Reimbursement arrangements - **Annex A -** Comments on DfT draft guidance document

Department for Transport

Concessionary travel for older and disabled people: guidance on reimbursing bus operators DRAFT

September 2010

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1. Introduction

1.1 A mandatory bus concession for older and disabled people has been in place since 2001. The scheme has gradually been extended since its introduction and since April 2008 has provided free off-peak local bus travel to eligible older and disabled people anywhere in England.

1.2 The mandatory bus concession is administered locally by Travel Concession Authorities (TCAs). For schemes commencing on or after 1 April 2011 the following authorities will be TCAs: County Councils, Unitary Authorities, Passenger Transport Executives, London Boroughs.

1.3 In addition to the mandatory bus concession TCAs are also able to offer discretionary concessionary travel schemes.

1.4 Provision for travel concessions in England is at present contained in five separate pieces of primary legislation: the Transport Act 1985, the Greater London Authority Act 1999, the Transport Act 2000, the Travel Concession (Eligibility) Act 2002 and the Concessionary Bus Travel Act 2007. The reimbursement of bus operators by TCAs for carrying concessionary passengers is governed by European regulation No 1370/2007.

1.5 This guidance is solely concerned with how TCAs in England reimburse bus operators for concessionary travel in accordance with the legal requirements. The Department intends that this guidance will assist TCAs in their compliance with legal requirements including European regulation No 1370/2007. This guidance supersedes previous guidance published on reimbursement.

Comment [PA1]: For elderly and disabled people

1.6 This guidance applies to schemes commencing on or after 1st April 2011.

1.7 This revised guidance has been informed by an extensive programme of research by the Institute of Transport Studies (ITS). Although representatives of local government and bus operators have been consulted during the development of this guidance, its contents represent the considered views of the Department alone. Guidance on reimbursement will continue to be improved in the future as new evidence becomes available.

1.8 TCAs and Bus Operators should also have regard to the Regulations which govern the application of the Transport Act 1985 and Transport Act 2000 requirements with respect to reimbursement for travel concession schemes. The current regulations are the Travel Concession Schemes Regulations 1986. However the Department for Transport is in the process of amending these regulations and it is anticipated that new Regulations under both the Transport Act 1985 and the Transport Act 2000 will be in place from April 2011.

1.9 This guidance is designed to provide pragmatic advice on calculating appropriate reimbursement for bus operators. It does not seek to be a definitive interpretation of the law, which is ultimately a matter for the Courts. It applies only to England (including London for the purposes of reimbursement of non-London Bus Network Services[1]).

1.10 TCAs are free to use the methodology of their choice in estimating reimbursement subject to ensuring compliance with the legislation that governs concessionary travel reimbursement. The methodology set out in this guidance represents the Department for Transport's preferred approach for calculating reimbursement and will usually be the approach used by the Secretary of State (or decision makers appointed on his behalf) in determining appeal applications by bus operators. We strongly encourage TCAs to discuss reimbursement arrangements with their local bus operators at the earliest opportunity.

1.11 The guidance sets out:

- The legislative background;
- The appeals process;
- Background to reimbursement principles;
- Advice on how to estimate the revenue forgone and additional costs;
- Background to the theoretical framework for reimbursement, including a summary of the available research evidence;
- Information on the calculations in the Department for Transport's Reimbursement Calculator through worked examples~~-~~.

1.12 If you have any comments, suggestions or questions about reimbursement please contact us at: concessionaryfares@dft.gsi.gov.uk.

[1] Arrangements for compensating Transport for London (TfL) for the cost of the statutory concession on the London Bus Network are negotiated between London Councils and TfL.

2. Legislative Background

The Legislative Framework

2.1 Travel Concession Authorities (TCAs) are required to implement the mandatory travel concession as set out in the Transport Act 2000 and the Greater London Authority Act 1999, both of which were amended by the Concessionary Bus Travel Act 2007. The mandatory travel concession guarantees free off-peak local bus travel to eligible older and disabled people anywhere in England.

2.2 In addition to the mandatory bus concession, TCAs are also able to offer discretionary concessionary travel schemes, using the powers provided in the Transport Act 1985.

2.3 TCAs are required by law to reimburse bus operators for carrying concessionary passengers. In respect of the mandatory concession, TCAs must reimburse bus operators for ~~all~~ concessionary journeys starting within their boundaries, regardless of where the concessionary passholder making the journey is resident.

Comment [TL2]: It is suggested that this wording is safer in that does not prejudge the issue of generated travel. Litterally interpreted, this phrasing - taken out of context - could be interpreted to mean that there is no such thing as generation. This could be taken one step further and explicitly refer to the "journeys that would have been made in the absence of the concessionary scheme".

2.4 In addition to the UK legislation governing concessionary travel schemes, TCAs should also have regard to European regulation No 1370/2007, which sets out the overarching rules for reimbursement of public service obligations. Concessionary travel schemes are considered to be public service obligations.

2.5 In both the Transport Act 1985 and the Transport Act 2000 there is provision for bus operators to apply to the Secretary of State for modification and in the case of schemes established under the Transport Act 1985, cancellation of the arrangements of the local authority, if they consider that there are special reasons why the arrangements would be inappropriate.

2.6 Arrangements for reimbursing operators for the cost of the mandatory concession under the Transport Act 2000 are legally distinct from reimbursement arrangements arising from the use of powers under the Transport Act 1985.

The Mandatory Concession

2.7 The provisions of sections 149 and 150 of the Transport Act 2000 apply in determining how operators are to be reimbursed in respect of the mandatory concession. A summary of the timetable for agreeing reimbursement arrangements as set out in the Transport Act 2000 is provided in the table below.

Final dates for action (where X = date of scheme commencement/ variation)	X minus 4 months	X minus 28 days	X plus 56 days
Required process for the mandatory concession	TCA to publish reimbursement proposals in as much detail as possible to allow for meaningful negotiation. (Transport Act 2000, section 150(1))	TCA to determine final reimbursement arrangements (Transport Act 2000, section 149(2))	Last date for bus operators to appeal to the Secretary of State. Prior notice must be given to the TCA. (Transport Act 2000, section 150(4) and 150(5)

Discretionary Enhancements

2.8 In addition to the mandatory bus concession, TCAs are also able to offer discretionary concessionary travel schemes, i.e. schemes which go beyond the statutory minimum in one or more respects. This does not necessarily require a separate scheme to be created; a scheme which offers benefits which include but are more generous than the statutory minimum will at the same time fulfil any obligation to ensure that the statutory minimum is provided.

2.9 The proposed arrangements for discretionary concessionary travel schemes should be published by the TCA at least 28 days before the scheme commences. It should be clear to operators from the published details what concessions they will be required to offer and the timing and amount of reimbursement that they can expect to receive to cover their revenue forgone and any additional costs incurred.

2.10 The Transport Act 1985 permits the service of a Participation Notice upon an operator who does not wish to participate voluntarily in a travel concession scheme made under that Act (a "s.93 scheme").

2.11 The operator can apply against the Participation Notice to the Secretary of State if he feels that there are special reasons why his participation would be inappropriate or if any details of the scheme or the reimbursement arrangements are inappropriate. Any such applications must be made no later than 56 days from the date the obligation to participate commences (or in the case of a new service from the date that the service is due to begin). Local authorities can request a specific period of notice (of at least seven days) if an operator intends to appeal.

2.12 If a TCA proposes to vary the terms or reimbursement arrangements of a scheme, this may be done by serving a Variation Notice on such operators 28 days before the commencement of the variation. Operators then have until the commencement of the variation to indicate that they are unwilling to participate.

2.13 When establishing what, if any, local enhancements to offer, local authorities need to consider how the reimbursement arrangements will work in practice and the potential impact on additional cost claims by operators. This is particularly important when the add-on involves a right to travel free, or at a concessionary rate, outside of the TCA's boundary (for example, cross-boundary travel before 9.30am on weekdays). It is important that in such situations there are clear and transparent arrangements in place with the neighbouring TCAs for reimbursing the local bus operators.

2.14 Ideally, bus operators should be able to claim reimbursement from the same TCA for all trips starting in a particular area, with inter-authority settlements (or "knock-for-knock" agreements) to cover out-of-area take-up of enhanced benefits. Unclear and confusing arrangements are likely to result in the bus operator applying to the Secretary of State for a modification of those arrangements.

The Appeals Process

2.15 The right of an operator to apply to the Secretary of State for modification of the proposed reimbursement arrangements offered by a TCA is an important safeguard. This application process is often referred to as the 'appeal process'. Applications should only be submitted after proper consideration and after attempts to reach a resolution at the local level have been exhausted. The time limit for making an appeal is 56 days from the commencement or variation of a scheme.

2.16 Any application submitted by an operator should be properly evidenced - data proformas are provided by the Department for both the operator and the TCA. It should be made clear exactly which elements of the reimbursement arrangements are, and are not, being disputed.

Comment [TL3]: It is suggested that the addition of the words 'at the time of the application' would both reduce the volume of applications and assist in their resolution outside the adjudication process.

2.17 Even after the submission of an application, TCAs and bus operators are encouraged to continue local negotiation with the aim of reaching a settlement.

2.18 The Department for Transport has published separate guidance for TCAs and bus operators with regards to the appeals process which can be found on the Department's website.

2.19 The Secretary of State, or his appointed representative, will~~is likely to~~ utilise the methodology set out in this guidance and in regulations, when determining appeal applications. This will provide a standard benchmark for assessing appeals cases.

Comment [TL4]: This para graph infers that no revision of this guidance is intended. Would it be better to say 'Guidance is provided for TCAs ....' so that it will pave the way for revised guidance in the context of the proposed revised regulations, should this prove necessary?

Comment [TL5]: Perhaps a slightly stronger wording here would emphasise the significance of the guidance.

3. Principles of Reimbursement

The Objective –"No Better, No Worse Off"

3.1 Requiring operators to use their assets to provide a free service for a proportion of the population is a major market intervention, and the requirement to provide adequate reimbursement is a fundamental one. Equally, however, European regulations prevent concessionary travel schemes being used to provide hidden subsidy (or state aid) to operators. The underlying principle which underpins reimbursement is therefore that operators should be left ***'no better, no worse off'*** as a result of the existence of concessionary travel schemes.

3.2 This means that Travel Concession Authorities should

- compensate operators for the ***revenue forgone*** – i.e. the revenue they would have received from those concessionary passengers who would otherwise have travelled and paid for a (full fare or discounted) ticket in the absence of a scheme; and

- pay operators any ***net additional costs*** they have incurred as a result of the scheme – this could for instance include the cost of carrying additional generated passengers (i.e. concessionary passholders that would not have travelled in the absence of the scheme) or other costs that would not have been incurred in the absence of the concession such as scheme administration costs. Those costs are net of additional revenue.

TOTAL REIMBURSEMENT DUE = Revenue Forgone [R] + Net Additional costs [A]

The Elements of Reimbursement

3.3 Calculating concessionary travel reimbursement is therefore predicated on determining what would have happened in the absence of the scheme (the counterfactual). TCAs need to estimate the various components of reimbursement as outlined below.

3.4 The revenue forgone is an estimate of the revenue that would have been received in the absence of a scheme – it is therefore dependent on

- The number of journeys that would have been made by concessionary travelers in the absence of a scheme. These journeys are also known as non-generated journeys: they would have happened anyway. This is covered in Section 6.
- The fares that operators would have offered and concessionary travelers paid in the absence of a scheme. This is covered in Section 5.

Revenue forgone [R] = Non-generated journeys [N]
X
Average fares that would have been paid [F]

3.5 The recommended approach to estimate the number of journeys that would have taken place in the absence of the concession is to apply an adjustment factor – the ***reimbursement factor*** – to the number of observed journeys made using the free fare concession. The reimbursement factor depends on the sensitivity to fare changes of passengers' desire to travel by bus. Annex B provides some theoretical background on the relationship between fares and the demand for travel.

Non-generated journeys [N] = Total concessionary journeys at free fare [J]
X
Reimbursement factor [RF]

3.6 The additional costs are made of up to four components (see Section 7):

- ***Scheme administration costs*** – these are administration costs associated with running the scheme.
- ***Marginal operating costs*** – the costs of carrying additional passengers assuming service levels are held constant.
- ***Marginal capacity costs*** – the net costs incurred from additional capacity on a route to accommodate generated journeys, after allowing for revenue gain.

- ***Peak Vehicle Requirement (PVR) costs*** – the costs associated with the requirement to run additional vehicles in the peak period due to generated concessionary travel.

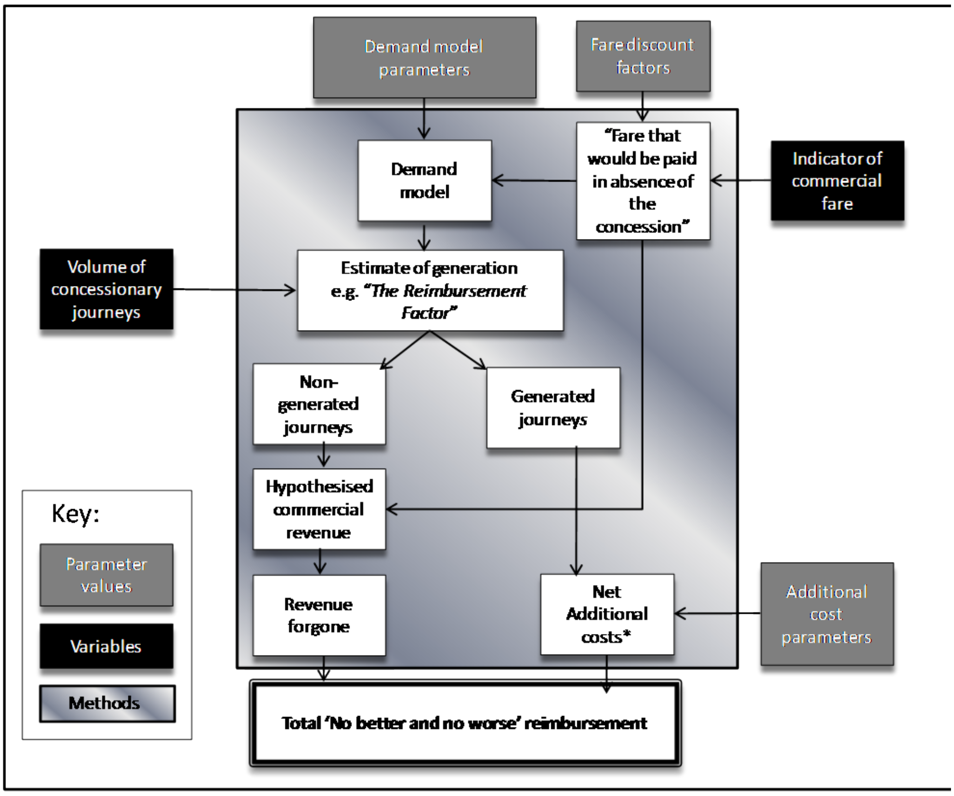
Net Additional costs [A] = Generated journeys [G] X Net Additional costs per generated journey [C] + PVR costs [P] + Scheme administration costs (S)
Net Additional costs per generated journey [C] = Marginal operating costs [MOC] + Net marginal capacity costs [MCC] per generated journey
Generated journeys [G] = Total concessionary journeys at free fare [J] X (1 - Reimbursement factor [RF])

3.7 EU Regulation Number 1370/2007 states that an allowance for ‘reasonable profit’ must be made in the reimbursement of bus operators. There is an implicit allowance for operator **profit** within the revenue foregone element of reimbursement through the average fare foregone. In addition, the guidance recommends that a profit allowance be made, in the form of rate on return on capital employed for additional peak vehicle requirements.

Comment [TL6]: Consistency of spelling

Comment [PA7]: Reasonable level of profit

3.8 The flowchart below illustrates how the various components of reimbursement fit together. The rest of the guidance and Annex D provide more detailed explanations as to what data inputs are required and how the different elements are calculated and combined.



Approach of the Guidance and Tools

3.9 This guidance sets out DfT's preferred approach for calculating reimbursement based on the latest research and evidence available. TCAs are free to use the methodology of their choice in estimating reimbursement subject to ensuring compliance with the legislation. We encourage TCAs to engage with their local operators as early as possible to help define the key variables in their schemes.

3.10 The Secretary of State, or his appointed representative, is likely to use the methodology set out in the DfT guidance as a standard benchmark for assessing appeals cases and may also consider additional evidence supplied by TCAs or operators which supports a departure from the standard approach.

3.11 This guidance is concerned with providing practical advice on how to calculate reimbursement. A Reimbursement Calculator based on the recommended methods is available (on the DfT website) to aid TCAs in their estimation of the total reimbursement required by operators and can be used to assist discussions and negotiations with bus operators. The Calculator is accompanied by instructions on how to perform the calculations and Annex D provides worked examples of some of the detailed calculations in the tool.

3.12 The new methodology outlined in this guidance requires much fewer data inputs than were previously needed. Nevertheless data quality is an important factor in achieving an accurate estimate of reimbursement and TCAs are encouraged to check and validate the data that feed into the calculations.

Research Evidence

3.13 The advice provided in the guidance draws from extensive research commissioned by DfT from the Institute for Transport Studies (ITS) at Leeds University. The purpose of the research was to develop a robust, evidence-based framework for estimating concessionary travel reimbursement.

3.14 A Reimbursement Working Group comprised of relevant parties from the bus industry and local government was also consulted during the research phase and during the development of this guidance. Its contents, however, represent the considered views of the Department alone. Guidance on reimbursement will continue to be improved in the future as new evidence becomes available.

3.15 Annex C provides a summary of ITS main research findings and other relevant evidence which underpin the reimbursement calculation methods described in the guidance.

Level of Calculation

Spatial Aggregation

3.16 The principles set out in this guidance can be used at different levels of spatial aggregation (e.g. area, operator, route) depending on the circumstances. It is suggested that it would generally be sensible to undertake revenue reimbursement and marginal cost calculations at the level of the operator while additional capacity and vehicle costs are often best treated on a route-specific basis.

Comment [TL8]: It is suggested that little is to be gained from treating marginal costs at anything more disaggregate than an operator level, and to do so could significantly increase workloads for all parties.

Timing of Calculations

3.17 In setting their reimbursement terms, TCAs will need to consider which elements of their calculation to base on outturn data. It is up to the TCA to determine the frequency of calculations required to deliver the principles set out in this guidance.

3.18 For instance, a practical and cost-effective way of calculating reimbursement would be to estimate total concessionary journeys, the reimbursement factor, the average fare and additional costs at the beginning of the financial year using projections based on the most up-to-date historical outturn data and with terms of payment on account and reconciliation agreed beforehand. An end-of-year correction could then be applied to the reimbursement calculations based on outturn~~more-up-to~~ data. In other areas where data are updated at regular intervals, ~~period-by-period payments~~ parties may prefer to ~~can be~~ calculate~~d~~ reimbursement payments on a period-by-period basis using the latest outturn data.

3.19 In terms of best practice, it would seem unreasonable to set scheme terms that:

- Limit the number of fare changes that an operator can apply in a year;
- Include clauses reserving the right for unilateral changes to terms, rates of factors at any time without consultation;
- Do not include a~~n end~~ latest review date for the reimbursement elements of the scheme.

Comment [TL9]: It is suggested that wherever possible 'actuals' should be used to reach final settlement figures.

Comment [TL10]: It is suggested that there is no need for inferred prescription of local methods

Comment [TL11]: Improved clarity?

4. Measuring Concessionary Journeys

4.1 Of all the data items required to provide a sound estimate of reimbursement, the total number of concessionary journeys (boardings) undertaken by older and disabled people in the reimbursement period is most easily observed and should be the easiest to obtain.

4.2 Almost all operators now have electronic ticket machines and should be able to provide empirical data on concessionary boardings by fare stage. However, it is recognised that it is difficult to audit data that have no fare transaction (i.e. estimates of passengers enjoying free travel). The increasing roll-out of smart ticketing may help in this regard but pending the full introduction of smart ticketing, TCAs may want to use statistically robust surveys to provide supporting information on the number of concessionary journeys or undertake spot checks to validate operator-supplied figures. Larger TCAs (notably the PTEs) already have substantial survey programmes able to provide statistically sound estimates of concessionary journeys and, potentially, of average fares.

5. Estimating the Average Fare

Introduction

5.1 Operators should be reimbursed for the ***average fare forgone***, i.e. the fare that concessionary travellers would have paid in the absence of a scheme. The average fare forgone features in reimbursement calculations in two ways:

- as a determinant of generation and the reimbursement factor (higher fares imply higher levels of generated travel and a lower reimbursement factor) – see Section 6;
- as a direct input in the calculation of revenue forgone (revenue forgone = average fare x observed concessionary journeys x reimbursement factor).

5.2 The calculation of the average fare forgone is not as straightforward as looking at the average equivalent single fare or, in the absence of such data, the average commercial adult 'cash fare'[2]. In the absence of the concession, it is likely that some of those passengers who now use buses for free would have bought various discounted products such as travel cards, day tickets and weekly tickets which allow an unlimited number of journeys to be made in a given period. These products offer a lower average fare per journey and take-up of those types of tickets would therefore have had the effect of reducing the average revenue per journey earned by operators. There is evidence from smartcard trip frequency data that some concessionary passholders use buses sufficiently often to make ticket type choice ~~a real question~~ in the absence of a scheme a significant issue.

5.3 It is also plausible to suggest that in the absence of a scheme operators would want to consider their marketing strategies to older people very carefully and either introduce discounted products for some of those now benefiting from the concession or rebalance the tariff structure (e.g. lower

Comment [AL12]: We have a concern that the overall structure of this section of the guidance does not fully recognise the complexities of the topic and could easily lead to confusion. In particular, the choice of "Discount Factors method" and "Basket of Fares Method" represents a false dichotomy. The ***pteg*** position paper on average fares attempts to draw out the different conceptual strands necessary to properly address average fare calculations, and might help DfT with the presentational challenge represenmted here.

Comment [PA13]: A definition would be helpful as this is likely to be used later in the discount factor calculation

Comment [PA14]: It would be useful to make explicit reference to multi-operator and multi-modal products for the avoidance of doubt.

Comment [TL15]: Improved clarity?

[2] The average equivalent single fare is the fare that would have been paid by the passenger if a cash single ticket had been purchased. A cash fare is a type of ticket that allows the purchaser to make a finite number of trips such as singles or returns.

off-peak, higher peak) or both. However, there is not sufficient evidence at the national level to be able to quantify this potential effect.

5.4 In general we would therefore expect the average commercial adult cash fare to be higher than the average fare forgone that concessionary travellers would have paid in the absence of a scheme. It is therefore not appropriate to use the average commercial adult cash fare in reimbursement calculations. However, there may be some circumstances where an operator does not offer discounted tickets or where tickets are priced such that they attract only a very small minority of passengers. In those cases it may be appropriate to use the average commercial adult cash fare as a proxy for the fare that would have been paid in the absence of a scheme.

5.5 The recommended approach to estimate the average fare forgone is to use the **Discounted Fare method**. This consists of applying a discount factor based on the prevailing ticket price structure for a TCA/operator to the average commercial adult cash fare.

5.6 This method is the suggested ~~preferred~~ default approach ~~for all operators~~ because fewer data inputs are required, they are easily auditable and it is not necessary to make assumptions about the trip rates associated with discounted tickets. The underlying trip frequencies used to derive the discount factor are also based on observed data for the concessionary market and therefore reflect the actual travel behaviour of concessionary passholders.

5.7 However, this approach may not be appropriate in certain circumstances such as where 60 per cent or more of an operator's concessionary passenger boardings (on services serving a TCA's area) are carried on buses where the average weekday daytime frequency (09.30 to 18.00) is one bus per hour or less.

5.8 In these cases, TCAs can use the **Basket of Fares method** as a fall-back approach. This consists in estimating the average fare based on the average fare per journey of a range of commercial cash and non-cash fares weighted by the journeys that would have been made using each ticket type.

5.9 In large urban areas, such as PTEs, the discount on the cash fare may be significantly higher than that suggested by the Discount Factor method for several reasons. For instance, the proportion of high frequency bus users may be greater than for the areas from which the ‘default’ trip frequency distributions were derived; the use of discounted tickets may also be greater in large urban areas because of the relatively large proportion of multi-modal journeys; and there may be a higher proportion of interchange trips relying on more than one bus operator, or

Comment [TL16]: Added clarity as regards the ITS evidence? The proposed wording does not suggest this finding is invalid at the local level, but there may be much stronger evidence locally that enables a case to be made. The suggested rewording leaves this possibility open.

Comment [TL17]: It is suggested that the labelling of two alternative methods - discounted fare or basket of fares - overcomplicates the picture and could mislead and even confuse practitioners. The two methods might better be described as a single method with an slightly different approach in dealing with time-based (or season) tickets. Is there merit in reviewing this section to improve clarity in explaining the approach better (and clarifying the circumstances in which each of the variants is preferred)? In this latter respect para 5.7 seems rather inadequate. Surely the role played by day and week tickets is a far more critical issue than bus frequency?

Comment [PA18]: The key feature of the DF method is that the it uses empirical evidence on concessionary passengers trip frequency distribution to infer the discount level given by a certain ticket price structure. Adding a reference to this would help clarify why, in the next para, it is said that no assumptions need to be made about trip rates. Perhaps move the last sentence in para 5.6 to para 5.5.

Comment [PA19]: Or where an operator does not offer discounted products.

Comment [PA20]: We can think of at least another circumstance where the DF method may not be appropriate, which is where ticket structure may not neatly fall into the categories used in the DF method.

return trips being made on a different operator's services. There may also be significant differences between the length of journeys made on cash fares and discounted tickets and the associated price structures, which can lead to particularly high discount factors where these are measured against the average equivalent cash fare of concessionary passengers.

5.10 TCAs in those areas may also have access to comprehensive journey data (e.g. from continuous sample surveys) and are able to develop further their established average fare calculation methods in line with the principles of the DfT Discount Fare methodology. In those cases it would be justified for TCAs to use their own data and methods to estimate the average fare forgone, after consultation with operators.

Comment [PA21]: Correction - Replace with "relative to the average cash fare"

Comment [PA22]: Our view is that the use of Average Equivalent Single Fares as part of the Discount Factor method is one way to take most of these factors into account, so a reference should be added to this approach (see Average Fares position paper).

Discounted Fare Method

Introduction

5.11 This is the recommended approach for estimating the average fare for predominantly urban operators. The basic principle of this method is to calculate a discount factor to adjust the full commercial adult cash fare downward so as to reflect the fact that in the absence of free-fare schemes, individuals would take up discounted tickets.

5.12 The discount factor is derived from a sample of smartcard data on observed concessionary passholders trip frequencies at free fares from four districts in the NoWcard scheme in Lancashire. The trip data have been used to model how eligible people would allocate themselves to different ticket types (cash, daily and weekly tickets) depending on the relative price structure.

5.13 Ideally we would want to base the discount factor on the trip distribution which would occur in the absence of the scheme, but this is not observable so this has to be inferred from the distribution in the presence of the scheme (at free fares). However, in the absence of a scheme and faced with having to pay full fares, it is expected that individuals would make fewer journeys and would buy a different mix of ticket types. The journeys in the observed NoWcard frequency distribution are therefore adjusted to account for this (journeys are reassigned from discounted products to single tickets and the total number of journeys is reduced).

Comment [PA23]: "the average equivalent single fare"

Comment [PA24]: There is a less than rational assumption in this approach, which is that trips are purely transferred from cheaper to more expensive tickets without being further reduced. This is addressed in our average fares position paper. We would suggest that the text in brackets is removed from this part of the Guidance.

5.14 Smartcard data based on zero-fare concessionary journeys has the advantage that it records actual travel behaviour by concessionary passengers and will not be coloured by the prevailing commercial strategies of bus operators. Local smartcard data on concessionary passholder trip making is not yet widely available in a sufficiently comprehensive form to be directly drawn on by individual TCAs. This is why the Discount Factor method makes use of an existing dataset to predict what the relative take up would be of different price combinations of tickets.

5.15 Because the smartcard data used in the derivation of the discount factor is based on a sample for a particular time period and particular area, there is no guarantee that the dataset is representative of concessionary passengers everywhere although the trip frequency distributions from the NoWcard data were found to be similar to those derived from Nottingham's smartcard data and from data from a large conurbation. However, at present NoWcard data provide the best available opportunity to observe concessionary trip frequency distributions in urban areas and provide a default set of assumptions in the absence of good alternative data. Annex C provides further information on the characteristics of the underlying NoWcard data used in the Discount Fare method.

Generic Ticket Types

5.16 The only information required as an input for calculating the average fare is data on the prevailing ticket price structure expressed as the price ratio of three generic ticket types.

5.17 In practice, fare structures can be extremely complex with a wide variety of ticket types being available across different operators (singles, returns, carnets, five-day tickets, weekly tickets, monthly tickets, etc) and with various geographical (Zone, A, Zone B, zone A+B) and temporal (peak/off-peak, weekends) combinations. Ticket products which are directly comparable are also likely to be branded with different names. It would be therefore difficult for TCAs to assemble a framework dealing with each distinct ticket product and monitor their prices.

Comment [PA25]: Multi-operator (including multi-modal) tickets add another dimension and should be mentioned explicitly for the avoidance of doubt. In at least one PTE, discounted products sold online also make up a significant proportion of total tickets sold and should get a mention.

5.18 The proposed method assumes that ticket products and their geographical and temporal dimensions can be summarised into three generic ticket types:

- 'cash' fares which entitle the purchaser to make a finite number of journeys, i.e. include cash singles, cash returns and carnets (e.g. ten journey tickets, etc);
- daily tickets; and
- weekly tickets.

5.19 Although concessionary travellers would have made use of all sorts of ticket types, including monthly tickets, the three generic products outlined above are deemed to be a sufficiently representative way of summarising the range of non-cash fares relevant to concessionary travel reimbursement without creating too complicated an overall structure.

5.20 In practical terms TCAs will need to discuss with each operator how to map individual ticket products onto the generic ticket types. Decisions will need to be made as to which tickets are in scope and which are deemed to be not relevant to the concessionary market (e.g. annual season tickets, peak period tickets, child tickets, etc). Some pragmatic judgements may also need to be made about atypical products and how they fit into the three generic ticket types.

5.21 Preferably the mapping should be defined in terms of the internal ticket product codes that operators use in their ETM systems, thus ensuring precision and auditability, and also facilitating production of data by the operator. A complete mapping exercise should only be needed when systems are initially set up, but should then be kept under review as operators change the product mix (but not as they change prices as this will be captured in the sales revenue data).

Price Ratios

5.22 Once the various products have been mapped onto the generic ticket types, data on total ticket sales and ticket revenue for each of the three ticket types can be obtained from operators so as to derive the average price per journey. These data should be easily available and auditable and do not require operators to make assumptions about the number of journeys made with each ticket type.

5.23 The average price of each generic ticket type can be derived as follows:

Average ticket price = Total revenue / Total number of tickets sold

5.24 Care will need to be taken in the cash fare category as this may comprise tickets with a different number of journeys per ticket. For instance the total revenue for return tickets will need to be divided by two and the total revenue for carnets of ten journeys will need to be divided by ten before the average revenue per journey for cash fares tickets is calculated.

5.25 The example in the tables below illustrates how ticket revenue and sales data on the products which have been assigned to generic ticket types can be used to derive the average price of each ticket type. The examples are purely illustrative using made-up data.

Comment [PA26]: Evidence from South Yorkshire who offered a Senior Master monthly product prior to free travel shows that take-up of such tickets was far from negligible. This is addressed in our position paper on average fares. It therefore seems to prejudice the calculation of average fares to discount such ticket types without any supporting empirical evidence.

More critically, the wording used in the this para seems to suggest that it is perfectly legitimate to use straight cash, failies and weeklies for the purpose of the DF method. This is likely to be a very big approximation in PTE areas where other tickets represent a significant proportion of the market.

We suggest that the wording in this para is replaced with something like: “the three generic categories above are deemed to be satisfactory for grouping all available ticket types.”

Comment [PA27]: Reference could be made here to alternative technologies for recording ticket usage such as smartcard readers, which could become the dominant ticketing method in some PTEs and for some operators within the next couple of years.

Comment [PA28]: Operators are not currently required to comply so it should be made explicit that it is planned to change Regulations to this effect.

Cash fares

Product	**Ticket price (£) [A]**	**Single journey multiplier [B]**	**Number of tickets sold [C]**	**Total revenue (£) [D]**	**Equivalent number of journeys [E=BxC]**
Single Zone 1	£1.50	1	50,000	75,000	50,000
Single Zone 1+2	£1.80	1	180,000	324,000	180,000
Return Zone 1	£2.80	2	15,000	42,000	30,000
Return Zone 1+2	£3.40	2	90,000	306,000	180,000
Carnet (10) Zone 1+2	£16.0	10	5,000	80,000	50,000
All cash fares				**827,000**	**490,000**
Average cash fare (per journey) = £827,000 / 490,000 = **£1.69**					

Comment [PA29]: We have made the point in our average fares paper that use of daily and weekly tickets is biased towards longer distance trips. Hence, there is an implicit bias in the calculation which assumes that the average cash fare available to passengers using discounted tickets is the weighted average of different cash products based on actual trip rates. Although we're not arguing that the DfT should propose that trip lengths be used as part of the weighting process as default, this bias should be explicitly acknowledged, perhaps suggesting that where trip length data by ticket type is available calculating an average equivalent single fare would improve the accuracy of the calculation.

Day tickets

Product	**Ticket price (£) [A]**	**Number of tickets sold [B]**	**Total revenue (£) [C=AxB]**
Day saver (Advance)	£3.20	3,000	9,600
Day saver (Standard)	£3.80	20,000	76,000
All day tickets		**23,000**	**85,600**
Average day ticket price = £85,600 / 23,000 = **£3.72**			

Weekly tickets

Product	**Ticket price (£) [A]**	**Number of tickets sold [B]**	**Total revenue (£) [C=AxB]**
5 Day saver	£13.00	3,000	39,000
7 Day saver	£15.00	1,000	15,000
All weekly tickets		**4,000**	**54,000**
Average weekly ticket price = £54,400 / 4,000 = **£13.80**			

Deriving the Discount Factor Using the Calculator

5.26 The three average ticket prices can be input in the Average Fare Calculator and the discount factor associated to that price structure is then easily derived. It can then be applied to the average cash fare reported for the period to derive the fare that would have been paid in the absence of a scheme:

Average fare forgone = Average cash fare x (1 – Discount Factor%)

Comment [PA30]: To be clear, our proposition to calculate an average equivalent single fare is used to calculate the discount factor. However, the average cash fare is calculated based on the actual trip making of passengers using cash products.

5.27 Annex D explains in detail how the discount factor in the Reimbursement Calculator is derived by way of a worked example.

Basket of Fares Method

Introduction

5.28 This method was the recommended approach in the previous DfT~~t~~ Reimbursement Guidance and Reimbursement Analysis Tool and is appropriate for TCAs to use where the discount factor method is not suitable, i.e. for operators with a high proportion of passengers carried on infrequent buses.

Comment [PA31]: "…or where ticket structure cannot easily be mapped onto the three categories described above".

5.29 It allows TCAs to estimate an effective discount rate by calculating a weighted average fare per journey from assumed usage of different commercial ticket types. It is not dissimilar to the first method but is more data-intensive, and requires TCAs to make assumptions about the number of journeys that would have been taken with each ticket purchased and the proportion of total journeys that would have been taken by concessionaires holding each type of ticket.

Data Requirements and Method

5.30 Table 5.1 below illustrates how the average fare should be calculated using a basket of fares though the suggestion of applying the method for different lengths of trip is entirely optional.

Type of ticket [A]	Price £ [B]	Assumed journeys per ticket purchased [C]	Implied revenue per journey £ [D=B/C]	% of total journeys with this ticket type [E]	Weighted revenue per ticket [F=DxE]
Single (<1 mile)	1	1	1	6.7%	0.067
Return (<1 mile)	1.8	2	0.9	44.4%	0.3996
Single (>1 mile)	1.3	1	1.3	4.4%	0.0572
Return (>1 mile)	2.1	2	1.05	26.7%	0.28035
Daily pass	2.5	3	0.83	6.7%	0.05561
Weekly pass	10	16	0.63	11.1%	0.06993
Totals				100%	
Weighted average fare					**£0.9294**

5.31 The first step is to consider all the ticket types [Col. A] that would have been purchased by concessionary passholders in the absence of the scheme and the associated commercial price [B]. Operator or survey evidence will be helpful in identifying the most relevant basket of tickets.

5.32 TCAs will have to make explicit assumptions about how many journeys [C] would have typically been made by holders of each ticket type. Although it is reasonably obvious for single and return tickets, it requires some judgements to be made on the use of multi-trip tickets. Again, good evidence from operators or surveys will be helpful in deciding what assumptions to make.

5.33 The default position is to assume that new passholders behave exactly the same as old pass-holders in terms of average journey lengths. Data from the National Travel Survey in Table 5.2 below shows that in 2009 the average local bus boarding length (outside London) ranged from 3.4 miles to 5.4 miles in different types of area.

London	2.3
Met built up areas	3.4
Other urban	4.0
Rural	5.4

Source: National Travel Survey

5.34 Another assumption needs to be made about the proportion of total journeys [E] that would have been made by eligible concessionaires in the absence of a scheme using each type of ticket.

5.35 From the data inputs above the following information can be derived:

- The implied revenue generated by each journey using a particular ticket type [D] – this is the price per ticket divided by the assumed number of journeys per ticket;
- The weighted revenue per ticket [F] – this is the implied revenue per journey multiplied by the percentage share of journeys made with this ticket type.

5.36 The average weighted fare per journey is the sum of the weighted revenues per ticket. In this example it is around 93 pence. Clearly it is lower than the average price of a single ticket.

5.37 In practice the best estimate of average fare in the basket of fares may be based on a combination of: (i) historical data (where available) about the types of ticket that those eligible for concessions previously bought; (ii) surveys of current concessionary travellers; and (iii) operator Electronic Ticket Machine (ETM) data about the type of tickets being purchased now by non-concessionary travellers. Some quality assurance of these last two data sources would significantly enhance the robustness of this calculation. Asking concessionaires what ticket they would have bought may not always give accurate data, and the travel patterns of non-concessionaires as indicated by ETM data may not reflect the likely patterns of concessionaires. However, such data may help inform judgements made in applying this methodology.

Comment [TL32]: The inference here is that Met areas have been split into urban and rural areas. Should this better read 'Met and other major urban areas'?

6. Estimating Demand

Introduction

6.1 The amount of revenue forgone that needs to be paid to operators is dependent on non-generated travel or the number of journeys that would have been made by current concessionary passengers in the absence of the concessionary travel scheme – it is not possible to observe this directly it and needs to be estimated.

Comment [PA33]: delete

6.2 The purpose of this section is to provide guidance on how the relative proportions of generated and non-generated journeys should be estimated. The proportion of non-generated demand drives the revenue reimbursement element of the calaculation, whereas it is the generated proportion that drives the additional cost element.

Comment [TL34]: Added clarity?

6.3 Throughout this section, and for the sake of simplicity, reference to 'free fares' or 'free scheme' should be taken as meaning free or concessionary fares, as the same principles apply. This is only relevant where the TCA chooses to use its powers under the 1985 Act to enhance the local scheme by adding travel at reduced (rather than free) fares at times, on services, or for groups outside the national scheme.

The Demand for Bus Travel

The Reimbursement Factor

6.4 The level of non-generated journeys is best expressed by the ***Reimbursement Factor (RF),*** the percentage of journeys that would have been made in the absence of a scheme (i.e. if commercial fares had been charged). The higher the reimbursement factor, the higher the number of journeys that would have been made in the absence of a scheme and the lower the number of journeys that are generated by the scheme.

Reimbursement Factor =

Estimated journeys made in the absence of the free scheme
Observed journeys made at free fare

6.5 As explained in Section 4, the Reimbursement Factor is applied to the observed number of journeys made at free fare to derive the estimated number of journeys made in the absence of a scheme. This, multiplied by the fare that would have been paid, gives the total revenue forgone for which operators need to be reimbursed:

Revenue forgone = Reimbursement Factor x Observed journeys at free fares x Average fare

Comment [PA35]: Average discounted fare

The Concept of Demand and Fare Elasticity

6.6 The number of journeys that people make depends on the prevailing fares and how they respond to changes in prices. The relationship between prices (fares) and the demand for a commodity (bus travel) is described by a ***demand curve*** and the responsiveness in demand for a good to a change in its price is the ***price elasticity of demand***. There is an inverse relationship between the fare elasticity of demand and the reimbursement factor – a higher fare elasticity (in absolute terms), with all other things being equal, gives a lower reimbursement factor and vice versa. Annex B provides some background on these concepts and the impact of fares on the demand for concessionary travel.

The Single Demand Curve Approach

6.7 The level of generated journeys is determined by the shape of the demand curve, the fare elasticity and other observed data on journeys made by concessionary travellers before and after the introduction of the free fare scheme. This is explained further in Annex B.

6.8 The purpose of the research commissioned by the Department has been to establish a robust relationship between the demand for bus travel by concessionary passholders and the fares that they would have paid based on best available evidence to date. A framework based on a Single Demand Curve, that represents the entire concessionary travel market covering all those who hold free bus passes has been produced. This enables the Reimbursement Factor corresponding to a given average fare in a local area or for a route or operator to be calculated accordingly.

6.9 While the analysis of available evidence showed some differences in the inherent characteristics of travellers by PTE and non-PTE areas, largely it did not support the view that individual responsiveness to changes in fares varied significantly by more detailed disaggregation of regions, income, age or other similar characteristics. Therefore, two single demand curves – one for PTE areas and one for non-PTE areas have been estimated.

6.10 The view taken in this guidance is that the two single demand curves are a reasonable representation of the change in trips due to concessionary fares in the defined areas, PTEs and non-PTEs. The change in the rate of passholding, itself a major influence on the change in trips, has been smaller in PTEs than in non-PTEs. The percentage of the eligible population with passes is now fairly similar in large urban areas and PTEs, but the recent growth in passholding has been higher in large urban areas, which suggests that the response to the change from half to free fares will be different. Therefore this guidance does not, as a generality, suggest that large urban areas should be treated the same way as PTEs. If the growth in passholding is closer to that seen in PTEs then TCAs might ~~could~~ choose a hybrid~~different~~ approach in order to meet the 'no better, no worse off' principle.

6.11 Annex C provides detailed explanations of this conceptual framework and the research evidence which underpins it.

Estimating the Reimbursement Factor using the Calculator

6.12 The Reimbursement Calculator provides users with a simple framework with which the reimbursement factor for a relevant route, operator or TCA can be calculated. The following steps are required to derive an appropriate reimbursement factor:

Comment [PA36]: We are aware that a number of TCAs have argued that their own socio-economic characteristics (car ownership, bus trips per head, concessionary trips per head) are a lot closer to the PTEs than to the 7 southern counties on which the non-PTE curve is based. Changes in pass-holding seem like much more a function of what was offered prior to free fares than an a factor affecting concessionary passengers demand curve. It therefore seems completely arbitrary to argue that large urban areas with very high bus usage have concessionary demand curves closer to the 7 southern counties on the basis of growth in pass-holders.

Comment [TL37]: Clearer?

Comment [TL38]: It is perhaps appropriate to add, perhaps in a footnote, an indication of the typical range of additional pass take-up in PTE and non-PTE areas so that TCAs can make a reasoned judgement. This would also, perhaps, be closer to the spirit of the ITS findings. Ideally, the full evidence basis on which this paragraph is based should also be added as an annex.

1 Users choose whether the relevant local area, route/set of routes, operator/set of operators is within a PTE or Non-PTE area.

2 Users then select the year for which the reimbursement rate is being calculated.

3 The average fare (separately calculated, see Section 5) that would have been paid by concessionary passengers in the absence of the free fare scheme is the main input required for the calculation of the reimbursement factor.

4 The reimbursement factor is generated automatically once these inputs are chosen.

Adjusting the Reimbursement Factor for underlying trends

Comment [TL39]: IT has been strongly argued by TCAs (see our initial joint response with the LGA), that there is no firm conceptual rationale or empirical evidence for the methodology being put forward here.
However, if DfT is minded to continue with the general approach set out here,, it might be better it were drafted in a way that made clear that adjustments:
* were merely advisory with the judgement being left with TCAs as to the applicability of the adjustment in principle, and
* could operate in either direction in principle;

The proposed wording changes below reflect these principles.

6.13 The Single Demand Curves derived from ITS research include underlying trends but these changes are averages, not specific to particular areas. The guidance therefore suggests that allowance can be made for specific changes in local demand that are not due to fare changes should these be significantly different from the average.

6.14 The Reimbursement Calculator provides a tool that can be used to adjust the reimbursement factor in cases where trends in concessionary fares after 2005/06 are significantly different from that assumed in the Single Demand Curves.

6.15 The calculations to derive a single demand curve for PTEs include a negative trend of 1.7 per cent per annum over the period 2005/06 and 2008/09, corresponding to a 5 per cent reduction over the whole period. In non-PTE areas a positive trend of 0.4 per cent per annum over the period 2005/06 and 2007/08 is included, corresponding to a 0.8 per cent increase over the whole period. Those figures are summarised in the table below:

	Period	**Per annum**	**Over period**
PTEs	2005/06 to **2008/09**	-1.7	-5.0
Non PTEs	2005/06 to **2007/08**	0.4	0.8

6.16 If a ~~operators and~~ TCA~~s~~ considers, in consultation with operators,~~think~~ that underlying trends in concessionary trips in its~~heir~~ area are significantly different from the figures quoted above then it~~hey~~ may wish to apply~~estimate~~ an underlying trend adjustment using the changes in adult full fare trips since 2005/06 but adjusted for changes in real fares. In other words the changes in adult full fare trips, adjusted for changes in real fares, are used as a proxy for the underlying trend in concessionary trips. The following paragraphs indicate a methodology that could be applied in such circumstances.

6.17 The data relevant to~~required for~~ this calculation are:

1 adult full fare trips made on all tickets types in 2005/06 and the most recent year for which data is available – assumed to be 2009/10

2 the average adult fare in 2005/06 and the average adult fare for 20009/10.

6.18 For ease of calculation the fares and trips are expressed as an index 2005/06=100.

6.19 The level of adult full fare trips in the reimbursement year should be~~are~~ adjusted to take account of two factors – the change in real fares between 2005/06 and 2009/10 and the underlying trend already included in the calculation of the single demand curve.

6.20 The change in real fares is calculated from the average adult fare in 2005/06 and the fare in 2009/10 and deflated by the CPI. The change in real fares could~~is~~ then be used to adjust the change in trips using a fare elasticity of -0.45 in PTEs and -0.5 in non PTEs, but also taking into longer run impacts from before 2005/06 where appropriate. If real fares have gone up then adjusted full fare adult trips will increase more or decrease less between 2005/06 and 2009/10 than unadjusted full fare adult trips.

6.21 The trips in the reimbursement year should also be adjusted for the underlying trends already included in estimation of single demand curve – typically in PTEs 5 per cent upwards and 0.8 per cent downwards in non-PTEs.

6.22 In compiling the data for adult full fare trips care should be taken to ensure that they are for comparable services and places and are not distorted by changes in responsibility for operating services. The data should be capable of being audited. Ideally the data on trips should apply to the period of eligibility of concessionary travel, for example after 9.30am weekdays and all day at weekends, but this is not essential and all period full fare trips are acceptable.

Comment [PA40]: delete

6.23 Trips and fares data for the purpose of calculating the underlying trends should preferably be compiled at the operator level within a TCA, but if so there will be a need to ensure that any market share adjustments are also taken into account.

6.24 In most cases, and averaged across an operator, it is not anticipated that the underlying trends will exceed +/- 5 percentage points difference compared with the underlying trends[3] already included in the Single Demand Curve. If the underlying trends are significantly different from~~greater than~~ a 5 percentage points difference, then this should be justified by reference to relevant changes in variables such as frequency and service quality and the effect these changes have had on trips.

6.25 Further explanations on the principles of making an adjustment for underlying trends can be found at Annex C. A worked example of how the calculations are done in the Calculator can be found at Annex D.

Non-zero fare concessionary schemes

6.26 The reimbursement factors produced by the Single Demand Curve can be used for a non zero fare as well as free concessionary scheme.

Comment [TL41]: Added clarity?

6.27 For example, reimbursement for a half fare scheme would start from the number of concessionary journeys at half of the current adult fare in the Single Demand Curve, say 50, and the number of concessionary journeys that would be made at the full adult fare, say 30. The ratio of these two values, 0.6, would be the reimbursement factor to apply the number of concessionary journeys observed at half fare. The average fare would be the average fare that would have been paid in the absence of the concession minus the concessionary fare actually paid (half fare). The operator also receives the revenues from the half fare. This approach assumes that journeys made under the non-zero fare concession are separately counted from the journeys made under the zero fare concession.

[3] So in most cases the underlying trend will not be above 0% in PTEs and 5.8% in non-PTEs.

7. Estimating Additional Costs

Introduction

7.1 In order to meet the principle of "no better, no worse off" bus operators should be reimbursed for the additional costs incurred as a result of the concessionary travel scheme. This section provides guidance on the procedure for calculating the amount of additional costs. It outlines a recommended approach, describes the unit values to be applied and when and where to apply those values. Annex C goes into more detail about the research and thinking behind the recommended approach.

7.2 This guidance is based in part on findings of detailed research about how different cost elements relate to demand for bus services and an approach that can be practically implemented by TCAs and operators with varying amounts of relevant data about the bus operations in their area. The default approach in this guidance does not require the building of complex models, but rather applies unit costs and relationships established from available empirical evidence to produce a rate of additional cost per passenger that is likely to be ~~broadly~~ appropriate~~right~~ for the particular circumstances of a TCA and operator.

Comment [TL42]: Improved clarity, 'broadly right' perhaps not a helpful concept.

7.3 This guidance does not rule out the use of alternative approaches such as detailed network modelling or data analysis to estimate the effect on costs of passenger demand with and without journeys generated by the concessionary travel scheme. The application of an alternative approach depends on circumstances and in particular the availability of robust data to populate models. It is desirable that such models should have a mechanism that includes the implications for the operator's net revenues of changes in demand and frequency. If it is the opinion of the TCA or the operator that more reliable results could be obtained from an alternative approach then it may use that approach. Operators may also wish to suggest alternative approaches that the TCA could adopt, though the final choice of a locally appropriate methodology rests with the TCA.

Comment [PA43]: ", analysis of passenger survey data"

7.4 Details of the research basis can be found in Concessionary Fares Project Report 9: Costs. Annex C to this guidance describes the main findings of this research and other relevant evidence, and how that has been applied to the guidance.

7.5 The research has investigated differences in cost relationships between areas and, apart from a difference between PTE and non PTE areas, finds differences to be relatively small. However we recognise that this will not always be the case so local data and local relationships can be used where these are demonstrably more appropriate. We also recognise that a different approach may be needed in a small number of places where the frequency of services and route density is significantly untypical, or the size of operators is small. Particular criteria are described below.

Types of Additional Costs

7.6 For the purpose of this guidance additional costs fall into four categories plus a set of other generic issues:

- Scheme administration costs;
- Marginal operating costs;
- Marginal capacity costs;
- Peak vehicle requirements;
- Other issues.

Scheme Administration Costs

7.7 Costs associated with the production of concessionary passes will be borne by the TCA. There are, however, likely to be other administration costs such as publicity, ticketing, software changes and management time which will be incurred by the operator, for which reimbursement should be made. Management time and other costs to do with special requests for information are also included in this heading. It is reasonable to set against such costs the savings associated with bulk purchase of travel, such as a reduced need for fares information and promotion.

7.8 Regular information supplied by the operator to the TCA as part of the scheme, for example number of journeys, and costs to do with information about services, are covered as part of the marginal operating costs.

7.9 The relevant amounts are a matter for negotiation between the TCA and the operator.

Marginal Operating Costs

Definition

7.10 Marginal operating costs are the costs to a bus operator of carrying an additional passenger assuming a fixed level of service. The components of these costs comprise fuel, tyres and oil, maintenance and cleaning, insurance, information and additional time costs. These costs exclude operators' administration/management time.

7.11 Marginal operating costs are applicable to all eligible services and all eligible operators without the need for further information.

Recommended Value

7.12 The recommended value is **7.2p per generated journey** (at 2009/10 prices).

Variation by Journey Length

7.13 The marginal operating cost per additional concessionary passenger of 7.2p ~~-~~is based on an average journey length of 4.1 miles. If TCAs and operators have good evidence that the journey length in their area is different from the average default value, then they may use a local journey length value instead and apply the following formula to calculate a marginal operating cost:

Marginal operating cost = 4.2 + 3 x [AverageJourneyLength (in miles) / 4.1]

All in pence 2009/10 prices

7.14 ~~-~~Evidence may come from surveys of passengers, observation of boardings and alightings or interpretation of ticket sales data. For the purposes of this guidance, evidence on the stage length of all concessionary journeys is sufficient (the distinction between the average stage length of generated and non-generated concessionary journeys is not essential).

Elements of Marginal Operating Costs

7.15 If there are local circumstances where one or more elements of the marginal operating costs is significantly higher or lower than the standard approach then the TCA ~~and the operator~~ may apply~~negotiate~~ a different rate, based on evidence supplied by the operator in question. The

Comment [TL44]: It is suggested that, in the end, it is the TCA's decision to determine fair reimbursement and this need not be successfully negotiated, although a negotiated outcome is always to be preferred. However if the evidence points to the validity of a different rate, then that is sufficient justification.

research findings on the bottom up approach to estimating marginal operating costs have the following components:

Item	**Marginal cost per generated concessionary passenger** **(pence, 2009/10 prices)**	**Percentage of total**
Fuel, tyres & oil *Of which fuel*	1.6 *1.5*	23.9
Maintenance & cleaning	1.2	17.9
Insurance	2.7	40.3
Information	0.5	7.5
Additional time costs	0.7	10.4
Total	**6.7***	**100**

* Note: ITS have identified a bottom up component approach to marginal costs. The total of these identified components comes to 6.7 pence. This is different from the recommended composite marginal operating costs of 7.2 pence. However in making any adjustment local variations to marginal operating costs they should be justified by reference to the components. If a change to any of the components is agreed then this change is scaled by the difference between 7.2 and 6.7. Thus if the agreed change in an increase of 0.5p in one of the components the recommended value is increased by 7.2*0.5/6.7 = 0.54 or to 7.74.

7.16 The component values cited in the above table are deemed to be robust and should be applicable in most cases. However, If TCAs or operators have good evidence that the level of one or more of these components is significantly different in their area from that described above, then a revised level of marginal operating cost can be applied.

7.17 The evidence to support a change should as far as possible be auditable and clarify the way in which the calculation is different from the default value. For example in the case of fuel costs a variation on the default values should state assumptions about passengers per tonne of additional weight, fuel economy and effect of additional weight on fuel economy. The insurance cost rate quoted above includes an allowance for the higher level of claims by concessionary passengers. Auditable evidence on claims paid or insurance costs per concessionary passenger might support a different value, and operators may be required to provide appropriate information to inform the TCA’s judgement as to the appropriate rate to apply.

Comment [TL45]: An additional paragraph indicating how the recently announced reductions in BSOG may affect this guidance. It is realised that it is impossible to be definitive, but a rider to the table that says that 'the fuel element quoted is based on the arrangements for BSOG that were in place at the date of publication of this guidance' might help in giving an early warning of possible changes ahead.

7.18 In cases where a different value is agreed by the TCA and operator then the overall marginal operating unit cost (7.2p) should be adjusted by a proportion using the relationship below:

Adjusted Marginal Operating Cost = 7.2 x [**Agreed** item unit cost minus **Default** item unit cost] / 6.7

Marginal Capacity Costs

Definition

7.19 These are the costs to a bus operator of carrying additional passengers and allowing the capacity of bus services to increase, by using the existing bus fleet more intensively to provide that additional capacity through increased frequency.

7.20 Marginal capacity costs should be net of the additional revenue generated from commercial journeys that arise from increased frequency. These costs are additional to the marginal operating costs.

7.21 Additional marginal capacity costs arise from increased frequency. Issues relating to increased seating capacity (larger buses) are covered later on in the guidance in the ‘Other issues’ section.

When to Apply Marginal Capacity Costs

7.22 As a general principle it is up to the operator to initiate a claim for marginal capacity costs. It is suggested that claims for marginal capacity costs, as well as PVR costs, are best treated on a route-specific basis.

7.23 As a general rule, but subject to local evidence, we would not expect claims for marginal capacity costs to be submitted if average load factors are less~~excess capacity (1 -~~ (i.e average load[4] as a proportion of average seating capacity) ~~is higher~~ than one~~two~~ third~~s~~. Operators that run buses with significant excess capacity on average are assumed to have minimised their costs as far as they can and, given that revenue will be no different with and without a scheme, there will be no reason to change capacity.

Comment [TL46]: The proposed wording has already caused some confusion. The suggestion is intended to simplify the definition and thereby improve clarity. In our position paper on average fares we argue that there is little justification to set this arbitrary threshold, which we do not see as consistent with the NBNW principle.

7.24 The evidence that should be brought forward by operators to support an additional marginal capacity cost claim is as follows:

4 Load factor is the two-way average over the period where the concession is available.

- Concessionary journeys as a proportion of total journeys on each relevant service in latest relevant year. Data should be by hour or by half hour covering peak times of travel for a typical weekday and Saturdays. Operators need to demonstrate typicality by providing relevant contextual data, e.g. showing how the period selected for analysis compares with the annual average.
- Average loads by hour or half hour covering peak times of travel for a typical weekday on each relevant service in each direction in latest relevant year.
- Seating capacity for each relevant service in each direction by hour or by half hour covering peak times of travel for a typical weekday
- Frequency of service by hour or half hour on each of the relevant bus services in each direction.

7.25 Operators should provide a commentary based on this data (but not excluding other data that they think is relevant) that demonstrate that it is in the operator's financial interest to provide extra services where there are generated journeys due to the concessionary travel scheme compared with the counter factual of no concessionary travel scheme.

Cost Model

7.26 When additional marginal capacity costs apply, the cost model in the Reimbursement Calculator can be used to derive an estimate in pence per journey. For avoidance of doubt, reimbursement for additional capacity costs should only apply to the subset of operations for which the operator has provided data that suggests that capacity will be lower without the concessionary fares scheme.

7.27 The inputs into the DfT model include unit costs based on an analysis of mileage and hours related bus costs (the derivation of these values described in detail in Annex C). It also relies on data about speed and informed assumptions about the relationship between frequencies, journey lengths and occupancy that are thought to be representative of different types of areas. The inputs are a mixture of local, area specific or national data and informed assumptions. The table below summarises the various inputs to the model. Annex D includes a worked example.

Variable	**Default value**	**Alternative approach**
Mohring factor	0.6	Local evidence
Speed	Area average	Local evidence

Comment [TL47]: Important to distinguish here between older/disabled persons persons on the mandatory scheme, the locally enhanced scheme and, where appropriate, child concessionary passengers. This will assist TCAs in distinguishing the full costs of the mandatory concession and of the their local policy choices. Whilst such a distinction is not directly relevant to the issue of compensation is it highly relevant to the issue of value for money. Suggested therefore that a footnote of the form: 'it may be helpful for the TCA to distinguish between mandatory and discretionary passengers in this analysis, and operators should not unreasonably withhold information if disaggregated data is available.' would be helpful. This suggestion is broadly comparable with the approach suggested in para 7.50 for PVR costs.

Comment [TL48]: It is suggested that both the total patronage and concessionary patronage peak periods of travel are relevant in this analysis.

Comment [TL49]: Is there any particular reason for excluding Sundays from this assessment?

Comment [PA50]: In our additional capacity costs position paper we have questioned the consistency between the methodology set out in the previous section and a prescriptive Mohring factor. In our view, this part of the table merits some detailed explanation.

Route length	6 miles PTE 7 miles non PTE	Local evidence
Frequency	Local bus vehicle miles, average route length	Use local evidence on average route length
Occupancy	Derived from local vehicle miles, local passenger journeys and default journey length	Use local evidence on journey length
Commercial adult journeys as % of total	60 per cent in statutory concession period	Local evidence
Unit Cost Vehicle hours Vehicle miles	 £13.30 £0.601	
Average commercial adult fare	Local evidence	Local evidence
Demand response to service change	0.66	

Vehicle miles & demand (Mohring factor)

7.28 This relationship is required to estimate the extent to which operators will change the frequency or network density of their services in response to changes in demand. It is a standard assumption that vehicle miles increase less than proportionately to demand.

7.29 For the purposes of this guidance we suggest using a Mohring factor of **0.6**, i.e. vehicle miles change by 0.6 per cent for every 1 per cent change in total demand. If operators or~~and~~ TCAs have good evidence from models using local data that the Mohring factor in their area is significantly different from 0.6 then a locally specific Mohring factor may be used.

Speed

7.30 The model provides data on average bus speeds by broad area type from CUBS (Comparison of Bus Systems)[5] that can be used as a default by TCAs in their area. If operators or~~and~~ TCAs have good evidence that average bus speed in their local area is different then a local average speed can be used.

[5] http://cubs.reseaulutions.com/

Comment [PA51]: Given the methodology set out in the previous section, we would argue that a more appropriate phrasing would be “in the absence of local evidence, it is suggested that a default Mohring factor of… be used”. However, we would again point to our own analysis which suggests that a default value of 0.6 (for which we argue there is no conceptual rationale in a profit maximising NBNW context) is a big over-estimate.

Comment [TL52]: Seems entirely reasonable that either party should be able to challenge the factor based on (appropriately substantiated) evidence. It is not necessary for 'A and B' to 'have' that evidence. This is consistent with the proposed wording in para 7.32. However, our suggested wording above would be preferred and ensure consistency throughout this document.

Comment [TL53]: Ditto above

Frequency, occupancy, ~~-~~and route length

7.31 The default average bus route length is **6** miles in PTE areas and **7** miles in non-PTE areas.

7.32 If operators or TCAs have good evidence that these averages in their local area are different then local averages may be used.

7.33 Data on occupancy (defined as bus passenger miles divided by bus vehicle miles) can be derived from data on vehicle miles, passenger journeys and journey lengths. Average occupancy can be calculated from local data on total passenger journeys multiplied by the appropriate journey length and divided by local data on bus vehicle miles.

7.34 If there is good local data on total bus vehicle miles then the average frequency can be derived by dividing total bus vehicle miles per hour by twice the average route length derived from area type or local data.

Unit costs

7.35 The recommended cost rates are **£0.61** per vehicle mile and **£13.30** per vehicle hour. These rates are applied to the calculated increase in vehicle miles and vehicle hours required to carry one additional passenger. In the Department's view, t~~T~~hese values are applicable to most situations and most areas of the country. Annex C describes the derivation of these values in more detail. However, if it appears to the TCA, in consultation with the local operator, that different unit costs are more appropriate in meeting the 'no better off, no worse off' principle, then local rates may be applied.

Commercial adult ~~-~~journeys as percentage of total journeys

7.36 The percentage of commercial adult journeys is used to derive average one way commercial adult boardings (by reference to the relevant average occupancy, average route length, and frequency – see worked example in Annex C). The number of adult boardings is required to estimate the additional commercial revenue generated from the increased frequency.

7.37 The figure should relate to the period during which the frequency effects take place. This is the same period over which the marginal capacity costs apply.

7.38 In England outside London, total commercial adult bus journeys as a proportion of total journeys is around **66** per cent with little variation by

Comment [TL54]: Agreed - see comments above

Comment [TL55]: In line with the general approach adopted throughout this guidance, the guidance is presenting a recommended (I would suggest the use of the word 'default' is better than 'recommended' in this case) approach, This sentence seeks to maintain that approach.

Comment [AL56]: We believe that the calculation of net revenue effects should include the impact of service changes on the sum of commercial (non-concessionary) passengers and non-generated concessionary passengers. The latter represent the journeys that would be made in the counter-factual, and would be just as affected by service changes as non-concessionary passengers. The NBNW principle implies that operators will be compensated for non-generated concessionary passengers at commercial levels and will therefore receive additional revenue from TCAs if the number of concessionary passengers increases.

Comment [PA57]: It would be useful to emphasise that this refers to all journeys including children, for avoidance of doubt.

broad area type (Source: DfT PSV survey). The proportion of adult journeys in the time period when the concession applies will be less, but this is not directly available from published data.

7.39 A plausible estimate after 9.30 am is around 60 per cent. If operators or~~and~~ TCAs have good evidence that commercial adult journeys as a percentage of total journeys in the period when the concession is available is significantly different in their local area then that data can be used.

Comment [TL58]: Ditto above

Average commercial adult fare

7.40 The average fare to be used in the calculation of the offsetting revenue gain due to increased frequency of services should be the local average commercial adult fare per journey, taking account of the different ticket types available, their prices and the number of journeys made using the ticket.

7.41 There is value in maintaining comparability of methodologies in the estimation of this variable with that used for average fare forgone calculation in Section 3, but if that is not possible then a~~A~~n example is shown below with illustrative figures:

Type of ticket	Price (£)	Average Journeys per sale	Sales	Total Journeys (Sales * journeys per sale)	Revenue (Sales * price)
Single	1.50	1	500	500	750
Return	3	2	100	200	300
Daily	4	3	50	150	200
Weekly	20	18	30	540	600
Monthly	60	80	10	800	600
Totals				**2,190**	**2,450**
Average commercial revenue per journey = Total revenue / total journeys = **£1.12**					

7.42 The first three columns are local data inputs (where available). The last two columns are calculated. The average weighted adult fare is total revenue divided by total journeys.

Demand response to service change

7.43 Evidence suggests that demands responds to increased frequency of bus services. For the purposes of this guidance we recommend that a long run service elasticity of 0.66 should be used in all cases i.e. that for a 1 per cent increase in frequency a 0.66 per cent increase in demand will occur in the long term. Annex C discusses this in more detail.

Net revenue effect

7.44 The net additional revenue per journey should be deducted from the gross marginal capacity costs to give net marginal capacity costs. In some cases the net additional revenue per journey from commercial passengers may outweigh the gross marginal capacity cost from the generated concessionary ~~-~~passengers. In such cases the net costs are set to zero.

7.45 The calculation of the net revenue effect with the interaction of the demand response to service change, average fare and other factors is illustrated at Annex D.

7.46 The net marginal capacity costs are additional to the marginal operating costs.

Peak Vehicle Requirements (PVR)

Definition

7.47 These are the costs associated with the requirement to run additional vehicles in the peak period due to generated concessionary travel. Generated concessionary travel may add (or conceivably reduce) demand in the peak period of travel, change the peak period or not affect the peak period of travel. The latter is likely to apply in the majority of cases and in such circumstances no additional peak vehicle is required, and no peak vehicle costs are calculated.

Comment [TL59]: This is not likely to be a material influence but it is possible, particularly in places where a 0900 start to the 'off peak' period has been selected, where 0800- 0900 peak demand may be lower as a result of the concession offered. The possibility of abstraction from peak demand should not, in our view, be ruled out by the guidance.

When PVR Costs Apply

7.48 If the operator wishes to claim additional peak vehicle requirements then the operator must supply data and analysis to substantiate~~support~~ such a claim. The expectation is that additional peak vehicle requirements will be exceptional so that operators will have to demonstrate that exceptional or unusual circumstances are relevant.

Comment [TL60]: It is suggested that something rather stronger than 'support' should be expected in these relatively rare circumstances

Evidence to be Provided

7.49 Operators wishing to make a claim for additional peak vehicle costs should expect to~~will~~ have to supply detailed data on passenger boardings by route by annual (or neutral period) average weekday half hour (or if not possible hourly) intervals for all services (individually) covered by the claim. As a minimum the time periods covered should be 0700 to1900 weekdays. If the existing peak of boardings (including concessionary travel) per hour or half hour, or the peak hour or half hour without generated concessionary travel is at the weekend, data should be supplied for the weekend hours as well.

Comment [TL61]: Perhaps a little too strong. At the end of the day it is for the TCA to judge the extent of the data and the approriateness of the analysis provided.

7.50 Data on passenger boardings should be broken down into concessionary journeys under the statutory scheme, other concessionary journeys and other journeys. In addition the concessionary journeys under the statutory scheme should be split between journeys made because of the statutory concessionary travel scheme and those that would have been made at the relevant average adult fare in the absence of the concession. This split should use the generation factor derived in the revenue reimbursement part of the calculation and assume that the rate of generation is the same in all time periods.

7.51 This methodology does not imply that every peak demand is met in full by putting on extra buses. Operators should state and substantiate ~~demonstrate~~ the criteria they use to decide whether to put on extra services to meet peaks in commercial journeys or allow load factors to be above 100 per cent for short periods.

Comment [TL62]: Suggested wording adds appropriate strengthening, in line with comments on earlier para

7.52 The formula to use for working out the peak vehicle requirement (PVR) is derived from the peak vehicle requirement parameter of **£16,745** – this is the national average cost per vehicle per annum that has to be added to the fleet to cater for additional concessionary journeys (Annex C provides further information on how this value was derived). This is a per year figure so equates to £64.40 per PVR per weekday or £1.61 per PVR seat per weekday assuming 260 weekdays per year and a mean of 40 seats per vehicle. If the new peak lasts one hour and that each additional peak passenger blocks one seat for one route length, the PVR cost per **additional peak period passenger** can be estimated using the overall route time and speed. The calculation would be £1.61 * one way route time (expressed in hours, and based on local circumstances or defaults) = £[…] per additional journey in the peak hour (or period). In local situations where different assumptions are appropriate (for instance, the average capacity and costs at the margin may different because of general use of double-deck vehicles on the route in question) then the TCA may, in consultation with the operator, apply different unit costs where these are more appropriate in meeting the 'no better off, no worse off' principle.

Comment [TL63]: In line with the general approach adopted throughout this guidance. Note; This broadly replicates the wording suggested in para 7.35.

7.53 In cases where the peak period with and without additional concessionary journeys is the same time period, then the calculated unit cost per additional journey can be applied directly to the additional concessionary journeys in that peak period only to calculate a total peak vehicle requirement cost.

7.54 In cases where the peak period with generated concessionary journeys is different from the peak period without generated concessionary journeys, for example, where the pm peak is higher than the am peak, the calculation is slightly different. The unit cost may be different between the two periods if the one way route times are different, but otherwise would be the same. The additional concessionary journeys over which the unit cost is applied are the difference between journeys in the “with generated journeys” peak period minus journeys in the “without generated journeys” peak period.

7.55 In these calculations the period referred to may be an hour or half hour, but should be the same length of time, i.e. hour or half hour when comparing journeys in the peak period.

7.56 The peak vehicle requirement costs should be added to other elements of the additional cost calculation.

Profit

7.57 An important element of the reimbursement for additional costs is the allowance for operator profit. This guidance is informed by the relevant European regulations and case law. Regulation (EC) No 1370/2007 defines ‘reasonable profit’ as ‘a rate of return on capital that is normal for the sector in a given Member State and that takes account of the risk, or absence of risk, incurred by the public service operator by virtue of public authority intervention’.

7.58 Reasonable profit relates therefore to the **expected rate of return on capital invested** and not a constant profit margin on all costs. This guidance takes the position that there is no need to make any further adjustment to the marginal operating costs and marginal capacity costs. In cases where an increase in the peak vehicle requirement is identified this guidance recommends that the reimbursement should include an allowance for profit.

7.59 In the light of evidence from a recent research report (Review of Bus Profitability, DfT - see Annex C) this guidance recommends that where peak vehicle requirement is increased as a result of the additional concessionary journeys then a return on capital of 10 per cent is used and added to the PVR costs. This is done by obtaining the value of an appropriate vehicle type and multiplying by **10 per cent**. This cost is then to be added to the cost rate derived from the methology set out in paragraph~~£16,745 (See~~ 7.52~~)~~ above to calculate the total peak vehicle cost per additional passenger. Operators should derive the average value of a vehicle from their accounts, and this should be the average written down value and not the new value. Therefore the total peak vehicle requirement parameter cost should be

Total PVR cost = £16,745 + [Average written down value x 10%]

Other Issues

Seating Capacity

7.60 The unit costs and inputs in this guidance refer to an average seating capacity. It is recognised that a possible response to the increase in demand from generated concessionary travel would be to increase seating capacity rather than increase frequency of service. Where this is likely to be the case operators can submit, or may be required to provide, information on the extra costs arising from the use of larger buses, but these costs should not exceed the net costs of increasing frequency (including revenue effects) of using existing buses.

Different Types of Areas and Operators

7.61 The ITS research produced indicative cost rates for services in PTE and urban non-PTE areas. ITS also considered services in rural areas, and the relevant inputs that could be used. ITS noted that the calculations were problematic because they were based on frequency and route density effects normally found in urban areas. Also load factors on some services in rural areas may not warrant the application of marginal capacity costs. On the other hand some, perhaps many, services in rural areas serve urban areas and to some extent may have the same characteristics as services in urban non-PTE areas. There is no hard and fast rule as to what constitutes a rural service, but we suggest that where more than half of boardings are in rural areas that service might come within the definition of rural. In the case of rural services so defined, this guidance suggests that the additional costs should be calculated according to the guidance above, but that TCAs and operators should bear in mind that in order to meet no better no worse off principles there is scope for variation in approach according to local circumstances, such as frequency of existing service and load factors.

7.62 The approach adopted in this guidance is appropriate for larger operators. In some cases smaller operators may find that the approach does not match their circumstances, for example ability to manage frequency changes within existing bus fleets. Operators with large fleets may find this easier as the variation in daily and hourly demand profiles for different services can be supplied from a common vehicle pool. Operators with small fleets (20 or less) may be less able to match supply with variations in demand from a common vehicle pool. In these cases this guidance suggests that small operators, in conjunction with the relevant TCA, should seek to agree which aspects of the approach described in this guidance can be used and where different approaches are required. Different approaches should be evidence based and demonstrate that they are consistent with the 'no better, no worse off' principle. The evidence required to support a claim for a peak vehicle requirement would remain the same as described above.

Modelling Approach

7.63 The approach to calculating additional costs described in this guidance attempts to bring together elements of local data with standard assumptions based on broad research findings. The intention of this approach is to minimise the need to collect new data while as far as possible reflecting the variation in local circumstances that affect costs.

7.64 However, there are alternative approaches based on financial modelling of actual or hypothetical bus networks that can work through the effects of an exogenous change in journeys on bus services at different times and incorporate subsequent rounds of effects on journeys, services, revenue and costs. Such models can require large amounts of data and analysis to establish robust relationships.

Comment [PA64]: We feel that our work on additional capacity costs based on crowding levels inferred from passenger surveys should be mentioned here, if nothing else, for the benefit of other TCAs.

7.65 This guidance does not suggest that TCAs or operators build these models from scratch, but if they are already available or existing models can be adapted for purpose, then TCAs may consider it appropriate to use them. The models may for instance be used to inform estimates of the Mohring factor that is relevant to a specific area. Models may also pick up the effect of operators running a flat profile of bus frequency and capacity across the day. This may be because of cost factors or marketing reasons. It does imply some spare capacity in the off-peak that could accommodate an increase in patronage due to a concessionary travel scheme without incurring marginal capacity costs.

Updating Figures

7.66 The marginal operating, marginal capacity and peak vehicle requirement unit cost figures quoted in the guidance are in **2009/10 prices**. To update to the prices of future years for the purpose of calculating reimbursement in those years this guidance recommends that the actual or forecast GDP Deflator index should be used. Latest values of the GDP deflator can be found on the HM Treasury website.

7.67 Other inputs to the calculation such as journey lengths should be left unchanged unless there is good evidence to change them.

ANNEX A: Glossary of Terms

Bus Journey

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.

Revenue Forgone

The revenue operators would have received from those concessionary passengers who would otherwise have travelled and paid for a (full fare or discounted) ticket in the absence of a scheme. It is the product of the number of journeys made in the absence of a scheme and the average fare forgone.

Additional Costs

The costs imposed on an operator by the existence of the concession that would not otherwise have been incurred. Additional costs can take the form of scheme administration costs, marginal operating costs, marginal capacity costs and peak vehicle requirement costs.

Reimbursement Factor

The number of journeys estimated to be made at 'average fare forgone' as a proportion of total journeys that are observed to be made at zero fare. The reimbursement factor is applied to the number of observed journeys at zero fare to estimate the number of journeys that would have been made in the absence of the scheme (non-generated journeys) and to determine the amount of revenue forgone. The reimbursement factor is closely related to the generation factor (mathematically RF = 1 / (1+GF)) and hence the fare elasticity. The higher the fare, the lower the reimbursement factor.

Comment [AL65]: Replace with "both are related to"

Non-Generated Journeys

Non-generated journeys are those journeys that are estimated to be made by concessionary bus passholders in the absence of the free fare scheme, if they had to pay 'the average fare forgone'.

Generated Journeys

Generated journeys are those journeys that are made by concessionary bus passholders as a result of a reduction in fares – these are in addition to the non-generated journeys that would have happened anyway.

Generation Factor

The generation factor (GF) is a measure of the increase in journeys, relative to the previous level of journeys, as a result of a reduction in fares. For example, a generation factor of 50 per cent at half fare means that journeys have increased by 50 per cent (as a proportion of the original number of journeys) as a result of moving from full fare to half fare. Thus the definition of generation depends on the starting point. In this guidance, other than where stated, generation is based on patronage that would have occurred with 'average fare forgone' being charged.

Comment [AL66]: This sentence is misleading and unnecessary. Moreover, it would be advisable to acknowledge that different definitions of the generation factor are in use, and hence clarity is required as to what is used in the Guidance.

Average Fare Forgone

This is the average fare that bus operators would have received from concessionary passengers in the absence of the free fare concessionary scheme.

Discount Factor

The average fare forgone will be a weighted average of the single, daily, weekly and other period tickets that concessionary passengers would have bought in the absence of the scheme. This is generally expected to be lower than a single cash fare. So a discount factor is applied to the cash fare to obtain an estimate of the average fare forgone.

Demand Curve

The demand curve is the relationship between the price of a particular good and the quantity that is demanded by consumers at that price. As a general rule, the demand curve slopes downward from left to right. So the higher the price, the lower will be the quantity demanded, holding all other factors constant. This general rule is expected to hold for the concessionary market where the higher the fare, the lower will be the number of journeys made, holding all other factors constant.

Fare Elasticity

The fare elasticity in economics refers to the slope of the demand curve or alternatively the proportionate change in quantity demanded of a particular good with a proportionate change in its price. In the context of the demand curve for the concessionary market, an increase in fares is expected to produce a less than proportionate reduction in demand. Depending on the functional form of the demand curve, the elasticity at different points on the demand curve can vary proportionately with fares, or less than proportionately with fares.

Damping Factor

For the concessionary market, it is expected that the fare elasticity will increase less than proportionally with higher fares. The damping factor λ can be between 0 and 1. As λ approaches zero (the higher the damping), the point elasticity is both closer to zero and is less sensitive to the fare.

Marginal Cost

In economics, the marginal cost is the change in total cost when the quantity produced changes by one incremental unit. In the context of reimbursement, the marginal cost is the increment in total cost that arises from one extra generated concessionary passenger journey.

Marginal Operating Cost

The marginal operating costs associated with an incremental passenger are the costs to an operator of additional (generated) concessionary journeys without any change in service capacity. These costs include wear and tear, insurance and fuel costs associated with the extra journeys.

Marginal Capacity Cost

If trip generation from concessionary passengers at free fare results in operators having to increase their service frequencies by using their existing fleet of vehicles, they will incur some additional costs beyond the marginal operating costs. These costs will include the additional fuel costs, bus driver costs etc of running the extra services.

Comment [AL67]: "…more intensively…"

Peak Vehicle Requirement Costs (PVR)

If trip generation from concessionary passengers at free fare during peak hours results in operators having to extend their bus fleet, the additional costs that are incurred, i.e. the costs of purchasing the new vehicle, additional bus driver costs etc, are referred to as the PVR costs.

Mohring Factor

The Mohring factor is an estimate of the responsiveness of service frequency or network density of their services in response to changes in demand. It is expected that vehicle miles change in less than proportion to demand.

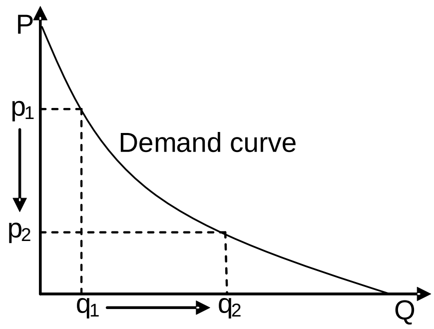
ANNEX B: Economic Principles

Introduction

B.1 This Annex provides some theoretical background on some of the economic principles which underpin concessionary travel reimbursement. Further information can be found in ITS Research Paper Economic Principles Underlying Reimbursement.

The Relationship between Price and Demand

B.2 The amount of any good or service that people buy depends, among other things, on its price. The relationship between the price of a particular good and the quantity that is demanded at any such price level is described by the demand curve. An illustrative example is shown below:



B.3 In the figure above, the x-axis is the quantity of the particular good demanded and the y- axis is the price of that particular good. Generally the demand curve is expected to slope downwards from left to right indicating that the higher the price the lower the quantity demanded will be. As illustrated, a reduction in price from p1 to p2 leads to an increase in the quantity demanded from q1 to q2.

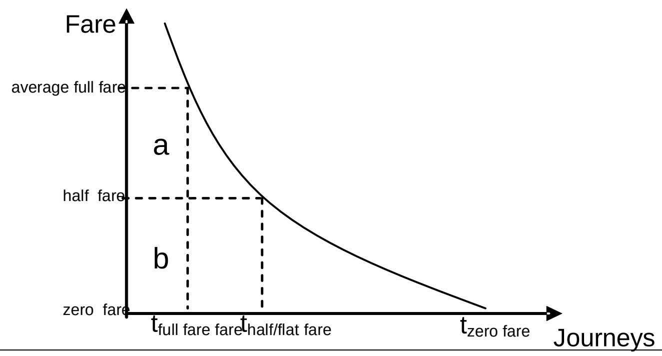
B.4 Another important aspect of the demand curve is its slope. The steeper the demand curve, the less responsive people's demand will be to a change in price. The slope of the demand curve at any particular point is referred to as the point elasticity of demand. This elasticity is usually negative as the demand curve slopes downward from left to right – people buy more as the price falls. However, for convenience, in discussions of the price elasticity the sign is often omitted, and 'higher' elasticity values are generally meant to refer to larger elasticity values in absolute terms (so an elasticity of -0.5 might be referred to as being larger than an elasticity of -0.4).

Demand for Bus Travel

B.5 The demand for bus travel is no different from that for other goods and services. As ticket prices change so do the number of journeys made by bus. The existence of concessionary fares schemes means that eligible travellers face much lower prices (in fact, zero outside the am-peak in most areas) and thus we would expect there to be more journeys made by these people than in the absence of a scheme. Indeed there is very strong evidence to support a relationship between falling fares and more bus passengers. This aggregate evidence, however, disguises the fact that there are two distinct groups responding to this fall: those that already use buses and those that start to use them only as a result of the improved price, or 'offer'. It is likely that these two groups behave differently.

B.6 The demand for essential goods and services tends to be more inelastic than demand for "luxuries" i.e. the quantity demanded is less responsive to changes in price. In the context of bus users, demand for journeys to the nearest place where they can buy reasonably-priced food is likely to be less elastic than demand for journeys to distant places. People who are in employment (and many older and disabled people work) will have relatively inelastic demand for their journey to work. If they have no alternative means of travel (car, train, bicycle) their demand will be still more inelastic.

Comment [AL68]: This paragraph doesn't seem to add much.



B.7 The figure above illustrates the impact of the move from full fare to a half-fare scheme (as in most TCAs) and then to free local and national travel in 2005/6. The y-axis gives the average fare and the x-axis the number of journeys made purchased (in a year) for local bus travel. If the average fare falls from **full fare** to **half/flat fare**, then $\mathbf{t}_{\text{half/flat fare}}$ will be demanded. If the fare falls to zero then $\mathbf{t}_{\text{zero fare}}$ will be demanded. This represents the amount of concessionary travel in the first year of free local bus travel.

B.8 In the absence of any concession the operator earns an amount equal to the number of journeys multiplied by the (average) full fare, here represented by the areas **a** and **b** (setting aside additional costs at this stage). Under a free fare scheme the operator earns no revenue from concessionary passengers. The operator needs to be reimbursed for the lost revenue from those who would have travelled at full price i.e. the areas **a** and **b**.

B.9 The difference between $\mathbf{t}_{\text{full fare}}$ and $\mathbf{t}_{\text{zero fare}}$ represents the number of additional journeys that are made by concessionary travel passholders because of the introduction of the free fare. To estimate the revenue forgone by the operator, the recommended approach is to apply an adjustment factor to $\mathbf{t}_{\text{zero fare}}$ to give revenue of **a + b**. This is obtained by applying a factor called the **Reimbursement Factor (RF)** to the average full fare. It is the reimbursement factor that determines the number of generated journeys and it is estimated to ensure that the operator receives the revenue he would have originally received in the absence of a scheme.

Comment [AL69]: Typo? The RF is applied to the trips made at zero fare to estimate the trips that would be made at full fare in the counterfactual (These are the "non-generated trips"). The revenue that the operator would have received in the counterfactual is then the product of the estimated non-generated trips and the average full fare.

The Reimbursement Factor

B.10 The reimbursement factor is the proportion of journeys that are made at zero fare that would have been made in the absence of the concession.

Reimbursement Factor =

Estimated journeys made in the absence of the free scheme

Observed journeys made at free fare

The Generation Factor

B.11 The generation factor is the proportion of journeys that are made at zero fare in addition to those to those that would have been made in the absence of the concession.

Generation Factor =

Observed journeys made at zero fare minus
Estimated journeys made at full fare

Observed journeys made at free fare

B.12 Therefore, the higher the reimbursement factor, the lower the generation factor and vice versa.

Fare Elasticity of Demand and the Reimbursement Factor

B.13 There is a direct relationship between the fare elasticity of demand and the reimbursement factor. At higher fare elasticities, people are more sensitive to changes in fare, and the reduction in journeys in moving from free fares to the full fare will thus be greater than if lower elasticities apply. Therefore, holding all other factors constant, the higher the elasticity, the lower the reimbursement factor will be and vice versa.

Demand and the Reimbursement Factor

B.14 The calculation of the reimbursement factor requires the estimation of a demand curve for the whole concessionary travel market and thereby an estimate of the number of journeys made at full fare.

The Shape of the Demand Curve

B.15 The demand curve can take one of several shapes depending on the specific characteristics of the market. Empirical evidence on the shape of the demand curve for the concessionary travel market is not clear-cut and a number of different sources of data, logical argument and assumptions are needed for its estimation. There is evidence on the behaviour of the adult commercial market in the region of adult full fares and the evidence about the concessionary market in the range of half to zero fare, or flat fare to zero fare. However, there is no recent information on the actual observed behaviour of eligible concessionary passholders between half fare and full fares so some extrapolation is required.

B.16 Based on the recommendations of ITS research, the preferred demand function is a damped negative exponential curve taking the following form:

$$T = ke^{\beta F^{\lambda}}$$

where:

e = Mathematical constant (2.7183 to four decimal places)
T = Number of bus journeys at fare F
k = Constant
β = Elasticity Constant
λ = Damping factor (0> λ >1)

B.17 This functional form is referred to as the ***damped negative exponential curve***. It has the following desirable properties:

- It crosses the x-axis implying a finite number of concessionary journeys at zero fare.

- The elasticity is damped by λ so that a proportionate change in fares will result in a less than proportionate change in demand elasticity.

The Damping Factor and Old and New Passholder Elasticities

B.18 The aggregate demand curve for concessionary bus journeys encompasses submarkets with different characteristics. There are those who took up the concessionary bus pass when they became eligible at the half fare, these passholders are referred to as old passholders. In addition, there are those who signed up for the bus pass just because of the introduction of the free fare scheme. People in this segment are referred to as new passholders. There is good reason to expect that the demand patterns and the responsiveness to changes in fares for these two market segments are different with new passholders being more sensitive to changes in prices and thus having higher elasticities of demand. In aggregating these two submarkets into a single demand curve, the demand elasticity will be a weighted average of the submarket elasticities. These weights change as fares increase as at higher fares, we would expect a higher proportion of the highly elastic submarket or the new passholders, will stop making many of their journeys with their concessionary bus pass. The elasticity must be damped to take these factors into account.

B.19 The formula for a fare elasticity based on the negative exponential demand curve is:

Fare Elasticity = $\lambda\beta F^{\lambda}$

B.20 The exact relationship between fares and fare elasticity depends on the exact magnitude of λ:

- A λ= 1 implies that the fare elasticity varies in exact proportion to fares, i.e. the fare elasticity is equal to βF. So a 5 per cent increase in fares will lead to a 5 per cent increase in the fare elasticity.
- With 0<λ<1, the fare elasticity varies less than proportionately with fares.

B.21 For instance with λ = 0.9 (low damping), the fare elasticity is 0.9β and a with λ = 0.3 (high damping), the fare elasticity is 0.3β. It follows from this simplified example that with low damping (0.9), the fare elasticity will be more sensitive to fare changes than with high damping (0.3).

B.22 The formula for a Reimbursement Factor based on the negative exponential demand curve is:

Reimbursement Factor = $e^{\beta F^{\lambda}}$

B.23 With low values of λ (implying high damping), the reimbursement factor will be much higher in comparison to fare elasticity with λ=1. On the other hand, at high values of λ (implying lower damping), the reimbursement factor will only be slightly lower than the fare elasticity at λ=1.

Comment [AL70]: Lower, I think

ANNEX C: Research and Summary of Evidence

Introduction

C.1 The advice provided in the guidance draws from extensive research commissioned by DfT from a research consortium led by the Institute for Transport Studies (ITS) at Leeds University.

C.2 The purpose of the research was to investigate the factors influencing the reimbursement of bus operators for concessionary travel using the latest data available with a view to develop a robust, evidence-based framework for estimating concessionary travel reimbursement.

C.3 The research team produced ten research reports which are available on the DfT website:

Research Report Number (RP)	**Title**
1	*Economic Principles*
2	*Issues Relating to Average Fares*
3	*Analysis of Concessionary Passholder Data from Lancashire and Nottingham*
4	*Shape of the Demand Curve*
5	*Elasticity Estimates from PTE and MCL Datasets*
6	*Analysis of the National Travel Survey Data*
7	*Survey Report*
8	*Whole Market Demand Elasticity Variation*
9	*Costs*
10	*Concessionary Fares Main Report* (final summary report)

C.4 This Annex provides a summary of ITS main research findings and other relevant evidence which underpins the reimbursement calculation methods described in the guidance.

Comment [TL71]: Worth including a footnote providing a link to the DfT website where the ITS research reports are available.

Average Fare

Characteristics of the NoWcard Data

C.5 Journey data was extracted for all concessionary journeys made by passholders from four TCAs in the NoWcard consortium for a five week period from 22nd February to 28th March 2009, two weeks before Easter. All four Districts are relatively urban in character, but they are not parts of contiguous large urban areas, and they each include some non-urban and rural areas to varying degrees.

C.6 Data has been provided for approximately 90,000 passholders, and nearly 600,000 concessionary journeys. These are defined as those starting in the NoWcard area on smartcard-enabled buses.

C.7 The data therefore exclude journeys made by card holders outside the NoWcard area and journeys in the NoWcard area made by card holders living outside the four districts.

C.8 The journey totals include peak concessionary journeys made before 9:30 am on weekdays by disabled passholders, the majority of whom will have paid a £0.50 flat fare. These represent about 1.25 per cent of the total.

Demand

Evidence on Elasticities

C.9 While there has been considerable academic interest in the magnitude of fare elasticities in existing research, not much of past research has been focused specifically on the concessionary market. Therefore only some basic inferences can be made into the nature of the market from such past studies. For the purposes of reimbursement, obtaining elasticity estimates that pertain to the concessionary market is absolutely vital and the ITS research explored the following data sources among others, to obtain elasticities specific to the concessionary market for bus journeys in England:

- The National Travel Survey (NTS);

- The Department for Transport STATS100A database of bus traffic and revenue;
- Scheme specific data on concessionary journeys following the introduction of free travel in four PTE areas and seven Shire Counties;
- A specifically commissioned telephone survey of those eligible for the concession on the basis of their age.

C.10 A brief description of the key features of these data sources and the inferences that were made from them is provided in the following table:

Source	**Description**	**Inferences**
PTE/Shire Data	Data on concessionary journeys and pass holding before and after the introduction of the local free fare scheme in 2006	- Actual number of journeys made at free fare in 2008/9 and number of journeys made at half/flat fare in 2005/6 - New passholders made up 10percent of all passholders in PTE areas and 40percent in the Counties - PTE point elasticity of –0.54 at £1 in 2005/6 prices and -0.55 in Counties - Estimates of average fare forgone of £1.12(PTE) and £1.20(Non PTE) in 2005/6 prices
STATS100A	Econometric estimation of whole market elasticities split between concessionary and commercial travellers in PTE areas	- Whole market long run point elasticity in the range of -0.3 to -0.4 at prevailing average revenue per journey including one day and period tickets is supported - No systematic variation in elasticities with average revenue per journey - No systematic regional variation in elasticity according to county type - Commercial market long run elasticities of ranging from -0.4 and -0.52 for PTEs
NTS Analysis	Panel data giving trip rates over a long period of time capturing changes that occurred to the concessionary scheme overtime	- The trip frequency distribution of passholders - In the absence of the zero fare scheme, concessionary travel would have declined by -3.0percent p.a. in PTE areas and -1.7percent p.a. in non PTE areas - Trends in car ownership and licence holding of bus users.

Comment [TL72]: This - the whole market (which market?) long-run point (which point?) - (fare) elasticity is a complicated concept and would benefit from being unpacked.

		- Analysis of NTS enabled trip rate models show that the introduction of the free fare scheme increased journeys rates by 26.5percent in PTEs and 45.4percent in Shires. The implied elasticities at full fare are -0.65 in the Mets and -0.75 in the Shires in 2008.
Telephone Survey	ITS Commissioned research on eligible concessionary travellers based on a Stated Intentions Approach	- Full fare elasticity of -0.58 using a proportional elasticity model. - By area type: -0.47 for Mets, -0.53 for the Unitaries and -0.60 for Shire districts. - Half fare/flat fare elasticity of -0.17 for Metropolitan areas, -0.27 for Unitaries and -0.3 for Shire districts at the prevailing concessionary fare

C.11 The ITS research recommends that long run elasticities are the most appropriate to be used for the purposes of concessionary travel reimbursement. Short run elasticities or the concessionaire reactions immediately after the introduction of the zero fare scheme in terms of journeys demanded will not take full account of adjustments made by concessionary travellers to travel patterns and will likely underestimate their fare elasticity.

C.12 Based on the inferences from the various data sources and academic judgement, the ITS research gives the following as their estimates of long run elasticities at "average full fare" as follows:

	Central Estimate	**Reasonable Range**
PTE	-0.5	-0.45 to -0.55
Non-PTE	-0.65	-0.60 to -0.70

C.13 Further information on the derivation of the elasticities can be found in ITS *Concessionary Fares Main Report* (Research Report 10).

C.14 Beyond this disaggregation in elasticities by PTE and Non-PTE areas, the ITS research did not find any other significant variation in elasticities by any other detailed disaggregation by area type, income or age.

The Treatment of New Passholders

C.15 As mentioned previously, one of the key outcomes of the free fare concession has been to expand the concessionary bus journey market to include new passholders. Given the inherent differences in the characteristics between new and old passholders, for the derivation of the relevant single demand curve for the entire market, an estimate of the proportion of total journeys that are made by new passholders is required.

C.16 The NTS data shows that while increases in pass holding in PTE areas have been fairly modest, the increase in pass holding in non-PTE areas is significantly higher. Data on observed journeys made after the introduction of the free fare concession does not distinguish between new and old passholders.

C.17 New passholders can be categorised into:

- Type I: Those who become eligible for the concession because they have reached the pensionable age
- Type II: Individuals eligible for the statutory concession but those who previously opted for alternatives to bus travel made available by TCAs such as tokens.
- Type III: Individuals who had chosen not to obtain the free bus pass prior to free bus travel being introduced.

Evidence on the Relationship between New and Old Passholder Trip Rates

C.18 The most quoted source of data on the relationship between trip rates by old and new passholders is the MVA study on the impact of the Welsh Assembly Government's free concessionary fare scheme. Survey data was collected on passholders that allowed the comparison of trip rates of old and new passholders. New passholders were simply defined as those who obtained a pass after free travel was introduced, so this includes both Type I and Type II passholders. The data published by this study suggest an all Wales average weekly trip rate ratio between new and old passholders of 46percent.

C.19 The ITS research team also had access to Smartcard data on concessionary travel patterns of residents in parts of Lancashire and Nottingham following the introduction of the English National Concession in 2008. On average, this data showed that Type III new passholders made half the number of journeys per week of those of old passholders of the same age. i.e. new passholder trip rates are approximately 50percent of old passholders' trip rates.

Estimating the Relevant Demand Curve

C.20 In the transition period from the half/flat fare scheme and zero fare scheme, there have been many changes in the concessionary market with Old Passholders making more journeys and new passholders taking up the bus pass and making bus journeys. The impact of all these changes has been to widen the concessionary bus travel market including a higher proportion of car owners. Car owners are expected to have higher fare elasticities as they have the choice of making any journey either by car or by bus and are more likely to drop out of the concessionary travel market at higher fares than non-car owners.

C.21 So as discussed above, the aggregated single demand curve for old passholders who have a lower level of car ownership and new passholders who have a higher level of car ownership will be shallower in the region from half fare to free fare. If the zero fare concessionary policy is reversed, then it is expected that with a sufficient time lag, the new sub market will drop out again. Based on this assumption it is expected that between half/flat and full fare, the market will only consist of **old passholders**, so the upper segment of the curve must largely represent the characteristics of **old passholders**. The damping factor λ for the old passholders' demand curve is predicted to be in the range of 0.8 for PTEs and 0.9 for Non-PTEs. This reflects the view that the proportionate reduction in journeys made by old passholders declines with higher fares.

C.22 So with an upper section with relatively low fare elasticity (because it largely represents old passholders) and a lower section with higher fare elasticity (representing old and new passholders), a damping factor within the range of 0.7 is plausible for the aggregate single demand curve for both PTE and Non-PTE areas.

Comment [AL73]: A range of 0.7 to what?

Abstraction

C.23 New passholders and some of the old passholders (prior to the introduction of the national concessionary scheme) would have paid commercial fares to make bus journeys in the absence of the scheme. It is therefore reasonable to expect that these passholders would instead of dropping out completely from the market from half fare and above, will instead actually make some additional journeys at the higher fare.

C.24 Given evidence from the telephone survey suggesting that only a small proportion of the growth in journeys made by concessionaires in 2008/9 was due to cross boundary and out of area journeys, the issue of abstraction is more relevant to New Passholders.

$$\text{The abstraction ratio} = \frac{\text{Journeys made at commercial fare before the take up of concessionary bus pass}}{\text{Journeys made after take up of concessionary bus pass}}$$

C.25 From the NTS analysis we have:

	2003-2006 (half/flat fare)	**2006-2008 (free local travel)**
Passholders	55 percent making 2.3 journeys/week	65 percent
Non passholders	45 percent making 0.3 journeys/week	35 percent

C.26 From the before and after data of the NTS sample it can be inferred that roughly 10 percent of the sample in 2006-2008 are those who switched into pass holding from not holding a pass pre-2006. Old passholders make more journeys because of the free fare concession, so it is plausible to assume that their average trip rate has risen to about 2.6 journeys per week after the introduction of the free fare scheme from about 2.3 journeys/week before. From the discussion above, it is also known that the rate of new passholder journeys is roughly twice that of old passholder journeys. Therefore the new passholders in the sample of those with passes in 2006-2008 make approximately 1.3 journeys per week. Those who switch from not holding a free pass at half fare are likely to be more active in terms of trip making to those who do not switch to holding a free bus pass to make it worthwhile for them to take up the pass. It is therefore assumed that on average the new passholders who switch made 0.4 journeys per week compared to the average of all non-passholders prior to the free fare scheme introduction in 2005/6.

Comment [TL74]: Improved clarity?

C.27 Thus the average journeys per week made at commercial fare by new passholders before free bus pass take up are 0.4 and journeys per week at free fare are 1.3.

The abstraction ratio = 0.4/1.3 ≈ 30 percent

C.28 With a New Passholder trip rates of 5.8 per cent and 23.2 per cent in PTEs and Non-PTEs respectively, applying a 30percent abstraction ratio gives an increase in journeys at every fare level above half fare of 1.74 per cent and 6.96 per cent respectively.

Derivation of the Single Demand Curve

C.29 With all of the above assumptions and evidence, we can map two separate single demand curves for PTE and Non-PTE areas that estimate the level of demand for bus journeys at every fare level for the whole concessionary market. The appropriate reimbursement factor that corresponds to the estimation of the local average forgone can then be read off the relevant single demand curve.

Underlying Trends and the Reimbursement Factor

C.30 Underlying trends are factors other than fares that affect bus journeys and changes in bus journeys. These factors can generally be controlled by~~specific to~~ operators, for example frequency or quality aspects of the bus; some are generally the responsibility of the local authority, for example the number and quality of bus stops and bus stations; and other factors are exogenous to the bus market, for example car ownership.

C.31 The previous reimbursement guidance recommended that an adjustment for underlying trends should be made where it was thought relevant. The reason for making an adjustment was that if the number of concessionary journeys were influenced by underlying factors, then not allowing for that influence could bias the estimate of the response of concessionary journeys to a change in the concessionary fare.

C.32 The approach in this guidance is different and uses the Single Demand Curve. In deriving the Single Demand Curve, the observed concessionary journeys were adjusted by an average underlying trend for PTEs and non-PTEs. In applying the Single Demand Curve to a specific operator's services in a TCA we judge, based on research findings, that the Single Demand Curve is the best estimate of the effect of the concessionary fare on the number of concessionary journeys.

C.33 However, the guidance also recognises that if underlying trends are different in particular places from the trend assumed in the Single Demand Curve, then the application of the Single Demand Curve may be adjusted for those differences. Note that underlying trends can be due to a number of different factors that can vary in incidence and direction in different parts of the country whereas the change in concessionary fares is the same or similar.

C.34 To derive a local underlying trend this guidance adopts a pragmatic approach. It does not require that the effect of each of the factors is identified. Rather it uses the trend in adult full fare journeys, adjusted for real fare changes, as a proxy for the underlying trends in concessionary journeys. This proxy is then compared with the underlying trend already included in the Single Demand Curve and a local underlying trend is derived. The methodology does not identify any specific factor that is causing the underlying trend.

Comment [TL75]: It is suggested that there are few absolute responsibilities in this classification.

Comment [AL76]: There is no obvious logic for making this adjustment. The Single Demand Curve is derived from reference data sets, adjusted as necessary for the local underlying trend so as to ensure that it represents only the relationship between fare and demand. The relevance of the underlying trend in the application area to this relationship Is not understood.

C.35 However if the local underlying trend deviates by more than 5 percentage points[6] from that used in the Single Demand Curve calculation then the case for having a local underlying trend of this size should be backed up by evidence of factors that could have caused such a trend. Examples of relevant factors are changes in service miles, changes in the quality of buses, and changes in the quality of passenger facilities.

Additional costs

Marginal Operating Costs

C.36 The research considered evidence from three different types of sources: (i) a new econometric model of bus operator costs, based on data for the period 1999-2007; (ii) past claims and settlements; and (iii) evidence from official statistics, the industry and academic research on the individual sub-components of marginal cost such as fuel and insurance.

C.37 The econometric model combines data from STATS 100 and TAS using operator level data. Total cost is the dependent variable and explanatory variables comprise final outputs (journeys), and intermediate outputs (vehicle miles, peak vehicle requirement). The preferred model is a translog function. The marginal cost per additional journey is calculated as the derivative of dTC/dQ where TC is total costs and Q is the number of trips holding vehicle miles and vehicle fleet constant. The model has a good fit to the data. The coefficient on the journey variable is not quite significant at the 95% confidence interval. The estimated marginal cost per journey is 8p.

C.38 The sub-components approach adds up to 6.7p per generated concessionary journey (see Table 7.1 in Section 7 of the guidance). The estimates of the different sub-components are derived from a variety of sources including official publications, industry data and academic research.

C.39 Recent claims and settlements were considered. There are problems with interpreting this data due to concern about whether quoted costs are average rather than marginal and whether costs include an element of additional capacity costs. A wide range of 1p to 15.3p per additional journey is found in this data.

Comment [TL77]: This could be considered something of a circular argument. The previous guidance said the answer was likely to be in the range 1-15p so that is what transpired. The evidence supporting any specific figure was thin, and in some cases probably non-existent. Would it not be better to omit this paragraph?

[6] So in most cases the underlying trend will not be above 0 per cent in PTEs and 5.8 per cent in non-PTEs.

C.40 The research gives most weight to the econometric and bottom-up estimates, with most weight given to the latter given the wide confidence interval on the econometric results. The recommended mean value per generated passenger journey outside London is 7.2 pence (2009/10 prices).

C.41 The research also considered varying the marginal cost estimate for journey length. This variation is justified given the variation in fuel, tyres and oil, and maintenance and cleaning costs with distance. The recommended approach is composed of a fixed element, 4.2 pence, and an element that is variable with distance7. The average bus stage length of concessionary passengers is 4.1 miles from the National Travel Survey 2008.

Marginal Capacity Costs

C.42 The research estimated marginal capacity cost using evidence from: (i) the econometric model of bus costs; (ii) accounting cost models of the CIPFA type; and a range of other evidence which is required in order to complete the analysis. Unit costs have been updated to 2009/10 prices.

C.43 The econometric evidence is based on evidence about vehicle miles and peak vehicle numbers. Vehicle hours were not included due to lack of data. The estimates derived from the econometric model are marginal capacity costs in the economic sense because the calculation is concerned with the way in which costs vary with vehicle mile and vehicle numbers. The econometric results provide an estimate of the additional capacity costs per vehicle mile of £0.853 (£0.530 per vehicle km) with a 95 per cent statistical confidence interval of £0.507 to £1.201 (£0.315 to £0.746 per vehicle km).This implies a cost elasticity, or marginal capacity costs as percentage of average capacity cost, at 46 per cent. Peak vehicle costs are £17,941 per vehicle with a 95 per cent statistical confidence interval of £12,335 to £23,547.

C.44 Accounting cost models provide estimates of the cost of vehicle hours, vehicle miles and peak vehicle requirements – see the table below:

Accounting models	**Per vehicle hr**	**Per vehicle mile**	**Per peak vehicle**
NERA (2006) – PTE	£29.86	£0.811	£27,515

[7] Formula for marginal operating costs by trip length of generated concessionary passenger is 4.2+3*(average trip length, (miles)/4.1) (all in pence 2009/10 prices)

NERA (2006) - non-PTE	£22.34	£0.607	£20,203
Whelan, Toner, Mackie and Preston (2001)	£26.01	£0.232	£24,030

C.45 The econometric and accounting evidence cannot be directly compared because the former excludes vehicle hours and that exclusion would tend to increase the estimates of the parameter value on vehicle miles in the econometric equation. An independent review of the evidence carried out by Professor Ian Preston concluded that there was a risk of double counting by adding in a separate estimate of the vehicle hours costs. The research and review noted that in theory an adjustment to the parameter on vehicle miles could be made to strip out the vehicle hours effect. But the size of that adjustment is unclear.

C.46 In order to make an informed judgement about the appropriate level of unit costs, and bearing in mind the comments about double counting, DfT also considered confidential evidence from operators and the timing and size of the change in demand likely to take place in the absence of a concessionary travel scheme. The unit costs proposed are well below average accounting costs. Within the vehicle hours unit cost the largest element is likely to be drivers hours. ITS also noted that drivers wages were paid on average as £10.20 per hour plus on-costs. Evidence of tenders suggests that marginal costs per hour can be lower than driver wages if drivers are being paid for hours that they do not drive. On the other hand, operators suggest that there is little slack in driver schedules so that a requirement to drive extra hours in the middle of the day requires additional remuneration for the additional hours employed.

C.47 Given the uncertainties about the use of the econometrics, the use of the accounting data, the use of the cost elasticities and other evidence, a pragmatic view that the appropriate hourly costs are around the hourly costs of drivers including an allowance for on-costs, i.e. a vehicle hours unit cost of £13.30 is recommended.

C.48 Similarly the recommended value for the rate per mile is based on a consideration of a range of evidence and in particular costs that are likely to vary directly with bus mileage, such as fuel, and excluding fixed costs. The recommended figure is £0.61 per vehicle mile. The peak vehicle requirement cost is set using similar considerations at £16,745 per peak vehicle.

C.49 In coming to a view of the figures, we have considered two general factors. The first is that marginal capacity costs will not apply where load factors are low. The second is that the change in overall journeys due to the concessionary travel scheme is significant, at least 15 to 20 per cent on average, in the period when concessionary travel is valid. The scale of this change is large compared with overall changes in demand that have occurred in the recent past.

Mohring factor

C.50 Evidence on the Mohring factor is limited. The value of 0.6 suggested in this guidance is within the range of values found in mainly theoretical studies that consider the response of operators to changes in demand that maximises the overall net benefit of passengers and bus operators. The theoretical relationship also depends on an element of spare capacity. In a practical situation where the criteria for changing vehicle miles is the effect on operator profit and load factors are also driven by commercial considerations it is possible that the Mohring factor would be different, but we do not know by how much. For the purpose of this guidance we recommend using a value of 0.6, but if TCAs or~~and~~ operators have good evidence from models or other analysis that is relevant to their area they should use an alternative value.

Comment [TL78]: Consistency with drafting in the main body of the text.

Comment [PA79]: As pointed out earlier and in our additional capacity costs paper, we feel that the presumption of this default value is neither consistent with the methodology proposed in the guidance nor conceptually or empirically valid in the context of NBNW, profit maximising operators and free concessionary travel. We therefore argue this paragraph needs to be redrafted in light of these comments.

Demand Response to Frequency Change

C.51 The extent to which the demand for bus service responds to increased levels of service has been covered in the literature, including TRL Report 593. The basic premise is that increases in the frequency of bus services reduces waiting time and increases in network density reduces walk time. Waiting and walk time have a higher value (higher disbenefit) than in-vehicle time so that passengers respond to changes in frequency and network coverage. The degree of response is thought to be significant but less than proportionate, i.e. demand increases but by less than the proportionate increase in bus vehicle miles. For the purpose of this guidance we subsume the service frequency and route density effects into a single vehicle miles effect.

C.52 Evidence considered in TRL 593 suggests that a 1% change in vehicle miles leads, in the long term, to a 0.66% change in passenger journeys. There is some evidence that responsiveness to a given frequency change is greater where frequency is lower to start with. This guidance recommends that an elasticity of 0.66 is used as a default unless there is very good evidence to the contrary.

Profit

C.53 A recent report for the Department for Transport by LEK, Review of Bus Profitability in England, considered the appropriate weighted cost of capital for bus operators. This proposed a range of the nominal weighted cost of capital of 8.2% to 10.9% in 2009. The report noted that feedback from major operators suggested that they believe that their respective weighted average cost of capital to be at the top end of this range. In the light of this evidence this guidance recommends that where peak vehicle requirement is increased as a result of the additional concessionary journeys then a return on capital of 10% is used and added to the PVR costs.

ANNEX D: Reimbursement Calculator

Introduction

D.1 A Reimbursement Calculator in Excel format based on the recommended approach set out in this guidance is available on the DfT website to aid TCAs in their reimbursement calculations and assist in discussions with bus operators.

D.2 This Annex describes briefly the Reimbursement Calculator and goes into the detail of some of the underlying calculations by way of worked examples.

Reimbursement Calculator

D.3 The Reimbursement Calculator is subdivided into five sheets which take users through the various steps required to calculate reimbursement:

Instructions	Instructions on how to use the Calculator. Note numbers are provided as hyperlinks throughout the Calculator which bring back users to this instructions sheet and the relevant detailed notes.
Start Page (Step 1)	On this page, users chose the relevant area type, the year of calculation and enter the number of observed concessionary journeys.
Average Fare (Step 2)	On this page users calculate the Average Fare Forgone.
Reimbursement Factor (Step 3)	The Average Fare Forgone feeds into the estimation of the Reimbursement Factor. An adjustment can be made for underlying trends if appropriate.
Additional Costs (Step 4)	On this page users can calculate the various components of additional costs.
Result Page (Step 5)	This page brings together the various components of reimbursement calculated in steps 1 to 4 and provides a figure for total reimbursement

	due.

D.4 The detailed workings underpinning the five calculation sheets are in separate sheets – these are hidden but they can be 'unhidden' (Format/Sheet/Unhide). They are as follows:

AF workings	Estimation of the discount factor using the Discount Factor method.
RF workings	Look-up between indexed fare and Reimbursement Factor and underlying trends calculations.
AC workings	Model that calculates additional marginal capacity costs.
PTEs	Construction of the Single Demand Curve for PTEs.
Non PTEs	Construction of the Single Demand Curve for Non PTEs.

Start page (Step 1)

D.5 On this page users enter

- The appropriate area type (PTEs/Non PTEs) - this will dictate which Single Demand Curve is used in the estimation of the Reimbursement Factor – [Cell G3];
- The year for which reimbursement needs to be calculated – [Cell G4];
- The total number of concessionary journeys observed in reimbursement period (See Section 4 of the guidance) – [Cell G6].

Average Fare (Step 2)

Average Fare Calculator

D.6 In [Cell B3] users need to chose which method will be used for the calculation of the average fare forgone. The options are as follows:

Method	Criteria	Action
Discount Fare method	Most circumstances	Enter the average ticket prices of cash fares, day and weekly tickets (see § 5.22–5.25 for how these should be calculated) in [Cells B15:B17] and the average

		fare is calculated in [Cell B23]
Basket of Fare method	For operators with a high proportion of total boardings on infrequent services (see § 5.7)	Enter data in [Cells A29:F39] and average fare is calculated in [Cell F41]
Local method	For operators in large urban areas such as PTEs where trip patterns are significantly different (see § 5.9-5.10)	Enter locally derived fare in [Cell B4]

D.7 The final Average Fare Forgone appears in [Cell B7] and will be fed through the Reimbursement Factor calculations in Step 3.

Calculation of the Discount Factor (AF workings)

D.8 The section below explains how the discount factor (in the Discount Factor method) is calculated in the sheet *AF workings*.

SmartCard Data Ticket Choice Assignment

D.9 Smartcard data on trip frequencies from the NoWcard scheme have been used to model how concessionary passholders would allocate themselves to different ticket types (cash, daily and weekly tickets) and fares at free fares. The data provides information on the concessionary journeys of about 90,000 passholders made over a five-week period in four Lancashire districts.

D.10 The data have been summarised to give the number of concessionary journeys made in each day of the five-week period, as well as the number of journeys made in each of the five weeks. The summarised data have then been used to simulate how the observed travel patterns would map onto different ticket types, assuming different combinations of price ratios.

D.11 For instance, in a fare structure where weekly tickets are priced at ten times the average cash fare and daily tickets are twice as expensive as the average cash fare, one would expect weekly tickets to become financially attractive to those making 10 or more journeys per week and we would expect those making two or more journeys in a day to buy a one-day ticket:

Ticket type	**Price ratio**	**Tickets**	**Journeys**	**Journeys per ticket**
Cash fare	1 (e.g. £1.6)	100,551	100,551	1

Daily	2 (e.g. £3.2)	121,673	297,313	2.4
Weekly	10 (e.g. £16.0)	13,431	193,200	14.4
Total		**235,655**	**591,063***	
Discount factor	19.1%			

* Components may not add up to total due to rounding.

- There were 591,063 zero-fare concessionary journeys observed in the dataset over the five-week period.
- Some 193,200 journeys were made in weeks where 10 or more journeys were made. These would have been associated with 13,431 weekly tickets (passholder weeks), leading to an average of about 14 journeys per ticket.
- Some 397,863 journeys would not be allocated to weekly tickets on this basis. Of these, 297,313 were made on days in which two or more journeys were made. These journeys would have been associated with 121,673 daily tickets purchased (passholder days)– this correspond to an average journey rate per ticket of 2.4.
- About 100,551 journeys would not have been made either in weeks where ten or more journeys were made or in days in which two or more journeys were made. It is assumed that these journeys would be allocated to cash fares.

Comment [PA80]: As argued in our average fares position paper, this does not make sense as it assumes that 100% of trips degenerated at a lower price are effectively made at a higher price. We argue that these degenerated trips (from weeklies and dailies) need to be reduced again in line with the reimbursement factor that applied to the average cash fare.

D.12 The analysis is repeated for a range of ticket price ratios and a look-up table dimensioned by the price ratio of weekly to daily to cash tickets is constructed. Owing to the limited period for which the data is available, in practice the analysis was limited to weekly ticket priced at 30 times the cash fare or less and daily ticket priced at 5 times the cash fare or less.

D.13 The look-up table is contained in [Cells A23:R62].

Discount Factor

D.14 For each price ratio and associated trip frequencies, a discount factor can be derived. If a passenger make two or more journeys using a daily ticket, the average cost per journey will be less than the average cash fare per journey, so that effectively the passenger buys his/her bus travel at a discount relative to the cash fare.

D.15 The implied discount factor on the cash fare based on this particular price ratio of 10:2:1 is derived from the total revenue denominated in terms of the cash fare:

Discount factor = 1 – [10 x 13,431 + 121,673 x 2 + 100,551] / 591,063 = 19.1%

D.16 However, this is the discount factor at free fares, before de-generation (see below).

Interpolation

D.17 In practice TCAs will need to input price ratios in the Calculator derived from real data and those are likely to be decimal numbers rather than integers (e.g. 9.9:1.8:1 based on a pricing structure of weekly tickets priced on average at £15.84, daily tickets priced at £2.88 and an average cash fares of £1.60). In those cases it is necessary to make an estimate of the number of journeys associated with that particular price structure by interpolating between the lower and upper band of the price ratio. This is done in [Cells A1:I12] of *AF workings*.

	Input values	Interpolation			
		Lower band	Upper band	Factor	Int'lated value
Weekly ticket price	9.9	9.00	10.00	0.90	
Daily Ticket Price	1.8	1.00	2.00	0.80	
Weekly Tickets		16,612	13,431	0.90	13,749
Weekly Trips		223,132	193,200	0.90	196,193
Daily Tickets		196,746	121,673	0.80	136,688
Daily trips		367,931	297,313	0.80	311,436
Single trips		0	100,551	0.80	80,441
Check trip total		591,063	591,063		588,070
Discount factor		41.4%	19.1%		21.3%

D.18 In this example the lower band price ratio is 9:1:1 and the upper band is 10:2:1. The number of journeys and tickets sold corresponding to each price ratio are looked up from the smartcard data table [Cols E and F]. A weighted average of the journeys made and tickets sold in the upper band and lower band price structure is taken [Col. H] with the weights based on the difference between the input values and lower band values [Col. G].

D.19 The last column in the table show the interpolated journeys and tickets which correspond to a price structure of 9.9:1.8:1 and the associated discount factor ([Cell H18]).

De-generation

D.20 The discount factor estimated above is based on concessionary passholders trip frequencies at free fare. However, in the absence of a free concession, the number of journeys that would be made would be significantly smaller if fares were paid than if travel was free. It is therefore necessary to 'de-generate' journeys to allow from the move from free to full fare. The amount of generation that was created depends on the assumed price per journey of the discounted tickets, which in turn depends on the assumed use. Hence, the degeneration factor is estimated using the same Single Demand Curve parameters (lambda and beta) applied in the reimbursement factor calculation and using the fares of the individual ticket types.

D.21 For instance in our example the price or fare per journey is the average price per ticket divided by the number of journeys per ticket – this is calculated in [Cells K1:K12].

	Single	Daily	Weekly
Price ratio	1	1.80	9.90
Price per ticket	£1.60	£2.88	£15.84
Tickets sold (from Look Up Table)	80,441	136,688	13,749
Trips made (from Look Up Table)	80,441	311,436	196,193
Trips per ticket	1.000	2.278	14.270
Price per trip	£1.60	£1.26	£1.110

D.22 The resulting fares are used to estimate the associated reimbursement factor from the Single Demand Curve using the following formula

$$RF = e^{\beta \times FarePerTrip^{\lambda}}$$

where the Single Demand Curve parameters are

β (PTE) = -0.661
λ (PTE) = 0.723
β (NPTE) = -0.837
λ (NPTE) = 0.640

D.23 The resulting Reimbursement Factors are then used to adjust the weekly and daily price ratios upwards in [Cells P1:R9].

Area	Non-PTE	
	RF	Price ratio
Single	0.322885	1
Daily	0.378285	2.4809135
Weekly	0.408795	13.947075

D.24 This effectively amounts to reassigning the number of journeys allocated to the weekly, daily and cash tickets as shown in [Cells T1:AA12].

	Input values	Interpolation			
		Lower band	Upper band	Factor	Int'lated value
Weekly ticket price	13.9	13.00	14.00	0.95	
Daily Ticket Price	2.5	2.00	3.00	0.48	
Weekly Tickets		6,533	5,316	0.95	5,380
Weekly Trips		115,226	98,805	0.95	99,674
Daily Tickets		147,002	28,386	0.48	89,958
Daily trips		366,814	107,683	0.48	242,195
Single trips		109,023	384,575	0.48	241,540
Check trip total		591,063	591,063		583,408
					7.5%

D.25 However, this leads to too many single journeys in the basket and these are also abated using the reimbursement factor at cash fare in [Cells AD1:AG8]. However, the abatement is only applied to the initial number of journeys in the basket (80,441) as the rest of the single journeys have been reassigned from weekly and daily tickets from the first de-generation step.

Comment [PA81]: As pointed out above, this is conceptually flawed.

	Single	Daily	Weekly
Price ratio	1	2.48	13.95
Tickets sold (from Look Up Table)	215,773	89,958	5,380
Trips made (from Look Up Table)	215,773	242,195	99,674

Average Fare Forgone

D.26 The resulting discount factor is 7.8 per cent in [Cell AG18]. This is fed back to the Average Fare calculator sheet in [Cell B21]. The discount factor is applied to the average cash fare to derive the average fare forgone in [Cell B23]. In this example:

Average fare = Cash fare x (1 – Discount Factor)

£1.47 = £1.60 x (1 – 0.078)

Reimbursement Factor (Step 3)

Reimbursement Factor Calculator

D.27 Based on the area type and year of calculation selected in the Start page, the average fare forgone calculated in the Average Fare calculator is read off the appropriate Single Demand Curve to derive the Reimbursement Factor in [Cell B8].

Estimation of the Reimbursement Factor (*RF workings*)

D.28 The underlying calculations are performed in *RF workings*.

- [Cells E1:G12] contain the CPI index and corresponding deflator factors;
- [Cells E27:G35] contain the Single Demand Curve parameters from the PTE/Non PTE sheets (see below);
- [Cell G39] contains the nominal average fare forgone for the year of calculation calculated in Step 2.
- [Cell G40] contains the average fare forgone deflated to 2005/06 and indexed to £1.12 (PTE)/£1.20 (Non PTE) = 1.
- [Cell G41] calculates the Reimbursement Factor using the variables above according to the formula in § B16.

Calculations of underlying trends

D.29 Should an underlying trend adjustment be appropriate, users need to input data on the full-fare commercial adult journeys and adult commercial fares in 2005/06 and the year of calculation in [Cells C15:D16] of the RF Calculator. The calculations are done in *RF workings*.

D.30 For example in a PTE area there were 35 million commercial journeys in 2005/06 and 34 million in 2009/10 and the average commercial fare was estimated at £1.15 and £1.25 respectively.

D.31 The observed adult full fare local journeys in 2005/06 are indexed at 100 [Cell F47], and the estimated adult full fare local journeys in 2009/10 have an index value of 97 [Cell G47].

D.32 The nominal average adult fare in 2005/06 of £1.15 is indexed to 100 [Cell F48] and the 2009/10 £1.25 average fare is adjusted by the change in the CPI between 2005/06 and 2009/10 of around 9 per cent [Cell G49] and indexed to 99.9 [Cell G50].

D.33 The index of journeys in 2009/10 is adjusted for real fare increase between 2005/06 and 2009/10 using a fares elasticity of -0.45 in PTEs (-0.5 in non PTEs). The result is 97.1 in [Cell G53]. The adjusted 2009/10 journeys are now 97.8 [Cell G61]. In other words the underlying trend in adult full fare journeys in the TCA is -2.9 per cent [Cell G54].

D.34 This underlying trend is then adjusted for the underlying change in concessionary journeys already included in the single demand curve estimates. In this case (PTE) this is a 5 per cent reduction in journeys.

D.35 The adjustment to concessionary journeys in the single demand curve is therefore the adjusted underlying trend for fare journeys over and above the underlying change already included. This is plus 2.2% in this example [Cell G60].

D.36 These underlying trend factors are then applied to a re-estimation of the Single Demand Curve in [Cells E66:H81].

Derivation of the Single Demand Curve (*PTE* sheet)

D.37 The following is a worked example of the estimation of the single demand curve for PTE areas. The same principles apply to the Non PTE sheet.

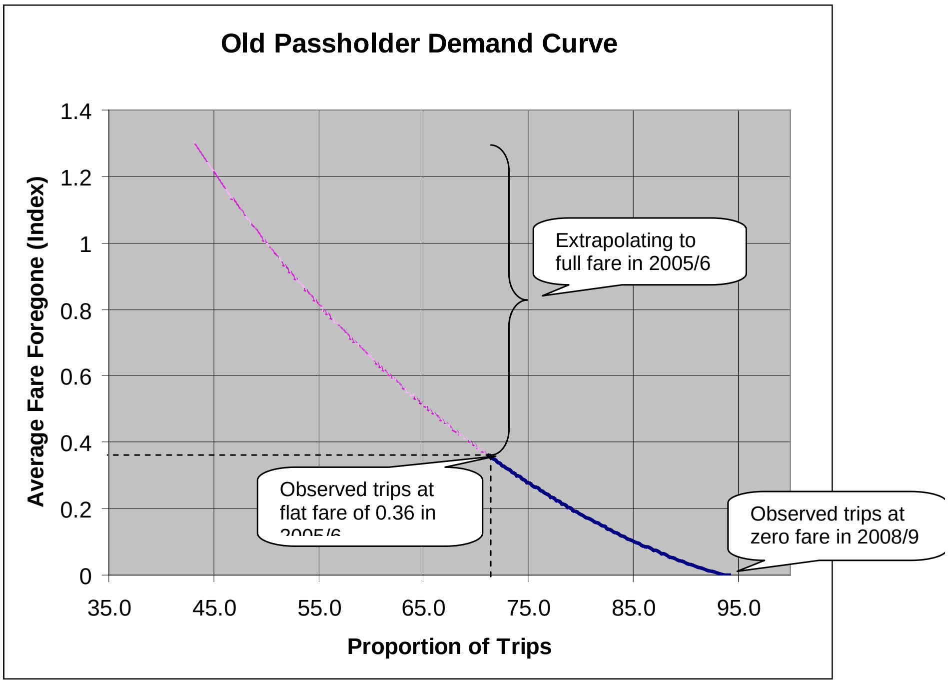
Step 1 – Estimating the Old Passholder Demand Curve

D.38 Let’s assume the observed number of journeys at free fare is 100 [Cell. There is also an estimate of the proportion of all journeys that are made by New Passholders. So taking the example of PTEs, 5.8 per cent of all journeys are estimated to be made by New Passholders, so at zero fare Old Passholders make 94.2 (index value) of journeys [Cell B816].

D.39 The number of journeys made by old passholders at half or flat fare is observed. For PTE areas the number of concessionary journeys by Old Passholders at flat fare (indexed at 0.36) as a proportion of journeys that are made at zero fare is 119.618/158.28 = 0.75573 [Cell C1].

D.40 Multiplying Old Passholder journeys at full fare of 94.2 journeys by this proportion gives us 71.2 journeys at the flat fare of 0.36 [Cell B743].

D.41 Using the two points 94.2 and 71.2 a demand curve is estimated using an assumed damping factor of 0.8 for old passholders and extrapolated to full fare. This gives an estimated demand at full fare (2008/9) of 48.4 (index value) [Cell C604].



Step 2 – Estimating the Single Demand Curve for all Passholders

D.42 The New Passholder journeys at zero fare are added back so that the index value of journeys is now 100. The impact of adding these journeys on to the lower section of the demand curve is that we now have a kinked demand curve. A single smoothed demand curve is estimated through the number of journeys observed at zero fare (100) [Cell E816], the degenerated journeys at half fare (71.2) [Cell E743] and the number of journeys estimated to be made at full fare by old passholders (48.4)[E604]. In this process, the elasticity constant β and the damping factor λ are re-estimated.

D.43 Average fare forgone or full fare forgone for the purpose of deriving the single demand curve and indexation:

D.44 For the purposes of estimating the single demand curves for PTEs and Non-PTEs respectively, the ITS research team derived an average fare forgone of £1.12 and £1.20 for PTEs and Non-PTEs respectively in 2005/6 prices. These fares are indexed at 1 as they are the relevant averages for the aggregate data on which the single demand curve is based on. Therefore when a local average fare is derived either using the discount method or any other preferred local method, these average fares are deflated back to 2005/6 prices and indexed relative to the average fares of £1.12 and £1.20 for PTEs and Non-PTEs respectively.

D.45 So for example: For an average fare of £1.50 in a PTE area in 2009/10, deflating back to 2005/6 with CPI gives £1.50 x 0.89 = 1.34. Indexing: 1.34/1.12 = 1.20. This indexed value is looked up on the demand curve.

Step 3 – Abstraction

D.46 The next step is to allow for the abstraction of new passholders from the commercial market to the concessionary market. For PTEs this implies an increase in the number of journeys made from half fare onwards of 1.74 per cent. i.e. : 30% x 5.8% = 1.74 [Cell J604].

Step 4 – Final Demand Curve for All Those Eligible for the Travel Concession

D.47 The final step is to smooth the demand curve by connecting journeys at zero fare (100) [Cell K816], journeys at half fare (72.9) [Cell K743] and journeys estimated to be made by all passholders at full fare (50.2) [Cell K604]. This final step will give us the final estimate of the elasticity constant β(-0.66) [Cell K7] and damping factor λ (0.723) [Cell K8].

Additional Costs (Step 4)

D.48 On this page users can estimate the various components of additional costs as they apply.

Marginal operating costs (MOC)

D.49 In the MOC Calculator in [Cells B5:B11], there is flexibility to vary the default value of 7.2p by the average boarding length (see § 7.13) if there is good evidence that the journey length in user's area is different from the average default value of 4.1 miles - in these case users should select the option 'Vary by Local Trip Length' in [Cell C8] and enter a local value in [Cell D9].

D.50 The marginal operating cost is calculated using the formula in § 7.13.

Marginal capacity costs (MCC)

D.51 The MCC calculator in [Cells B16:B31] can be used to estimate additional marginal capacity costs when they apply (see § 7.22-7.2). Some of the parameter values in the model are given while for some other parameters users need to enter local values or they have a choice between a local value and a default value. The marginal capacity cost is then given in [Cell D31].

D.52 All the underlying calculations are performed in the sheet *AC workings* [Cells [A43:K172] as described below by way of a worked example for a PTE.

Data inputs

D.53 The Table below shows some illustrative data inputs that enter the MCC calculations. In this example (for a PTE, 2009/10) the Default value was used where there is a choice between the Default value and a locally derived value.

Variable	**Status [Cell reference where option is chosen as applicable]**	**Value**	**Cell reference of value**
Mohring power	Default [C18]	0.6	[D18]
Vehicle/mile cost	Given	£0.61	[D20]
Vehicle/hr cost	Given	£13.30	[D21]
Speed (mph)	Default [C22]	8.79	[D22 or D23]
Mean vehicle occupancy	Default [C24]	10	[D24]
Mean route length (miles)	Default [C26]	6.21	[D26 or D27]
Average commercial adult fare	Local	£1.45	[D28]
Commercial Journeys as a % of total	Default [C29]	60%	[D29 or D30]

Step 1 - Assumptions on base passenger (pax) boardings/hr/mile of route

D.54 Passenger boardings / Mile of route / Bus

Pax boardings / Mile of route / Bus [G74] =

2 x Mean vehicle occupancy [H70] / Mean route length [H72]

3.221 = 2 x 10 / 6.21

D.55 Passenger boardings / Mile of route / Hour

Pax boardings / Mile of route / Hour [G76] =   = Pax boardings / Mile of route / Bus [G74] x Bus frequency χ_0 [H64]   19.32 = 3.221 x 6

D.56 Speed includes stops and turn times then derive excluding turn times

Step 2 – Establish the Link between Patronage and Frequency Supplied (the supply response to demand changes)

D.57 The aggregate relationship observed between patronage and frequency is described as follows

$\chi_1/\chi_0=(B_1/B_0)^{0.6} \rightarrow \chi_1=\chi_0*(B_1/B_0)^{0.6}$ where χ is the frequency measured as the number of buses per hour   B is the total number of passenger boardings per hour   0 is without an additional passenger   1 is with an additional passenger   0.6 is the Morhing Factor

Comment [PA82]: Proposed to replace with MF, so as not to presume a fixed value, which is also inconsistent with the proposed methodology for assessing additional capacity cost claims.

D.58 This formula suggests that a bus operator will not increase the supply of bus service in direct proportion to demand – instead as demand rises there will be a less-than-proportional increase in frequency and some increase in load factor.

Comment [PA83]: Again – internally inconsistent.

D.59 Impact of one Additional Passenger on Boardings per Hour

Additional pax / Mile of route / Hour [G87] = 1 / Mean route length [H72]   0.16 = 1 /6.21   Thus χ_1 (buses / hr with additional passenger) χ_0 * [(Pax boardings / Mile of route/ Hour + Additional pax / Mile of route / hr) / Pax boardings / Mile of route / Hour]$^{\text{Morhing Factor}}$

[G89] = [H64] x {[G76] + [G87]) / [G76]} [Calculator D18 or D19]

$6.03 = 6 \times [(19.32+0.16)/19.32]^{0.6}$

Step 2 – Use Additional Capacity Cost Estimates to put £ figures on Changes in Vehicle miles and Vehicle hours

D.60 This section looks at the implications for vehicle miles and vehicle hours.

D.61 Vehicle hours per hour is determined by frequency, speed and length of route:

- Without a marginal passenger:

Veh hrs / hr to operate BOTH sides of the route = χ_0 / [Speed / (Mean route length * 2)]

[I95] = [H64] / ([Model D22 or D 23] / ([H72] x 2))

8.482 = 6 / [8.79 / (6.21 x 2)]

Veh hrs / hr on one side = veh hrs / hr to operate BOTH sides of the route / 2

[I96] = [I95] / 2

4.241 = 8.482 / 2

- With a marginal passengers

Veh hrs / hr to operate BOTH sides of the route = χ_1 / [Speed / (Mean route length x 2)]

[I97] = [G89] / ([MCC Calc D22 or D 23] / ([H72] x 2))

8.524 = 6.06 / [8.79 / (6.21 x 2)]

Veh hrs / hr on one side = veh hrs / hr to operate BOTH sides of the route / 2

[I98] = [I97] / 2

4.262 = 8.524 / 2

D.62 The difference in vehicle hours is

Δveh hrs [I99] = Veh hrs / hr on one side with marginal pax [I98] - Veh hrs / hr on one side without marginal pax [I96] 0.021 = 4.262 – 4.241

D.63 The additional cost per veh hour per additional passenger journey is change in vehicle hours times the unit cost

Additional cost per veh hr [I101] = Δveh hrs [I99] x £/veh hr [I100] £0.28 = 0.021 x £13.30

D.64 Veh miles / hour is determined by frequency, speed and length of route:

- Without a marginal passenger:

Veh miles / hr to operate BOTH sides of the route = χ_0 x Speed / [Speed / (Mean route length * 2)] [I104] = [H64] x [Model D22 or D 23] / ([Model D22 or D 23] / ([H72] x 2)) 74.52 = 6 x 8.79 / [8.79 / (6.21 x 2)] Veh miles / hr on one side = veh miles / hr to operate BOTH sides of the route / 2 [I105] = [I104] / 2 37.26 = 74.52 / 2

- With a marginal passenger:

Veh miles / hr to operate BOTH sides of the route = χ_1 x Speed / [Speed / (Mean route length * 2)] [I106] = [G89] x [Model D22 or D 23] / ([Model D22 or D 23] / [H72] x 2) 74.89 = 6.03 x 8.79 / [8.79 / 6.21 x 2)]

Veh miles / hr on one side = veh miles / hr to operate BOTH sides of the route / 2

[I107] = [I106] / 2

37.45 = 74.89 / 2

D.65 The difference in vehicle miles is

Δveh miles [I108] = Veh miles / hr on one side with marginal pax [I107] - Veh miles / hr on one side without marginal pax [I105]

0.19 = 37.45 – 37.26

D.66 The additional cost per vehicle mile per additional passenger journey is change in vehicle miles times the unit cost

Additional cost per veh mile [I110] = Δveh miles [I108] x £/veh mile [I109]

£0.11 = 0.19 x £0.61

D.67 The total gross additional capacity costs (excluding PVR costs) are the sum of the vehicle hour costs and vehicle mile costs per additional passenger journey:

Total additional capacity cost per generated passenger trip [D132] = Additional veh hr cost [I101] + Additional veh mile cost [I110]

0.40 = 0.28 + 0.11

Step 3 – Calculate the Offsetting Revenue Gain due to the Service Elasticity effect of Frequency Change on Commercial Patronage and Revenue

D.68 This section calculates the revenue implications of service increase. First we calculate the percentage change in demand:

Fare paying passengers have a long-run elasticity to frequency of 0.66

Percentage change in frequency is $(\chi_1 - \chi_0) / \chi_0$

[G144] = (G89] - [H64]) / [H64]

0.5% = (6.03 – 6) / 6

Percentage change in demand in long-run [G145] = Percentage change in frequency [G144] x Long-run frequency elasticity [E141]

0.33% = 0.5% * 0.66

D.69 Next we calculate the number of commercial journeys:

Total boardings per hour (both ways) [G147] = Pax boardings / Mile of route / Hour [G76] x Mean route length [H72] x 2

240 = 19.3 x 6.21 x 2

Total boardings per hour (one way) {G148] = Total boardings per hour (both ways) [G147] / 2

120 = 60 / 2

Commercial journeys [G150] = Percentage of commercial journeys [G149] * Total boardings per hour (one way) [G148]

36 = 120 x 60%

D.70 The change in commercial journeys is therefore

Change in commercial journeys [G152] = %Change in demand [G145] x Commercial journeys [G150]

0.237 = 0.33% * 72

D.71 The revenue gain per passenger is therefore:

Revenue gain per generated passenger journey [G156] = Change in commercial journeys [G152] * Average commercial fare [G154]

£0.34 = 0.237 x £1.45

Net of marginal costs of commercial journeys generated by the service elasticity [G159] = Marginal operating Cost [MOC Calc D11] x Change in commercial journeys [G152]

£0.02 = 0.072 x 0.237

Step 4 – Calculate the Net Additional Capacity Cost per Generated Journey

D.72 All the components can now be brought together to calculate total net additional marginal capacity cost per generated journey:

Gross additional capacity cost per generated passenger journey:

time-related [J164]	£0.28	
distance-related [J165]	£0.11	
Revenue gain per generated passenger journey [J167]:	£0.34	
Marginal cost of generated commercial journeys [J168]:	£0.02	
Net additional capacity cost per generated passenger journey:		£0.07

[J171 = J164 + J165 – J156 + J159]

Reimbursement arrangements - **Annex B** - Technical annex on the proposed adjustment for underlying trends

DfT Concessionary Travel Reimbursement Consultation Response

Annex B. Technical annex on the proposed adjustment for underlying trends

November 2010

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Content

1. Introduction

1.1. DfT's draft Guidance of September 2010 suggests that the Reimbursement Factor calculated from the ITS Single Demand Curve can be adjusted where underlying trends in a specific area are different to the "average". The Guidance and Reimbursement Calculator spreadsheet set out a precise mechanism for making this adjustment, using the trend in non-concessionary trips as a proxy for the trend in concessionary trips.

1.2. This Note argues that the proposed adjustment is misconceived and that even if this was not the case, the practical procedure that is proposed is flawed. No theoretical rationale is provided for the adjustment, and if retained in its present form, the proposal will deeply confuse many practitioners, as well as stimulate numerous appeals of little merit.

2. Key concepts

2.1. To understand these concerns, it is desirable to restate some of the key concepts involved in calculating "No Better Off/No Worse Off" reimbursement. The most fundamental is the role of the Reimbursement Factor, which is used to estimate the proportion of observed concessionary trips that would have been made if there was no concession, i.e. in the counterfactual situation. Since the only difference between the observed and counterfactual situations represented by the Reimbursement Factor is the absence of the concessionary fare, it follows that the Reimbursement Factor should reflect the impact of fare on demand and nothing else. The relevance of "underlying trends" to the accurate calculation of the Reimbursement Factor is not understood.

2.2. The default Reimbursement Factor calculation recommended by DfT is based on an assumed demand curve shape (the "Single Demand Curve"), and two parameter values ("Beta" and "Lambda"). Between them, these dictate the point elasticity at any given fare, and allows the demand at one fare to be compared with the demand at another fare. The Reimbursement Factor is simply the ratio of demand at the commercial fare, and at zero fare. The Reimbursement Factor is thus a function of the commercial fare (to be more precise, the estimated fare forgone, or the fare that would have been paid by passholders in the absence of the concession), and the two parameter values.

3. The reference data sets and reference elasticities

3.1. ITS have recommended two sets of parameter values, for PTEs and non-PTES respectively, based on similar analysis of historic data on concessionary trips between 2005-6 and 2008-9. The point elasticity at any particular fare is dictated by the parameter values. The elasticity implications of the recommended parameter values have been validated by the large volume of research carried out by ITS, and in particular, the analysis of NTS data, of STATS100A data, and the data collected in the ITS telephone survey. However, the precise parameter values have been derived from the 2005-6 to 2008-9 historic data, which represents observed changes in demand in four PTEs and seven Counties. These might be called the reference data sets. For convenience, the parameters that ITS have derived from them might be called the reference elasticities, although it must be understood that specific elasticity values are determined by the parameters and the fare at which the elasticity is evaluated, and in some respects are incidental to the Reimbursement Factor calculation.

3.2. To genuinely deliver No Better/No Worse reimbursement, the Reimbursement Factor should reflect only the difference between the observed situation with the concessionary fare, and the counterfactual in which there is no concession, with all other things being equal. It follows that if the Reimbursement Factor is adjusted relative to the value that would be calculated by the ITS parameters, then it is being assumed that different elasticities apply to those observed in the reference data sets. The key issue is therefore the potential rationale for this difference.

3.3. There are two possible arguments for wishing to apply different elasticities. One is that the reference elasticities are biased in some way, and do not accurately reflect the fares effects implicit in the reference data. It should be noted that if this is the case, then the bias will colour all applications of the reference elasticities, anywhere, irrespective of local factors. The second is that the reference elasticities are not appropriate for application to a particular area because of differences in the characteristics of the application area compared to the reference areas.

4. Biased elasticities

4.1. Why might the elasticities derived from the reference data sets be biased in some way? There are numerous reasons why bias is a possibility. The principle concern would be the accuracy of various adjustments made to isolate the impact of the change from the pre-free concessionary fare to a free concessionary fare, and to eliminate all other influences on trip making over the relevant years. The heart of the estimation methodology relies upon the before-and-after comparison of observed trips being on a like-for-like basis.

4.2. A very wide range of influences may have affected the “observed” concessionary travel volumes in the reference data sets other than fares. Potential influences include changes in demographics, service quality, and car availability, but there are others, and there may remain influences which cannot be readily explained or quantified. Moreover, the historic data on concessionary travel volumes has the potential to be extremely inconsistent in the way in which it is recorded and/or collated, especially with regard to the key transition from 2005-6 to 2006-7.

4.3. The reference data sets were chosen so as to maximise the likelihood that these other influences on observed concessionary travel volumes (both from non-fare factors, and “noise” arising from data collation issues) could be minimised. Research Report 5, which describes the analysis process of the historic data, sets out the steps taken to minimise these other influences. There is no evidence to suggest that the results are significantly or systematically biased, although of course it is possible to drill down into detail to dispute precisely how adjustments have been calculated. Moreover, at a detailed level, practical judgements are inescapable, since firm evidence is extremely difficult to establish.

4.4. Overall, therefore, no case seems to have been made that the reference elasticities are biased, although it is acknowledged that some might be devised.

5. Potential reasons for bias

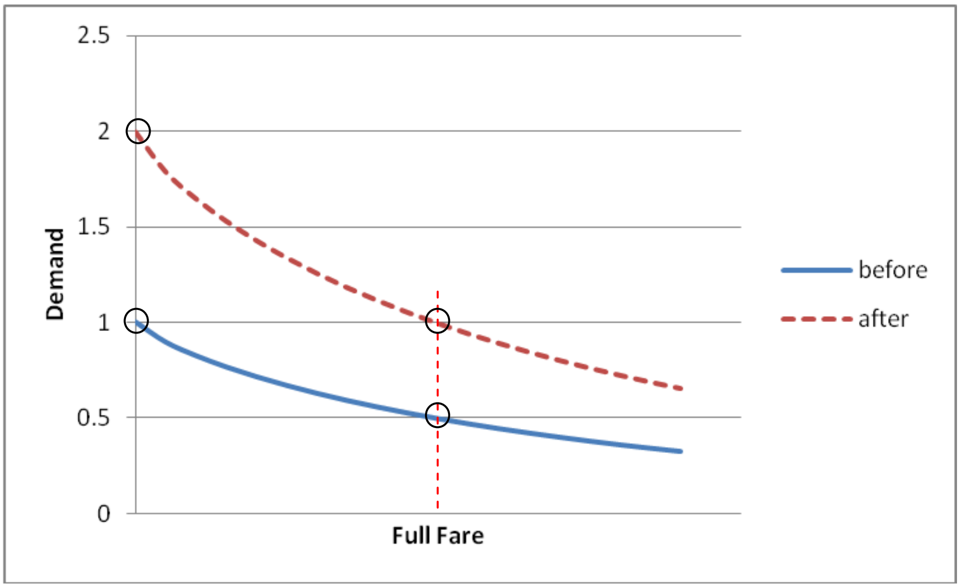
5.1. Reasons that might be suggested for non-negligible bias in ITS’s single demand curves, either due to intrinsic socio-economic differences between atypical areas and those included in ITS’s reference data sets or because there may be changes in concessionary passenger behaviour over time. Recent communication with the DfT suggests that it is this that the proposed adjustment is attempting to correct for. The draft Guidance suggests that where the trend in non-concessionary trips is different from that observed by ITS between 2005/6 and 2008/9 then there must be changes in the bus product (i.e.: quality) which are fundamentally affecting passengers' response to fares. We see two major conceptual flaws with this approach:

1. It implies that changes in the bus product somehow directly affect fare elasticities when one thing, by definition, has nothing to do with the other.
2. It implies that any differences in underlying trends are due to changes in the bus product therefore ignoring a huge range of other external factors which can affect demand for travel.

5.2. Let's assume that bus travel can be represented by an equation of the form:

(1) $Demand=K.Fare^{\alpha}.Time^{\beta}.Quality^{\gamma}$,

as is conventionally the case in aggregate models of public transport demand (e.g.: the National Transport Model) . One important property of this model is that changes in one variable do not affect the demand elasticity with respect to other variables. If we assume no changes to travel time or quality factors then we get the result that demand is purely a function of fare, represented by the full line in the figure below. Now let's assume that a step-change in quality leads to a doubling of demand, represented by the dotted line. By definition the reimbursement factor remains the same since the fare elasticity is independent of other factors.



5.3. For the reimbursement factor to change between these two scenarios the demand function would need to look something like:

(2) $Demand=K.Fare^{\alpha}.Time^{\beta}.Quality^{\gamma}.(Fare.Quality)^{\delta}$

5.4. The factor (Fare.Quality)δ could be interpreted as representing the conditional impact of quality factors on fare elasticities. The problem is that due to various confounding factors and the relatively marginal nature of quality improvements, it is probably impossible to prove empirically whether parameter delta is different from zero, let alone rigorously estimate its exact value. At a more fundamental level, equation (2) is theoretically inconsistent with the single demand curve proposed by ITS and would require the research to be repeated on this new basis.

5.5. Intuitively, it is also difficult to find support for this proposition as it implies that changes in quality not only lead to a certain proportional increase from the base level of demand but also lead to a change in the way individuals value money.

5.6. Turning now to the second flaw highlighted above, evidence from the past 30 years shows a fairly strong correlation between economic output and public transport demand, which was demonstrated, e.g., by Dargay and Hanly (1999). Travel demand is also obviously affected by other external factors such as changes in population, city centre employment, public sector investment as well as changes to the price and quality of competing modes. At the level of individual operators, we have also observed big changes in demand as a result of differences in network coverage over time, supported by Dargay and Hanly's findings on the elasticity between bus demand and service mileage. In effect, service quality seems to be a relatively marginal factor when all else is taken into account, and much more likely to have a visible effect on individual services than across the network as a whole.

6. The case for variation in elasticity values

6.1. If the reference elasticities are accepted as being unbiased estimates of the average elasticities for the reference data sets, then a second rationale for varying the Reimbursement Factor is differences in the characteristics of the application area relative to the average of the reference data sets. In principle, it is quite possible that there is a case that different elasticities apply, since the geographical coverage of the reference data sets is limited.

6.2. ITS acknowledge that the reference data sets are not necessarily representative of the unitary authorities, or the Midlands and Northern Shire areas. Consequently, the socio-economic and geographical characteristics which condition local sensitivity to fare changes might be significantly different to those in the PTEs and southern Shires. However, there is no readily available evidence that this is so, and ITS have not attempted to further disaggregate the elasticity results beyond the PTE and non-PTE groupings .

6.3. The robustness of the ITS results would clearly be strengthened by expansion of the geographical scope of the reference data sets to include additional areas. However, it is important to recognise that the principal reason for the selection of the County areas included in the existing reference data sets was the relative accessibility of consistent data for individual Counties stretching across the 2005-6 to 2008-9 period. The characteristics looked for were:

- Availability of a county-wide concession that pre-dated the introduction of free travel in April 2006;
- Some degree of co-ordinated administration of the scheme over the relevant years, giving some chance of consistent data on concessionary trips and the pre-free concessionary fare;
- Good information about the take-up of discretionary alternatives to the statutory concession, and how these might have changed over the period;

- Good information on passholding, preferably with annual pass renewal.

6.4. Despite favourable conditions, and the fact that most of the relevant data was already held in one form or another by MCL, considerable work was needed to develop the high level (County-wide) figures required for the analysis. Constructing additional data sets to widen the representativeness of the reference elasticities would be much more challenging, if only because of the passage of time since 2005-6. Indeed, the forthcoming move to County administration may destroy many opportunities to collate consistent historic data from constituent Districts.

6.5. It is suggested that DfT should encourage TCAs which might be able to satisfy these conditions to identify themselves, and there is a case that DfT should pro-actively seek potential candidates for inclusion in an expanded reference data set for the 2005-6 to 2008-9 period. This would allow TCAs that felt that their circumstances were significantly different to those in the reference areas to set out the basis for their concerns. However, time and money would probably need to be spent on refining the data that was immediately available, and it is inevitable that some residual uncertainties about the robustness of data are likely to remain.

6.6. It should also be noted that while the ITS derivation of the reference parameters has focussed on average values for the PTE and non-PTE data sets as a whole, Research Report 5 does reveal substantial variation around these average values, particularly for the seven Counties. It is quite likely that at least some of this variation arises from residual "noise" in the data, but there is the possibility that there is a systematic variation which merits further investigation. While not necessarily directly leading to robust elasticity estimates for the individual Counties, such work could add to the case for variations in elasticity values that might be endorsed by DfT at national level. The appropriate way to reflect such variations is with the publication of a wider range of single demand curve parameters, potentially offering "rural" or "large urban area" Beta and Lambda values as alternatives to the current single set of "non-PTE" values.

7. Issues associated with measurement of underlying trends

7.1. It is clear from the above that DfT's proposal that TCAs should adjust Reimbursement Factors by reference to the trends in commercial trips is regarded as misconceived. However, even if this was not the case, DfT must recognise that the proposed use of commercial passengers as a proxy for underlying concessionary travel trends is fraught with difficulty.

7.2. Potential dangers will be magnified if the consequence of the proposal is that individual operators put forward a case that their own Reimbursement Factors are adjusted, in isolation from trends in their competitors. In any case, the proposal puts TCAs entirely in the hands of the bus operators, since only the operators can provide data on non-concessionary patronage.

7.3. Issues include:

- The likely reliability of operator estimates of passenger numbers. Particularly with the growth in use of discount tickets, these will be heavily dependent upon operator assumptions about trips per ticket sale. The likelihood of a TCA being able to audit these assumptions going back to 2005-6 is remote.

- The estimation of the average commercial fare, also subject to a variety of difficult-to-audit assumptions.
- Data from individual operators will be substantially coloured by changes in market share that are unrelated to underlying passenger trends, such as route swaps, mergers and acquisitions, restructuring of operations, and changes in the scale or nature of the commercial network relative to the supported bus network.

7.4. The latter is one of the most significant elements of noise that could be introduced into the data, inadvertently or not, and implies that if any reference to commercial trip trends is retained in the Guidance, it should be based on whole-TCA analysis, covering all significant operators, and not use individual submissions by isolated operators.

Reimbursement arrangements - **Annex C** - Position paper on additional capacity costs

DfT Concessionary Travel Reimbursement
Consultation Response

Annex C. Position paper on additional capacity costs

November 2010

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Content

1. Background

1.1. As stated by DfT in its draft Guidance, “the underlying principle which underpins [concessionary] reimbursement is (...) that operators should be left ‘no better and no worse off’ as a result of the existence of the (...) scheme”. The draft Guidance goes on to say that this implies operators should be reimbursed for:

- Revenue forgone – “i.e. the revenue [operators] would have received from those concessionary passengers who would otherwise have travelled and paid for a (...) ticket in the absence of the scheme”
- Net additional costs – i.e. those costs incurred by the operator which would not have taken place in the absence of the scheme, net of any increases in fare paying demand due to possible increases in frequency.

1.2. Additional costs are made up of four components:

- Scheme administration costs;
- Marginal operating costs: the additional operating costs incurred in carrying those passengers generated by the scheme, assuming they can be accomodated within the capacity that would have been provided in the counterfactual;
- Net marginal capacity costs: the net costs incurred from the additional capacity necessary to accomodate generated journeys, after allowing for the impact of that capacity on fare paying passengers;
- Peak vehicle requirement (PVR) costs.

1.3. This note concentrates on the calculation of marginal capacity costs, and in particular the estimation of the additional capacity requirements relative to the counterfactual. In our view the draft Guidance does not provide a convincing and consistent methodology for dealing with this issue. We therefore put forward our own approach, along with empirical evidence from three PTEs, which we feel complements the approach set out in the draft Guidance.

2. Summary of DfT proposal

2.1. The Guidance addresses two separate issues with respect to the additional capacity cost calculation:

- When to apply marginal capacity costs;
- Unit cost per generated passenger (under the heading ‘cost model’).

When to apply marginal capacity costs

2.2. The draft Guidance recommends that the onus should be on operators to initiate and demonstrate a claim for marginal capacity costs. The implied assumption is therefore that, under normal conditions and for the majority of bus networks, generated concessionary passengers can be accomodated within the capacity that would have been commercially provided by operators in the counterfactual. As we will demonstrate in section 5, this appears to be a sensible principle based on our empirical analysis of occupancy levels across PTE bus networks.

2.3. The draft Guidance also suggests that additional capacity cost claims are best treated on a route-specific basis. Although this seems to be a sensible principle, we would actually go further and suggest that the analysis needs to be done at an even more disaggregate level to take into account variations in passenger load between individual bus departures throughout the day.

2.4. Although no details are provided on the methodology and criteria[1] that should be used to assess an operator's claims for additional marginal cost, the draft Guidance does suggest that operators should include the following evidence:

- Concessionary journeys as a proportion of total journeys by route (service) disaggregated by hourly or half hourly period.
- Average passenger loads per route by hourly or half hourly period and per direction
- Seating capacity per route (service) by hourly or half hourly period and per direction
- Service frequency per route (service) by hourly or half hourly period and per direction

Cost Model

2.5. The draft Guidance provides a model for calculating an average marginal capacity cost per generated passenger. The model is implemented in a spreadsheet provided as part of the consultation documents.

2.6. It is implicit in the Guidance that the unit cost per generated passenger should be uniform across a TCA area although it is possible, subject to data availability, to vary input parameters by operator.

2.7. The Guidance states that *"**for avoidance of doubt, reimbursement for additional capacity costs should only apply to the subset of operations for which the operator has provided data that suggests that capacity will be lower without the concessionary fare scheme**"*. Therefore, our interpretation is that the unit cost per generated passenger should only be applied to that proportion of generated passengers which operators can demonstrate have led to an increase in capacity requirements.

2.8. The key parameters driving the cost model are:

- Mohring factor, which establishes the relationship between frequency and demand levels
- Average operating speed, which can be obtained from the CUBS database[2] or derived from local data. Note that the CUBS database does not include any data for the metropolitan areas.
- Route length
- Service Frequency
- Average occupancy, based on scheduled service mileage, local trip numbers and average journey lengths
- Commercial adult journeys as % of total

[1] The draft Guidance states that operators should provide a "commentary based on this data that demonstrate that it is in the operators' financial interest to provide extra services where there are generated journeys due to the concessionary travel scheme compared with the counter factual situation".

[2] http://cubs.reseaulutions.com/

- Unit costs (veh-hour and vehicle-mile), default values based on the ITS research are provided by the DfT. These are uniform across the country.
- Average commercial adult fare, similar to that used for the calculation of revenue forgone
- Demand response to service changes, based on TRL (2004) and fixed in the Guidance.

Peak vehicle requirements (PVR)

2.9. The draft Guidance implies a presumption that peak vehicle requirements due to generated passengers will only occur in exceptional circumstances and hence it is up to operators to substantiate any claims.

2.10. The data to be provided as part of such claims should include passenger boardings by route and hourly or half hourly period, making a distinction between concessionary and non-concessionary passengers. The result from this analysis should be an estimate of the number of generated concessionary trips which lead to the counter factual peak vehicle requirement to be exceeded.

2.11. The PVR cost per additional peak period passenger is then obtained by multiplying through by one way route journey time (in hours) and £1.61 (units = 1 / [peak passenger*route hour]).

2.12. In addition an allowance should be made for a reasonable level of profit on capital invested which should be added to the figure in the previous paragraph.

3. Critique of the DfT proposal

3.1. Although our own analysis lends support to the DfT’s presumption that generated passengers do not normally give rise to additional capacity costs, we find that the draft Guidance offers TCAs very little assistance in assessing the inevitable claims by operators that such costs have indeed occurred.

3.2. In our view, the key question, and one which the draft Guidance fails to address, is to what extent the capacity that would have been provided in the counter factual could have accommodated those additional passengers without affecting operating costs and commercial revenues. We feel that this issue is complicated further by the inconsistency between the draft Guidance and the reimbursement calculator, with the latter offering no opportunity to record the proportion of generated passengers which demonstrably generate additional capacity requirements but instead setting a default Mohring factor.

3.3. It is therefore our assessment that, in this respect, the draft Guidance is not fit for purpose. We address additional specific concerns in the remainder of this section.

When to apply marginal capacity costs

3.4. Although TCAs are not effectively provided with a methodological approach or criteria for assessing claims by operators, there is a vague statement that operators should demonstrate that “it’s in [their] financial interests to provide additional capacity”. It should be made clear how this is meant to relate to the NBNW principle. We would argue that a more appropriate statement would be that “operators should demonstrate that [the proposed] level of additional capacity is required to leave them NBNW than in the counter factual”.

3.5. It is suggested in the draft Guidance that no additional capacity costs occur when average load factors (presumably by route and during the peak hour of operation) are below 33%.

While this appears to be an attractive proposal due to its apparent simplicity we would argue it is neither consistent with the NBNW principle nor easy to implement in practice.

3.6. If we think of a typical morning peak service which picks up passengers at a uniform rate up along the route up to the seating capacity, then unloads at the final stop and travels back empty in the outbound direction its average occupancy (relative to seating capacity) would be 25% even though its maximum load was 100% of seating capacity. We would therefore argue that using average load factors, even at a very disaggregate level, does not adequately help answer the question of whether generated concessionary passengers require additional capacity to be provided. This is because such an indicator tells us very little about the extent to which generated passengers lead to overloading on individual services at specific pinchpoints in the network.

Inconsistency between the draft Guidance and the Reimbursement Calculator

3.7. There appears to be a significant inconsistency between the draft Guidance and the Reimbursement Calculator on the point that "*additional capacity costs should only apply to the subset of operations for which the operator has provided data that suggests that capacity will be lower without the concessionary fare scheme*".

3.8. The Reimbursement Calculator does not give the opportunity for operators or TCAs to input the proportion of generated passengers which give rise to marginal capacity costs and hence the rate per generated passenger caculated by the cost model is applied to all generated passenger, which is obviously in conflict with the presumption that additional capacity costs do not normally arise.

The appropriateness of the Mohring factor in the cost model calculation

3.9. Although carrying a different meaning originally, the Mohring factor has come to provide an aggregate representation of the increase in capacity required to accomodate a certain volume of additional demand. While we appreciate the advantages of using this indicator to provide a simple measure of the level of additional capacity cost claims we would question the suggestion of a default value in the draft Guidance.

3.10. Given that additional capacity costs should only arise from those generated passengers which have led to an increase in capacity requirements it makes little sense to set a default Mohring factor other than zero in the cost model. In our understanding, this parameter would be derived empirically as part of an operators' claim for additional capacity costs. The suggestion in para 7.29 that a non-zero default parameter should be used, followed by the statement that "if operators and TCAs have good evidence (...) that (...) is significantly different in their area then a locally specific Mohring factor should be used", seems to be in direct contradiction with para 7.22.

Revenue generation from additional capacity

3.11. The PTEs strongly support the view expressed in the Guidance that additional costs should be net of revenue gain due to increases in service frequency. Additional capacity on existing routes is likely to decrease waiting times for revenue generating passengers, and will therefore lead to an increase in demand and revenue for operators.

3.12. However, we have concerns over the way in which this principle is implemented in the reimbursement calculator, by excluding non-generated concessionary passengers from the calculation of additional revenue. Operators are fully compensated by transport authorities at commercial rates for non-generated concessionary passengers. Hence, such passengers have an effect on operator cash flows similar to if they were effectively paying for a ticket themselves. Any increases in revenue from non-generated passengers that result from increases in capacity need therefore be netted off from the additional capacity costs incurred. The reimbursement calculator should therefore be corrected to properly reflect the underlying conceptual rationale.

Sensitivity of results to changes in network parameter values

3.13. We find it very worrying that small deviations from the default parameters which characterise the bus network (e.g.: load factors, bus speeds etc) appear to have a disproportionately large, and in some cases counter-intuitive, impact on the resulting additional capacity costs. Without a clearer explanation of the underlying conceptual rationale it is difficult to see why this should be so, and in any case it is unsatisfactory for such calculations to be so sensitive to input data that is very largely in the gift of bus operators.

3.14. One particular point of concern that has become apparent when testing the reimbursement calculator is that higher average load factors lead to lower additional capacity costs per generated passenger. Thus the more spare capacity an operator provides, the greater will be the reimbursement for additional capacity costs. This seems to us to be deeply counter-intuitive and unsatisfactory, and seems to be a symptom of the internal inconsistencies described above in paragraphs 3.7 – 3.10.

3.15. Another example is average operating speed, where the draft Guidance directs TCAs to the CUBS database, which is maintained by a third party and excludes data from PTE areas. It is unclear whether the DfT is recommending that PTEs should attempt to use this data source and how. Assuming that the data available through the CUBS database is not representative of PTE areas and no local evidence exists, it would be up to operators to give an estimate of this parameter. We feel that this is a risky approach given the sensitivity of the proposed procedure to input values. Furthermore, unless more detailed information is provided by DfT about the quality and reliability of the source of default parameters, it will be difficult for TCAs to assess whether locally derived parameters represent an improvement in the accuracy of default parameters.

3.16. Moreover, the Guidance is not clear on the exact definition of each of these network parameters. In the case of average operating speed, for example, we can think of several different ways in which this parameter could be calculated (including/excluding layover time, including/excluding dwell time at bus stops), which lead to wide variations in additional capacity costs.

Marginal vs average costs as the correct basis on which to calculate additional capacity cost payments

3.17. One key element in the additional cost calculation is the unit cost of providing additional capacity. ITS have estimated a **marginal** capacity cost in the range of 30-50p/veh-km based on fairly robust econometric models, whereas accounting models give a substantially higher **average** cost. The DfT appears to have chosen to follow a middle ground somewhere between the ITS's marginal costs and the average costs estimated from accounting models.

3.18. However, economic theory is clear: the point at which marginal cost = marginal revenue is where an operator chooses to stop producing because its change in profit is zero. Relating this to the issue of generated passengers, should the ENCTS scheme be scrapped tomorrow an operator's costs would only fall by the **marginal capacity cost** of carrying those generated passengers given that it would still need to cover all the fixed costs of running the vast majority of its services. Paying these marginal costs would therefore leave the operator no better and no worse off than in the counterfactual.

3.19. Should the generated passengers increase fixed costs (e.g.: through greater peak vehicle requirements) then an operator would be right to claim some of these back. However, even then, the correct cost would be slightly below average cost (defined as total costs divided by total passengers) because some costs are fixed regardless of generated passengers (depots, admin, etc).

3.20. A key conceptual issue that needs to be better resolved in the final version of the Guidance is whether operators should be reimbursed on a marginal cost or average cost basis and why.

4. Proposed PTE methodology

4.1. The PTEs have developed a methodology for the estimation of additional capacity requirements based on local survey data. The key assumption is that the impact of generated passengers on an operators' financial position[3] arises only where their presence increases crowding levels beyond the point at which revenue generating passengers become inconvenienced[4]. The conceptual framework underpinning this assumption is provided in appendix A. The key point we make in that

4.2. Our proposed methodology is as follows:

1. Calculate the load factor at the maximum load point for each of a sample of bus departures where complete on-board passenger surveys or boarding/alighting counts have taken place[5]. In the case of passenger surveys it should be possible to obtain the number of concessionary passengers on board the bus at the maximum load point.
2. Plot the distribution of bus mileage against load factor.
3. Calculate the proportion of bus departures for which the maximum load factor goes above a certain crowding threshold (which we refer to as X% below). Where data permits,calculate the proportion of departures where overloading is due to generated passengers (which we refer to Y% below).
4. Calculate the proportion of generated concessionary passengers relative to total demand (which we refer to as G% below).
5. Estimate the local Mohring factor as the ratio between the estimated proportion of bus departures which are overloaded due to concessionary passengers and the proportion of

[3] Excluding marginal operating costs assuming fixed service levels which are taken into account elsewhere.

[4] Unlike in the context of Mohring's work, the decisions of profit-maximising operators should not be influenced either by passengers' consumers surplus or by generated passengers (for whom price should equal marginal cost in the context of NBNW)

[5] Only bus departures on which all passengers were surveyed from start to end should be considered.

generated passengers. This parameter can then be fed into the DfT Reimbursement Calculator.

4.3. The underlying rationale for this approach is that the observed occupancy profile is representative of the commercial judgement made by operators about the optimum level of crowding at present. We therefore assume that, in the absence of generated passengers, bus departures would be reduced until the previously observed proportion of overloaded buses was reached.

4.4. If we take the observed level of mileage above the threshold level of occupancy as X% (point 3) and the proportion of generated passengers relative to total demand as G% (point 4), the proportion of mileage on which additional capacity costs should be paid is then equal to the product (G.X). The corresponding Mohring factor (the percentage change in mileage divided by the percentage change in demand) is therefore **M=(G.X)/G**.

4.5. Where on-board survey data is available it should be possible to distinguish the proportions of bus departures where overloading is caused by generated and non-generated passengers. In this case, if we take the proportion of mileage above the threshold level of occupancy due to generated passengers as Y%, the Mohring factor is given by **M=Y/G**.

4.6. This still leaves the question of what the appropriate threshold load factor should be. In our view, this is an empirical matter to be addressed, for example, through Stated Preference surveys. Evidence from rail commuter data[6] suggests that the value of time begins to increase from the point at which the load factor hits 100% of seating capacity. If we assume the average rail commute is representative of the typical journey lengths by bus then this would be an appropriate threshold.

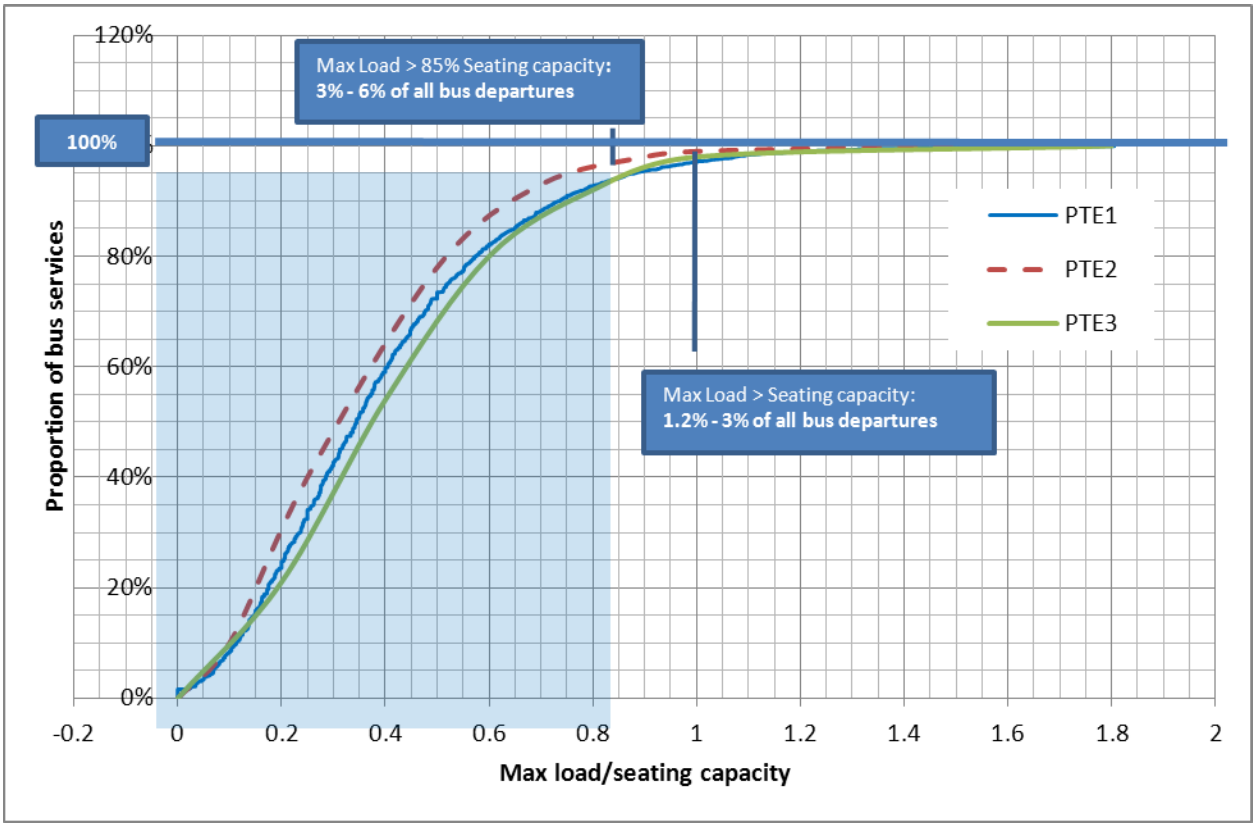
5. PTE evidence on additional capacity requirements

5.1. The majority of PTEs currently undertake a rolling programme of on-board bus passenger surveys which yield the input data for the additional capacity methodology described in the previous section. Survey data from three PTEs has been used to test the proposed methodology and the results are summarised below.

5.2. Figure 1 shows the cumulative probability distribution of the maximum load factor relative to seating capacity. The results show that the seating capacity is only exceeded on between 1.2% - 3% of sampled bus departures. In fact, more than 90% of all sampled bus departures have at least 20% empty seats, which supports the presumption that generated concessionary passengers can generally be carried within pre-existing capacity. These results also suggest that optimum commercial decisions by operators result in some degree of crowding (measured as a proportion of seating capacity).

[6] PDFH

Figure 1. Proportion of surveyed bus departures by maximum load factor



5.3. Table 1 summarises the key outputs of our analysis using the proposed PTE methodolgy. Although there are some non-negligible differences in the level of crowding between the three PTE areas, the results are broadly consistent and suggest a Mohring factor in the range 0.04 – 0.1 if we assume a crowding threshold at 100% of seating capacity. This is much lower than the factor of 0.6 derived by Mohring under welfare maximising conditions and gives further support to the draft Guidance's presumption that additional capacity costs do not normally occur. But even assuming a crowding threshold at 85% of seating capacity the Mohring factor would only increase to 0.1 – 0.26.

Table 1. Analysis of additional capacity requirements (PTE methodology)

Crowding Threshold	Area	Departures above crowding threshold	Departures above crowding threshold due to generated passengers	Generated concessionary passengers as proportion of total demand	Implied Mohring factor
100%	PTE1	3.0%	1.3%	13.1%	0.1
	PTE2	1.2%	0.6%	13.5%	0.04
	PTE3	3.3%	1.4%	15.5%	0.09
	Average	2.5%	1.1%	14%	**0.08**
85%	PTE1	4.8%	2.1%	13.1%	0.16
	PTE2	2.9%	1.3%	13.5%	0.1
	PTE3	7.6%	4.0%	15.5%	0.26
	Average	5.1%	2.5%	14%	**0.17**

Assumptions: Reimbursement Factor = 50%

Sample: PTE1 = 4855 bus departures; PTE2 = 25000 bus departures; PTE3 = 25000 bus departures.

5.4. Another interesting result is that the the proportion of crowded services due to generated passengers seems to be in a relatively stable ratio (around 40-50%) to the total proportion of crowded services. This suggests that this evidence could be combined with boarding/alighting surveys which may not distinguish concessionary from non-concessionary passengers.

Peak Vehicle Requirements (PVR)

5.5. It has been possible to obtain disaggregate estimates of occupancy levels by time period for PTEs 1 and 2, which shows that the degree of crowding is about twice as high in the morning (7.30 – 9.30 am) than in the afternoon peak (4 – 6 pm). Bearing in mind that the free statutory concession is valid only from 9.30am this result suggests that generated passengers are unlikely to have an effect on peak vehicle requirements. This empirical finding lends support to the DfT's presumption that peak vehicle requirements do not normally change as a result of generated concessionary passengers.

6. Conclusions

6.1. This paper provides a discussion of the DfT's draft Concessionary Reimbursement Guidance with respect to reimbursement for additional capacity costs.

6.2. It is our view the draft Guidance does not provide suitable criteria or a convincing and consistent methodology for assessing operators' claims that the need for additional services has arisen as a result of free concessionary scheme.

6.3. In the spirit of the Guidance, the PTEs have therefore developed a methodology based on local survey data which, it is felt, is rigorous, consistent with the Guidance and based on a robust conceptual rationale.

6.4. This methodology has been implemented using survey data from three PTEs and the results have been broadly consistent. It is proposed that this methodology is acknowledged in the final version of the Guidance and that the empirical results are shared with the wider TCA community.

ANNEXES

A. Theoretical framework for the calculation of additional capacity costs in the context of free concessionary travel and profit maximising operators

Introduction

6.5. One signficant challenge in developing a rigorous framework for concessionary bus travel reimbursement is the calculation of the additional capacity required to carry generated concessionary passengers.

6.6. ITS have argued that the framework set out by Mohring in 1972 (and further developed by a number of other authors) for the calculation of the welfare-maximising level of frequency is relevant for the analysis of the problem at hand. Mohring's research led to the well-known square-root rule, which suggests that the optimum level of frequency is proportional to the square root of demand.

6.7. We would argue that the square root rule is not applicable in the present context since it is based on the assumption that bus operators set their frequency so as to maximise total social welfare rather than profit. The DfT's draft Guidance begins by recognising this point by stating that the onus should be on operators to demonstrate that additional capacity costs do occur. Effectively, this is a presumption that under normal conditions the Mohring factor is zero. However, the draft Guidance goes on to suggest without further justification that a default Mohring factor of 0.6 should be used as a default in the cost model.

6.8. This note attempts to set out a robust conceptual framework for analysing additional capacity costs in the context of profit maximising operators. It is concluded that, under profit maximising and NBNW conditions, operators would only provide additional capacity to carry generated passengers where those passengers are likely to have a detrimental impact on the level of demand by revenue generating passengers.

Theoretical framework

6.9. Starting from the context of Mohring's work (the calculation of the welfare maximising level of frequency) total welfare can be represented by the following function (Savage and Small, 2008):

$$W(f) = p.D(p,f) - c_{capacity}.f - c_{passenger}.D(p,f) + CS(p, f) \qquad (1)$$

Where

- W(f) = welfare generated from a given level of frequency f
- f = frequency
- p = average fare
- w = average waiting time
- ivt = average in-vehicle time
- D(p,f) = demand level at fare p and frequency f

- Ccapacity = cost of a unit of frequency
- Cpassenger = marginal cost per passenger
- CS = consumer surplus, which is a function of fare and frequenc y

6.10. It can be shown that the optimal frequency in this context is indeed proportional to the square root of demand. However, bus operators' behaviour is aimed at profit maximisisation, where profit can be expressed as:

$$\pi(f) = p.D(p,f) - c_{capacity}.f - c_{passenger}.D(p,f) \qquad (2)$$

6.11. This function differs crucially from (1) in that it ignores the benefits to existing passengers from any changes in frequency (in particular through reduced waiting time). It should be noted that, by definition, the term CS(p,f) in equation (1) must be larger than the revenue received by operators (p.D) and it is therefore to be expected that equation (2) will lead to a different optimum service level from equation (1).

6.12. Now let's try to understand how a profit-maximising operator would set the frequency level in the context of free concessionary travel by separating out fare paying and concessionary demand in the profit maximising function above:

$$\pi(f) = p.D_{paying}(p,f) + p_{CT}.D_{CT}(f).RF + p_{gen}.D_{CT}(f).(1-RF) + -c_{capacity}.f - c_{passenger}.(D_{paying}(p,f)+D_{CT}(f)) \qquad (3)$$

Where

- D_{paying} = fare paying trips
- D_{CT} = concessionary trips
- RF = Reimbursement factor (= proportion of CT trips which would have taken place at full fare)
- p_{CT} = fare that would have been paid by non-generated CT passengers in the counterfactual.
- p_{gen} = compensation for additional marginal cost and capacity required to carry generated CT passengers

6.13. The no better no worse off definition implies, by definition, that:

$$p.D_{paying}(p,f) + p_{CT}.D_{CT}(f).RF = p.D(p,f) \qquad (4)$$

Hence,

$$\pi(f) = p.D(p,f) + p_{gen}.D_{CT}(f).(1-RF) + -c_{capacity}.f - c_{passenger}.\left(D(p,f)+(1-RF).D_{CT}(f)\right) \qquad (5)$$

6.14. Let's now assume that the profit maximising level of frequency in the counter factual leaves enough free capacity to carry the generated CT passengers (i.e.: the implicit base assumption in the draft Guidance). In that case, $p_{gen} = c_{passenger}$, profit is not a function of generated demand and the optimal frequency is exactly the same as it would be in the couterfactual:

$$\pi(f) = p.D(p,f) + (p_{gen} - c_{passenger}).D_{CT}(f).(1 - RF) + -c_{capacity}.f - c_{passenger}.D(p,f) =$$
$$= p.D(p,f) - c_{capacity}.f - c_{passenger}.D(p,f) \tag{6}$$

6.15. This reasoning highlights the fact that a profit maximising operator may or may not change its level of service to accomodate additional passengers, depending on the degree of available capacity[7] in the counterfactual, which essentially seems to be the implicit assumption in paragraphs 7.22 and 7.23 of the draft Guidance**.** It is therefore unlikely that there is a clean cut square root with respect to generated CT trips in the context of profit maximisation. The use of a Mohring factor of 0.6 in the absence of supporting empirical evidence is therefore not justified in the context of NBNW reimbursement of operators for additional capacity costs.

Impact of generated CT passengers on operator profitability

6.16. In the context of profit maximisation, and given the condition that operators should be no better and no worse off as a result of concessionary payments, equation 6 suggests that the payment for additional capacity costs should be zero since that would leave operators with the same level of profit as in the counterfactual (equation 2).

6.17. However, our relatively simple model does not take into account the impact that generated concessionary passengers would have on fare paying passengers. To address that issue we could modify equation 6 as follows:

$$\pi_{CT} = p.D(GC(p,f,ivt(D,D_{CT}),o(D,D_{CT},f)) + (p_{gen} - c_{passenger}).D_{CT}(f,ivt(D,D_{CT}),o(D,D_{CT})).(1 - RF) - c_{capacity}.f - c_{passenger}.D(GC(p,f,ivt(D,D_{CT}),o(D,D_{CT},f)) \tag{7}$$

Where:

- $o(D, D_{CT}, f)$ = degree of overcrowding as a function of generated and non-generated demand
- $ivt(D, D_{CT}, f)$ = average in-vehicle time as a function of generated and non-generated demand

6.18. The additional capacity payment per passenger (p_{gen}) should therefore be such as to compensate operators for loss of revenue due to increased in-vehicle time and overcrowding. Working out $ivt(D,D_{CT})$ and $o(D,D_{CT},f)$ then becomes an empirical matter.

[7] Note that according to Mohring and subsequent research the square root rule would hold regardless of the level of spare capacity on the network.

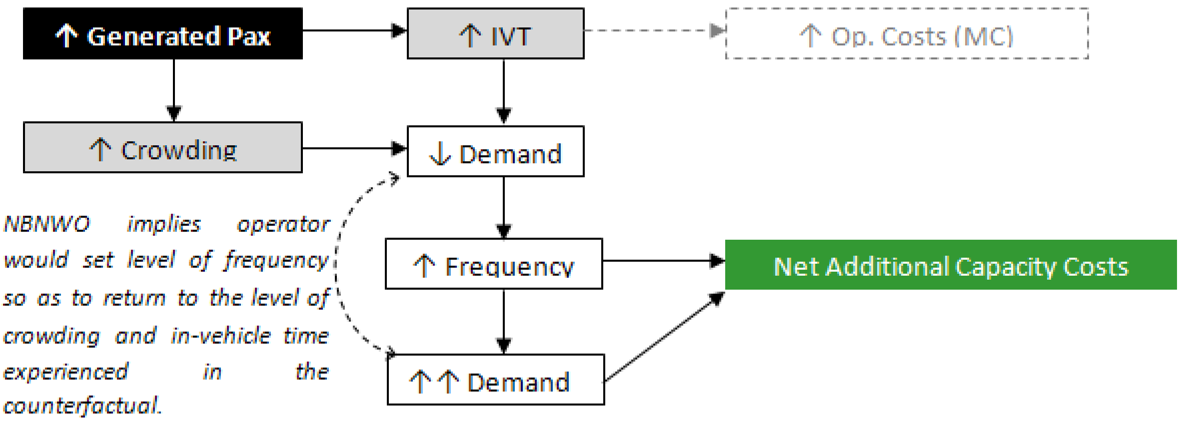
Conceptual framework for empirical analysis of crowding and travel time effects

6.19. The assumption in equation 7 is that generated CT passengers impact on operator profitability in three ways:

- They may contribute towards **overcrowding** on heavily loaded services, which, in turn, could reduce the level of demand by fare paying passengers due to the added inconvenience;
- They may increase route travel time through additional boarding and alighting time, which, in turn, increases **in-vehicle time** for other passengers and could therefore reduce demand by fare paying passengers.
- The increase in route travel time also increases **operating costs** – however that effect is already taken into account in the calculation of additional marginal costs.

6.20. The operator would then need to increase frequency to a level such that it would balance out the previous increase in crowding and in-vehicle time. In order to maintain the same level of profitability the operator would have to be compensated by the additional capacity costs incurred by that increase in frequency. Conversely, the increase in revenue from fare paying passengers would need to be deducted from the compensation to be paid to the operator.

6.21. The diagram below attempts to illustrate this process.



6.22. In order to calculate the correct amount of compensation due to operators (net additional capacity costs) it therefore becomes necessary to answer the following questions:

- On what proportion of services do generated CT passengers have a material effect on crowding? What is the optimum level of crowding in the counterfactual? What increase in frequency is required to bring crowding levels back to this optimum? → f_1
- What impact does an additional generated passenger have on in-vehicle time relative to a fare paying passenger? What increase in frequency is required to bring average boarding time per stop to the same level as in the counterfactual? →f_2

6.23. The required change in frequency would then be $f_{CT} = \max(f_1, f_2)$.

6.24. A before and after survey carried out at the time when free travel was introduced in West Yorkshire suggests that this measure led to a 50% reduction in average boarding times due to simplified ticketing. Assuming a Reimbursement Factor of 50%, one would conclude that the increase in journey times due to generated passengers is roughly equivalent to the reduction in journey times amongst non-generated passengers. It is therefore likely that crowding effects (giving rise to the change in frequency f_1) would dominate the calculation of additional capacity costs.

Reimbursement arrangements - **Annex D** - Position paper on average fare calculations

DfT Concessionary Travel Reimbursement
Consultation Response

Annex D. Position paper on average fare calculations

November 2010

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Content

1. Background

1.1. Under the 1986 Regulations, bus operators are entitled to reimbursement for revenue forgone as a consequence of their participation in a concessionary travel scheme. A key element of the calculation of revenue forgone is an estimate of “the average fare that would have been paid by concessionary passholders in the absence of the scheme”.

1.2. In the past, reimbursement calculations have often been based on an estimate of the “cash” fare, calculated from fare scales used to calculate the price of single or return journeys, (or the cash received from such ticket sales). However, reliance on the cash fare has become increasingly unsatisfactory as operators have broadened the range of ticket products offered to passengers to include a variety of tickets such as day tickets, weekly tickets and other season tickets. It has also become more difficult for operators to report network-wide cash fare scales because of geographic variation in fare structures. And the vast majority of TCAs have typically not had access to data to enable them to assess the scale or value of use of non-cash ticket types.

1.3. DfT’s draft Guidance therefore provides a default method for calculating the average fare via a discount factor, envisaged as applying to the average cash fare. The method has been devised to be operable with the minimum amount of information from operators, by using analysis of a reference dataset from the NoWcard smartcard scheme.

1.4. PTEs are better equipped with data than most TCAs, allowing them to use more accurate local evidence instead of having to rely upon the NoWcard data (which may not be fully representative of the local situation). In addition, PTEs may be faced with ticket system characteristics that are more complex than those for which the Discount Factor method is designed. In addition, we have some concerns about the detailed implementation of the Discount Factor method.

1.5. The paper therefore discusses a number of areas where, in ***pteg***’s view, there is a strong case for modifying DfT’s Guidance and/or the recommended methodology. The paper sets out:

- our understanding of the fundamentals of the DfT approach;
- a discussion of the issue of “degeneration”;
- the significance of the Adult Equivalent Single Fare;
- an alternative methodology to the current Discount Factor method;
- illustrative data from one PTE to contrast the results from different average fare calculation methods;
- a number of other concerns that have been identified with the current Guidance and/or spreadsheet implementation.

1.6. ***pteg***’s position has been informed by access to detailed data from a number of PTEs which provides an evidence base for variations from the draft Guidance. Further details of this analysis can be provided if required. Where quoted in this paper, data has been anonymised to preserve commercial confidentiality.

2. Fundamentals of the DfT approach

Concept of the average fare

2.1. The statutory concession allows older and disabled passholders to use the bus at zero fare. In the absence of the concession, the decision to travel would be made in the light of the fare that passholders would have to pay. Given the availability of the range of fares and ticket products offered by an operator[1], they would choose what tickets to buy, probably on the basis of the combination of products that minimised their overall financial outlay.

2.2. The average fare that would be paid in the absence of the scheme will therefore be the average of the fare per journey for a large number of journeys. The fare per journey will vary significantly through geography (i.e. trip length) and also choice of ticket type. Where ticket products allow an unlimited number of journeys to be made within the validity of the ticket, then the average fare per journey will be the price per ticket divided by the number of journeys made with the ticket[2].

2.3. If we knew the total fare revenue paid by the passengers of interest, and the number of journeys made, then the most direct measure of the average fare per journey is simply the total fare revenue divided by the total number of journeys. An arithmetically equivalent way of reaching the same answer is through a weighted average of the price per journey of each type of ticket, using weights determined by the number of journeys made with each type of ticket.

2.4. Note that in order to calculate such a weighted average, it is necessary to know the number of tickets sold, the average price per ticket, and the number of journeys made with each ticket. But if one of these items of information is missing, the calculation cannot be done, because the average number of journeys per ticket sale (which determines the price per journey) cannot be calculated.

Simplification of fare products

2.5. Average fare calculations are complicated by the number of alternative ticket products that an operator might offer, and the range of prices (and variations in scope of use) associated with each product. The DfT's simplification of the possible range of ticket types to "Single", "Daily" and "Weekly" provides one useful way of summarising what may be a large number of similar commercial offers, although it may over-simplify the practical choices that are available. This issue is discussed separately in Section 7.

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[1] ***pteg*** agrees with the view expressed in the Guidance that it is plausible that in the absence of the scheme operators would change their commercial offer in some way, probably to reduce the overall fare that would be charged. It is regretted that no mechanism for allowing for this effect has been provided.

[2] For travel cards, the payment at time of travel for journeys made using a day ticket or week ticket etc will usually be zero, except for a first payment to purchase the ticket if it is bought on-bus. But since the average fare per journey is simply the purchase price divided by the number of journeys made, there is no need to make any particular allowance for the fact that some journeys using the ticket are perceived to be made at zero marginal cost per journey, whereas others are not.

2.6. For the purposes of the discussion in this section, we assume that this characterisation of fare products is sufficient. The methodology for calculating an average fare therefore reduces to the need to estimate the average fare per journey for cash, day tickets and weekly tickets, and the distribution of journeys between them.

"Basket of fares" or "discount factor"

2.7. We suggest that the apparent choice of methods provided by DfT, between the preferred Discount Factor approach, and the so-called Basket of Fares method, is a false dichotomy and can cause confusion.

2.8. Both methods are ways of approaching the practical requirement of a TCA to calculate an appropriate average fare for reimbursement purposes, for a particular operator and a particular reimbursement period (e.g. a month, quarter or year etc). The end product in both cases is an estimate of the average fare that would be paid in the absence of the concession.

2.9. In the case of the **Basket of Fares** method, the average fare is calculated directly from data on the price per ticket, assumed journeys (by passholders) per ticket and assumed distribution of concessionary journeys by ticket type. These values are all supplied by the user. The output is a weighted average fare.

2.10. In the case of the **Discount Factor** method, the user inputs the average fare per journey for "cash" fares, plus the average price per ticket for each of the generic ticket types e.g. daily and weekly tickets. The output is also a weighted average fare, in which the assumed journeys per ticket and distributions of journeys by ticket type have been calculated (with adjustments) from NoWcard data. However, this value is translated into a discount factor which can be applied to an estimated cash fare per journey to "get back to" the weighted average fare.

2.11. So in effect, what the Discount Factor method does is provide the user with an empirical distribution of the number of journeys per ticket, and distributions of journeys by ticket type, that the user would otherwise need to supply to make use of the Basket of Fares method. This is a considerable step forward since most TCAs are not in a position to derive this information.

2.12. However, we note that PTE data demonstrates that there may be a significant difference between the average cash fare, as paid by passengers choosing to use cash tickets, and the ***average equivalent single fare*** – the average cash fare that would be paid by users of other ticket types. This arises because of differences in trip length – non-cash users may tend to make longer trips than cash payers, for a variety of reasons. Consequently, whereas the discount factor is applied to the cash fare actually paid by cash users, the calculation of the discount factor should be based on the price ratio between discounted products and the average equivalent single fare. The implications of this issue for the mechanics of the average fare calculation are discussed in Section 3.

Inferring the allocation of concessionary journeys between ticket types

2.13. The actual choice that concessionary passengers would make between the different ticket types available cannot be directly observed, and some combination of evidence and hypothesis is required to allow the weighted average fare to be calculated. In our view, there are two main options:

- Inferring the choice between ticket types from observed data on existing concessionary passholders travel frequencies at the zero fare;
- Inferring the choice from observed data on actual choice of ticket type by non-concessionary bus passengers at prevailing commercial fares.

2.14. The Discount Factor method uses data on existing concessionary travel at zero fares. Price ratios are calculated from the input data on ticket prices and ticket sales; these give the number of journeys that would need to be made over the period of validity of the ticket to justify its purchase relative to using a cash fare for each journey. Consequently, the Discount Factor method inspects the NoWcard data to determine in how many days and weeks trip frequencies are such as to justify the purchase of, respectively, daily and weekly tickets (given their price relative to a cash fare).

2.15. By contrast, the Basket of Fares method uses empirical evidence and, in most cases, assumptions on the travel behaviour of non-concessionary passengers to work out a discounted fare based on a weighted average of commercial tickets available.

2.16. In Section 6, we contrast the average fare obtained by using the NoWcard trip frequency distribution and the results from non-concessionary passenger surveys.

“Degenerating” trips

2.17. In the absence of the concession, the NoWcard travel patterns used in the Discount Factor method could be expected to change systematically in two respects:

- First, the total number of journeys made by passholders would fall, reflecting the change from paying nothing to paying a commercial fare. So some adjustment is needed to reflect the abandonment of trips “generated” by the free concession; this adjustment is sometimes called ***degeneration***.
- Second, passholders might also adjust their patterns of trip making so as to minimise expenditure, with some consolidation of single or return journeys so as to take account of the discounts available from daily tickets. However, it might be that fewer weekly tickets would be bought because passholders may not wish to invest in the cost of a weekly ticket justified on discretionary journeys. It is acknowledged that these possibilities reduce the confidence in the outcome from the discount factor method, but it is difficult to devise an evidence-based method for dealing with this issue. However, it is noted that these two effects would work in different directions, and the net outcome could easily be neutral.

2.18. Degeneration is the most significant change that can be anticipated, and DfT’s Discount Factor method sets out a methodology for dealing with it. ***pteg*** has some concerns about both the principles and the detailed implementation of the DfT method which are discussed in Section 4.

2.19. The draft Guidance is not clear about its assumptions on how degeneration would take effect, and the rationale for the detailed method adopted is not provided. However, it appears to attempt to deal with this issue in the five stages described below:

1. First, it calculates the total number of NoWcard trips that would have been made on single, daily and weekly tickets prior to degeneration given the current price of discounted products.
2. Secondly, it adjusts the number of trips made on daily and weekly tickets by changing the price ratios that determine the thresholds of attractiveness for discounted products, by multiplying them by a factor of (1+RF), where RF is the Reimbursement Factor calculated from the respective average fare per journey taken from the NoWcard data. Using these revised price ratios, a revised distribution of journeys between ticket types is looked-up from the NoWcard data;
3. The number of journeys assumed to use cash fares in step 1 is then multiplied by the respective Reimbursement Factor to obtain a revised number of single trips.
4. The extra trips which are no longer made using discounted tickets (the difference between the figures calculated in steps 1 and 2) are assumed to revert to single tickets in full.
5. This final distribution of journeys by ticket type is used to calculate a new weighted average fare, which gives the discount factor relative to the average adult cash fare.

3. Trip length and the *Average Equivalent Single Fare*

3.1. The fare scales used to determine the price for journeys when passengers purchase single or return tickets (or other fixed-trip variants such as carnets) is usually distance related and determined by fare scales. Discounted tickets tend to be more coarsely related to distance, if at all, and the cross-over points when discount tickets become financially attractive will depend upon trip length. The consequence is that the average cash fare actually paid by passengers may not be representative of the cash fare that would be paid by other ticket type users, if they paid cash.

3.2. PTE monitoring systems will typically collect data on passenger trip length, and will usually be able to relate this to the cash fare that operators charge for each journey, irrespective of whether a cash fare is actually used or not. This allows the calculation of an ***Average Equivalent Single Fare*** (AESF) representing the fare that would have been paid if all trips (regardless of ticket type) had been made using cash fares.

3.3. Data from PTEs shows that there may be significant differences between the average cash fare actually paid and the AESF. Typically, the AESF is higher (implying a longer trip length) for users of discount tickets than for users of cash fares. As a result, the implied trip frequency threshold used in the Discount Factor method is likely to be higher than in reality and lead to an upward bias in the average fare.

3.4. The consequence for the calculation of discount factors is that the allocation of journeys to ticket types should reflect the relative prices of the alternative products that would have been available for a specific journey (or a reasonable proxy such as the AESF) rather than the average cash fare currently observed. However, once all journeys have been allocated to individual ticket types, the average discounted fare should be calculated as the weighted average of the cash, daily and weekly fares actually paid to operators. This calculation is illustrated in Section 5.

3.5. It seems likely that differences between the AESF and the observed average cash fare will be commonplace although it is recognised that outside the PTEs TCAs may have little realistic prospect of estimating the AESF reliably on a continuing basis. It is therefore suggested that while TCAs should be advised to make some attempt to measure the AESF and contrast it with the average cash fare to monitor the scale of the issue (possibly through the occasional ad-hoc survey) this should not be set as a formal requirement in the Guidance.

4. Degeneration

Critique of the DfT Method

Overarching conceptual rationale

4.1. We agree with the DfT's view that travel patterns will clearly change in the counter-factual situation, since the requirement to pay fares will reduce the number of trips made. However, it could be expected that trip making by concessionary passengers able to use discount tickets would reduce less than those using cash fares, since the average price per trip will be less for discount ticket users than cash fares.

4.2. Consequently, there is an *a priori* expectation that the distribution of passenger trips would change, so that the proportion of trips made using discount tickets will increase. This in turn implies that the discount factor calculated from the distribution of trips in the counterfactual will be greater than if calculated from the observed distribution of trips with free fares.

4.3. However, the effect of the procedure implemented in the DfT's reimbursement calculator is to reduce the discount factor relative to that which would be calculated from the observed NoWcard data, which is opposite to what would be expected on *a priori* grounds. We argue below that the reason for this illogical result is the assumption in the DfT method that all trips degenerated from daily and weekly tickets will still be made in full but at a higher price.

Degeneration of cheaper into more expensive trips

4.4. The fourth stage of the DfT degeneration method described in Section 2 makes the assumption that all the trips currently made on discounted products which are degenerated would transfer to cash fares. We would argue that this is an erroneous assumption since it implies that all current concessionary trips in scope to use discounted tickets would still be made in the counter factual. Moreover all these trips would be made at a higher price per journey than if they had used daily or weekly tickets, which is inconsistent with the principle of degeneration (i.e.: less trips will be made at a higher price[3]).

4.5. We would argue that the DfT's methodology therefore needs to be corrected by modifying step 4 so that the difference in the number of trips made using daily and weekly tickets calculated in steps 1 and 2 is then reduced by the Reimbursement Factor associated to the average cash fare.

[3] This general principle is also implicit, at a more fundamental level, in the use of a downward sloping demand curve, which implies that demand will be lower at a higher price.

Degenerated trip ratio thresholds

4.6. A key step in the DfT's degeneration approach is to change the price ratios that determine the thresholds of attractiveness for discounted products, by multiplying them by a factor of (1+RF).

4.7. Although it is not clear to us what this factor is meant to represent and no underlying conceptual rationale is given, we would speculate that (1 / RF) is what was actually intended since that gives the ratio between the number of trips currently made at free fares and those that would have taken place in the counter factual situation.

Suggested alternative procedure

4.8. An alternative and simpler approach to degeneration is proposed. This makes the simplifying assumption that in moving from the observed NoWcard distribution of journeys to the distribution in the counterfactual, **the number of trips reduces to reflect the change from zero to the average fare per journey of each ticket type, but the average number of trips per ticket remains constant**. An alternative interpretation (which gives identical arithmetic results) is that the number of passholders assigned to each ticket type would reduce in moving from free fares to the counter-factual.

4.9. The effect is that:

- the number of cash journeys reduces by the Reimbursement Factor associated with cash trips;
- the number of journeys assigned to daily tickets, reduces by a Reimbursement Factor calculated from the average price per trip for daily tickets; and
- the number of journeys assigned to weekly tickets reduces by a Reimbursement Factor calculated from the average price per trip for weekly tickets.

4.10. This gives revised numbers of journeys made using each ticket type, and a changed distribution of journeys between the ticket types, thus allowing an appropriate average fare per journey to be calculated.

4.11. This approach does not require adjustment of price ratios or trip thresholds, and the *a priori* expectation of higher proportions of discount ticket users in the counter-factual is fulfilled. Moreover, the post-degeneration discount can be easily and transparently calculated in a single step, as illustrated in Section 5 below.

5. Adapted Discount Factor Method

5.1. A modified version of the Discount Fare method has been devised to address both concerns with the degeneration process, and also the need to reflect the possible difference between the average cash fare and the AESF. The essence of the proposed procedure is summarised in Table 1.

5.2. As in the standard DfT Discount Factor method, it is assumed that the TCA already has access to estimates of the average cash fare per journey, the average price per ticket of day tickets, and the average price per ticket of weekly tickets. In addition, it is assumed that the TCA has an estimate of the overall Average Equivalent Single Fare. The illustration set out in Table 1 uses data drawn from PTE1.

Table 1. Illustration of Adapted Discount Factor Method

				Prior to degeneration				
	Average price per ticket	AESF	Price ratios relative to AESF	Tickets	Journeys	Journey %	Price per journey	*RF*
Cash Tickets	1.59		-	79,559	79,559	14%	1.59	*0.43*
Daily Tickets	3.88	1.93	2.01	71,073	168,069	29%	1.64	*0.42*
Weekly Tickets	12.05		6.24	31,669	333,653	57%	1.14	*0.54*
					581,281			
				Following degeneration				
				Tickets	Journeys	Journey %		
Average fare	1.32			34,130	34,130	12%		
Discount factor	17%			29,677	70,178	25%		
				17,228	181,512	64%		
				81,035	285,820			

5.3. Price ratios are then calculated relative to the Average Equivalent Single Fare – the average amount that would be paid if cash fares were purchased irrespective of the potential use of other ticket types. The Average Equivalent Single Fare in this instance is £1.93, significantly more than the average fare paid per journey by cash users, which is £1.59.

5.4. The price ratios enable the numbers of tickets sold and journeys made using ach ticket type to be looked-up from the NoWcard data. More precisely, the values in the look-up table reflect the observed journey frequency distributions of NoWcard passholder concessionary journeys. The values correspond to the number of weeks in which passholders were observed to make more journeys than the weekly ticket price ratio (and the associated journeys), and of the journeys left, the number of days in which more journeys were made than the day ticket price (and the associated journeys).

5.5. The journeys per ticket from the NoWcard data enable the price per journey to be calculated: £1.64 per journey for day ticket users and £1.14 for weekly ticket users. Reimbursement factors are calculated for each ticket type, corresponding to the change in journey volumes in going from zero fare to the “full” fare for each ticket type. Thus journeys by cash fares would reduce to 42% of their free fare volume, daily tickets to 46%, and weekly ticket use to 55% of the free fare volume. These Reimbursement factors have been calculated by reference to the average fare per journey deflated to 2005/6 prices, using the single demand curve parameters for PTEs established by ITS.

5.6. Application of the reimbursement factors leads to revised “degenerated” journey numbers, more appropriate to a non-zero fare situation. The revised journey distribution allows a weighted average fare to be calculated, based on the price per journey for day and weekly tickets established from the NoWcard data, and the actual cash fare per journey paid. This gives an average fare per journey of £1.32.

5.7. This average fare represents a discount factor of 17% relative to the observed average cash fare. It is suggested that this procedure for using the NoWcard data provides a much clearer and logical way of dealing with the degeneration issue than the current DfT default method.

5.8. For most TCAs, and some PTEs, lack of reliable data on non-concessionary journey patterns means that there is little alternative but to use a methodology based on the NoWcard journey distributions. However, we do have some concerns at the narrowness of the database provided by the NoWcard data as it currently stands, which are discussed below in Section 6. These concerns are validated by the availability of data on the observed patterns of use of ticket types by non-concessionary passengers from some PTEs, which can use alternative methods for estimating average fares.

6. Average fare calculations based on non-concessionary travel patterns

Background

6.1. The NoWcard data provides a systematic way of using observed concessionary travel patterns to categorise existing concessionary trips into those that would be in scope for use of weekly, daily and cash fare in the counter-factual. These distributions will be valid if the observed travel patterns were to remain unchanged, and if passholders chose to buy tickets on the basis of minimising their cash outlay.

6.2. The alternative to using data on zero fare concessionary passengers is to draw on the actual use made of different ticket types by non-concessionary passengers. At least one PTE is able to access complete information on the journeys made and ticket prices of each main ticket type. This enables both an average fare to be calculated for adult non-concessionary passengers, and the results of this calculation to be compared with the average fare that would be inferred from the DfT's Discount Factor method.

6.3. As with the observed data on free concessionary passengers, there are some potential weaknesses in this approach. It could be argued that non-concessionary passengers will not be sufficiently similar to concessionary passholders in terms of trip purpose and general frequency of use. In the case of this particular PTE, the data excludes use of some weekly tickets, and longer-period tickets, which it is felt gives some assurance that the data provides a reasonable guide to likely passholder trip patterns. Moreover, the unequivocal nature of this data suggests that if available, it should be given substantial weight relative to other estimates which rely more heavily upon assumptions. This data and its implications are discussed further in Section 6.

Comparison between use of NoWcard data and use of non-concessionary passenger surveys

6.4. The price per ticket used as the input to the illustrative calculation set out above in Table 1 come from the continuous monitoring survey of PTE1. This survey allows the use of different ticket types made by non-concessionary passengers to be directly observed. The data is summarised in Table 2.

6.5. The figures are for adult non-concessionary passengers (i.e. exclude children), and also exclude weekly and longer period tickets that are sold off-bus, which account for about 10% of journeys but an unknown amount of revenue. The exclusion of these ticket types is regarded as correction of the major difference between the travel patterns of non-concessionary adults and concessionary passengers, namely the smaller proportion of work journeys that will be made by concessionary passholders. The figures have been "normalised" to represent 100 journeys in total.

Table 2 Use of Ticket Types by Non-Concessionary Passengers in PTE 1

Non-concessionary adult bus passengers (excluding use of tickets sold off-bus)	Revenue paid by passengers	Tickets purchased	Passenger journeys made	Price per ticket	Price per journey
Cash singles and returns	£46.540	28.870	29.280	£1.612	£1.590
Day tickets	£35.333	9.100	25.627	£3.883	£1.379
Weekly ticket	£34.651	2.877	45.093	£12.045	£0.768
All singles, returns, day and week tickets	£116.525	40.848	100	£2.853	£1.165

6.6. Note that the small difference between the price per journey and price per ticket for cash singles and returns reflects the small number of return tickets sold in the PTE 1 area.

6.7. Overall, some 45% of journeys by non-concessionary passengers are made using weekly tickets, and 25% using daily tickets. However, the most significant aspect of the PTE 1 data is the number of journeys that are made per daily ticket and weekly ticket purchase, which are much higher than those implied by the NoWcard data. This leads to lower average fares per journey for the users of these ticket types, and a much lower average fare for all journeys compared to the results in table 1.

6.8. The consequence is that the overall average fare per journey is £1.165 (a discount factor of 27%), which contrasts with the £1.32 (a discount factor of 17%) calculated using the Adapted Discount Factor method. This implies that the latter will significantly over-estimate the average fare, leading to over-generous reimbursement of bus operators.

6.9. However, even higher overall average fares would be calculated by the Discount Factor method as represented in the current DfT Reimbursement Calculator. If the cash fare per journey is assumed to be equivalent to the actual cash fare paid (i.e. £1.590) then the Reimbursement Calculator implies an overall average fare per journey of £1.44 (a discount factor of 9%).

6.10. These comparisons suggest that there is a significant gap between the simulated journey distributions provided by the NoWcard data and the evidence of actual journey distributions from non-concessionary bus passengers. More work is therefore needed to give confidence that the default methodology is sufficiently robust. In the interim, our view is that where TCAs (such as the PTEs) have access to data that provides additional evidence, they should be encouraged to use that information to improve the accuracy of their average fare calculations.

7. Other Issues

Dealing with complex ticketing structures

7.1. The Discount Factor method as currently implemented (and with pteg's suggested adaptation) relies upon the simplification of the actual fare systems offered by bus operators into three generic ticket types. The need to do so is well understood, and for most TCAs and many operators, the reduction of a potentially large number of competing fare products to just three is entirely appropriate. However, further thought is needed about precisely how fare products that do not fit neatly into the “cash”, “daily” and “weekly” classifications should be treated.

7.2. We are unsure of the justification of excluding tickets providing travel for longer periods than a week. There is some evidence that prior to free travel, passholders were willing to invest in monthly concessionary trips, when these were made available.

7.3. We are also concerned that greater use of commercial smartcard products in the future might undermine some of the underlying assumptions implicit in the discount factor method. The commercial advantages of smartcards include the possibility of offering a wider range of pricing models to passholders, which potentially could even further confuse the issue of satisfactorily mapping ticket products onto the generic ticket types.

7.4. In principle, use of smartcards to provide carnet-style stored value products (offering fixed numbers of journeys at a given price) should lead to the classification of these trips and revenues as “cash fares”; but there is considerable scope for confusion and inconsistency. Guidance on the treatment of emerging ticket products would therefore be helpful.

7.5. Another key issue is the treatment of multi-operator (including multi-modal tickets), which typically represent a very substantial proportion of journeys in PTE areas. While it would seem in the spirit of the guidance to include those tickets either in the daily or weekly category we would like to see that formally recognised in the text.

7.6. In addition, there are practical implementation challenges in obtaining an estimate of the average price of discounted tickets when multi-operator tickets. The main problem is that often substantial assumptions need to be made about the allocation of tickets to individual operators, which do not occur when we are dealing with single operator products. For the avoidance of doubt, we would therefore suggest that the Guidance should explicitly acknowledge that the use of local judgement may be required when attempting to incorporate multi-operator products into the pre-specified categories.

Representativeness of NoWcard data

7.7. Although four districts in south west Lancashire may provide a reasonable proxy for many parts of England, there are reasons why we would expect the trip frequency distributions for areas with different geographical characteristics to differ from those reflected in the current NoWcard data. In particular, we would expect the largest urban areas (with higher density and more frequent bus networks) to be associated with higher proportions of passholders making more frequent bus trips (and hence likely to be more attracted to discount tickets). The reverse is probably true of more rural areas.

7.8. Clearly at present the existing NoWcard data is all that is readily available. However, we strongly urge DfT to:

(a) Seek to expand the scope of the smartcard data sets available for analysis;

(b) Consider further analysis of the existing data to identify alternative look up tables by area types. This would allow the possible weaknesses of the current look-up table to be assessed, and potentially provide opportunities for specifying alternative look up tables to better match the full range of TCA areas.

Weaknesses in spreadsheet implementation

7.9. For completeness, we note that the spreadsheet made available with the draft Guidance requires further work to make it fully fit for purpose, even if there were no changes in the underlying methodology that it seeks to implement.

7.10. Particular issues that have been identified include:

- The effective limits of the current NoWcard look-up tables are daily tickets priced at no more than five times the cash fare per journey, and weekly tickets priced at no more than 30 times the cash fare per journey. It would be sensible to extend the range of daily ticket price ratios to, say, ten.
- Users need to be given clear advice on how to reflect situations in which operators do not offer daily or weekly ticket products to any significant degree (which is effectively equivalent to a price ratio close to infinity).
- User inputs that lead to error conditions (e.g. daily price ratios that exceed 5) need to be detected, with appropriate user warnings flagged up and default values adopted. Error trapping throughout the spreadsheet is poor or non-existent, and a critical step towards improving the spreadsheet's fitness for purpose is ensuring that error values are not generated by extreme value sin input data.

7.11. More generally, the current spreadsheet does not reflect good practice in terms of clarity of structure and auditability. It is appreciated that the version of the spreadsheet made available at the time of publication of the draft Guidance should be considered as work in progress and not regarded as a definitive version of a tool for practical use by TCAs. Nevertheless, DfT should appreciate that the "current" version falls far short of a product that a TCA could use with confidence to implement the principles described in the guidance. This is principally because of the complexity of key formulae, which in turn arises from the way in which parameters are passed between worksheets.

8. Conclusions

8.1. Estimating an appropriate value for the average fare that would be paid by concessionary passholders in the absence of the scheme is one of the most challenging aspects of "no better off and no worse off" reimbursement. This is because of a combination of factors, including the diversity of ticket products that might be purchased by concessionary passholders in the counter-factual situation, and lack of data on the pricing of these products, on their use by non-concessionary passengers, and on their impact on concessionary passenger travel patterns in the counter factual situation.

8.2. The DfT's Discount Factor method overcomes many of these difficulties, by drawing on a "default" database containing information on concessionary passenger trip frequency distributions (the NoWcard data) as a substitute for detailed local data.

8.3. The robustness of the approach depends on the representativeness of the NoWcard data; while much better than nothing, and probably sufficiently representative of most areas of England, there must be doubts about how accurately it will reflect travel patterns in large urban areas and mainly rural areas. DfT is urged to expand the scope of the reference data set or otherwise provide more confidence in the reference data set.

8.4. Accepting the NoWcard data "as is", we are sceptical of the correctness of the process that the "Discount factor method", as implemented in the current DfT Reimbursement Calculators. We believe that it lacks an obvious rationale, and that it leads to a rebalancing of the distribution of journeys between ticket types that is counter-intuitive. We have suggested an alternative approach which in our view is clearer to understand, is more intuitive and better satisfies *a priori* expectations.

8.5. In addition, PTE data is able to demonstrate that the average cash fare paid by non-users of discount tickets is likely to be different to the average cash fare that would be paid by all passengers because of differences in trip lengths. PTEs may be unusual in having the ability to monitor the Adult Equivalent Single Fare, and thus allowing for this feature to be properly incorporated into the calculation. However, in principle all TCAs should be encouraged to assess the scale of this issue, and to take steps to modify the calculations accordingly.

8.6. Some PTE data also allows the results of calculations using various NoWcard-based methods to be compared with observed average fares per journey calculated for non-concessionary passengers. This demonstrates that even when modified along these lines, the average fare per journey is higher than that observed for non-concessionary passengers. There are a number of potential explanations for this difference, but these are difficult to properly evidence. However, the unmodified Discount Factor method results in significantly higher average fares per journey, and if adopted would very clearly not lead to no better, no worse off reimbursement calculations.

8.7. The complexity of the fare systems, the extent to which the commercial offer makes heavy use of discounted tickets, and the ready availability of data all vary considerably between PTEs. Consequently for most PTEs, for average fare calculations to be as accurate as is reasonably practicable, some combination of local data and use of "standard" methodology is likely to be required.

Reimbursement arrangements - **Annex E** - Proposed changes to the regulations governing concessionary travel reimbursement

DfT Concessionary Travel Reimbursement
Consultation Response

Annex E. Proposed changes to the Regulations governing concessionary travel reimbursement

November 2010

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Content

1. Introduction

1.1. We understand that the DfT proposes to consider the adequacy of the current (1986) regulations on concessionary travel (CT) as part of the broader review of administration and reimbursement issues. This note sets out some detailed comments from the PTEs as a contribution to the DfT review.

2. General comments

2.1. Existing Regulations should be reviewed in light of EU Regulations, in particular regulation 1370/2007, to ensure they are consistent in terms of reimbursement.

2.2. The regulations make repeated reference to 'eligible services', which is defined in Regulation 2 by reference to the 1985 Act (section 94(4)), even though the same principles are usually applied to local schemes incorporating non-eligible services. When dealing with eligible people, there is no such restrictive definition; the wording just refers to 'persons eligible to travel' (irrespective of the way in which that eligibility is defined). Some loosening of definition would be appropriate here to allow for local variations. One way to achieve this would be for the definition to be extended to add 'or defined in the local scheme as being a service within the scope for the purpose of concessionary travel' or some similar wording. It may make sense to consolidate the 2009 regulations on eligible service regulations into a revised set of regulations covering reimbursement.

2.3. There are a number of areas where a general updating is required to reflect other administrative changes, for instance references to PSV licences, but we have not reflected these issues in this note.

3. Detailed comments

3.1. The 'no better and no worse off' principle (Regulation 4) underpins the current administrative methods relating to reimbursement. We assume this will remain. The wording might be made slightly clearer by omitting the words 'in the aggregate'. If individual operators are being fairly compensated, then the aggregate payment will also be fair. The converse need not necessarily be, and is often not, true.

3.2. Regulation 5(2)(b) makes no reference to costs being net of revenue, yet this principle has been assumed in the ITS work. It would be helpful if reference to 'costs' could be replaced by 'costs net of generated revenue' to be clearer about this point. This regulation also refers to 'basic operating costs' which is defined in Regulation 2, but the definition makes no reference to the treatment of profit. Again clarification of the principle that has been confirmed as part of the ITS work, and possibly through the JR process – which we understand to be that a profit element is allowable if, but only if, there is a need for an operator to increase investment and/or working capital – might be helpful.

3.3. Regulation 7 indicates that total number of journeys and fares value are appropriate variables by which the 'appropriate reimbursement' should be assessed, but there is no reference to any need to make estimates of generated travel. In fact, this concept does not appear to be addressed explicitly in the regulations. We feel the concept is so central to the issue of reimbursement that it ought to be introduced in any revision that takes place, even though the issues raised by its estimation are best left to guidance.

3.4. Regulation 15 is worded to protect commercial confidentiality of operators. Though the inference is that is that anything else may be required, this is not clear and might be contested. In any case it would be desirable to place a positive obligation on the operator to provide prescribed information to the TCA, rather than identify what may not be required. There is quite a fine line between 'the amount of fares' in 16(1)(b) and the 'total turnover' in 15(b). Some rewording here might make for better regulation, which should also take into account the information that may be required to fully implement the ITS approach to average fare calculations. If ITS's recommendations were to be fully adopted then there is a need to obtain rather more information on fares and ticketing from operators than is currently allowed.

3.5. Given the much more flexible rules that have been introduced for service tendering over past years, it seems appropriate that the 'de minimis' threshold in Regulation 6 (repeated in Regulation 17(1)) should be raised. We would suggest a figure of £500k, which is probably of the same order as would have applied were an indexation from 1985 to have been applied.

3.6. We note that the concept of 'special amenity element' in the fare calculation has proved useful in the past, but could benefit in some widening in scope to avoid operators effectively restricting travel to the concessionary market by setting fares at levels that are an almost total deterrent to those passengers not eligible for concessions. Operators have been known to do this in the past to maximise reimbursement (and total) revenue. We therefore suggest that as well as referring to 'special amenity elements' there should also be a means by which fares can be judged to be highly unattractive to fare paying passengers and reduced accordingly for reimbursement purposes.

3.7. We regard Regulation 18 (2) as being over-restrictive. Whilst we are aware that arrangements have been reached voluntarily in some TCAs, we believe that there should be right for information to be required for periods of at little 28 days rather than the 3 months stated currently.

3.8. In our view Regulation 19 is deficient in that is prevents TCAs choosing to collect boarding and alighting information of non-concessionary passengers as a means of estimating average fares. We feel it should be a right of TCAs to collect such information, as is now well established practice in most PTEs areas. Furthermore, we would not wish to lose the more general rights of TCAs set out in this Regulation as we move into the era of smartcards, though it would, in our view, be appropriate to take this opportunity to extend the regulation to cover smartcard-based data collection, including checks on the accuracy of smartcard readers. This should also be reflected in Regulation 20, where we would argue that the new BSOG-based funding method should remove the requirement for cost reimbursement set out in Regulation 20(2).

3.9. We would suggest that the requirement for fares notification in Regulation 21 should be extended. A much freer fares regulatory environment was envisaged in 1986 than is now appropriate, and it is no longer acceptable that authorities should be informed of fares changes to passengers after the event, particularly in areas where arrangements for (non-statutory) fractional fares are applied. We would suggest a minimum of 28 days notice.

3.10. Again a minimum of 42 days notice for withdrawal of a service from a voluntary scheme is no longer appropriate in an environment where 56 days is now required for a service change. We suggest a minimum of 70 days notice should be required.

4. Applications to the Secretary of State by operators

4.1. Regulations 38 to 48 deal with the details of the procedure around the operator application (usually referred to as 'appeals') process. We feel that this process has not worked as well as it might have done in recent years and that a radical review of the arrangements is timely. Indeed, aspects of the process have probably encouraged operators to submit appeals rather than conclude negotiations with TCAs. We would suggest that the following issues are taken into account in any review that the Department conducts:

4.2. We suggest that current arrangements heavily favours operators and put them at little risk should their applications fail. The process is, in our view, in urgent need of rebalancing. We feel changes in the regulations could help achieve this. We see good reasons in principle for

- Operators being required to fund the cost of the appeals process, with reasonable costs being awarded to TCAs in the case of unsuccessful appeals;
- Further applications against reimbursement arrangements being disallowed, in cases where determinations have not found in favour of operators and the scheme has not been changed materially, for a period of a few years. This would avoid repetitive appeals being launched, or operators selecting a different aspect of a local scheme as a basis for a further appeal.
- It being an adequate defence by a TCA which has been subject to recent appeal, that a newly-introduced scheme addressing all the concerns raised in the determination and making no other material changes should be refused without a need for further consideration of the evidence.

4.3. We feel that the publication of appeal determinations is vital to the improved understanding by all parties of the 'no better, no worse off' principle. Whilst determinations do not constitute case law, by assembling adjudication letters it should be possible to make a reasonably accuracy risk assessment and thereby achieve more locally negotiated settlements. We fully recognise that there are issues of commercial confidentiality raised by this change. However, we consider that many of these problems could be dealt with by requesting that operators identify commercially sensitive information when they provide data in support of an application. If it was then necessary to quote this data in the determination, it could be redacted from the published version.

4.4. We feel that there is much to be said for provision of draft determinations to the parties directly involved in the application. This would help in achieving greater clarity and reducing the likelihood of misinterpretation of data that had been provided to the adjudicator. It would also provide opportunity to sort out any problems likely to arise in implementing the adjudicator's findings or proposed remedies prior to formal issue of the determination.

4.5. It may be possible for the appointment of adjudicators to be dealt with outside the redrafting of regulations, but we can see merit in looking to appoint a 'panel of experts' rather than a set of adjudicators who act individually, potentially having different interpretations of the guidance and other relevant documents. We would also suggest that such a panel should include people with experience of operating the reimbursement system both from TCA and operator perspectives, and who are familiar with the practical issues involved in the interpretation of Guidance, especially at the margin of applicability. The inclusion of such individuals might assist in the establishment of good practice in a highly technical area.

4.6. We are concerned that under the current arrangements, applications under the 1985 Act can only be made when the operator is subject to a Participation Notice, whereas appeals under the 2000 Act can be made within 56 days of the coming into effect of the reimbursement arrangements. Assuming the arrangements for reimbursement would be better integrated across both Acts, there is potential for adjudications to cover elements of reimbursement that aren't the subject of an appeal. We suggest this issue is tackled in any revision of the regulations.

4.7. We feel that it would be beneficial to have regulations under section 150(6)(c) of the 2000 Act in respect of regulating the conduct of any appeal proceedings. In particular, those should set out timescales for the stages of the process. Our view is that a speeding up of the process is required. The guidance should also indicate that the expected outcome of any appeal will be for the Secretary of State to give directions to the TCA in respect of the reimbursement arrangements which will then be applied by the TCA to the reimbursement calculations/end of year recalculation, rather than a monetary award.