predictive power, and the coefficients of interest are statistically significant.

F.5.3 We are confident that this analysis is a significant improvement on the evidence base underpinning the current service frequency elasticity contained within the guidance.

F.5.4 On the evidence available, this analysis has provided a series of model specifications which are robust and stable. The dynamic model is most appropriate for estimating this elasticity, therefore we recommend using an average of the dynamic model estimates, and this average is 0.71. This is very close to the current value in the calculator of 0.66.

F.5.5 All else being equal, a higher service frequency elasticity reflects that commercial passengers are more responsive to changes in service frequency. Therefore, where service frequencies are increased because of the ENCTS, a higher service frequency elasticity will result in a greater modelled increase in commercial passengers arising from that frequency increase: and therefore a reduction in the level of reimbursement required to leave bus operators no better and no worse off.

F.5.6 Future research could build on this analysis in a number of ways. Even though our method includes data from multiple operators across regions of the country with different characteristics, including more bus operators across a wider geographic area would allow for richer insights about passenger behaviour and how demand responses vary at a local level.

F.5.7 As explained above, our approach relies heavily on accurately geocoding bus routes using publicly available spatial data. We were able to perform the geocoding with high confidence for only a portion of the routes. Although our results are consistent with the elasticity in the current calculator, operator-provided spatial data would have allowed us to increase the precision and robustness of our estimates.

F.5.8 There is currently limited available evidence on bus service frequency elasticity in the UK. It is important to note that the service frequency elasticities estimated in this analysis are based on data from operators from a wide range of areas, and that the service frequency elasticity in different areas may be materially different from those provided in this report.

Annex G Primary research topic guides and surveys

G.1 Bus operator survey

SURVEY INTRODUCTION

This survey

We are conducting a survey of all operators of local bus services across England to understand experiences of the ENCTS and where improvements can be made. More specifically, we are keen to hear about experiences of the reimbursement guidance and calculator, the appeals process, and extending current travel times and the disability eligibility criteria.

This survey follows on from the DfT's call for evidence in the summer of 2021 that many operators responded to. We are now seeking more detailed and up to date information from you through completion of the survey which you can access by using the link below. The survey will take approximately 10 minutes to complete.

We are extremely grateful for any feedback that you can provide, which will directly feed into any updates to the ENCTS guidance and reimbursement tool.

ABOUT YOUR ORGANISATION

Firstly, we have a few questions about the operator you represent. We are asking these questions to better understand how different types of operator (e.g. size and coverage) feel about the ENCTS.

1. **What is the name of the organisation that you represent?**
   Please enter the name in the box below:

2. **What is your role within the organisation?**
   Please select one
   - a. MD/CEO ☐
   - b. Senior Manager ☐
   - c. Planning/Operational Manager ☐
   - d. Other (please state) ☐

3. **In which local authority areas do you typically operate local bus services?**
   Please select all that apply:
   - a. London ☐
   - b. North East ☐
   - c. North West ☐
   - d. Yorkshire and the Humber ☐
   - e. East Midlands ☐

f. West Midlands ☐
g. South East ☐
h. East of England ☐
i. South West ☐

4. As at 01 May 2023, how many public service vehicle (PSV) buses licensed for over 22 passengers (including standing) do you operate?

Please enter a number below

5. At present, what percentage of all bus journeys on your network do you estimate are concessionary journeys (statutory or discretionary)?

Please select one

a. Under 5% ☐
b. 5-10% ☐
c. 11-20% ☐
d. 21-30% ☐
e. 31-40% ☐
f. 41-50% ☐
g. 51-60% ☐
h. Over 60% ☐
i. Don't know ☐

6. In the area(s) that you operate in, which discretionary concessions are offered?

Please select all that apply

a. Extensions to the beginning of the statutory time period during weekdays (travel pre-0930) ☐
b. Extensions to the end of the statutory time period during weekdays (travel post 2300) ☐
c. Concessions for companions to disabled people ☐
d. Allowing use of discretionary companion passes issued by other Travel Concession Authorities ☐
e. Concessions on Dial-a-Ride services and/or Demand Responsive Transport ☐
f. Concessions on Park and Ride services ☐
g. Youth concessions ☐
h. None of the above ☐
i. Other (please state) ☐

GUIDANCE AND CALCULATOR

There is guidance in place to assist operators in how they should be reimbursed for concessionary travel and for making a claim. We are keen to hear your feedback on both as an operator and to understand where improvements can be made for its use.

7. Firstly, what is your awareness and usage of the guidance and calculator?

Please select one for each row

a. I am aware of the guidance and calculator	☐ Yes	☐ No
b. I have used the guidance and calculator	☐ Yes	☐ No

8. [If you are aware/have used the guidance and calculator] To what extent do you agree the current reimbursement guidance and calculator is fit for purpose?

Instruction text: Please select one

a. Strongly agree	☐
b. Slightly agree	☐
c. Neither agree nor disagree	☐
d. Slightly disagree	☐
e. Strongly disagree	☐
f. Don't know	☐

9. Which areas of the reimbursement guidance do you believe are working well, and which need to be changed?

Please select all that apply

	Need changing	Working well	Don't know
a. Updates to the reimbursement/generation factor	☐	☐	☐
b. The discounted fare method (AF model)	☐	☐	☐
c. The NowCard average fare default look-up table	☐	☐	☐
d. The use of Passenger Transport Executives (PTEs) and non-PTE demand curves	☐	☐	☐
e. Calculation of marginal operating costs	☐	☐	☐
f. Calculation of marginal capacity costs	☐	☐	☐
g. Calculation of Peak Vehicle Requirement (PVR) costs	☐	☐	☐
h. Calculation of administration costs	☐	☐	☐
i. The Mohring Factor	☐	☐	☐
j. The default cost/vehicle hour and cost/vehicle mile	☐	☐	☐
k. Updates to inflation	☐	☐	☐
l. Other (please state)	☐	☐	☐

10. If you would like to give a reason for your response to Q9, please provide this below:

Please provide details below:

---

11. Do you have any suggestions as to how areas of the reimbursement guidance could be improved?

Please provide details below:

APPEALS PROCESS

We are also interested in your perceptions and experiences of the appeals process and whether there are improvements that could be made.

12. Since 2010, has your organisation previously lodged an appeal?

Please select one

a. Yes ☐
b. No ☐

13. Which of the following would make the appeals process more efficient and effective?

Please select all that apply

a. Longer timeframe for lodging an appeal to DfT / Secretary of State ☐
b. Changes to the data submission requirements / DfT proforma ☐
c. Longer timescales for responding to completed proformas ☐
d. Engagement with the decision maker ☐
e. Face to face meetings – oral hearings ☐
f. Other (please state) ☐
g. Don't know ☐
h. None ☐

14. Please provide any additional explanation or reasons for your response in Q13:

Please enter text

---

15. How would you rate the existing resource requirement needed for appeals?

Please select one

a. Very high ☐
b. High ☐
c. Neither high nor low ☐
d. Low ☐
e. Very low ☐
f. Don't know ☐

16. How could the resource required for the appeals process be reduced?
Please provide a response below

DISABILITY ELIGIBILITY CRITERIA AND DISCRETIONARY CONCESSIONS

In line with the commitment in the National Bus Strategy, DfT is reviewing eligibility for free bus travel for disabled people. This is to ensure that we are improving equality of opportunity and helping disabled people participate fully in public life.

17. To what extent do you agree that the current disabled eligibility criteria should be extended to include a wider range of disabilities? (This would assume the scheme would be offered on the same basis i.e. financially no better and no worse off for providing the concession)
Please select all that apply

a. Strongly agree ☐
b. Agree ☐
c. Neither agree nor disagree ☐
d. Disagree ☐
e. Strongly disagree ☐
f. Don't know ☐

18. Please describe what changes (if any) you would like to see made to the disabled eligibility criteria, and why?
Please enter your response in the box below:

19. What impact would an extension of the disability eligibility criteria have on you as an operator? For instance, would you anticipate any additional costs or practical issues?
Please enter your response in the box below:

20. How are companion passes processed?

a. Passenger taps card once and driver records whether 1 or 2 passengers are travelling ☐
b. The cardholder is recorded electronically but the companion manually ☐
c. Both rides are manually recorded ☐
d. Varies by area (please provide details) ☐
e. Other (please state) ☐
f. Don't know ☐

21. Question text: Why do you record rides manually?

a. The companion element does not work ☐
b. Some TCA cards persistently don't work ☐
c. Due to mechanical ticket machines ☐
d. Other (please state) ☐
e. Don't know ☐

REVIEW OF TRAVEL TIMES

In addition to disability eligibility criteria, DfT is also reviewing the times at which an ENCTS passholder can travel. We would like to know your views on this, and the potential impact it could have on the services you operate.

22. Would you be in favour of the ENCTS being extended to include travel before 0930 on a weekday? (This would assume the scheme would be offered on the same basis i.e. financially no better and no worse off for providing the concession)

Please select one

a. Yes ☐
b. No ☐
c. Don't know ☐

23. Why is that?

24. Are there any other times that you think the ENCTS travel should be either extended or restricted?

Please provide details of the times below and your reasons why

OVERALL VALUE FOR MONEY

25. Finally, do you consider the ENCTS to be good or bad value for money?

a. Good value for money ☐
b. Neither good nor bad value for money ☐
c. Bad value for money ☐
d. Don't know ☐

26. What is the reason for your response?

27. To what extent do you consider the following to be a benefit of the ENCTS?

Please provide a rating for each benefit

- a. Increases access to services and activities for eligible people ☐
- b. Reduces cost-based barriers to accessing transport ☐
- c. Supports a physically active lifestyle ☐
- d. Supports social inclusion, mental health and wellbeing ☐
- e. Reduced congestion / environmental benefits as a result of modal shift ☐
- f. Other (please state) ☐

This study will analyse data from a range of sources to understand changes in travel behaviour post-Covid, to assess whether the reimbursement guidance reflects current travel behaviour, and what the value for money is of the ENCTS and potential changes to it. Would you prepared, in principle, to share data that you have access to for this study? If yes, please provide your details below (please note, your details will not be used for any other purpose other than to follow up with you on data provision).

Please provide details of the data, name and email address below

FINAL THOUGHTS

28. Finally, if you have any further comments about your experiences of the concessionary fare scheme and how it could be improved, please leave them below.

That's all of our questions. Thank you so much for your time.

Please click 'Submit' to save your response.

G.2 Travel Concession authorities survey

THIS SURVEY

We are conducting a survey of all Travel Concession Authorities (TCA) across England to understand experiences of the ENCTS and where improvements can be made. More specifically, we are keen to hear about experiences of the reimbursement guidance and calculator, the appeals process, and extending current travel times and the disability eligibility criteria.

This survey will take approximately 10 minutes to complete. We are extremely grateful for any feedback that you can provide, which will directly feed into any updates to the ENCTS guidance and reimbursement tool. Please access the survey by using the link below.

ABOUT YOUR ORGANISATION

Firstly, we have a few questions about the Travel Concession Authority (TCA) you represent. We are asking these questions to better understand how different types of TCA feel about the ENCTS.

1. **What is the name of the TCA you represent?**
   Please enter the name in the box below:

2. **What is your role within your organisation?**
   Please select one
   a. Director ☐
   b. Senior Manager ☐
   c. Officer ☐
   d. Other (please state) ☐

3. **Which discretionary concessions do you offer within your area?**
   a. Extensions to the beginning of the statutory time period during weekdays (travel pre-0930) ☐
   b. Extensions to the end of the statutory time period during weekdays (travel post 2300) ☐
   c. Concessions for companions to disabled people ☐
   d. Allowing use of discretionary companion passes issued by other Travel Concession Authorities ☐
   e. Concessions on Dial-a-Ride services and/ or Demand Responsive Transport ☐
   f. Concessions on Park and Ride services ☐
   g. Youth concessions ☐
   h. None of the above ☐
   i. Other (please state) ☐

GUIDANCE AND CALCULATOR

There is guidance in place to assist Travel Concession Authorities (TCAs) in reimbursing bus operators for concessionary travel. Alongside this is a tool for TCAs to calculate bus travel reimbursement for carrying concession permit holders for free. We are keen to hear your feedback on both as a TCA and to understand where improvements can be made for its use.

4. **Firstly, what is your awareness and usage of the guidance and calculator?**
   Please select one
   a. I am aware of the guidance and calculator ☐ Yes ☐ No
   b. I have used the guidance and calculator ☐ Yes ☐ No

5. To what extent do you agree the current reimbursement guidance and calculator is fit for purpose?

Please select one

a. Strongly agree	☐
b. Slightly agree	☐
c. Neither agree nor disagree	☐
d. Slightly disagree	☐
e. Strongly disagree	☐
f. Don't know	☐

6. Which areas of the reimbursement guidance do you believe are working well, and which need to be changed?

Please select all that apply

	Need changing	Working well	Don't know
a. Updates to the reimbursement/generation factor	☐	☐	☐
b. The discounted fare method (AF model)	☐	☐	☐
c. The NowCard average fare default look-up table	☐	☐	☐
d. The use of Passenger Transport Executives (PTEs) and non-PTE demand curves	☐	☐	☐
e. Calculation of marginal operating costs	☐	☐	☐
f. Calculation of marginal capacity costs	☐	☐	☐
g. Calculation of Peak Vehicle Requirement (PVR) costs	☐	☐	☐
h. Calculation of administration costs	☐	☐	☐
i. The Mohring Factor	☐	☐	☐
j. The default cost/vehicle hour and cost/vehicle mile	☐	☐	☐
k. Updates to inflation	☐	☐	☐
l. Other (please state)	☐	☐	☐

7. If you would like to give a reason for your response to Q6, please provide this below:

Please provide details below:

8. Do you have any suggestions as to how areas of the reimbursement guidance could be improved?

Please provide details below:

APPEALS PROCESS

We are also interested in your perceptions and experiences of the appeals process and whether there are improvements that could be made.

9. Since 2010, has any operator ever appealed against the ENCTS arrangements in your area?

Please select one

a. Yes ☐

b. No ☐

10. Which of the following would make the appeals process more efficient and effective?

Please select all that apply

a. Longer timeframe for lodging an appeal to DfT / Secretary of State ☐

b. Changes to the data submission requirements / DfT proforma ☐

c. Longer timescales for responding to completed proformas ☐

d. Engagement with the decision maker ☐

e. Face to face meetings – oral hearings ☐

f. Other (please state) ☐

g. Don't know ☐

h. None ☐

11. Please provide any additional explanation or reasons for your response in Q10:

Please enter text

12. How would you rate the existing resource requirement needed for appeals?

Please select one

a. Very high ☐

b. High ☐

c. Neither high nor low ☐

d. Low ☐

e. Very low ☐

f. Don't know ☐

13. If known, please could you provide the approximate hours of internal time and cost of external support per appeal?

Please provide a response below

14. How could the resource required for the appeals process be reduced?
Please provide a response below:

DISABILITY ELIGIBILITY CRITERIA

In line with the commitment in the National Bus Strategy, DfT is reviewing eligibility for free bus travel for disabled people. This is to ensure that we are improving equality of opportunity and helping disabled people participate fully in public life.

15. To what extent do you agree that the current disabled eligibility criteria should be extended to include a wider range of disabilities?
Please select all that apply

a. Strongly agree ☐
b. Agree ☐
c. Neither agree nor disagree ☐
d. Disagree ☐
e. Strongly disagree ☐
f. Don't know ☐

16. Please provide a reason for your response to QD15, including what changes (if any) would you like to see made to the disabled eligibility criteria?
Please enter your response in the box below:

17. What impact would widening the disability eligibility criteria have on you as a TCA? For instance, would you anticipate any additional costs or practical issues?
Please enter your response in the box below:

REVIEW OF TRAVEL TIMES

In addition to disability eligibility criteria, DfT is also reviewing the times at which an ENCTS passholder can travel. We would like to know your views on this, and the potential impact it could have on the services operated within your TCA.

18. Would you be in favour of the ENCTS being extended to include travel before 0930 on a weekday? (This would assume the scheme would be offered on the same basis i.e. financially no better and no worse off for providing the concession)
Please select one

a. Yes ☐
b. No ☐
c. Don't know ☐

19. Why is that?

20. Are there any other times that you think the ENCTS travel should be either extended or restricted?
Please provide details of the times below and your reasons why

OVERALL VALUE FOR MONEY

21. Finally, do you consider the ENCTS to be…

a. Good value for money ☐
b. Neither good nor bad value for money ☐
c. Bad value for money ☐
d. Don't know ☐

22. What is the reason for your response?

23. To what extent do you consider the following to be a benefit of the ENCTS?
Please provide a rating for each benefit

a. Increases access to services and activities for eligible people ☐
b. Reduces cost-based barriers to accessing transport ☐
c. Supports a physically active lifestyle ☐
d. Supports social inclusion, mental health and wellbeing ☐
e. Reduced congestion / environmental benefits as a result of modal shift ☐
f. Other (please state) ☐

This study will analyse data from a range of sources to understand changes in travel behaviour post-Covid-19, to assess whether the reimbursement guidance reflects current travel behaviour, and what the value for money is of the ENCTS and potential changes to it. Would you prepared, in principle, to share data that you have access to for this study? If yes, please provide details of the data you have, alongside your contact details below (please note, your details will not be used for any other purpose other than to follow up with you on data provision).

Please provide details of the data, and your name and email address below:

FINAL THOUGHTS

24. Finally, if you have any further comments about your experiences of the concessionary fare scheme and how it could be improved, please leave them below.

That's all of our questions. Thank you so much for your time.

Please click 'Submit' to save your response.

TOPIC GUIDE

G.3 Stakeholder interviews

SUMMARY INFORMATION

The research questions for the study are as follows:

1. **The Annual Reimbursement Guidance and Calculator**
    a. How do different stakeholders use the concessionary guidance and calculator?
    b. What challenges do they encounter?
    c. How could usability be improved?
    d. What works well and should be retained?
2. **The appeals process**
    a. What are the experiences and perceptions of stakeholders of the appeals process?
    b. How could the process be improved?
3. **Disabled eligibility criteria**
    a. What are the experiences and perceptions of stakeholders regarding the current disabled eligibility of the ENCTS?
    b. How well are the existing qualifying criteria perceived to work for each type of disability? How could this be improved?
    c. What amendments to the disabled eligibility criteria would the different stakeholder groups ideally like to be made, why and how? For example, what opinions are held regarding potentially extending the scheme to include those with non-visible disabilities?
    d. What are the experiences and perceptions of stakeholders regarding the current uses of companion passes? How could this be improved, and what should be retained?
    e. What are the expected costs and benefits of amending the disabled eligibility criteria in these ways?
4. **Review of travel times**
    a. What are the experiences and perceptions of the current weekday travel time limitations for the ENCTS and what amendments would stakeholders wish to consider?
    b. What are the expected costs and benefits of amending the current travel times in these ways?

5. **The overall value for money of the ENCTS**
    a. What are the positive and negative impacts of the ENCTS to DfT, bus operators, Travel Concession Authorities (TCAs), and bus passengers with and without concessionary bus passes?
    b. What monetised costs and benefits to DfT, bus operators, TCAs and bus passengers with and without concessionary bus passes can be identified through secondary research?

Disabilities include hidden disabilities such as neurodiverse, mental health, cognitive impairment; sensory disabilities; mobility disabilities and other disabilities. The questions included within this topic guide contain a reference to the research question(s) above that we aim to address.

SYSTRA will be interviewing a range of different stakeholder types, and not all of the questions within this topic guide will be applicable. This master version contains the full list of questions, with each question containing a reference to which stakeholder type it will be asked to. This includes:

- All = asked to all stakeholders
- T = Transport/industry group
- C = Charity
- UG = Passenger/disability user groups

INTRODUCTION [5 MINS]

Hello, thank you for your time and agreeing to speak with us today.

Introduce self and SYSTRA:

- Part of SYSTRA's Social and Market Research team. We undertake a lot of independent research, like this, to better understand views and experiences on different topics.
- We are currently carrying out this research into experiences of the English National Concessionary Fares Scheme on behalf of the Department of Transport.
- Currently, there is a mandatory concession available providing free off-peak travel to people of state pension age and those with eligible disabilities.
- We are conducting a full review of the scheme and we are interested in understanding how it is used at present and where the scheme could be improved. This includes looking at the processes, such as the current guidance/ calculator and the appeals procedure. We are also interested in experiences of the current disabled eligibility of the scheme, and the weekday travel time limitations.
- Your feedback today will help DfT to understand the experiences of the concessionary fares scheme and where potential improvements could be made

Explain ‘rules’:

- Approximately 45 mins;
- Voice recorder/ anonymity;
- No right or wrong answers;
- Research conducted in accordance with the Market Research Society and Data Protection legislation. Participation is completely voluntary and you can withdraw at any time. More information can be found in the privacy notice for the research, which was attached to the email organising this discussion.
- Any questions?

YOU AND YOUR ROLE [5 MINS]

Please can you tell me a little about your role at [organisation] [probe to gather information relating to organisation, their role, and in what context they have used/ experienced the ENCTS]

OVERALL IMPACT OF THE ENCTS [5-10 MINS]

As mentioned, we’re interested to hear your views and experiences of the English National Concessionary Travel Scheme. As I’m sure you are aware, the scheme provides free bus travel throughout England for those who are eligible. This includes for residents who have attained the state pension age, as well as eligible disabled people. Passes are valid between 9.30am and 11pm on weekdays, and at any time at weekends and public holidays. Some local authorities have extended the Scheme’s eligibility times on a discretionary basis, meaning passes are valid for longer everyday in some areas of England.

For the first part of this discussion, I would like to understand your opinions on the concessionary fares scheme as a whole.

- [5a] Please could you tell me what you consider the main benefits to be of the scheme for the organisation/users that you represent? [All] [prompt to discuss the impact on different groups]
- [5a] And are there any negative impacts for the organisation/users that you represent? [All] [prompt to discuss the impact on different groups]
- [5a] Do you receive any feedback from the users you represent in relation to the concessionary fares scheme? [C/UG] [prompt to understand whether this feedback is positive/negative, what it covers]

DISABLED ELIGIBILITY CRITERIA [15 MINS]

I mentioned earlier that one of the types of concessionary pass is the disabled person’s pass. Currently to be automatically eligible, a person’s condition has to meet one of seven categories of disability. This includes an eligible disabled person who is blind or partially sighted, profoundly or severely deaf, is without speech, has a disability or injury which has a substantial adverse effect on their ability to walk, does not have arms or has long term loss of the use of both arms, has a significant learning disability, or cannot be granted a driver's licence due to their physical fitness.

In line with the commitment in the National Bus Strategy, DfT is reviewing eligibility for free bus travel for disabled people. This is to ensure that we are improving equality of opportunity and helping disabled people participate fully in public life

- [3a/3b] With the current eligibility list in mind, how well do you think this meets the needs of users? [All] [prompt to discuss by different types of disability]
- [3b] Are there any types of disability that are not currently included by the scheme at present, but that you think should be? [All] [probe which type of disability and why]
- [3c] How could the criteria list be improved? Should it be widened? [All] [probe physical and cognitive impairments/hidden disabilities]
- [3e] What impact would widening the disabled eligibility criteria have on the users/organisation that you represent? [All] [probe both positive and negative impacts; probe to discuss impacts on administration, clarity of eligibility criteria]
- [3e] [If any negative impacts are described by interviewee], How do you think these negative impacts might be mitigated? [All]
- [3a] Do you receive any feedback from the users you represent relating to the disabled eligibility criteria? What feedback have you received? [UG/C for disabilities]
- [3d] Some local authorities allow the use of companion passes as a discretionary concession, which is funded using local resources. [All]
- Do you have any experiences of companion passes?
- What are your views towards these?
- [3d] Do you think the statutory scheme should be expanded to include companion passes? [All]
- [3d] What impact would this have on the users/organisation that you represent? [All] [probe both positive and negative impacts]

TRAVEL TIMES [10 MINS]

The English National Concessionary Travel Scheme currently allows free off-peak travel for those eligible, between 9.30am and 11pm on a weekday, and any time on a weekend/bank holiday. Some local authorities extend the scheme before and after these times using local resources (such as Council Tax).

In addition to disability eligibility criteria, DfT is also reviewing the times at which an ENCTS passholder can travel. We would like to know your views on this, and the potential impact it could have on the users/organisation that you represent.

- [4a] What are your experiences of the current travel times for which concessionary passes can be used? [All]
- [4a] Have you noticed some operators offering travel beyond these times? [UG/C]
- [4a] Would you be in favour of the concessionary scheme travel times being

extended? [note if needed, this would assume the operator is no better and no worse off for providing the concession] Why? [All]

- If concessionary travel times were to be extended, how do you think they should be extended? [prompt: before 09.30/after 11pm] Why these times? [probe on macro- and micro-level benefits of extending travel to those specific times] [All]
- [4b] What impact would extending the current travel times have on the users you represent? [All] [probe social impacts, economic impacts and also both negative and positive impacts]
- [If any negative impacts are discussed] What do you think might help mitigate any negative impacts that may occur? [All]

GUIDANCE AND CALCULATOR/ APPEALS [10 MINS]

DfT is also interested in the current guidance and calculator which is in place to assist operators and Travel Concessionary Authorities in the reimbursement for concessionary travel and the appeals process. We are keen to hear your feedback/ experience of the guidance and calculator, and the appeals process, and understand where improvements could be made.

- [1a] What experience do you have relating to the reimbursement guidance and calculator? [T] [probe whether this is awareness, personal use, feedback from stakeholders, and any difference between the guidance and calculator]
- [1a] What do you think of the reimbursement guidance and the calculator? [T]
  - Do you feel the current reimbursement guidance/calculator is fit for purpose? [probe: does it contain the information you need? Is it easy to understand and use?]
  - [1d] Which areas of the reimbursement guidance, as a whole, do you believe are working well and should be kept as they are? What makes them work well?
  - [1b] And which areas are not working so well?
  - With regards to the calculator, which areas of it work well, and should be kept as it is? What makes these areas work well?
  - Which areas are not working so well?
- [1b] Do you think that any parts of the guidance and calculator require changing? [T] [Probe with list from the TCA/operator survey]
  - What would be your main areas of improvement?
  - Why?
  - [1c] Are there any changes that could be made that would improve usability?
- [2a] What experience do you have relating to the appeals process? [T]
- Could you describe a typical experience of using the appeals process? [prompt e.g. to think of the last time they used it] [T]
- [2a] What are your opinions of the appeals process? [T] [Skip the following questions if they do not have experience/awareness of the appeals process]
  - What works well?

- What does not work so well?

- [2b] Do you have any opinions on how the appeals process be made more efficient and effective? [T] [Prompt if needed, longer timeframe for lodging an appeal, changes to the data submission requirements, longer timescales for responding to completed proformas, engagement with the decision maker, face to face meetings (oral hearings)]
- [2a] How do you find the existing resource requirements of appeals? [T]
- [2b] How could the resource required for the appeals process be reduced? [T]

OTHER IMPROVEMENTS AND FINAL THOUGHTS [10 MINS]

- [All] Aside from the areas we have discussed today, do you think there are any other parts of the concessionary fares scheme that could be improved or changed? [All]
- [All] Are there any groups other than those with disabilities that are not currently eligible that you think should be? [All]
- [All] Do you think there should be concessionary travel for young people? Why/ why not? [All]
- [If yes] What age should this cover? Why? [All]
- That's all of my questions – thank you very much for all for your contributions which are really valuable; and which will help DfT understand the experiences of the concessionary fares scheme and where potential improvements could be made. Do you have anything else you would like to add before we end the call? [All]

G.4 General Population Survey

INTRODUCTION

The Department for Transport (DfT) is currently conducting research and analysis into several areas of concessionary travel by bus in England. The English National Concessionary Travel Scheme (ENCTS) allows off-peak free travel on local bus services for passengers of state pension age and eligible disabled passengers across England.

THIS SURVEY

We are keen to hear about your experiences of travelling by bus (if you use it) or your perceptions of bus travel (if you don't currently use the bus). We are also interested to hear your experiences of using a concessionary pass if you have one, and where improvements could be made to the scheme.

This survey will take approximately 10 minutes to complete. We are extremely grateful for any feedback that you can provide, which will directly feed into any updates to the ENCTS. Please access the survey by using the link below.

YOUR DATA

All survey responses are confidential and results will be reported anonymously. The research complies with the Market Research Society Professional Code of Conduct and General Data Protection Regulation.

The survey will ask you information including your age, gender identity and whether you have a disability. These questions will be used to understand any differences in views toward the scheme between different groups of people and will not be used for any other purpose.

DfT's privacy policy also has more information about your rights in relation to your personal data, how to complain and how to contact the Data Protection Officer. You can view it at https://www.gov.uk/government/organisations/department-for-transport/about/personal-information-charter

If you are happy to proceed with the consultation please click 'Next' to start.

DEMOGRAPHIC QUESTIONS

To begin with, we have a few questions about you. These questions will be used to understand how different types of people travel and will not be used for any other purpose.

1. **Question text: Which age group do you fall within?**
   Instruction text: Please select one

Question type: Single select
Routing: None
Other: Forced

a.	Under 60 years of age [Screen out]	☐
b.	60 - 65	☐
c.	66 - 71	☐
d.	72 - 79	☐
e.	80 - 89	☐
f.	90 and older	☐
g.	Prefer not to say **[Screen out]**	☐

2. **Question text: Which of the following do you identify as?**
   Instruction text: Please select one

Question type: Single select
Routing: None
Other: Forced

a.	As a man	☐
b.	As a woman	☐
c.	Prefer to identify as (please specify)	☐
d.	Prefer not to say	☐

3. In which county of the UK do you live in?

Instruction text: Please select one

(Please note: we will not be able to identify you from this information – we use it to see where in the country survey responses have come from and to understand how experiences vary across the country)

Question type: Single select
Routing: None
Other: Unforced

a. Bedfordshire ☐
b. Berkshire ☐
c. Bristol ☐
d. Buckinghamshire ☐
e. Cambridgeshire ☐
f. Cheshire ☐
g. City of London ☐
h. Cornwall ☐
i. Cumbria ☐
j. Derbyshire ☐
k. Devon ☐
l. Dorset ☐
m. Durham ☐
n. East Riding of Yorkshire ☐
o. East Sussex ☐
p. Essex ☐
q. Gloucestershire ☐
r. Greater London ☐
s. Greater Manchester ☐
t. Hampshire ☐
u. Herefordshire ☐
v. Isle of Wight ☐
w. Kent ☐
x. Lancashire ☐
y. Leicestershire ☐
z. Lincolnshire ☐
aa. Merseyside ☐
ab. Norfolk ☐
ac. North Yorkshire ☐
ad. Northamptonshire ☐
ae. Northumberland ☐

af. Nottinghamshire ☐
ag. Oxfordshire ☐
ah. Rutland ☐
ai. Shropshire ☐
aj. Somerset ☐
ak. South Yorkshire ☐
al. Staffordshire ☐
am. Suffolk ☐
an. Surrey ☐
ao. Tyne and Wear ☐
ap. Warwickshire ☐
aq. West Midlands ☐
ar. West Sussex ☐
as. West Yorkshire ☐
at. Wiltshire ☐
au. Worcestershire ☐
av. Prefer not to say ☐

4. Which of the following best describes the area you live in?

Instruction text: Please select one

Question type: Single select
Routing: None
Other: Unforced

a. Inner city area ☐
b. City outskirts ☐
c. Town ☐
d. Village ☐
e. Rural ☐
f. Prefer not to say ☐

5. Please type the name of the city that you live in

Question type: Open
Routing: Q4_a,b

CURRENT TRAVEL BEHAVIOUR

6. Question text: Do you have access to a car, van, motorbike or moped, as a driver?

Instruction text: Please select all that apply

Question type: Multi select
Routing: None
Other: Forced

a. Yes – car or van ☐
b. Yes – motorbike or moped ☐
c. No – none of these **[Single select]** ☐

7. Question text: Which of the following best describes your use of buses over the last year?

Instruction text: Please select one

Question type: Single select
Routing: None
Other: Forced

a. I travel by bus 5 days a week or more ☐
b. I travel by bus 2 to 4 days a week ☐
c. I travel by bus about once a week ☐
d. I travel by bus less than once a week, but at least once or twice a month ☐
e. I travel by bus less than once a month, but more than twice a year ☐
f. I travel by bus once or twice a year ☐
g. I have not travelled by bus within the last year ☐
h. Don't know ☐

8. Question text: Approximately, how many bus journeys do you make in a typical week?

Instruction text: Please enter a number below

By journey, we mean one, single bus trip in one direction.

Question type: Open
Routing: Q7_a,b,c
Other: Forced

9. Question text: For what purpose(s) do you travel by bus?
Instruction text: Please select all that apply

Question type: Multi select
Routing: Q7_a-f
Other: Forced

a.	Commuting to and from work	☐
b.	Visiting friends and/or family	☐
c.	Education	☐
d.	Tourism/leisure	☐
e.	Shopping	☐
f.	Healthcare	☐
g.	Other (please specify)	☐

10. Question text: When travelling by bus, what time(s) of day do you tend to travel?
Instruction text: Please select all that apply

Question type: Multi select
Routing: Q7_a-f
Other: Forced

a.	Before 9.30am on a weekday	☐
b.	Between 9.30am and 4pm on a weekday	☐
c.	Between 4pm and 7pm on a weekday	☐
d.	Between 7pm and 11pm on a weekday	☐
e.	After 11pm on a weekday	☐
f.	Weekend at any time	☐

11. Question text: You mentioned that you have not travelled by bus within the last year. Why is this?
Instruction text: Please select all that apply

Question type: Multi select
Routing: Q7_g
Other: Forced

a.	I have alternative transport e.g. car	☐
b.	Bus is too expensive	☐
c.	Buses do not operate in my area	☐
d.	Buses do not serve my destination	☐
e.	Buses are unreliable	☐
f.	Lack of information about services/fares	☐
g.	Lack of ability/confidence to access journey and ticketing information online	☐
h.	Bus journey times are too long	☐

i. Lack of flexibility and convenience when travelling by bus ☐
j. Prefer the comfort of other modes e.g. car ☐
k. Accessibility issues e.g. difficulty getting on board, finding a seat, wheelchair access ☐
l. Fear of COVID / illness ☐
m. Other (please specify) ☐

CONCESSIONARY FARES

12. Question text: Do you own a travel pass that provides you with free bus travel?

Instruction text: Please select one

Question type: Single select
Routing: None
Other: Forced

a. Yes ☐
b. No ☐
c. Don't know ☐

CONCESSIONARY FARES USAGE (PASS OWNERS)

13. Question text: What type of free bus travel pass do you own?

Instruction text: Please select all that apply

Question type: Multi select
Routing: Q12_a
Other: Forced

a. Disabled person's bus pass ☐
b. Older person's bus pass ☐
c. Another type of bus pass that allows free travel (please specify) ☐
d. Don't know ☐

14. Question text: Do you ever pay for bus travel? i.e. at certain times of day, and not including Park & Ride services

Instruction text: Please select one

Question type: Single select
Routing: Q12_a
Other: Forced

a. Yes ☐
b. No ☐

15. Question text: How many trips do you pay for on average?
Instruction text: Please select one

Question type: Single select
Routing: Q14_a
Other: Forced

a. I pay for 6 or more trips per week ☐
b. I pay for 3-5 trips per week ☐
c. I pay for 1-2 trips per week ☐
d. I pay for 1-2 trips per fortnight ☐
e. I pay for 1-2 trips per month ☐
f. I pay for less than 1-2 trips per month ☐
g. Don't know ☐

16. Question text: Since owning a free bus travel pass, how has the number of journeys you make by bus changed compared to before you had a pass?
Instruction text: Please select one

Question type: Single select
Routing: Q12_a
Other: Forced

a. I make more than 4 times the number of journeys I did previously ☐
b. I make 2-4 times the number of journeys I did previously ☐
c. It has increased, but not as much as 2 times ☐
d. The number of journeys I make by bus has not changed ☐
e. It has decreased, but not as much as 2 times ☐
f. It has decreased by 2 times ☐
g. Don't know ☐

17. Question text: To what extent, if at all, does owning a concessionary bus pass influence your bus use?
Instruction text: Please select one

Question type: Single select
Routing: Q12_a
Other: Forced

a. It is the only reason I travel by bus ☐
b. It is the main reason I travel by bus ☐
c. It is one of the reasons I travel by bus ☐
d. It does not impact my reasons for travelling by bus ☐
e. Don't know ☐

18. Question text: If you could use your concessionary pass before 9.30am on a weekday, how would this impact how you travel by bus?
Instruction text: Please select one

Question type: Single select
Routing: Q12_a
Other: Forced

a. I would travel more ☐
b. I would travel about the same (would make no difference) ☐
c. I would travel about the same (but would move my travel time) ☐
d. I would travel less ☐
e. I can already use my pass to travel before 9.30am ☐
f. Don't know ☐

19. Question text: On average, how much more would you travel? Please note, a 'bus journey' below is defined as one single bus trip in one direction
Instruction text: Please select one

Question type: Single select
Routing: Q18_a
Other: Forced

a. I would make at least 5 more bus journeys per week ☐
b. I would make 4 more bus journeys per week ☐
c. I would make 3 more bus journeys per week ☐
d. I would make 2 more bus journeys per week ☐
e. I would make 2 more bus journeys per fortnight ☐
f. I would make 2 more bus journey per month ☐
g. I would make 2 more bus journey every three months ☐
h. I would make 2 more bus journey every six months ☐

20. Question text: You stated you would travel more if you could use your pass before 9.30am, would you have previously made these trips by another mode of transport?
Instruction text: Please select one

Question type: Single select
Routing: Q18_a
Other: Forced

a. Yes, previously made this trip by another form of transport ☐
b. No, I wouldn't have made the trip at all ☐
c. Don't know ☐

21. Question text: If you could use your concessionary pass after 11pm on a weekday, how would this impact how you travel by bus?

Instruction text: Please select one

Question type: Single select
Routing: Q12_a
Other: Forced

- a. I would travel more ☐
- b. I would travel about the same (would make no difference) ☐
- c. I would travel about the same (but would move my travel time) ☐
- d. I would travel less ☐
- e. I can already use my pass to travel after 11pm ☐
- f. Don't know ☐

22. Question text: On average, how much more would you travel? Please note, a 'bus journey' below is defined as one single bus trip in one direction

Instruction text: Please select one

Question type: Single select
Routing: Q21_a
Other: Forced

- a. I would make at least 5 more bus journeys per week ☐
- b. I would make 4 more bus journeys per week ☐
- c. I would make 3 more bus journeys per week ☐
- d. I would make 2 more bus journeys per week ☐
- e. I would make 2 more bus journeys per fortnight ☐
- f. I would make 2 more bus journey per month ☐
- g. I would make 2 more bus journey every three months ☐
- h. I would make 2 more bus journey every six months ☐

23. Question text: You stated you would travel more if you could use your pass after 11pm, would you have previously made these trips by another mode of transport?

Instruction text: Please select one

Question type: Single select
Routing: Q21_a
Other: Forced

- a. Yes, previously made this trip by another form of transport ☐
- b. No, I wouldn't have made the trip at all ☐
- c. Don't know ☐

24. Question text: Is there anything that would encourage you to use your concessionary pass more?

Instruction text: Please select all that apply

Question type: Multi select
Routing: Q12_a
Other: Forced

a.	Being able to use pass before 9.30am on a weekday	☐
b.	Being able to use pass after 11pm on a weekday	☐
c.	More frequent services	☐
d.	More reliable services	☐
e.	Better timetable/service information	☐
f.	Improved waiting facilities	☐
g.	More reassurances around Covid/risk of other illnesses	☐
h.	Improved on-board accessibility for disabled people	☐
i.	Other (please specify)	☐

25. Question text: What impact does owning a concessionary pass have on your day to day life?

Question type: Single select for each row

Routing: Q12_a
Other: Forced

Instruction text: Please select one for each row

		Agree	Disagree	Don't know
a.	I feel more confident	☐	☐	☐
b.	I feel part of my community	☐	☐	☐
c.	I feel less isolated	☐	☐	☐
d.	I am more able to socialise with others	☐	☐	☐
e.	I feel more independent	☐	☐	☐
f.	I have improved access to healthcare services	☐	☐	☐
g.	I have improved access to leisure services	☐	☐	☐
h.	I have improved access to education / employment opportunities	☐	☐	☐

CONCESSIONARY FARES LAST TRIP (PASS OWNERS)

We would now like to ask you a few questions about the last bus journey that you made.

26. Question text: Thinking about the last bus journey that you made, did you use your concessionary pass?

Instruction text: Please select one

Question type: Single select
Routing: Q12_a
Other: Forced

a. Yes ☐
b. No ☐

27. Question text: What was the main purpose of this journey?

Instruction text: Please select one

Question type: Single select
Routing: Q12_a
Other: Forced

a. Commuting to and from work ☐
b. Visiting friends and/or family ☐
c. Education ☐
d. Tourism/leisure ☐
e. Shopping ☐
f. Healthcare ☐
g. Other (please specify) ☐

28. Question text: Would you have made this journey by bus if you had to pay?

Instruction text: Please select one

Question type: Single select
Routing: Q26_a
Other: Forced

a. Yes ☐
b. No ☐
c. Don’t know ☐

29. Question text: Would you have…
Instruction text: Please select one

Question type: Single select
Routing: Q28_b,c
Other: Forced

a. Made this trip by another form of transport ☐
b. Not made the trip at all ☐
c. Don't know ☐

ENCOURAGING BUS USE (NON-PASS OWNERS)

30. Question text: Why do you not have a concessionary pass?
Instruction text: Please select all that apply

Question type: Multi select
Routing: Q12_b
Other: Forced

a. I do not travel by bus ☐
b. It is too much hassle/difficult to apply ☐
c. I do not know enough about the scheme ☐
d. I do not know how to apply ☐
e. I did have a pass but I have lost it ☐
f. fI am put off by the online application / I do not have internet access to apply ☐
g. I am not yet eligible for one ☐
h. Other (please state) ☐

31. Question text: Will you apply for a concessionary pass once you become eligible?
Instruction text: Please select one

Question type: Single select
Routing: Q12_b
Other: Forced

a. Yes ☐
b. No ☐
c. Don't know ☐

32. Question text: Why is that?
Instruction text: Please provide a response below

Question type: Open
Routing: Q12_b
Other: Unforced

33. Question text: If you had a concessionary pass that allowed free travel, what impact would this have on the number of journeys you make by bus?
Instruction text: Please select one

Question type: Single select
Routing: Q12_b
Other: Forced

a. I would travel by bus more ☐
b. It would make no difference ☐
c. Don't know ☐

34. Question text: On average, how much more would you travel? Please note, a 'bus journey' below is defined as one single bus trip in one direction
Instruction text: Please select one

Question type: Single select
Routing: Q31_a
Other: Forced

a. I would make at least 5 more bus journeys per week ☐
b. I would make 4 more bus journeys per week ☐
c. I would make 3 more bus journeys per week ☐
d. I would make 2 more bus journeys per week ☐
e. I would make 2 more bus journeys per fortnight ☐
f. I would make 2 more bus journey per month ☐
g. I would make 2 more bus journey every three months ☐
h. I would make 2 more bus journey every six months ☐

35. Question text: What improvements to bus travel would be most likely to encourage you to make more journeys by bus?
Instruction text: Please rank your top five improvements

Question type: Ranking of five
Routing: Q12_b
Other: Forced

a. Cheaper fares ☐
b. Free travel at certain times of the day ☐
c. More frequent services ☐
d. More reliable services ☐
e. Better timetable/service information ☐
f. More bus routes ☐
g. More comfortable on-board experience ☐
h. Buses being quieter on-board ☐
i. Improved waiting facilities ☐
j. More reassurance around Covid/risk of other illnesses ☐
k. Improved personal safety on-board ☐
l. Improved on-board accessibility for disabled people ☐
m. Other (please specify) ☐
n. N/A – nothing would encourage me to make more journeys by bus ☐

ABOUT YOU

Finally, we have a few optional questions to help categorise the responses that we receive. Your responses are anonymous and confidential.

36. Question text: Do you have any long-term physical or mental health conditions or illnesses lasting or expected to last 12 months or more?

Instruction text: Please select one

Question type: Single select
Routing: None
Other: Unforced

a. Yes ☐
b. No ☐
c. Prefer not to say ☐

37. Question text: Which of these long term physical or mental impairments do you have, which limit your daily activities or the work that you can do?

Instruction text: Please select all that apply

Question type: Multi select
Routing: Q36_a
Other: Unforced

a. Vision (e.g. blindness or partial sight) ☐
b. Hearing (e.g. deafness or partial hearing) ☐
c. Mobility (other than wheelchair user) ☐
d. Dexterity (difficulty in using your hands and wrists) ☐
e. Cognitive impairment, for example, dementia, traumatic brain injury, learning disabilities ☐

f. Learning disability ☐
g. Memory ☐
h. Mental health ☐
i. Anxiety ☐
j. Stamina or breathing or fatigue ☐
k. Autism or Asperger syndrome ☐
l. Sensory processing difficulties ☐
m. 'Non-visible' physical health conditions, for example, chronic pain, respiratory conditions, diabetes, incontinence ☐
n. Wheelchair user ☐
o. Something else (please state) ☐
p. Prefer not to say ☐

38. Question text: What is the occupational status of the main income earner in your house?

Instruction text: Please select one

Question type: Single select
Routing: None
Other: Unforced

a. Senior managerial or professional ☐
b. Intermediate managerial, administrative or professional ☐
c. Supervisor, clerical, junior managerial, administrative, professional ☐
d. Manual worker with industry qualifications ☐
e. Manual worker with no industry qualifications ☐
f. Unemployed ☐
g. Looking after the home ☐
h. Student ☐
i. Retired ☐
j. Prefer not to say ☐

39. Question text: Please provide your best estimate for your total household income. This is before tax and deductions, but including any benefits/ allowances.

Instruction text: Please select one

Question type: Single select
Routing: None
Other: Unforced

a. Up to £10,000 ☐
b. £10,001 - £20,000 ☐
c. £20,001 - £35,000 ☐
d. £35,001 - £50,000 ☐

e. £50,001 - £70,000 ☐
f. £70,001 - £100,000 ☐
g. Over £100,000 ☐
h. Don't know ☐
i. Prefer not to say ☐

40. Question text: Finally, if you have any further comments about travelling by bus or your experiences of the concessionary fare scheme and how it could be improved, please leave them below.

Question type: Open
Routing: None
Not forced

That's all of our questions. Thank you so much for your time.

Please click 'Submit' to save your response.

Annex H Details of NTS research

H.1 Introduction

H.1.1 The following aspects of the NTS dataset were analysed in order to answer the research questions outlined in Section 2 of this report.

H.1.2 The NTS data has been analysed in terms of trip rates per person using the methodology below:

$$TripRate = \frac{\Sigma JJXSC.W5}{\Sigma W2} . 52. 14$$

H.1.3 Where:[39]

1. JJXSC: Number of trips per week
2. W5: Weighted travel sample (composite of unweighted response (W1), household non-response (W2) and household (W3) weights)
3. W2: Weighted diary sample (adjusts for household non-response)
4. 52.14: Factor from week to annual

H.1.4 In estimating the trip rates, only journeys where bus was stated as the main mode of travel were analysed. Coach travel was also excluded as the ENCTS is valid on local buses in England. Only including those who travelled by bus as the main mode means that individuals who used the bus as part of a stage of their overall journey will not be reflected in the trip rates.

NTS analysis

H.1.5 This first section of the analysis of NTS data summarises how the proportion of respondents using bus (in comparison to all respondents) has changed between 2018 and 2021. The period of analysis of NTS across different segments is 2018 to 2021 because:

1. 2018 and 2019 provide data prior to the COVID-19 pandemic. Observing two years helps demonstrate that 2019 was not an anomalous year distorting any conclusions drawn pre- and post-pandemic
2. 2020 to 2021 were the only two years available post-pandemic and the transport system and wider economy were in recovery

H.1.6 In the proportions of respondents in each age group using bus is summarised in the table below.

39 *Source: NTS Data Extract User Guide, 1995-2016.*

Table 69. Proportion of Individuals Surveyed Using Bus (NTS)

	Proportion of individuals				
Age Group	**2018**	**2019**	**2020**	**2021**	**% Change 2018 to 2021**
Under 16	16.3%	17.0%	8.7%	8.2%	-50.0%
17-25	24.8%	25.9%	15.2%	15.0%	-39.7%
26-35	16.9%	16.5%	9.4%	6.6%	-60.7%
36-45	12.6%	11.2%	6.1%	6.2%	-50.8%
46-55	11.4%	10.7%	7.4%	6.1%	-45.9%
56-64	13.1%	14.0%	7.6%	6.9%	-47.0%
Over 65	25.0%	23.4%	9.2%	10.9%	-56.4%
Total	17.5%	17.2%	8.8%	8.5%	-51.5%

H.1.7 Across all age groups there is a reduction in bus users surveyed of 51.5% in 2021 in comparison to 2018. By individual age group the reduction varies from 39.7% (17-25 year olds) to 60.7% (26-35 year olds).

H.1.8 Whilst these are large reductions, the absolute number of b

H.1.9 us users surveyed in 2021 is 10,376 people and for each age group it varies from 1,030 (17-25 year olds) to 2,139 (Under 16s). Therefore, despite the reductions there remains a sufficient sample size to obtain robust outputs.

Bus Trips per Person by Region (Over 65)

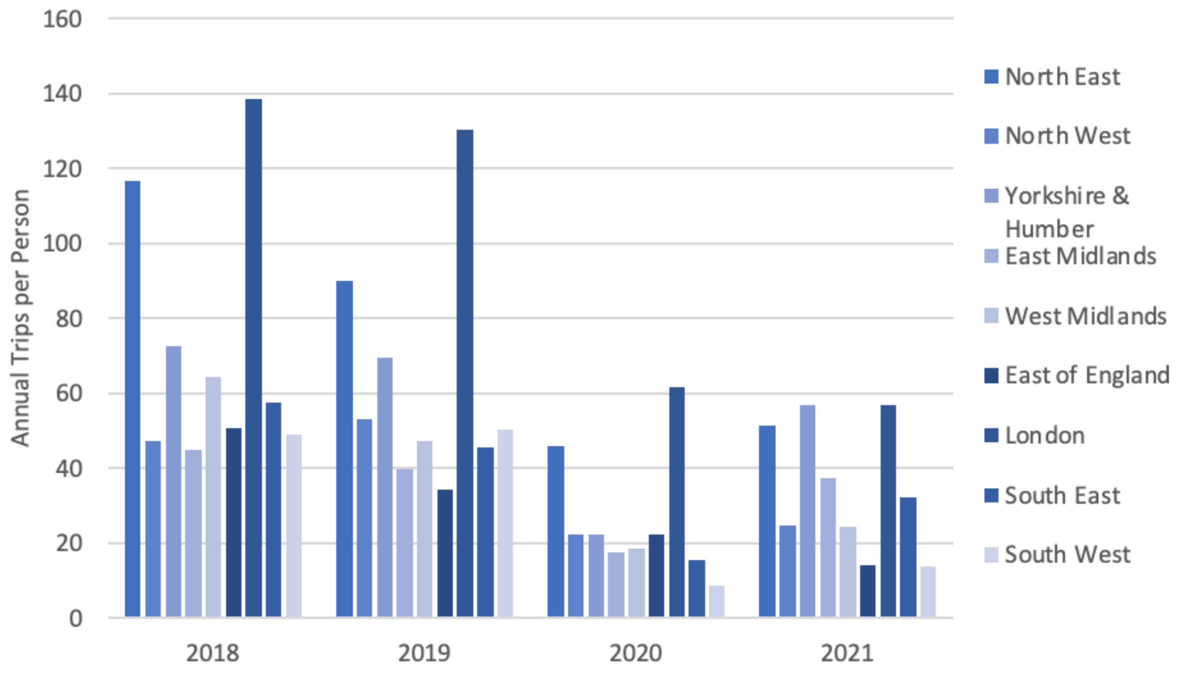
H.1.10 Regional variations in bus trips per person for the Over 65s were analysed to answer part of the research question 'Is there any regional variation by age group or disability status?'

H.1.11 The reason for answering this question was to help understand how the concessionary travel market varies by region and therefore how reimbursement might vary by region, including for any extensions to the scheme to other passengers (i.e. more disabilities covered and younger persons).

H.1.12 In Figure 4 3, trips per person are shown between 2018 and 2021 for each region of England. There appears to be regional variation in trips, particularly for London and the North East in comparison to the other regions of England. Although, by 2021 Yorkshire and Humber shows similar trip rates post-pandemic.

H.1.13 It is likely that this is indicative of population density and both the coverage and frequency of the bus network in these areas. These aspects will help to facilitate higher trip rates by bus.

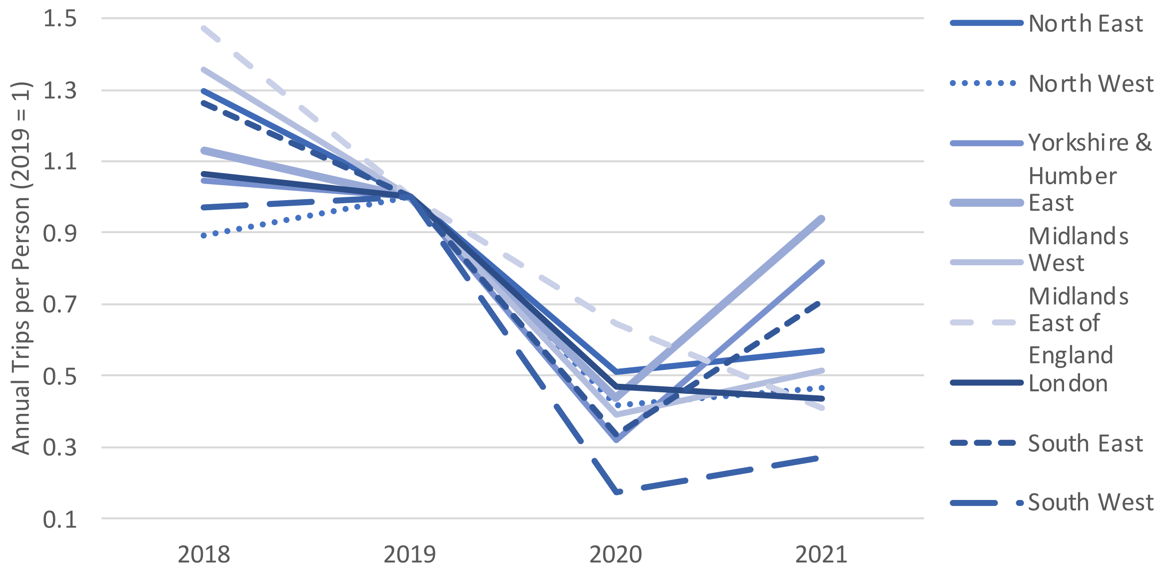
Figure 85. Bus Trips per Person by Region (Over 65s)



H.1.14 The above data is also shown in the figure below to help answer the question 'Can the effects of the COVID-19 pandemic on the above be understood from the time series available?'

H.1.15 The graph shows that there is substantial variation in the recovery post-pandemic as of 2021. In proportionate terms (relative to 2019), the South West has had the weakest recovery, whilst the East Midlands has had the strongest.

Figure 86. Index Bus Trips per Person by Region (Over 65)



H.1.16 The sample sizes in 2021 vary across each region from 89 in the North-East to 298 in the South East. A total of 1,895 responses were analysed for the Over 65s. This means that sample sizes are fairly low by region but were considered reliable as the range and order of trip rates pre- and post-pandemic appears plausible.

H.1.17 The regional variation in trips per person for Over 65s has the following implications on the demand forecasts and reimbursements to operators:

1. It reinforces the need to assess different TCAs across England to ensure reimbursement rates are calibrated to local conditions (as higher frequencies and coverages of public transport and lower car ownership are likely to positively influence concessionary travel)
2. Policy options being tested such as extensions to other disabilities, young persons and at all times of day should reflect such regional variation because it is unlikely that the use of the concessionary travel scheme to new market segments will be consistent across regions (as indicated by the analysis of Over 65s by region).

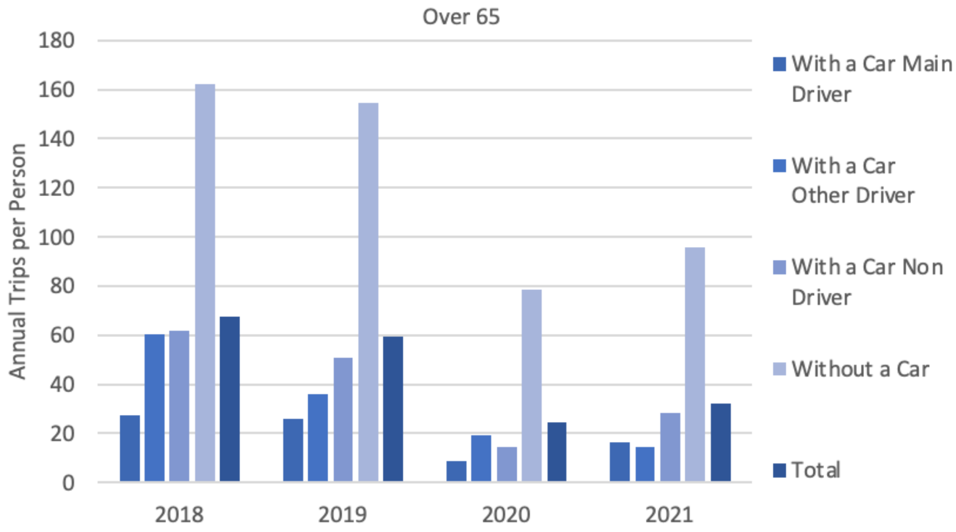
Bus Trips per Person by Car Access (Over 65/Under 65)

H.1.18 In this sub-section, the research question 'Do trip rates vary by access to car and does this vary by age group and/or disability status?' is examined. The NTS provides data on respondents access arrangements for car travel, with bus trips by such arrangements summarised in the figure below.

H.1.19 The rationale behind this analysis is to understand if car access has an impact on the extent of concessionary travel undertaken.

H.1.20 For the Over 65s (sample size: 1,893 in 2021), far more trips per person are undertaken for those without access to a car, whilst the fewest trips per person are (for all years except 2021) made by those with access to a car as the main driver.

Figure 87. Bus Trips per Person by Car Access (Over 65s)



H.1.21 The rates are compared for 2019 and 2021 in the table below for the Over 65s and Under 65s by access arrangements to car. The table demonstrates that Over 65s who are eligible for the ENCTS undertake more trips by bus than Under 65s when they have:

1. Access to a car as a main driver, or;
2. Do not have access to car travel.

H.1.22 However, this does not seem to be the case when the respondent has access to car as another driver or a passenger.

Table 70. Comparison of Trips per Person by Car Access

	2019			2021		
Car Access	**Over 65s**	**Under 65s**	**Diff.**	**Over 65s**	**Under 65s**	**Diff.**
With a Car Main Driver	25.9	9.2	16.7	16.2	3.8	12.3
With a Car Other Driver	36.2	46.2	-10.0	14.7	11.7	3.0
With a Car Non Driver	51.0	57.8	-6.8	28.3	29.6	-1.2
Without a Car	154.5	133.0	21.4	95.8	84.1	11.8
Total	59.2	47.8	11.5	32.2	25.1	7.1

H.1.23 Across all age groups there is a reduction in bus users

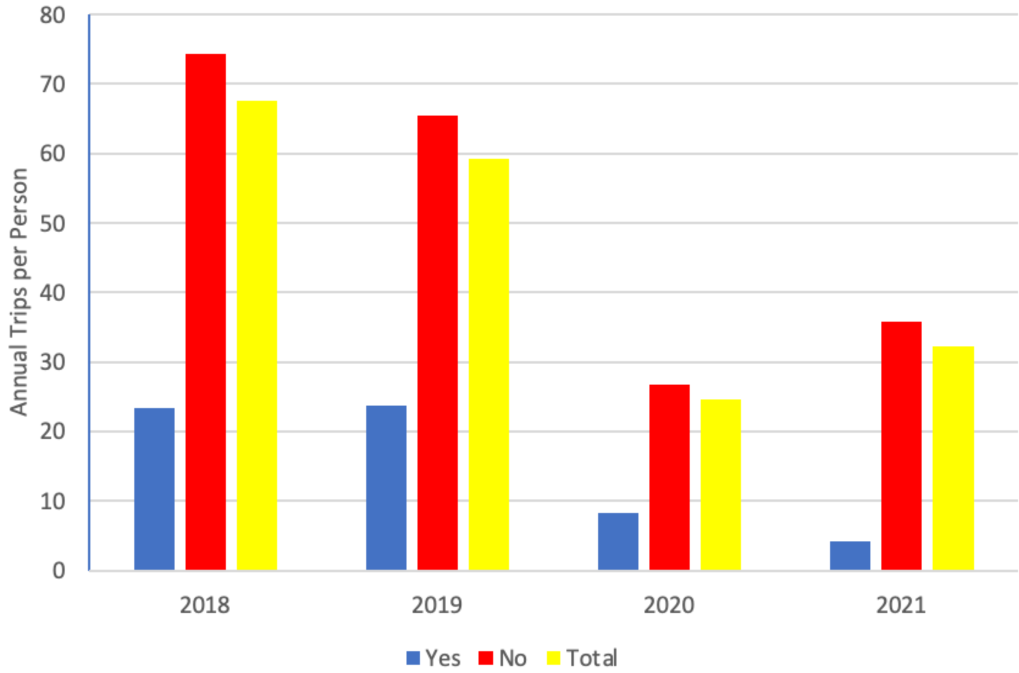
Bus Trips per Person by Car Access (Over 65/Under 65)

H.1.24 A review of the NTS data demonstrated that trip rates would not be possible to estimate by disability or groups of disabilities due to lack of such segmentation. Therefore, proxies had to be used in line with the research question: “If required, can any proxies be used for mobility disability in support of the above question?” The above question being “Do trip rates vary for disabled passengers and how does this vary across different disabilities?”

H.1.25 The first proxy analysed was for trip rates by Blue Badge status. The output of which is summarised in the figures below. The purpose of the analysis was to help understand how extensions of the ENCTS across more disabilities might be impacted.

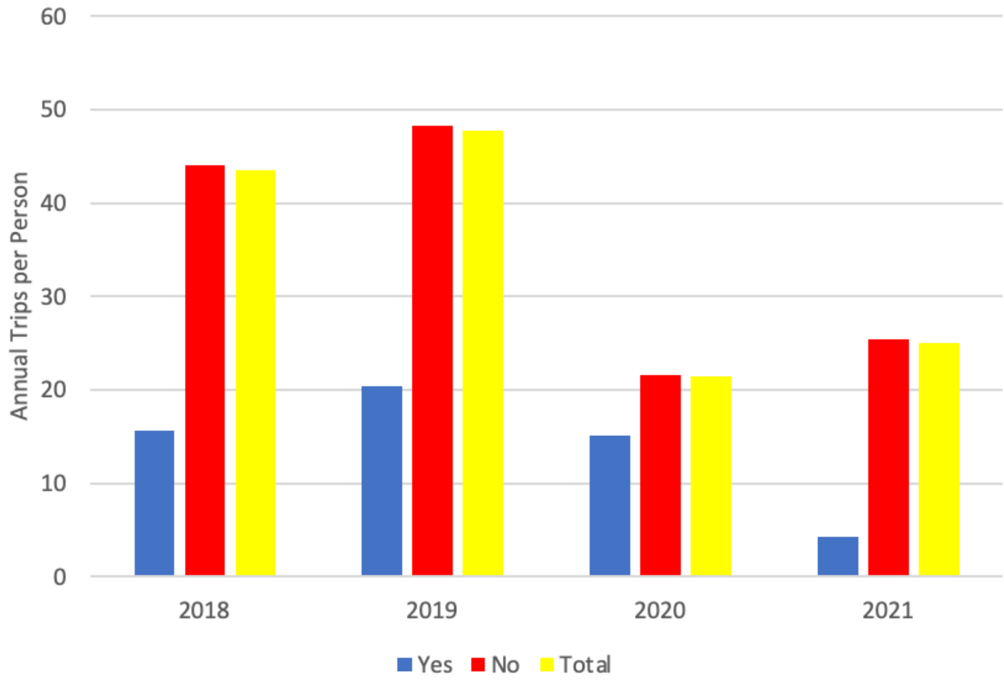
H.1.26 From the figures below it can be seen that respondents with a Blue Badge (Yes) undertake far fewer trips than those without the Badge (No). This might be due to the potential for convenient parking close to key destinations, whereas the bus might require a walk or other mode of travel to complete the trip.

Figure 88. Bus Trips per Person by Blue Badge Status (Over 65s)



H.1.27 The trend is similar for Under 65s, with those holding a Blue Badge making far fewer trips by bus than those without the badge.

Figure 89. **Bus Trips per Person by Blue Badge Status (Under 65s)**



Bus Trips per Person by Mobility Difficulty (Over 65/Under 65)

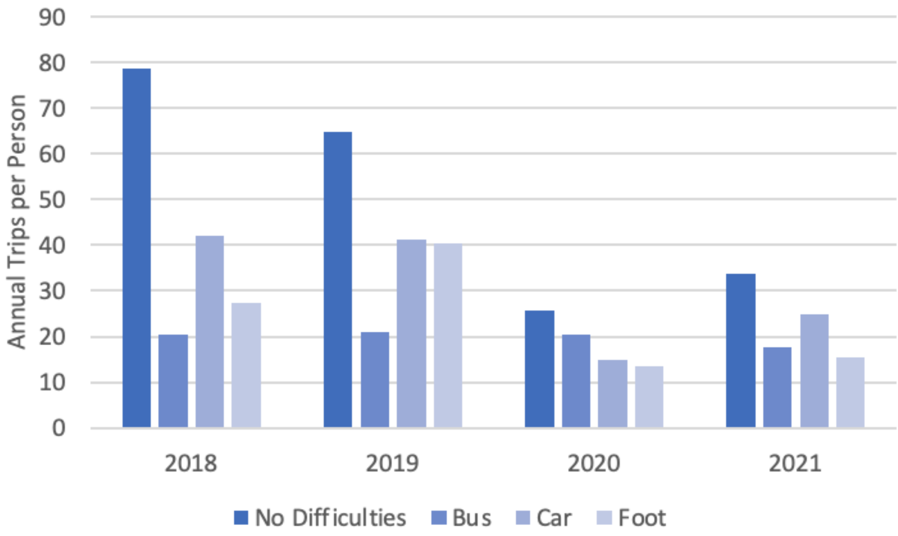
H.1.28 A second proxy from the NTS to assess the research question 'Do trip rates vary for disabled passengers and how does this vary across different disabilities?' was used. This proxy was for bus trips by mobility difficulty, with respondents noting the difficulty according to transport mode the issue is with rather than a specific disability.

H.1.29 In the figure below, trip rates for the Over 65s are summarised by mode of mobility issue. This demonstrates that trip rates are higher where respondents don't have any mobility issues with any mode of transport. The fewest trips undertaken prior to 2020 (pre-pandemic) were for those with a mobility issue with bus travel. However, this is not the case in 2020 or 2021.

H.1.30 It is not clear why the situation would have changed pre- and post-pandemic but it is noted that sample sizes are fairly low in 2021 where mobility issues are noted:

1. No Difficulties: 1,507
2. Bus: 240
3. Car: 199
4. Foot: 297

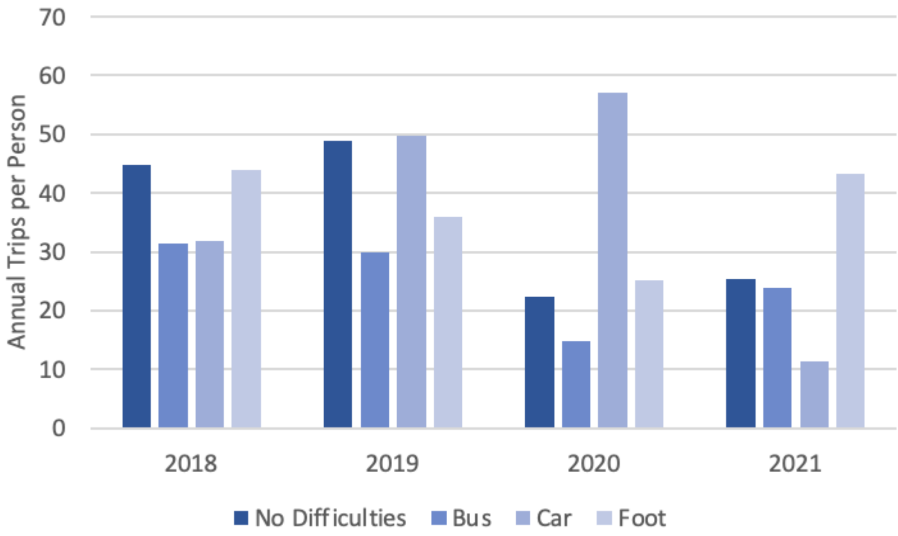
Figure 90. **Bus Trips per Person by Mobility Issue (Over 65s)**



H.1.31 The same analysis is presented for Under 65s in the figure below. The trip rates vary much more by mode of issue than for Over 65s, which again leads to the possibility that sample sizes are too low to provide useful information:

1. No Difficulties: 6,118
2. Bus: 214
3. Car: 168
4. Foot: 250

Figure 91. **Bus Trips per Person by Mobility Issue (Under 65s)**



H.1.32 The inconsistent trip rates across different modes of difficulty and a lack of understanding of the drivers behind such inconsistencies leads to the conclusion that the sample sizes are likely to be too low for any implications for the ENCTS to be drawn.

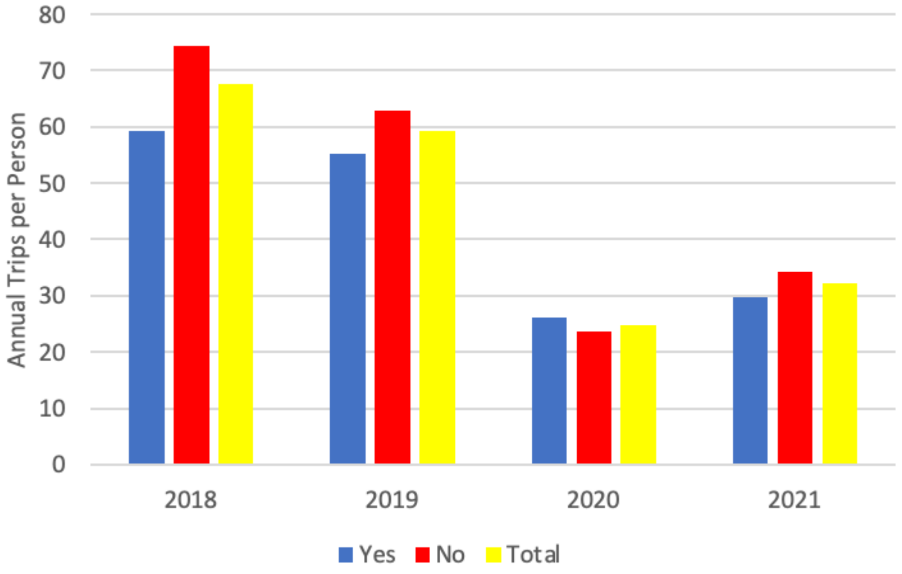
Bus Trips per Person with Physical/Mental Health Condition

Lasting at Least 12 Months (Over 65/Under 65)

H.1.33 The third and final proxy for disabilities is for respondents who noted that they had an unspecified physical or mental health condition likely to last for at least the next 12 months. The analysis was undertaken to assess the research question 'Do trip rates vary for disabled passengers and how does this vary across different disabilities?'

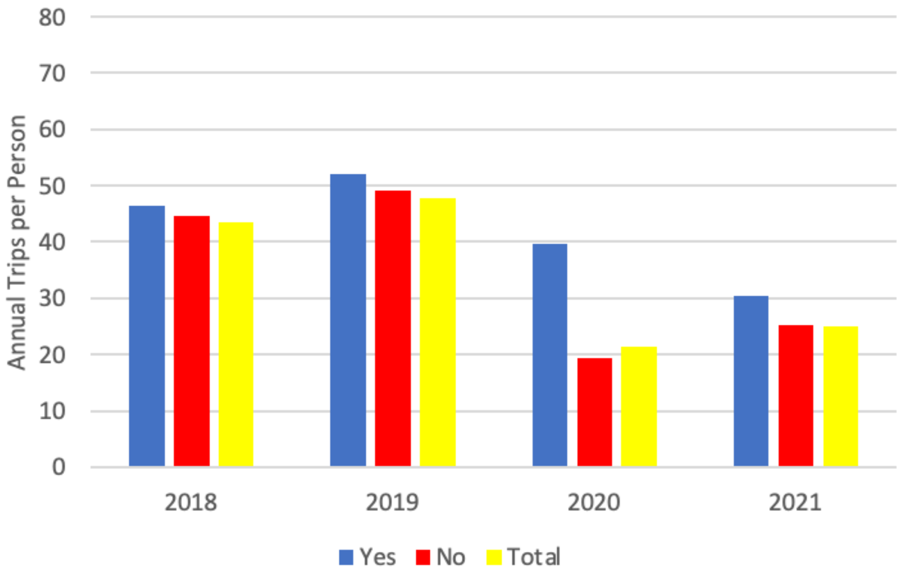
H.1.34 In the figure below, the number of bus trips per person for those with and without a physical or mental health condition is shown for the Over 65s. The graph demonstrates that fewer trips were undertaken prior to 2020 when respondents had a health issue. However, similar numbers of trips were undertaken post-pandemic regardless of having a health issue.

Figure 92. **Bus Trips per Person with/without a Health Issue (Over 65s)**



H.1.35 The same analysis is presented for the Under 65s in the figure below. Trips per person are higher for those with a health issue for all years summarised. This might be because health issues make it harder for people to travel by other modes such as car and, therefore, public transport is more suitable for their needs.

Figure 93. **Bus Trips per Person with/without a Health Issue (Under 65s)**



H.1.36 The findings across both Over 65s and Under 65s are contrary to expectations. Prior to undertaking the analysis it was expected that physical and mental health issues would lead to lower trips per person. However, this is only apparent in 2018 and 2019 for the Over 65s.

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