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| **Urban Transport Group*****COMMERCIAL IN CONFIDENCE*****Issues with DfT Guidance and Calculator for Concessionary Travel Reimbursement*****Andrew Last, Minnerva Ltd****Version 7 of January 2016* |  |

**PREAMBLE AND KEY POINTS**

This Note was initially written as an aide-memoire of residual issues and concerns with the DfT Guidance and Calculator published in late 2010. It has subsequently been updated from time to time, both to reflect the outcome of continued dialogue with DfT, and also to capture experience of the PTEs in their negotiations with bus operators, to the extent that these have involved debating aspects of the Guidance. The current version of this note reflects PTE negotiating activity in the last two years, approximately, and has benefitted from telephone interviews with CT officers at all six English PTEs and Nottingham City Council (for convenience, collectively called here “PTEs”). The author is extremely grateful for the help and assistance he has received from colleagues.

Key points from this recent experience are as follows.

A number of PTEs noted the value gained from investment in preparation for each round of negotiation, and the importance of establishing and training a core group of officers to drive the negotiations. Familiarity with previous negotiating rounds, and the available data resources, was a key part of the preparation process.

All PTEs used the DfT Calculator to some degree in their negotiations, but the way in which it is used varies considerably; in some instances, it simply provides background assurance that there is justification for the reimbursement arrangements agreed, whereas in other individual PTE-operator negotiations, the Calculator and its inputs are at the heart of discussions with the operator about the appropriate level of reimbursement.

There has been only one instance in which DfT Appeals procedures have been fully invoked by an operator in a dispute with a PTE in the last two years. In that instance, the Determination issued by the Adjudicator imposed a modest increase in payments relative to the “final” offer of the PTE, but this was substantially less than the amount claimed by the operator. In a number of other negotiations, operators have given notice of intention to appeal, but have then asked DfT for stays of execution to allow “negotiations to continue”.

Reluctance to pursue appeals may reflect a perception, probably based on earlier experience, that appeal outcomes were arbitrary and inconsistent. The recent experience of the one PTE to go through the process has been more satisfactory than that, but this could arise from the approach of the particular individual appointed as the Adjudicator, which might not be the same with different appointees.

PTE experience is that attitudes to the Calculator and its inputs vary between the big bus groups, and also between the subsidiaries within each group. Different operators have tested different ways of securing more favourable outcomes. For example, in some negotiations, it has been claimed that the level of reimbursement was supported by calculator results, but with little evidence revealed; other operators have tabled a full set of proposed calculator inputs with detailed justifications.

Forecasts of ENCTS journey numbers provide a common source of dispute between PTEs and operators because they are a crucial dimension to voluntary agreements on payments for a year or more ahead. Forecasting methods vary greatly between the PTEs, and there is the potential for identifying and then applying best practice across the PTEs. The scope for argument with operators has been compounded recently by the availability of Smartcard-based journey data, adding to ETM and survey data sources.

The ability to build average fare lookup tables from their own ENCTS smartcard data has enabled some PTEs to significantly improve negotiating outcomes. Generally, locally derived lookup tables have been accepted by the relevant operators with little comment. However, one operator invested some time in opposing the principle of applying a lookup table from one PTE in another PTE’s area, though this was not taken to appeal.

Measuring the change in fares from 2005/6 (required to calculate the Reimbursement Factor) is a continuing source of contention, with lack of clarity of principle in the Guidance compounded by the need to rely upon data that is now nearly ten years’ old. However, a correction to numbers in DfT’s Calculator (brought to light by Nexus) now means that use of the default value based on the National Fares Index is less generous to operators than was previously the case.

Reimbursement of Marginal Capacity Costs (MCC) remains the area in which the DfT Calculator can be most criticised for counter-intuitive results, and arbitrary sensitivity to the values of a number of input parameters. Operators have familiarised themselves with how to secure better outcomes from the calculations, and expectations of significant net Marginal Capacity Cost payments have risen.

In particular, MCC payments calculated by the DfT Calculator increase with low levels of occupancy. There is a concern that some operators are basing their business models on the fact that MCC payments can be maximised by operating services with minimal commercial patronage but which are able to attract non-negligible numbers of concessionary passengers.

Access to historic data from continuous surveys has been a significant factor in the success of some PTEs in securing their negotiating objectives, particularly with regard to MCC inputs. Increasingly, as survey resources are reduced to reflect availability of smartcard data, access to comprehensive current data will diminish. It is important that PTEs take steps to archive and document historic data resources, so that the opportunity to draw on this information is not lost to future negotiation rounds.

The subsidiaries of one group operator have also promoted an additional cost methodology based on a counter-factual network. In essence, this replaces the MCC calculation of the Calculator, and includes Peak Vehicle Costs, and as proposed to two PTEs, leads to very substantially greater additional costs than the Calculator suggests. In neither case have the operators involved appealed against the outcome of the negotiations, and so questions remain about potential DfT attitudes to the operator’s methodology. There are also many technical concerns with operator assumptions drawn on in their counter-factual calculations, that as yet have not been properly challenged.

The Note that follows is very largely based on previous versions, but the opportunity has been taken to clarify text and update details where appropriate. Significant new material, principally drawing attention to newer developments, are highlighted using italics.

**1 INTRODUCTION**

The Department for Transport (DfT) provides Guidance to English Travel Concession Authorities (TCAs) on how to calculate reimbursement for bus operators to compensate them for carrying free bus passengers under the English National Concessionary Travel Scheme. DfT’s Guidance does not have the force of law, but it carries substantial weight since it is the basis on which DfT will determine any appeals that bus operators may make, if they believe a TCA is not reimbursing them properly. DfT also makes available a Calculator spreadsheet which implements the recommendations in the Guidance, and can be used by a TCA to calculate the reimbursement due to an individual operator from a TCA.

Current Guidance[[1]](#footnote-1) on reimbursement of concessionary travel for older and disabled people was largely devised in 2010, for application from April 2011, and has been marginally revised in subsequent years. The final version of the Guidance published for 2011-12 was subject to a number of iterations, during which some key principles were revised and associated text rewritten[[2]](#footnote-2).

***pteg***,the Urban Transport Group’s predecessor, and other interested parties have continued to be involved in dialogue with DfT throughout the evolution of the Guidance to the present day. All parties acknowledge that the subject of concessionary travel reimbursement is very complex and that in combination the large number of assumptions that need to be made lead to significant uncertainties. However, there are a number of issues on which there are differing views, which have substantial reimbursement implications. To date, modifications to the Guidance since November 2010 have been very minor. This may reflect DfT concerns that any significant changes to the Guidance would have a destabilising effect on many existing arrangements between TCAs and bus operators. However, pressure for more wide ranging revisions to the Guidance is likely to grow in the future.

*[It is notable that since the “new” Guidance and Calculator were introduced with effect from April 2011, the number of appeals made by bus operators has significantly reduced. While partly due to the more prescriptive nature of the Guidance, it is believed that it also reflects mistrust of the appeal process, which by reputation is supposed to have led to illogical and inconsistent outcomes that were satisfactory to neither party. It is difficult to assess the accuracy of these sentiments since DfT does not publish appeal Determinations and there is little to be gained from publicising outcomes by those directly involved. However, the consequence is that while bus operators have often used the possibility of an appeal to increase pressure during the negotiating process, in practice there has been considerable reluctance to actually invoke the full Determination procedure, because of the unpredictability and hence perceived high level of risk associated with the outcome.*

*Serious steps towards invoking the appeal process appear to have been taken in only three or four operator-PTE negotiations in the last year, and only one was pursued to the point at which a Determination was issued by the DfT adjudicator.]*

Over time since statutory free travel was first announced, ***pteg*** undertook technical research into a number of aspects of concessionary travel reimbursement. This has often complemented analysis carried out by individual PTEs in the context of revisions or updates of local reimbursement arrangements. In many instances, fresh rounds of negotiations with bus operators have led to new arguments about interpretation of the Guidance, and in some cases the presentation of additional evidence or analysis. The purpose of this paper is to collate this collective experience into a form that is readily accessible in the future, either for use by PTEs in local negotiations, or for the Urban Transport Group (UTG) in dialogue with DfT as and when further revisions to the Guidance are contemplated.

Because of the potential role of these arguments in detailed negotiations between individual authorities and bus operators, the current document should be regarded as commercially sensitive, and should not be further disseminated without reference toUTG officers. However, it is of course hoped that PTE colleagues will find the arguments and evidence set out in the document are useful in individual negotiations.

The audience for the paper is primarily technical. Even so, it is quite likely that most readers will have only occasional contact with detailed aspects of the reimbursement calculations themselves. Consequently the next section provides an overview of the theoretical rationale for the reimbursement process. Later sections then discuss in detail the three main components of reimbursement, namely the measurement of average fares, estimation of the Reimbursement Factor, and additional costs.

Appendix 1 reproduces the list of issues and concerns, building on and updating what has been collated since 2013. The main body of the paper provides further discussion of each of these issues, as well as a guide to additional evidence or references where available. Appendix 2 lists these external references. Note that the status of the referenced documents varies considerably, from fully published, public domain material to internal notes that are confidential and may not be circulated without permission.

**2 OVERVIEW OF CONCESSIONARY TRAVEL REIMBURSEMENT CONCEPTS**

The over-arching principle on which reimbursement should be calculated in England[[3]](#footnote-3) is that bus operators, both individually and in aggregate, should be left “no better off and no worse off” financially through the provision of free concessionary travel. This requires concession authorities to identify the difference between the financial positions of the operator with and without the concession, by reference to a counter-factual situation in which no concession is provided.

The established practice is, at least in principle, to calculate reimbursement relative to the observed number of concessionary journeys actually carried by the operator, and some measure of the average fare that would have been charged for those journeys. Adjustments are then made to allow for the likelihood that:

* in the counter-factual, fewer journeys would be made by concessionary passholders (because some observed concessionary journeys have been generated by the availability of free travel);
* there will be some difference between the average fare that is most easily measured (such as the cash fare), and the average fare that would have been paid by passholders in the absence of the concession;
* the operator will incur some additional costs associated with carrying generated concessionary passengers.

These are the three fundamental building blocks on which concessionary travel reimbursement calculations need to be based, which involve linked, but quite distinct, concepts. In practice, reimbursement payments due to an individual bus operator for a specific period might be calculated by applying a single combined reimbursed rate per concessionary passenger. But in calculating the rate, it is essential to separately consider the different elements.

Figure 1 summarises the conceptual calculation flow. Typically, payments for an individual operator will be driven by the number of concessionary journeys carried in a particular period, and the indicator of the commercial fare in that period (e.g. the average cash fare). Reimbursement is calculated from formulae which combine these local variables with other parameters that are relatively fixed.



**Figure 1 Reimbursement Calculation Flow Chart**

The calculation process involves a number of steps.

The first step is to estimate the average fare that would be paid by concessionary passholders in the absence of the concession (the “average fare forgone”). In the DfT Calculator, this calculation is driven by an estimate of the average cash fare paid, which is then reduced via a discount factor intended to reflect the availability of various discount tickets (such as day tickets), and the probability of these tickets being used by passholders.

Second, a demand model (which simulates how passenger volumes vary with changes in fare) is used to determine the proportion of concessionary passenger journeys “generated” by the concession. This is necessary because it is not possible to directly observe the number of journeys that would have been made in the counterfactual. Instead, observed concessionary journeys are used as a proxy, but with allowance made for generation, i.e. the proportion of concessionary journeys that would not have been made at the commercial fare.

In the DfT Calculator, the measure of generation is the “Reimbursement Factor”, which is the ratio of passenger journeys at the commercial fare, to passenger journeys at the (zero) concessionary fare. The demand model parameters reflect assumptions about the sensitivity of demand to fare levels (often summarised as an elasticity); the Reimbursement Factor is a function of these parameters, as well as the average fare forgone. If the concessionary fare was not zero, then the concessionary fare charged would also need to be taken into account, since the amount of generation is determined by the difference between the fare actually paid, and the fare that would have been paid in the absence of the concession.

Third, once the Reimbursement Factor has been calculated, it can be applied to the observed quantity of concessionary journeys to estimate the quantity of non-generated journeys (i.e. the number that would be made in the counter-factual), and the number of generated journeys (i.e. those observed journeys that would not be made in the counter-factual).

Fourth, since the objective is that the operator should be financially no worse (or better) off, the reimbursement due for revenue forgone is the same as the revenue that would be earned by the operator in the counterfactual. This can be thought of as the hypothesised commercial revenue, which is the product of the non-generated (“commercial”) trips and the average fare forgone. Note that if the concession was not free, then revenue forgone would be the hypothesised commercial revenue, less any revenue from fares paid directly to the operator by concessionary passengers.

Fifth, since operators will carry additional passengers because of the concession, some additional operating costs are likely to be incurred. The DfT Calculator estimates an additional cost rate per generated passenger using various factors that reflect network characteristics, which when multiplied by the number of generated passengers gives reimbursement for additional costs. This calculation is made significantly more complex where additional service capacity (in particular, enhanced service frequency) is needed to accommodate generated concessionary passengers. Additional commercial patronage is likely to be attracted by improved service levels, and consequently the potential for increased commercial revenue needs to be allowed for, to offset additional operating costs.

Total “no better off, no worse off” reimbursement is then the sum of the reimbursement for revenue forgone, and reimbursement for net additional costs. Typically, reimbursement for revenue forgone is significantly larger than reimbursement for additional costs, but the relative proportions are very dependent upon circumstances.

The DfT Calculator implements this sequence of calculations in an Excel spreadsheet. The user is required to fill designated cells with input values (for example, with the year of calculation, the number of concessionary journeys made, and then the more detailed inputs for the other components). The spreadsheet uses macros to shift the focus of calculation between separate worksheets. Although this works adequately as a one-off process for an individual operator, it is cumbersome and inefficient if a TCA has to calculate reimbursement for a large number of operators, as do most PTEs. In practice, therefore, the Calculator spreadsheet tends to be used as a guide to the reimbursement that would be calculated with strict observance of the Guidance, but other mechanisms are used for the practical calculation of payments due to individual operators.

However, the Guidance is clear that in the event of an appeal by an operator, DfT will use its Calculator to inform a decision on the correct level of “no better, no worse off” reimbursement. Consequently, there is a need to ensure that reimbursement arrangements lead to operator payments that are consistent with those that would emerge from the Calculator, or that there is a clear rationale for why results may be different.

**3 AVERAGE FARE ISSUES**

One of the three key components of reimbursement calculations is the mechanism for estimating the average fare forgone - that is, the average fare per passenger journey that concessionary passengers would pay, and that operators would receive, in the counter-factual.

The fares charged by an operator to various passengers making different sorts of journeys vary widely, especially by distance and time-of-day, and will reflect a range of ticket types that are on offer. Across an operator as a whole, the overall average fare will be subject to small variations on a day-to-day basis, reflecting fluctuations in the passenger mix, and changes in fare levels determined by the operator on a commercial basis. Operator reimbursement depends upon an estimate of the average fare that concessionary passengers would have paid for their journeys in the absence of the concession, and therefore needs to reflect both the variations in fares paid by individual passengers, and the extent to which concessionary passengers (who actually travel for free) would take up each of the different ticket types on offer, if the concession was not available.

Standard practice is to measure the general level of fares, which is likely to fluctuate over time, using a relatively easily calculated quantum such as the average cash fare paid per journey by commercial passengers. This is sometimes called the Reference Fare. For some of the PTEs, the Reference Fare is calculated from survey data that measures concessionary passenger journey trip lengths and compares them to adult cash fare scales. For other TCAs, it is often estimated from auditable returns provided by an operator that can be traced back to individual passenger ticket transactions. The Reference Fare is usually based on adult cash fares (i.e. adult single “walk-on” fares, potentially returns fares etc), and so “average cash fare” is often used as short-hand terminology for the concept of the Reference Fare. The Guidance says very little about the Reference Fare, a weakness which is discussed in more detail below.

The average fare forgone is then estimated by applying a Discount Factor to the Reference Fare. The Discount Factor is intended to reflect the likelihood that in the absence of the concession, passholders would make use of a wider range of ticket types than those reflected in the Reference Fare, e.g. would purchase daily or weekly discount tickets as well as cash fares. At present, the Guidance does not recognise that passholders would use anything other than one of these three generic ticket types in the counter-factual; as discussed below this represents a concern as smartcard-equipped ticket machines on buses will increasingly provide scope for more variants in ticket types.

The Guidance identifies two alternative methods for estimating the Discount Factor. DfT’s recommended approach is to use what DfT call the “Discount Factor method”. The alternative offered is labelled as the “Basket of Fares method”. Either method results in a discount factor that, within the DfT Calculator, is applied to the average cash fare per journey to produce the average fare forgone.

Although the Guidance does not make this clear, in effect with either method the discount factor is calculated from a weighted average fare. The difference between the two methods is that:

* with the “Discount Factor method”, the weights and average fare per journey are derived through an automatic process within the Calculator by reference to a look-up table, and are not provided by the user.
* With the “Basket of Fares method”, the weights and average fare per journey needed to populate the weighted average fare calculation must be user-specified;

To avoid ambiguity, when we refer to “the Discount Factor method” we mean the process of deriving an average fare forgone using a look-up table; otherwise, the term “discount factor” is used to refer to the outcome of either of these two methods, which is a measure of the extent to which the Reference Fare (e.g. the average cash fare) should be reduced to reflect the likely use of discount tickets in the counter-factual.

**Nature of the look-up table**

The look-up table summarises the frequency with which concessionary passholders have been observed to make trips every day and every week. . It was built from concessionary journeys recorded using smartcards collated by the “NoWcard” group of authorities, and is often referred to as “the NoWcard look-up table”. For a large number of combinations of relative prices of cash fares, day tickets and weekly tickets, the look-up table identifies the number of occasions on which sufficient journeys were made per week for it to be cheaper for passholders to make their observed journeys with a weekly ticket, and likewise for journeys per day and daily tickets.

A fragment of the look-up table built into the Calculator is in Figure 2, which shows the look-up table entries for daily ticket price multiples of 3 and 4 (in other words, situations in which the daily price is 3 or 4 times the average cash price per journey), in combination with weekly price multiples of 11, 12 and 13 (in which the weekly ticket is prices at 11, 12 or 13 times the average cash fare per journey).



**Figure 2 Fragment of Average Fares Look-up Table**

Each entry (i.e. block of cells for a given pair of day and weekly price ratios) shows how the observed NoWcard concessionary passholder journeys would be assigned between weekly tickets, daily tickets and cash fare journeys. For example, for a weekly price ratio of 11 and a daily ticket price ratio of 3, the look-up table reports that

* there were 10,517 weeks (within the total captured by the NoWcard smartcard data) in which 11 or more concessionary journeys were made, and in these weeks 162,809 journeys were made;
* of the remaining journeys, 80,177 journeys were made on days in which 3 or more journeys were made. There were 21,418 such days;
* 348,077 journeys were made during weeks in which fewer than 11 journeys were made, and on days in which fewer than 3 journeys were made.

Each block of cells reports on how the same total number of journeys (591,063 journeys in the case of the NoWcard data) would be assigned between cash, day and weekly journeys on the basis that, for example, if a weekly ticket costs 11 times the cash fare, then in the counter-factual, concessionary passholders who make 11 or more journeys per week will buy a weekly ticket. The result is that for each combination of price ratios, the look-up table allows us to identify the proportion of journeys that would be made using each ticket type, and the average number of journeys made per ticket purchased. For example, if the weekly ticket price is, say, £15 and this represents eleven times the average cash fare per journey, the look-up table allows us to calculate that the average weekly ticket price per journey is £15 \* 10,517/162,809 = £0.969.

The journey proportions and average price per journey by each ticket type are the key variables needed to carry out a weighted average fare calculation.

The advantage of the look-up table approach is that it reduces the need for externally derived assumptions about the relative usage of different ticket types. Without it, the journey proportions and average prices per journey might not be known with any confidence for day and weekly tickets. In particular, in the commercial market, the average number of journeys made for each day or week ticket depends upon the relative prices of these tickets – for example, fewer journeys will be made, on average, for each day ticket purchased if the price of the day ticket is relatively low. Consequently, while industry “rules of thumb” can often be quoted by bus operators about the average number of journeys made per day and week ticket, these are not sensitive to relative prices, and are a poor guide to the actual average usage of tickets with a given combination of prices. The look-up table approach therefore allows TCAs to derive an average fare forgone using only information from operators on ticket prices, which in principle can be defined unambiguously and can be readily audited.

However, the likelihood that this approach will lead to “no better, no worse off” reimbursement depends on the extent to which the default look-up table built into the DfT Calculator is fully representative of individual TCA areas. The default look-up table was built from 5 weeks of data collected in 2009 on the concessionary journeys made by passholders living in four districts in Lancashire. Apart from the passage of time since this data was assembled, the reliability of the discount factors estimated from the NoWcard dataset depends upon the journey frequencies of concessionary passholders in the TCA areas being similar to those from which the default look-up table have been constructed.

**Building and use of alternative look-up tables.**

Most TCAs do not have the means of constructing look-up tables from their own areas, but PTEs are increasingly able to do so.

Look-up tables need to be built from data on ENCTS concessionary journeys recorded by smartcard equipment. There are other ways in which partial information on journey frequencies can be calculated (e.g. from surveys) but none have the potential for completeness[[4]](#footnote-4) that smartcard data represents. Even smartcard data may not be sufficiently complete to give reliable look-up table results if smartcard implementation amongst bus operators is partial, or passenger compliance with smartcard procedures is poor. Incomplete capture of data on journeys made by passholders will lead to look-up tables with understated journey frequencies, and the possibility of under-estimated discount factors. Datasets will be most complete when the data covers a large enough area that most of the ENCTS journeys made by residents of the area also make the vast majority of their journeys within that area, nearly all of which are reflected in captured smartcard transactions.

The pace at which bus operators have implemented smartcard-based recording of ENCTS has been slower than expected, but a number of PTEs have now built their own look-up tables, including Centro and Nexus, both of which used datasets that provide about 95% smartcard coverage of concessionary journeys in the respective areas, very similar to the level of completeness offered by the NoWcard data. Other PTEs have constructed their own lookup tables, but from less complete datasets.

*[It is inevitable that lookup tables built from less complete datasets will lead to discount factors that are somewhat underestimated, and if applied would therefore lead to the calculation of higher levels of revenue forgone than would probably be justified if a fuller dataset was available. However, the practical problems associated with smartcard implementation in some areas could mean that some PTEs may not be able to reliably estimate their own lookup tables for some years. It is probable that a systematic relationship between “level of completeness” and the resulting discount factors could be established, which would allow these PTEs to apply lookup tables from their own areas with more confidence than would otherwise be the case.* UTG *should consider undertaking a modest piece of work to explore this relationship, since it would directly strengthen the negotiating position of those PTEs that are without access to their own lookup tables, and will help demonstrate the consistency and credibility of the established PTE alternatives to the NoWcard lookup table.]*

Both the Centro and Nexus datasets demonstrates that concessionary journeys are made much more frequently in these two PTE areas than in the areas from which the NoWcard look-up table was built. Table 1 summaries the number of journeys that populate the NoWcard, West Midlands and Tyne & Wear look-up tables, the number of passholder-weeks in which at least one journey was made, and the average journeys per week[[5]](#footnote-5) that results.

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| **Average journey frequencies in different areas** | Default NoWcard data (2009) | West Midlands data (2013) | Tyne & Wear data(2014) |
| Total number of journeys | 591,063 | 32,218,934 | 9,617,909 |
| Number of passholder weeks with at least one journey recorded | 123,557 | 4,468,929 | 1,386,231 |
| Average number of journeys per non-zero week | 4.784 | 7.210 | 6.938 |
| **Table 1 Comparison of NoWcard, West Midlands and Tyne and Wear ENCTS Journey Frequencies** |

The journey rate per non-zero journey week in the two PTE areas is between 45% and 50% higher than in the NoWcard area, implying that there will be more occasions on which passengers are making sufficient journeys to justify the purchase of day and weekly discount tickets.

This is confirmed in Table 2, which compares the average fare forgone and discount factors calculated using the West Midlands and NoWcard look-up tables. The illustration uses 2013 ticket prices for some example PTE operators.

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| **Illustration of fares and discount factors** | Operator A | Operator B | Operator C |
| Average cash price per journey | £1.60 | £2.04 | £1.97 |
| Average price per day ticket | £5.00 | £4.50 | £4.09 |
| Average price per weekly ticket | £17.00 | £15.77 | £12.92 |
| Average fare forgone (NoWcard look-up table) | £1.54 | £1.84 | £1.72 |
| Discount factor from NoWcard look-up | 3.7% | 9.8% | 12.6% |
| Average fare forgone (Centro look-up table) | £1.42 | £1.61 | £1.47 |
| Discount factor from Centro look-up table | 11.4% | 20.9% | 25.6% |
| Average fare forgone (Nexus look-up table) | £1.46 | £1.68 | £1.53 |
| Discount factor from Nexus look-up table | 8.6% | 17.9% | 22.1% |
| *Error if default look-up table used* | *5.5% - 8.5%* | *9.5% - 14.3%* | *12.4% - 17.0%* |
| **Table 2 Impact of alternative look-up tables on Discount Factors** |

Looking at the values for Operator A, the average fare forgone that would be calculated is £1.54 with the default look-up table (a discount factor of 3.7% relative to the average cash fare). With the look-up table derived from West Midlands data, the average fare forgone would be £1.42, and £1.46 if based on the Tyne & Wear lookup table. This implies that if the area in question is more similar to either of the PTE areas than the Lancashire districts in terms of journey frequencies, then the average fare forgone might be overestimated by between 5.5% and 8.5%. This would be translated directly into a significant over-payment of reimbursement for revenue forgone. If bus operator ticket prices offer more attractive day and weekly fares (e.g. such as Operator C), the error would be much greater at between 12.4% and 17.0%.

The use of an inappropriate look-up table could therefore significantly bias estimates of the average fare forgone. Since this is often the most significant component of the overall reimbursement calculation, the potential for non-compliance with the “no better off, no worse off” objective is very large, if look up tables appropriate to the local area are not used.

**What to do if local look-up tables are not available**

Ideally, local look-up tables should be built for any given area, but this is a remote possibility for most TCAs, and currently is difficult to achieve even in all PTE areas. The next best option is therefore to demonstrate that the look up table selected for application in a given areas is similar to that of the area from which the table was built. The Guidance already acknowledges[[6]](#footnote-6) that large urban areas may be different to those from which the default look-up tables were derived. It is possible to demonstrate that on the basis of a variety of socio-economic characteristics, the PTEs as a whole have more in common with each other than they do with the 4 Lancashire districts[[7]](#footnote-7).

However, it is likely that systematic differences between area types still apply, and it would be better if DfT promoted a mechanism through which look up tables for an “application” area could be better matched to those of a “reference” area. Such a mechanism was developed for DfT and described in an unpublished research report by MVA Consultancy[[8]](#footnote-8), finalised in May 2012. This work also rebuilt new look-up tables from NoWcard data, using a larger number of districts encompassing a wider spread of area types, and for a whole year as opposed to just five weeks. DfT has not, as yet, incorporated any of the results from this work into the Guidance or the DfT Calculator, leaving authorities with a choice of using either the entirety of the default look-up table, or a look-up table from another area. But no mechanism is available for systematically representing an in-between state. However, UTG could make use of the same concepts as those set out in MVA’s work for DfT, to allow a PTE to demonstrate that it had fully reflected its own characteristics in the choice of look-up table it had adopted.

Apart from debate about the similarity of one TCA area as a whole (e.g. Greater Manchester) to another (e.g. West Midlands), individual bus operators, such as those with a significant number of cross-boundary routes, have also been known to argue that their own operating territory is sufficiently different to the generality of a PTE area to justify using the NoWcard table for its services. As with many aspects of reimbursement, in principle there is a theoretical case for better matching various inputs into the reimbursement calculator to the characteristics of individual areas, and potentially individual operator catchments, and this argument might apply to look-up tables. If the choice is restricted to only a crude “either NoWcard/or ANO area” it is highly unlikely that the catchment of an individual operator within a PTE area would be sufficiently different to the rest of the PTE area to justify use of a wholly different look-up table. However, a methodology has been developed[[9]](#footnote-9) to allow lookup tables from different areas to be merged together, so that the result in effect represents a weighted average of the constituent lookup tables. This permits a more nuanced approach to the selection of lookup tables than would otherwise be possible.

**DfT Calculator Implementation of the Discount Factor method**

There appear to be a number of errors in the DfT Calculator, especially regarding the application of “degeneration”[[10]](#footnote-10), and how the final discount factor is calculated. These are difficult to appreciate without a detailed explanation of how the methodology is intended to work, which is set out in a separate file note[[11]](#footnote-11). However, the key observations are as follows:

* calculation of “Degenerated” price ratios – there is no apparent rationale for the way in which Reimbursement Factors are currently applied. The arithmetic in the DfT Calculator will underestimate the degenerated price ratios, leading (in isolation) to over-estimates of discount factors.
* The method for applying degeneration to the volume of cash journeys appears arbitrary, and equally valid but alternative calculations would have the impact of significantly increasing the proportion of journeys assigned to discount tickets and hence increasing discount factors overall.
* The calculation of the “final” discount factor in cell AG18 does not seem consistent with the principles that should be used for estimating the weighted average fare. Correct calculation would lead to significant increases in the estimated discount factor if all other factors remained the same.

Overall, we believe that the net effect is that the Calculator as it currently stands will significantly and systematically underestimate the discount factors that should be calculated for a given set of input ticket prices, and consequently will lead to substantial overestimates of reimbursement for revenue forgone.

There is some evidence that supports this conclusion through comparisons of the results of “Basket of Fares” type calculations and the equivalent ”Discount Factor” calculations[[12]](#footnote-12). In general, authorities are unlikely to have the data from which to construct a robust basket of fares calculation. Even in PTE areas where comprehensive survey data may be available on passenger journeys, the PTE may not have revenue visibility on the full range of commercial ticket products offered by the operator. However, data is available in at least two PTE areas, which either on the basis of entirely their own data, or with revenue data supplied by some of their major operators, enables a basket of fares calculation to be populated without relying on too many arbitrary assumptions.

Where the most complete information is available, discount factors would seem to be justified that are much larger than those estimated by the DfT Calculator. This evidence supports our view that the current implementation of the Discount Factor method in the DfT calculator will systematically underestimate discount factors, and will leave operators better off than in the counter-factual, all other things being equal.

**The average cash fare and Reference Fare**

It was noted above that in calculating reimbursement, the average fare forgone is estimated by applying the Discount Factor to a Reference Fare. Implicitly, the Guidance assumes that the Reference fare is identical to the average cash fare input into the Discount Factor calculation (i.e. the value used to estimate day and week price ratios and hence draw appropriate discount factor values from the look-up table). Because most TCAs have no alternative, they will often rely upon operator estimates of the average cash fare paid by adult commercial passengers, which can be relatively easily reported by operators, and the same measure will be used for both roles.

PTE reimbursement methods often use continuous survey data to estimate what is frequently referred to as an “equivalent cash fare”, derived from the journey length distribution of concessionary passengers applied to a cash fare scale. PTE data[[13]](#footnote-13) can often demonstrate that the journey length distributions of different groups of passengers will not be identical, and this can lead to significant variations in the average equivalent cash fare that might be calculated. In particular:

* the average equivalent cash fare of concessionary passengers is often (but not always) higher than the average cash fare paid by commercial passengers;
* commercial pricing strategies may lead to the journey lengths of commercial cash passengers being significantly different to that of users of daily and weekly tickets.

At present there is no facility within the DfT Calculator to distinguish between, on one hand, the measure of average cash fare used to estimate the average fare forgone, and on the other hand, the measure of the cash fare that is used to calculate period by period reimbursement. There is a concern that the measure of the cash fare that is used for monitoring period by period fare levels, such as the adult equivalent cash fare of concessionary passengers, may not be the most appropriate input into the calculation of the average fare forgone.

The average fare forgone needs to accurately reflect the ticket price options that would be available to concessionary passholders in the counter-factual[[14]](#footnote-14). The DfT methodology in effect assumes that best estimates of the day and week ticket prices that would be offered to passholders in the counter-factual are those observed to be offered to commercial passengers. However, this raises the question as to whether the observed average cash fare (as used to determine the price ratios which allow the discount factor to be identified) is the best estimate of the cash fare that would be paid by concessionary passholders in the counter-factual.

Established practice in some PTEs is to measure the cash fare using the average equivalent concessionary fare (in other words, the average cash fare that would be paid by concessionary passholders to make their recorded concessionary journeys, if each journey was “valued” at the cash fare). But as noted, this will often reflect a different average trip length to that of commercial cash passengers: either because the former reflects changed journey lengths influenced by free travel, or because the pricing of the commercial fare offer favours shorter (or longer) cash journeys lengths compared to alternative day or weekly products. In either case, it is more likely that the average cash fare paid by commercial (cash) passengers will better reflect the counter-factual cash fare that would be paid by concessionary passengers, rather than the average equivalent concessionary fare.

These considerations will influence the accuracy or otherwise of the average fare forgone calculated by either the “Discount Factor method” or the “Basket of Fares” method. But a second issue is then consistency between the discount factor and the measure of the average cash fare used to calculate the average fare forgone on a period by period basis. If the discount factor is calculated on one basis (i.e. the average cash fare paid by commercial passengers) but the average fare forgone is calculated by applying the discount factor to a different measure (such as the equivalent concessionary cash fare), then reimbursement for revenue forgone will be in error[[15]](#footnote-15).

At present, the DfT Calculator ensures consistency between the average cash fare used for calculating the discount factor, and the calculation of the average fare forgone, because it does not recognise that different measures could be used for the two distinct roles. It would be desirable for the DfT Calculator to be adapted to allow PTEs to calculate a discount factor based on the average cash fare paid by commercial cash passengers (to secure a more accurate estimate of the average fare forgone), and at the same time allow for a different on-going measure of the commercial fare such as the average equivalent cash fare, which is a well-established part of current procedures in some PTEs.

**Need to adapt methods to wider range of commercial ticket types**

The “Discount factor method” currently confines estimates of the discount factor to consideration of three generic ticket types, namely cash fares, day tickets and weekly tickets. When this methodology was devised, longer-period tickets were not included for a combination of pragmatic reasons, including the desire to avoid over-complication, and the judgement that few concessionary passholders were likely to make significant use of tickets that were for longer periods than a week. The introduction of smartcard ticket equipment is facilitating the development of “smart” products that do not directly align to the three generic ticket types, such as products that cap expenditure and effectively convert cash fares into day or weekly ticket products if the cardholder makes more than a certain number of journeys in a day or a week. Excluding these from consideration will increasingly lead to the discount method not fully reflecting the commercial choices that passholders would have in the counter-factual, especially as smart products replace the “conventional” day and weekly tickets on which the discount factor method is focussed.

Investigation is needed to identify the nature and potential significance of ticket products that do not match the generic ticket types currently allowed for in the Calculator. Also, smartcard data is beginning to reveal that a small minority of passholders make very frequent and regular journeys, which potentially throws doubt on underlying assumptions about usage of longer period season tickets in the counter-factual. Should ticket types other than cash fares, daily and weekly tickets prove to be significant in passengers’ choice set of tickets, then the current methodology would need to be enhanced to ensure that it continues to reflect the main choices that passholders would have in the counter-factual.

It should also be recognised that in many areas, particularly for the PTEs, the availability of multi-operator and multi-mode tickets further complicates passengers’ ticket choice. Explicit modelling of how passengers select between the wider range of options available is likely to be significantly more complex than the more pragmatic methods currently employed[[16]](#footnote-16).

It is not clear to what extent ignoring the existence of the wider array of ticket products would lead to a bias in estimated discount factors in one direction or another. To date, the simplifications employed in the DfT Calculator, and pragmatic PTE judgements on how to translate local data into appropriate inputs to the Calculator, have not in themselves been the source of major conflict with operators. However, this situation may change, as pressures on finance increase, and the existence of a wider range of ticket types than is acknowledged by the Guidance becomes more difficult to ignore.

**4 REIMBURSEMENT FACTOR ISSUES**

**The Single Demand Curve**

As described in Section 2, the purpose of the Reimbursement Factor (RF) is to estimate the proportion of observed concessionary trips which would have been made in the counterfactual i.e. in the absence of the concession. Given that it is not possible to directly observe it, the quantity of journeys that would have been made in the absence of the concession is estimated by applying the Reimbursement Factor to the observed quantity of concessionary journeys made with free fares.

Prior to the introduction of the DfT Guidance that came into effect in 2011, the Reimbursement Factor was the most frequent source of conflict about reimbursement between Travel Concession Authorities and bus operators. This was consequently a key area for ITS research, and led to results in two areas that were previously much debated:

* the mathematical formula(e) which should be used to represent the relationship between bus fares and concessionary passenger demand: ITS concluded that Reimbursement Factors should be calculated with reference to a mathematical expression which was labelled a “Single Demand Curve”, the shape and sensitivity of which is determined by a pair of parameters;
* the most appropriate parameters to quantify this relationship, often referred to as fare elasticities: ITS established two alternative sets of parameters, one for PTE areas, and the other for non-PTE areas.

The Single Demand Curve (SDC) is a mathematical formula which relates the demand for concessionary travel to the fare that concessionary passholders might pay. An expression can be derived that allows the ratio of demand to be calculated at a given commercial fare such as the Average Fare Forgone, and at the zero concessionary fare. Arithmetically, this is identical to the Reimbursement Factor, which therefore enables the volume of journeys made by passholders in the counter-factual to be estimated.

For a given Average Fare Forgone F and a zero concessionary fare, the appropriate Reimbursement Factor is calculated using the formula

RF = Exp(βFλ)/ Exp(0) = Exp(βFλ)/1 = Exp (βFλ)

as set out in paragraph C.22 of Annex C (Economic Principles) of the Guidance.

The shape and slope (which determine the point elasticity) of the SDC is controlled by the two parameters, λ and β, established by ITS from analysis of reference data sets with different values for PTE and non-PTE areas. In the case of the SDC for PTEs, the reference data draws on time series data on concessionary journeys made in 2005-6 to 2008-9 in the four PTEs which did not have a zero concessionary fare in 2005-6. The parameters therefore attempt to capture the observed impact of the introduction of free travel on concessionary demand.

Although there inevitably remain areas of uncertainty, by-and-large ITS conclusions on the shape of the demand curve and parameter values have been accepted by the practitioner community. However, there is concern that the way in which DfT recommends that these concepts are applied is inconsistent with fundamental principles of “no better off, no worse off” reimbursement, as well as creating much scope for debate about the practical implementation of the recommended method.

**Reimbursement Factors in the Guidance**

Whereas the formula above can easily be shown to estimate the difference between concessionary demand at the fare that passholders would pay in the counter-factual, and at a zero fare, the Guidance states (paragraph 6.19) that “the appropriate reimbursement factor must be calculated based on the change in local fares between 2005/6 and the current reimbursement period”. No rationale is provided for this statement, either in the Guidance main text or in the discussion of economic principles. What is not stated is that if local fares have not changed in real terms since 2005/6, the Reimbursement Factor that is calculated is determined by an estimate of the average fare in PTE or non-PTE areas in 2005/6, irrespective of current or historic fare levels charged by the operator on services for which reimbursement is being calculated. Thus the Guidance in effect standardises reimbursement factors for all operators in PTE areas and non-PTE areas respectively, but with variation between operators reflecting only the change in the fare charged by the individual operator between 2005/6 and the present.

The average 2005/6 full fares assumed in PTE and non-PTE areas, and their provenance, are not highlighted, but they are quoted in passing in appendices to the Guidance[[17]](#footnote-17), and are embedded in some of the formulae within the DfT Calculator spreadsheet. The values used by DfT are £1.12 for PTE areas and £1.20 for non-PTE areas.

The DfT implementation of the Single Demand Curve therefore calculates the Reimbursement Factor without reference to the absolute level of the current fare, and the only local factor that is taken into account is the change in fare from 2005/6 to the reimbursement year e.g. 2011/12. Thus operators charging identical fares in the reimbursement year will be reimbursed by differing amounts, if their fares have changed since 2005-6 by different amounts. Also, the same reimbursement factor (i.e. assumed level of generation) would be calculated for different operators, if the change in the fare from 2005-6 in real terms is identical, even if their reimbursement year fares are very different. This is regarded as potentially being in breach of the 1986 Regulations that individual operators should be financially no better and no worse off. In our view, two operators who charge identical fares in a given reimbursement year, and for whom all other characteristics are identical, should be reimbursed on the basis of identical Reimbursement Factors.

The extent of the potential error is illustrated in Table 3 below. The top three rows show the reimbursement calculations for four different scenarios, assuming an identical average fare forgone (i.e. after discount) in 2011-12 of £1.50. This is equivalent to £1.24 in 2005-6 prices, and is 10.8% greater than the assumed 2005-6 average fare value of £1.12, or in ITS terms a Fare Index of 1.108. The Reimbursement Factor implied by the Single Demand Curve parameters is 48.67%[[18]](#footnote-18). In our view, this is the value of the Reimbursement Factor most likely to deliver “no better off, no worse off” reimbursement, on the basis of the ITS research. With 1000 concessionary passengers, and the 2011/12 average fare forgone of £1.50, it leads to reimbursement for revenue forgone of £730 (calculated from 1000 \* 48.67% \* £1.50.

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| --- | --- | --- | --- | --- |
| Scenario | **(a)** | **(b)** | **(c)** | **(d)** |
| 2011-12 average fare forgone (2011-12 prices) | £1.50 | £1.50 | £1.50 | £1.50 |
| Reimbursement Factor calculated direct from SDC[[19]](#footnote-19) | 48.67% | 48.67% | 48.67% | 48.67% |
| **2011-12 Reimbursement for revenue forgone – using SDC** | £730 | £730 | £730 | £730 |
| 2005-6 average fare forgone (2005-6 prices) | £1.00 | £1.50 | £1.24 | £1.12 |
| Change in nominal (current price) fares | 50% | 0% | 21% | 34% |
| Change in fares in constant prices | 24% | -17% | 0% | 11% |
| Reimbursement Factor from DfT Calculator | 45.76% | 55.82% | 51.24% | 48.67% |
| Non-generated concessionary trips | 458 | 558 | 512 | 487 |
| **2011-12 Reimbursement for revenue forgone – DfT method** | £686 | £837 | £769 | £730 |
| Under- or over-reimbursement using DfT method | £44 | -£107 | -£39 | £0 |
| **Table 3 Illustration of reimbursement implications of DfT method** |

The lower rows of the table illustrate the implications of the DfT implementation of the Single Demand Curve, if various assumptions about the 2005-6 average fare are made.

* In scenario (a), a 2005-6 fare of £1.00 is assumed. This would imply that the change to a 2011-12 fare of £1.50 is a 50% increase in nominal (current price) terms, and a 24.1% increase in real terms[[20]](#footnote-20). The DfT Calculator produces an estimated Reimbursement Factor of 45.76%, and an estimate of revenue forgone of £686, £44 more than the correct value.
* In scenario (b), it is assumed that the 2005-6 fare was £1.50 – in other words, that there was no change in current prices between 2005-6 and 2011-12. This leads to the DfT Calculator estimating £107 over-reimbursement of the operator.
* In scenario (c), the 2005-6 fare is assumed to be £1.24, which is identical in real terms to 2011-12. The Calculator estimate of the Reimbursement Factor is 51.24%, and reimbursement would be £39 more than is justified.
* Scenario (d) is the only scenario in which the Calculator Reimbursement Factor estimate is identical to that which would be calculated by the Single Demand Curve if properly applied, and it arises if the 2005-6 average fare is set to £1.12 – the value assumed by ITS to represent the average fare in PTE areas in 2005-6. Revenue forgone is therefore also identical with the two methods, in this secnario.

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These characteristics are seriously at odds with the underlying assumption of reimbursement calculations that demand varies with the operator’s fare level. It is very difficult to see how this can be reconciled with the TCA objective (as specified by Regulation 4 of TCSR 1986) that operators should be reimbursed so that they are individually financially no better off and no worse off.

**Practical Issues**

Quite apart from these issues of principle, the requirement to estimate a change of fares since 2005/6 also raises many practical problems and creates substantial and unnecessary scope for TCA-operator conflict. TCAs seeking to apply the Guidance in, for example 2015-16, need to be able to make consistent, like-for-like comparisons between fares that are ten years apart. As feared when this methodology was introduced by DfT, debate between operators and TCAs about how to appropriately measure the change of fares from 2005/6 has been one of the biggest continuing sources of contention since the “new” Guidance was introduced.

The Guidance recognises that satisfactory estimates of the change in fares from 2005/6 for individual operators may not be readily available, and suggests as alternatives either TCA-wide estimates (in other words, estimates averaged in some way over all operators in the TCA), or alternatively using the National Bus Fares Index which DfT publishes. But the DfT’s preferred option is to use data that enables the 2005/6 fare charged by an individual operator to be compared with that charged by the same operator in the reimbursement period. Doing so is particularly difficult and raises a number of questions.

What average fare? The Guidance says that TCAs can estimate “the fare that concessionary passengers would have paid in the absence of a concessionary fare scheme in 2005/6”, in other words the average fare forgone. But it also acknowledges that the methodology for estimating the average fare forgone in 2005/6 may not be the same as in the current period – indeed, this is highly likely since the current recommended method was only made available in 2010. Many TCAs would not have made allowance for discount factors in 2005/6, whereas they will do so if they follow current recommendations. If, with hindsight, the historic average fare forgone should have made more allowance for discount fares than it did, should the comparison be with the 2005/6 value after making a retrospective adjustment? Whatever approach is adopted is likely to provide an unsatisfactory basis for comparisons between 2005/6 and the present.

How to accommodate changes in individual operator service patterns? The likelihood of significant changes in service patterns since 2005/6 was strong even in 2010, and will be a much more common problem today. Second best approaches such as references to TCA-wide or national data seem unavoidable where radical changes have taken place, for example substantial expansion or contraction of services. But reference to these external data sources will inevitably increase the likelihood that the estimate of the reimbursement factor is not appropriate for the individual operator and the fares it currently charges.

What to measure? As is evident from the discussion in the previous Section, there are a number of ways in which an average fare can be calculated, even if the potential use of discounted fares is ignored. For PTEs, the most readily available data on fares will often relate to the cash fare scale, which might have been supplied by operators as a standard fare scale, or in the form of fare tables. In some instances, an effective operator average fare scale can be constructed from survey data. In conjunction with the survey data, this information then provides the potential for estimating the average cash fare that would have been paid by different groups of passengers. But there is a large range of possible groups for which an equally plausible calculation could be carried out, including:

* actual commercial cash paying passengers
* all commercial passengers, irrespective of the type of ticket actually bought
* concessionary passengers.

Each of these may have different journey length distributions[[21]](#footnote-22) which will lead to varied estimates of the average fare. And since the objective is to measure the average fare at two different points in time, the question then arises as to whether the average fare is calculated relative to the trip length distribution of the selected group of passengers in 2005/6, or the current period, or use different trip length distributions in 2005/6 and the current period. There are therefore many different combinations of passenger group, fare scale and trip length distribution, representing alternative average fare definitions, for each of which there may be a plausible justification.

In practice, for most TCAs, choices will be severely limited by data availability, and PTEs may be unusual in having more options than most. However, some degree of arbitrary choice between these alternatives seems inevitable, and such is the sensitivity of reimbursement outcomes to variations in input values that disputes about the best method to use are difficult to avoid. This is particularly frustrating since the need to estimate the change in fare arises only because of the way in which DfT has chosen to implement the ITS recommendations on Reimbursement Factor calculation. As discussed above, in our view this is misconceived, and itself gives rise to a wholly avoidable departure from “no better off, no worse off” principles.

[*It should also be noted that it appears that DfT’s “default” values for the change in average fare, supposedly based on the National Fares Index, may have been in error for some time. If local values of the change in fares from 2005/6 are not available, DfT advises the user to use the national change in fares as a default. However, examination by Nexus in Autumn 2014 of the values incorporated in the DfT Calculator revealed that these were not consistent with the published values of the National Fares Index. The consequence was that if a user relied upon the DfT default values incorporated in the Calculator, there was the potential for the reimbursement factor to be over-estimated by a significant amount, at least in the case of PTE areas (the error was less for non-PTE areas). This has now been corrected, but it is important that users access the most recent version of the DfT Calculator if they intend to use correct values of the DfT default assumptions[[22]](#footnote-23).*]

**5 ADDITIONAL COSTS**

Additional costs arise from the likelihood that some operating costs will increase as a result of an operator having to carry additional passenger journeys which have been generated by the concessionary fare. Other additional costs may also be incurred that are directly attributable to the operator participating in the scheme. Reimbursement for additional costs “necessarily incurred” in providing the concession is intended to ensure that the operator is no better off and no worse off as a consequence of the concession and is additional to (and calculated separately from) reimbursement for revenue forgone.

 The DfT Calculator provides scope for calculating different types of additional costs:

* Marginal operating costs. These are costs such as additional fuel, tyre wear and insurance that are likely to be closely related to the number of passengers carried. In the DfT calculator, it is calculated through a simple formula that relates a rate per generated passenger to journey length.
* Marginal capacity costs. These are costs associated with the provision of additional capacity (i.e. extra services and enhanced frequencies) needed to accommodate generated passengers. The Calculator estimates a cost rate per generated passenger, calculated through a complex formula which requires a large number of input variables. It is highly sensitive to these input values.
* Scheme administration costs – the Calculator recognises that a TCA may wish to make payments that reflect administrative costs (for example, if it requires data to be provided in a specific form), but the Calculator does not provide any basis for calculating them – they need to be provided by the user from an off-line source.
* Peak vehicle requirements – the Guidance states that DfT expects that additional peak vehicle requirements [arising from the provision of the concession] will be exceptional, and that operators will have to demonstrate that exceptional or unusual circumstances are relevant. It discusses some aspects of how PVR costs might be calculated, but does not provided a detailed methodology. The Calculator provides for the user to enter a PVR cost (in total) but assumes this will be calculated off-line, independently of the Calculator spreadsheet itself.

Of these elements, there is little to be said about scheme administration costs.

With regard to Marginal operating costs, the principle that some costs, largely “consumables”, will be directly affected by additional concessionary journeys is now widely accepted. The formula derived by ITS and included in the Calculator consists of a fixed element and a variable element, with the latter determined by the average journey length. In combination these lead to an average marginal operating cost per generated passenger. With the cost parameters calculated by ITS, the fixed component is much the biggest, and the influence of the average journey length is relatively modest. The average journey length should be that of concessionary passengers, although many TCAs may not be able to distinguish the average journey length of concessionary passengers from that of other passengers.

Most debate with both operators and DfT has been on the subject of marginal capacity costs, and increasingly, determining additional peak vehicle requirements and associated costs.

**Marginal capacity costs**

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 … through increased frequency”. Reimbursement should be net of the additional revenue generated from commercial [passenger] journeys that arise from increased frequency. They are additional to both marginal operating costs, and to peak vehicle costs.

The Guidance states that “there is a presumption that marginal capacity costs could potentially apply to all routes within a network”, and suggests that they can be calculated either using the DfT Calculator spreadsheet, or by other methods such as counterfactual or hypothetical network models where available. Although there is some discussion of the latter options, the main emphasis in the Guidance is on the DfT MCC Model.

The key assumption underlying the MCC model is that there is a straightforward relationship between the quantity of bus services supplied by the operator, and the number of passengers that are carried. This relationship is expressed through the so-called Mohring Factor, which DfT recommends is set at a value of 0.6. This implies that a 10% increase in passenger volumes (for example, as reflected in the difference between passenger numbers with and without the concession) would lead to a 6% increase in the supply of bus capacity. The evidence to justify this assumption is discussed in more detail below.

It also leads to counter-intuitive results with regard to average occupancy. If all other input values are kept constant, lower levels of average occupancy (which imply a higher level of unused capacity) lead to higher estimated values of marginal capacity costs. This does not seem sensible. For example, if input values are set to default DfT recommended values for PTE areas, including DfT’s default value of average occupancy of 10.00, the net cost rate is calculated to be 11.6 pence per generated passenger. If average occupancy is reduced to 9, then the calculated cost rate increases to 16.7 pence per generated passenger. In other words, with 10% fewer passengers on board each bus, on average, the calculated cost of providing additional capacity to accommodate generated concessionary passengers increases by over 40% per passenger. Intuitively, lower occupancy, providing more scope for generated passengers to be accommodated without requiring additional capacity, should be expected to lead to lower levels of marginal capacity cost. But with DfT’s MCC model, the reverse is the case. We regard this as a serious and fundamental weakness in the MCC model.

[*There is evidence from some PTE areas that some commercial operators are basing their business model on the fact that the DfT Calculator gives very high marginal capacity cost payment rates for services that carry very few commercial passengers and primarily attract concessionary passengers. Such services would probably not exist in the absence of the concession, but current Guidance provides no framework for examining such questions. Consequently it can be difficult for PTEs to dispute high MCC values claimed by operators, especially if they are driven by relatively robust estimates of Calculator inputs. Currently, the instances of this situation appear to be relatively few and isolated[[23]](#footnote-26), but it would be a matter of great concern if the concessionary travel reimbursement regime incentivised operators to focus on services with minimal commercial traffic but potential high concessionary use.]*

**Role of revenue generation in the Marginal Capacity Cost calculations**

The MCC calculations are made significantly more complex by the need to allow for the likelihood that increased provision of bus capacity (to accommodate generated concessionary passengers) will encourage more commercial passengers and create additional commercial revenue. For the operator to be left no better off and no worse off, this additional revenue needs to be subtracted from the gross additional cost of providing the additional capacity. The relationship between the supply of services and the demand for travel is captured by the “service elasticity”, which DfT recommends is set at 0.66. This implies that a 10% increase in service frequency would lead to a 6.6% increase in commercial passengers, and hence a 6.6% increase in commercial revenue.

Net Marginal Capacity Costs are therefore the outcome of two sets of calculations that work in opposite directions: greater volumes of generated concessionary passengers imply larger increases in service capacity, and larger levels of gross additional costs, but the additional capacity implies higher levels of generated commercial revenue that will reduce the net financial impact. The magnitude of these changes, and how much one balances out another, is sensitive not only to the key behavioural parameters (the Mohring Factor, and the service elasticity), but also the various other factors required to implement the MCC methodology. In some circumstances, the additional commercial revenue generated by the assumed additional capacity can outweigh the gross additional costs, leading to zero reimbursement for marginal capacity costs; but in other circumstances, the calculated net marginal capacity cost per generated passenger can be very significant.

**Sensitivity of MCC results to variation in input values**

As discussed in more detail below, neither the Mohring Factor nor the service elasticity are particularly robust and well-established parameters, but it is unlikely that individual TCAs or bus operators will have strong local evidence to support alternatives to the DfT default values. However, there is more likelihood that there will be local evidence for the other parameters required by methodology. Unfortunately, this also creates more potential for conflict between the different parties, because the outputs from the Marginal Capacity Cost calculations are greatly sensitive to the precise values adopted. This is illustrated in Table 4, which shows the change in overall additional cost per generated passenger, and marginal capacity cost, when individual local input values are reduced by 10%. These are all relative to DfT default values for PTE areas.



**Table 4 Sensitivity of output cost rates to changes in input local values**

Of these inputs, concessionary journey length has only a modest impact on the output marginal capacity cost per generated passenger, and route length none at all[[24]](#footnote-27). However, a 10% variation in any of the others will, in isolation, lead to proportionately much greater change in the calculated cost rates.

PTEs can often be better equipped than most TCAs with data from which MCC inputs can be sourced, especially with regard to passenger journey length. However, it is rare for either a TCA or a bus operator to have access to robust local estimates of all the MCC inputs.

. Howeverthe Guidance. It , presumably to guard against the dangers of a “pick-and-mix” approach, which could tempt interested parties to select only a combination of values that it is perceived will optimise their own respective positions. I. In this context, it is unfortunate that the provenance of many of the values quoted by DfT is unclear, which makes the objective assessment of the robustness of alternative parameter values unnecessarily contentious.

[*Nearly all the inputs to the DfT Calculator can be derived from the data that in the past has been routinely collected by PTEs as part of their continuous monitoring surveys. However*, w*ith increased use of smartcards as the basis for recording the volume of concessionary journeys, PTEs have been reducing the scale of continuous monitoring surveys, if not stopping them completely. This will inevitably have the consequence of reducing the robustness of (and ability to defend) their estimates of inputs to the DfT Calculator.*

*It may well be that individual PTE experience of negotiations with bus operators on reimbursement matters has not required detailed debate on Calculator inputs, and in the past there may not have been any need to use local survey data to bolster the PTE’s position. However, where resolution of negotiations has proved difficult, access to objective, independently verifiable evidence on the inputs to the DfT Calculator has significantly strengthened PTE negotiating positions. Consequently, even if local survey data is no longer collected by a PTE on a regular basis, it is strongly recommended that individual PTEs create an archive of historic local data to provide a resource that can be drawn on in future negotiations. This may be a matter of some urgency, given staff turnover and the potential for lack of documentation, especially since the need to draw upon such a resource might not become apparent for a year or more.*

*It is also worth noting that in most PTE areas, it is negotiations with one or two smaller operators that can prove disproportionately time consuming, especially if a number of inputs to the Calculator are seen as being open for debate because of lack of local evidence. Having ready access to a well-established set of local values (even if based on survey data going back some years) can head-off unnecessary debate and save time and effort all-round*.]

**Estimates of local variables**

There a number of specific issues that may arise in identifying robust values for local variables.

Passenger journey length and average occupancy: these are distinct inputs into the MCC calculations, but are intimately related characteristics of the bus network. Average occupancy is typically defined as passenger miles/bus miles (i.e. the total distance travelled by bus passengers divided by the total distance travelled by buses while in service); and passenger miles can be calculated by multiplying the number of passenger boardings by the average journey length per boarding.

Good data on journey length is likely to be routinely available only in some PTE areas, and most TCAs, and bus operators are likely to rely upon a “rule-of-thumb” quoted by DfT which suggests that “the average journey length is about half the average route length.” The origins of this are not known, and PTE data suggests that even if approximately correct on average, there is very wide variation between operators and services. Even so, the “rule of thumb” will frequently be used by bus operators as the basis for their own MCC inputs, and wherever possible, TCAs should seek a more robust survey-based estimate of average journey lengths and the consequent average occupancy.

Average bus speed in PTE areas: experience shows that the DfT default value is wide of the mark. The DfT default for PTE areas is based on analysis of published timetable information in small and medium sized towns, even though the data set used specifically excludes services in PTE areas. Estimates of bus speeds in PTE areas based on local survey data or from operator supplied data give significantly higher average speeds than the DfT defaults. This evidence alone suggests that exclusive reliance on DfT’s default values has the potential to result in calculated marginal capacity costs being in significant error.

Calculation process for average commercial fare: one of the most sensitive inputs into the MCC calculation is the average fare paid by commercial passengers, which is used to net-off the impact that higher service levels might have on commercial revenues against the gross additional costs incurred. The value of this variable can determine whether there appears to be a case for significant marginal capacity costs, or none at all.

In principle, the most satisfactory basis for calculating this figure is probably a reported value of total commercial revenue (excluding reimbursement payments for concessionary passengers) divided by a best estimate of total commercial passenger journeys. However, great care is needed to ensure that both of these values are estimated on a consistent basis. In particular, revenues need to include both on-bus and off-bus revenue, while scrutiny may be required of operator estimates of passenger journeys if these cannot be estimated from independent surveys. Operator estimates of usage of discounted tickets are likely to rely on “rule of thumb” values for the average number of passenger journeys made with each ticket sold, while the reliability of ETM records of passenger journeys (i.e. “button presses”) will be heavily dependent upon operational issues such as driver discipline.

Exclusion of non-generated concessionary journeys from generated revenue calculation: at a detailed level there is a clear logical flaw in the one aspect of the current MCC calculation. “Commercial journeys as a percentage of total journeys” provides the basis for estimating how much additional revenue the operator would earn from running additional capacity (to accommodate generated concessionary passengers). But this will exclude changes in the volume (and hence revenue forgone) of non-generated concessionary passengers. In the counter-factual, the volume and hence revenue from non-generated concessionary passengers will be determined by service levels in exactly the same way as passenger volumes and revenues from commercial passengers. Consequently, in our view the value that should be input into the “revenue gain” element of the MCC calculation should be based on the volume of commercial passengers plus the volume of non-generated concessionary passengers. Since the Reimbursement Factor necessary to estimate this amount from observed concessionary passengers has already been established during the prior calculation flow, it would not be difficult to ensure that gains in revenue forgone from non-generated concessionary passengers are properly accounted for.

**Other Inputs into the Marginal Capacity Cost Calculator**

In addition to the values of local variables identified above (which all, in principle, should be specific to an individual operator), the Calculator also requires values to be supplied for some other key parameters, although it is unlikely that most TCAs would have the data to support alternative values to those recommended by DfT. These inputs are as follows:

* Unit costs (per vehicle hour and per vehicle kilometre) – the default values were a key output from the ITS research. The Guidance notes that “although data on vehicle costs may be readily available from operators’ accounts, it is not straightforward to estimate a true marginal cost.” There are no strong grounds for criticising the default values, and it is suggested that default values are applied unless it becomes apparent that they are not appropriate in a particular situation.
* Service elasticity (demand response to service change) – DfT’s recommended value is based on a review of empirical evidence, but operators have consistently claimed that the default value is significantly inaccurate. The role of the parameter in the calculation is to identify the additional commercial patronage (and hence fare revenue) that may have been attracted to the operator by enhanced services put on to accommodate generated concessionary passengers. This is one topic on which DfT is known to have commissioned research to review the evidence, but it is understood that the results have been inconclusive. Some PTEs have seen reports from operators that purport to demonstrate that lower service elasticities can be justified, but the quality of evidence appears flimsy.
* Mohring Factor (vehicle miles and demand) – this parameter is also contentious, partly because there is very little empirical evidence to quantify the extent to which operators adjust service levels to reflect changes in demand levels. However, PTEs are uniquely able to shed light in this issue through analysis of continuous survey data, which also provides an alternative methodology for estimating marginal capacity costs. This is discussed below.

**Alternative estimates of the Mohring Factor**

The fundamental rationale for reimbursement for marginal capacity costs is to provide compensation for the cost of providing any additional capacity necessary to accommodate generated concessionary passengers. But a striking feature of the literature on additional costs is the absence of a strong evidence base that quantifies the relationship between the service levels that bus operators choose to supply and the demand that they are trying to accommodate. This is surprising since one would expect that the deregulated environment in Great Britain outside London would provide a clear demonstration of the extent to which changes in passenger demand lead operators to change service levels.

As it is, DfT’s Marginal Capacity Cost Model relies upon the value of a parameter known as the Mohring Factor, named after the economist who first identified its value during academic research in the US in the early 1970s. DfT’s recommended value is very largely based on theoretical studies, and assumes that a 10% increase in passenger demand would lead operators to increase service levels by 6%.

A practical reason for the lack of UK evidence is that for TCAs, and even for bus operators, it is very difficult to observe bus services at a sufficient level of detail to allow meaningful analysis of supply and demand relationships. In addition, it seems that bus operators do not articulate explicit policies that reflect their commercial judgements about how much unused capacity is affordable, and to what extent passengers should have to put up with crowded conditions. In the absence of clearly articulated service planning policies, actual service provision will be the outcome of a series of incremental, tactical decisions about changed frequencies which will be such that the relationship between the maximum load and the legal capacity of individual buses will be extremely varied, and volatile.

However, the data collected by some PTEs does provide an opportunity to observe the level of crowding on board buses at an individual service departure level. In at least two PTEs, the boarding and alighting points of all bus passengers are established, together with their ticket type. Consequently it is possible to build up a loading profile for each bus service departure showing the number of passengers on board at each stage[[25]](#footnote-28). By relating the peak load to the capacity of the bus, it is possible to identify how “crowded” the bus is, and also to identify the number of concessionary passengers contributing to the peak load. At an operator or network-wide level, this enables the frequency with which bus services are “crowded” to be estimated, giving a snapshot of current *de-facto* planning policies. This is illustrated in Figure 3, which shows a typical distribution of peak loads relative to capacity.

 **Figure 3 Frequency distribution of bus departures with different levels of peak load**

The chart draws on analysis of over 7,000 individually surveyed bus departures, from all operators in one PTE for all time periods, during 2009-10. The horizontal axis represents different levels of “crowdedness”, measured from the peak load (on each surveyed bus departure, at the peak load point) as a percentage of the licensed seating capacity. The vertical axis represents the percentage of buses observed at different levels of crowdedness or more. Clearly, all bus departures have a peak load that is not less than zero percent of the seating capacity (at the left hand margin of the chart); at the other end of the chart, only a very small percentage of departures exceed 100% of the licensed seating capacity.

If available capacity is measured by the licensed seating capacity, then the data shows that the peak passenger load exceeds this capacity on 3% of service departures. In our view, the observed distribution of crowded buses can be regarded as a summary of the *de facto* planning policies of the operators – reflecting how, in practice, operators trade-off the need to minimise overcrowding (which would discourage passengers and in extremis lead to lost revenue) against the provision of excess and unprofitable capacity. It is therefore reasonable to assume that in the event of a change in the number of passengers carried, operators would adjust the level of service provided to maintain the observed proportion of crowded buses.

Figure 4 shows the “tail” of the frequency distribution, on an exaggerated scale, to show how taking out generated concessionary passengers reduces the number of buses that might be regarded as crowded. The axes are as in Figure 3, but the distribution is only shown for the small proportion of buses in which the peak load exceeds 80% of seating capacity and more.



**Figure 4 Distribution of frequency of crowded buses, with and without generated passengers**

The top line shows the observed frequency distribution: so for example, the data demonstrates that overall, bus frequencies are such that 7% of service departures have a peak load equal to or greater than 85% of the seating capacity. The surveys show that only 3.5% of services would exceed this level of crowding if generated concessionary passengers were not carried. It is therefore reasonable to assume that in the counter-factual, service levels would be reduced so that the level of crowding returned to the observed 7%. The effective cost saving would therefore be that associated with 7% - 3.5% = 3.5% of service departures.

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The difference between the number of crowded buses, with and without generated concessionary passengers, provides a means of estimating the implied Mohring Factor. About 21% of all passengers can be considered to be generated concessionary passengers. The analysis suggests that, at an 85% capacity threshold, carrying the 21% of generated passengers leads to 3.6% more service departures, implying a Mohring Factor of about 0.167 – in contrast to the default DfT value of 0.6. At a higher capacity threshold (implying that operators permit a higher proportion of buses to be relatively crowded), the Mohring Factor drops to 7.3%. But even with the most generous assumption about capacity thresholds, of 70%, the Mohring Factor is only 0.3 - about a half of the default value recommended by DfT.

As DfT itself notes, the default values are largely based on theoretical studies (which in our view are largely irrelevant to the context of concessionary travel reimbursement in England). The values reported here appear to be the only empirical evidence available on this important component of reimbursement calculations. The results suggest that appropriate values for concessionary travel reimbursement are much less than those recommended as default values by DfT.

**Identifying additional costs using a “Counter-factual network” approach**

The Marginal Capacity Costs calculated by the DfT Calculator are intended to reflect only those additional operating costs associated with more intensive use of an existing fleet of vehicles. If additional vehicles are required to accommodate generated concessionary passengers, then reimbursement can be claimed for the additional peak-vehicle requirement. DfT Guidance states that in the majority of cases, generated concessionary passengers will not affect the peak period of travel, and consequently will not incur additional peak vehicle costs. The DfT Calculator does not offer any procedure for identifying additional peak vehicles, but the Guidance does describe data and an outline calculation process. Critically, it says[[26]](#footnote-32) that “*Operators should demonstrate the criteria they use to decide whether to put on extra services to meet peaks in commercial services or allow load factors to be above 100 per cent for short periods.*”

As far as we are aware, no operator has articulated their service planning criteria, but some operators have set out an alternative service network representing the service patterns that would be operated in the absence of the concession i.e. if generated concessionary passengers were not travelling. In particular, a number of subsidiaries of one group have populated a proforma spreadsheet with the detailed demand and service data that DfT identifies in its Guidance as relevant to the case for changes to the peak vehicle requirement. As presented to PTEs by operators , these calculations purport to demonstrate that significantly more reimbursement for additional costs could be justified than would be calculated by the DfT calculator. Partly this is because the operator spreadsheet calculates both marginal operating costs and peak vehicle costs, of which the latter is not explicitly calculated by the DfT Calculator.

Treflected in the spreadsheet S.

Recent examples suggest some developments in operator thinking which significantly increases the net additional capacity costs implied by a counter-factual network approach. Wit was envisaged that operator reaction to the need to accommodate generated concessionary passengers would primarily take the form of enhanced service frequenciesHowever

However, the counter-factual networks now being put forward by operators incorporate significant changes in vehicle allocation, with capacity reductions (in the counter-factual) achieved by wholesale substitution of smaller vehicles (which the operators claim to have much lower unit costs) for larger buses. The consequence is that large savings in operating costs are supposedly achieved, but without offsetting losses of revenue from commercial passengers.

[*In considering counter-factual network scenarios proposed by operators, it is essential that the service planning judgements underlying the scenarios are examined critically by qualified service planners.* *While strategies of substituting small for large buses are not obviously invalid responses to the counter-factual situation, the sense and feasibility of doing so need to be tested. Moreover, the evaluation of the cost and revenue consequences of operating different fleet configurations is unknown territory with regard to concessionary travel reimbursement. In particular, if further pursued by operators in the future, significant questions need to be addressed, including:*

* *what evidence is there to support vehicle-type specific unit costs, and how appropriate are the implicit assumptions for additional cost calculations;*
* *what is the likely response of commercial passengers to changes in vehicle type, particularly downgrades from newer, high-quality high capacity vehicles to smaller and older vehicles*.]

**APPENDIX 1 CHECKLIST OF ISSUES AS AT SEPTEMBER 2013**

| **Issue** | **Current DfT Guidance** | **Summary of concern/issues** | **Nature of supporting evidence/argument**  | **Source and currency of experience** |
| --- | --- | --- | --- | --- |
| ***Average fare calculations*** |
| Process for updating and expanding scope of look-up tables | Guidance encourages TCAs to use their own smartcard data to construct area-specific look-up tables | DfT needs to endorse a mechanism for widening the scope of the look-up tables incorporated into the Calculator. Individual PTEs without their own look-up tables can then draw on data from other PTEs with less risk of criticism of being “off-Guidance” | Research carried out for DfT in 2011 by MVA Consultancy, but not published by DfT, suggests an appropriate mechanism, and also established enhanced and updated look-up tables | Both Centro and Nexus have now constructed their own look-up tables. Data has also been assembled that demonstrates that lookup tables from PTES are more likely to be appropriate to other PTE areas than the NoWcard lookup table |
|  |  | Operator arguments that different look-up tables should apply e.g. because their services are “more NoWcard-like” | In principle, it is likely that different discount factors would apply to e.g. out-County passholders. Methods have been developed for calculating a weighted average of lookup tables to combine tables from different areas |
| Principles of the Discount factor method | The Guidance provides a detailed rationale for the calculation sequence | The logic behind some of the steps in the sequence appears weak or flawed, partly because of lack of clarity of principles | Discussion of the detailed methodology | Research for Transport Scotland has developed a stronger conceptual rationale for the method which exposes some of the shortcomings of the current calculations |
| Detailed implementation of the method | As exemplified by the DfT Reimbursement Calculator | There appear to be errors in how calculations are carried out regarding the application of “degeneration”, and how the final discount factor is calculated | Diagnosis of the detailed arithmetic coded into the spreadsheet | Previous ***pteg*** correspondence with DfT, supported by GMPTE examples. |
| Outcome of the application of the discount factor method with example PTE data | As above | The discount factors calculated using example operator price data leads to discount factors that appear to be too low, leading to inflated average fare values | Comparison of calculated average fares and equivalent basket of fares calculations. The issues/errors identified above are likely to contribute to the apparent bias in the current method | TfGM and Nexus data, and average fares quoted by operators in an additional cost context |
| Need to adapt method to wider range of commercial ticket types | Current guidance restricts “Discount factor method” ticket types to cash fares, and day tickets and weekly tickets | Smartcard ticket products promoted by operators may not match the three generic ticket types, with the result that the discount factor method does not properly simulate the choice of tickets by passholders in the counter-factual. | Data on commercial operator ticket use | Nexus data from one major operator provides an example of the range of ticket types being promoted, and the issues raised for the discount factor method. |
| Need to distinguish between average cash fare paid by commercial passengers and the average equivalent cash fare of concessionary passengers | Guidance does not recognise that differences in trip lengths will lead to differences in the average cash fare | Greater clarity is required on the definition of the average cash fare, and how that is carried through into the discount factor calculation | Data on commercial and concessionary passenger trip lengths from continuous surveys | Nexus, Merseytravel and probably other PTEs |
| **Average fares overview**: for *the vast majority of TCAs who had no independent data on use of ticket types, the discount factor method is a significant advance relative to a basket-of-fares calculation largely based on operator assumptions. However, PTEs have increasingly been able to demonstrate flaws in the DfT model, as well equip themselves with more appropriate lookup tables. It would be advantageous to PTEs for a review of the discount factor method to be placed on the agenda, and in any case PTEs may wish to review whether their local survey data could be used to populate basket-of-fares type calculations.**It is worth noting that various issues associated with average fares impact on all aspects of the current reimbursement calculation (including the determination of the Reimbursement Factor and Additional Costs). Similar data and definitional problems arise in all three applications, and DfT should take a much more holistic approach that is consistent across these three areas.* |
| ***Reimbursement Factor Calculations*** |
| Concept of Reimbursement Factor calculations based on changes in commercial fares from 2005-6, and not related to actual fares in the reimbursement year | Guidance sets out a brief rationale  | Arguments flimsy and not otherwise supported. Not consistent with NB/NW principles. Not consistently applied within Calculator (e.g. to average fare “degeneration”).  | Issues easily demonstrated by hypothetical example | ***pteg*** set out these arguments to DfT following the publication of the “final” (post-consultation) Guidance in 2010 |
| Calculated RFs are partly determined by historic values of the “average 2005/6 commercial fares” in PTE and non-PTE areas  | Values used are not declared explicitly in the Guidance | Lack of transparency is highly unsatisfactory, as is the minimal information on the provenance of the values incorporated in the Calculator | It would be desirable to establish a robust independent estimate of the average 2005-6 commercial fare in PTE areas. | PTEs are likely to have access to the necessary data from historic reimbursement arrangements. |
| Source of data on changes in fares | Guidance emphasises that preference (and all logic) is for local data on changes in local fares | Local values for change in fares difficult to source and not meaningful in some circumstances. Guidance gives no definition of what is meant by “average fare”  | Issues and wide range of competing interpretations can be demonstrated from operator arguments and PTE continuous surveys | Issues fully exposed in various PTE negotiations with operators leading to recent voluntary agreements |
|  |  |  |  |  |
| National data on changes in fares may be in conflict with PTE data | Guidance recommends default values based on National data in certain circumstances  | Operators likely to argue that National data should be used. Not clear how national fares index for PTE areas would compare with PTEs own data where available  | Data on changes in fare levels based on continuous surveys | Errors in DfT Calculator data now identified and corrected |
| Different Reimbursement Factors for different classes of concessionary passengers  | Not referenced | Operator argument | No evidence of different elasticities between different groups, and in any case overall principle of RF calculation is that elasticities are for concessionary passengers as a whole. |
| **Reimbursement factor calculation overview**: *the adoption of the current Guidance method whereby the RF is based on the change in fare from 2005-6 seems to have been a last-minute pragmatic judgement by DfT. Despite its conceptual flaws, and the great scope for argument created by how it has to be put into practice, it may have led to less variation in outturn RF’s and hence contributed to the widespread acceptance of the new Guidance from 2011-12. Operators have sought to use the practical difficulty of measuring the change in fare from 2005-6 to argue for higher reimbursement levels. PTEs have generally been able to use their own data sources to produce their own independent estimates. PTEs may need to be prepared for operators to argue that the conceptual basis for the current method is flawed, if they believe that to be in their interests.* |
| ***Additional costs*** |
| Principles of capacity cost calculations | As set out in Guidance | Counter-intuitive result that capacity costs are higher with lower average load factors | Easily demonstrated by hypothetical examples applied to Calculator | Effect is not dependent upon local values, although scale of impact will be determined by local input data |
| Concern that the MCC calculation incentivises operators to run services with minimal commercial demand but high levels of (generated) concessionary demand |
| Values of Mohring Factor | Guidance sets out recommended values | Source of current values not relevant to CT reimbursement in deregulated bus network, when more appropriate values have been derived from PTE data | Analysis of PTE survey data allows the relationship between supply and demand to be quantified  | Nexus (2012-13) and GMPTE (2011-12) analysis |
| Values of Service level Elasticity | Guidance sets out recommended values | Concerns have only been raised by operators |  | It would be useful to know if any PTEs have carried out analysis of local data (in a non-CT context) that could provide some additional evidence on this topic |
| Exclusion of non-generated concessionary passengers from revenue gains associated with additional capacity | Current Guidance restricts calculation to commercial journeys only | Non-generated concessionary journeys would also be influenced by changes in capacity in the counter-factual, further increasing revenue gains from additional capacity | Logical flaw in current Guidance, easily demonstrated through hypothetical example | Scale of impact likely to be dependent on local values of input data |
| Scope for debate about definition of some of the local data inputs | Current guidance vague on definitions | Ambiguity creates major source of argument because outcomes are highly sensitive to some inputs (particularly the “average fare” used for determining commercial revenue gains from additional capacity) | Alternative interpretations of Guidance can be easily demonstrated by example | Recent PTE negotiations |
| Time period to be used for calculation of inputs | Current Guidance unclear | Not clear whether some or all of the local values should be calculated only for those times of day when the concession is in operation (i.e. excluding weekday am peak) or 24/7 | Need for consistency and avoid scope for operators to pick and mix. However, may be academic where PTEs do not have access to sufficiently detailed data to derive local values | Recent PTE negotiations show implications of data calculated using alternative assumptions |
| Operator application of “Counter factual network” approach | Current guidance difficult to apply | Operator failure to spell out service planning criteria | Service alterations proposed by operators very detailed – need review by PTE service planners |
| No guidance provided | Major element of reimbursement claim is reliance on un-evidenced unit costs | To date, limited opportunity to explore |
| Not type of strategy envisaged in guidance – potential DfT response is unknown | Strategy of replacing larger buses with smaller buses raises various questions |
| Additional cost overview: *although the recommended additional cost methodology can be criticised quite easily, both on theoretical grounds and from the practical perspective of being highly sensitive to input values, the method does provide a helpful focus for discussions on additional costs. It is clear that PTE data sources from continuous surveys can offer some extremely important ways of validating operator assertions about input values, and in some cases (e.g. trip lengths) only PTEs are likely to be able to access plausible alternatives to DfT default values.**DfT’s research into the Mohring Factor and service elasticities seems unlikely to be published and currently no change is expected. However, operators have increasingly promoted additional cost calculations based on counter-factual networks. These raise more questions than answers, and require careful scrutiny.*  |
| ***DfT Calculator spreadsheet*** |
| Overall structure and philosophy | The recommended Excel spreadsheet | Use of macros creates unnecessary level of complexity and uncertainty | PTEs have developed alternative spreadsheets which exactly replicate the DfT Calculator but which address most of these issues. They demonstrate that the calculation process can be far simpler and more transparent than the implementation of identical concepts in the DfT Calculator |
|  |  | Fragmentation of reimbursement calculation into many distinct worksheets creates unnecessary complexity |
|  |  | Imbedding of look-up references in formulae to identify parameter values creates excessively long expressions which are very difficult to interpret and audit |
|  |  | Structure does not lend itself to testing of alternative reimbursement scenarios e.g. for different operators, years, datasets etc |
|  |  | These structural issues create significant problems in satisfactorily auditing the DfT spreadsheet as a whole |
| Overview of Calculator Spreadsheet issues: *although it is easy to demonstrate how the current Calculator could be significantly improved, it is unlikely that DfT will explicitly acknowledge these problems. However, there may be a willingness to address some of these issues. If UTG uses discussion on the methodological issues outlined above to provide access to one of the PTE versions of the that address these issues, it is possible that the DfT technical staff carrying out calculations might be persuaded of the merits of a different approach in future versions of the DfT spreadsheet.* |

**APPENDIX 2 REFERENCES**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Title | Author/organisation | Date | Status |
| 1 | Concessionary travel for older and disabled people: guidance on reimbursing bus operators (England) | Department for Transport | September 2015 | Published on DfT website |
| 2 | Review of Look-up Tables from Centro Smartcard Data | Andrew Last/Minnerva Ltd | 17/2/2014 | Research for TfGM - unpublished |
| 3 | Provision of Look-up Tables for DfT Concessionary Travel Reimbursement Calculator | MVA Consultancy and Minnerva Ltd | 18/5/2012 | Unpublished research for DfT |
| 4 | Combining Look-up tables used in concessionary travel reimbursement calculations | Andrew Last/Minnerva Ltd | 29/1/2015 | Research for Nexus - unpublished |
| 5 | File Note: Principles and application of DfT “Discount Factor Method” | Minnerva Ltd | 16/4/2014 | Unpublished file note for ***pteg*** |
|  |  |  |  |  |
| 6 | Calculating Average Commercial Fares for Concessionary Travel Reimbursement | Minnerva Ltd | 17/8/2010 | Unpublished case study for ***pteg*** based on GMPTE data |
| 7 | File Note: Differences in the journey length distributions of users of different ticket types | Minnerva Ltd | 17/4/2014 | Unpublished file note for ***pteg*** |
| 8 | Scotland-wide Older and Disabled Persons Concessionary Bus Scheme – Further Reimbursement Research | MVA Consultancy in association with Minnerva Ltd | 7/2/2013 | Published |
| 9 | Note on Reimbursement Factor Calculations | Minnerva Ltd | 8/12/2010 | Unpublished file note for pteg |
| 10 | Bus operator reimbursement: the case for additional capacity costs | Minnerva Ltd | 4/8/2011 | Unpublished note for Nexus |

1. Most recently published in September 2015 for schemes commencing in April 2016. See Reference 1. [↑](#footnote-ref-1)
2. DfT undertook a formal Consultation on draft Guidance dated September 2010, to which ***pteg*** responded in detail. Some significant changes were made in the final version of the Guidance, on which the current version is largely based, but in the ***pteg*** view some of these late changes, on which there was no opportunity to comment, created additional difficulties. [↑](#footnote-ref-2)
3. Reference 1 identifies the principal source of official guidance on reimbursement, published by DfT. [↑](#footnote-ref-3)
4. By complete, we mean having confidence that data on nearly all journeys made by a passholder in a particular day have been captured. Alternative data collection methods such as surveys are likely to under-record days in which a passholder makes no journeys, which are an important consideration in simulating the possible purchase of weekly tickets. [↑](#footnote-ref-4)
5. It is important to note that these values may not be directly comparable with average journey frequencies that might be calculated from conventional survey data, because weeks in which no journeys are made will not be included in the dataset from which the look-up table is built. [↑](#footnote-ref-5)
6. E.g. paragraph 6.11 [↑](#footnote-ref-6)
7. See reference 2, which describes work on behalf of TfGM which examined the case for use of the Centro–derived look-up table in the Greater Manchester area. It illustrates more generally that in terms of key characteristics, the PTE areas are more similar to each other than they are to the NoWcard area [↑](#footnote-ref-7)
8. Reference 3 [↑](#footnote-ref-8)
9. See Reference 4 [↑](#footnote-ref-9)
10. “Degeneration” is used by DfT to describe the process through which look-up table results, based on concessionary journey volumes observed with a free fare, are adjusted to represent the journey frequencies that might be expected in the counter-factual, without journeys generated by the free concession. [↑](#footnote-ref-10)
11. Reference 5 [↑](#footnote-ref-11)
12. Reference 6 [↑](#footnote-ref-12)
13. See Reference 7 [↑](#footnote-ref-13)
14. This is a quite different argument to the question of whether operators would change the commercial offer to passholders in the absence of the concession, which is not debated in this note. [↑](#footnote-ref-14)
15. This is demonstrated in Reference 8 [↑](#footnote-ref-15)
16. Some technical options for more complex choice modelling are available such as multinomial logit, but it is unlikely that these can be readily applied in a practical reimbursement context. [↑](#footnote-ref-16)
17. E.g. in paragraph H.41 of the Guidance [↑](#footnote-ref-17)
18. Calculated as RF = Exp(βFλ) = Exp (-0.6687 \* (1.1080.7232)) [↑](#footnote-ref-18)
19. See Reference 9 [pteg note on Reimbursement Factor issues] [↑](#footnote-ref-19)
20. Calculated using the 2011-12 deflator value of 0.827 quoted in the 2016-17 DfT Calculator. [↑](#footnote-ref-20)
21. As illustrated in Reference 7 [↑](#footnote-ref-22)
22. For the avoidance of doubt, the version of the DfT Calculator with corrected values was labelled as “Version 3.3 – 07 October 2014” and was released on 20th November 2014. Very confusingly, the updated version superseded a previous release, issued on 13th November, labelled “Version 3.3 – 13 November 2014” with uncorrected National Fares index values. The current version, labelled Version 3.4 of 22nd September 2015 (for application from April 2016) maintains the corrected values. [↑](#footnote-ref-23)
23. It should be noted, however, that subsidiaries of one, relatively small company have quite aggressively pursued reimbursement claims in two different PTE areas largely based on MCC calculations. This has resulted in at least one appeal that has gone through the full process to a DfT Determination. [↑](#footnote-ref-26)
24. This reflects poor execution of the spreadsheet by DfT as noted above. The introduction of average route length into the arithmetic is redundant: it does not affect the results of calculations and unnecessarily adds to the complexity of calculations. [↑](#footnote-ref-27)
25. As described in Reference 10 [↑](#footnote-ref-28)
26. Paragraph 7.63 of the Guidance published in September 2015. [↑](#footnote-ref-32)