Peer review of proposed methodology for benchmarking PT operator bids

New Zealand Transport Agency

29 November 2012
Peer review of proposed methodology for benchmarking PT operator bids

Dear Leah,

We are pleased to provide our peer review report on NZTA’s proposed benchmarking methodology for public transport (PT) operator bids under the new Public Transport Operating Model (PTOM).

This report is provided in accordance with the terms of our letter of engagement dated 5 November 2011, and is subject to the restrictions set out in Appendix A of this report.

There are three main findings of our peer review:

First, we found that the proposed methodology, Data Envelopment Analysis (DEA), is fit for purpose. The model specification is sound, and this methodology is frequently used for benchmarking or comparing efficiency in PT operations.

Second, we suggest that no precise recommendation can be made about the amount of data points (ie competitive PT bids) required for benchmarking purposes. While we have discussed some possible guidelines for selecting data points, this issue will have to be considered once data on contracts let out under the new PTOM becomes available.

Third, the reporting of benchmarking results will have a significant influence on the usability of the model. We suggest that the best approach would be to use DEA to rank negotiated bids against winning bids from competitive tenders as proposed in Covec’s report to NZTA.
If you have any queries please do not hesitate to contact us.

Yours sincerely

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# Table of contents

Introduction and context 1
  Goal of peer review 1
  New PTOM 1
  The need for a benchmarking method 1
  Main findings 2

Is DEA fit for purpose? 3
  Features of the model 3
  Choice of model 3
  Typical uses of DEA 4

How to populate the model? 5
  Behaviour of model variables 5
  Actual data is required to fully test the model 6
  Treatment of group tenders and supplier quality premiums 6
  Number of data points required 7
  Selecting comparable data points 8

Reporting benchmarking results 10

References 13

Appendix A Restrictions 14
Introduction and context

Goal of peer review

NZTA engaged PwC to conduct a peer review of the proposed DEA benchmarking methodology for public transport operator bids under the new PTOM.

In accordance with the NZTA peer review manual, we have produced a brief report that discusses whether the proposed benchmarking model “is technically sound and delivers the agreed project objectives”. We have also responded to some specific questions raised by NZTA. This is a high-level review that covers:

- The appropriateness of DEA as a benchmarking methodology for PT operator bids, including a discussion of whether the proposed methodology is applied correctly
- Guidance on selecting data points to populate the model, including a discussion of the number of data points used and the types of data inputs that should be used
- Options for reporting and presenting the results.

New PTOM

The New Zealand government announced the new PTOM in March 2012. Agencies including the New Zealand Transport Agency are working to implement the new components. The PTOM seeks to achieve two main goals for the sector:

- Grow the commerciality of public transport services and create incentives for services to become fully commercial
- Grow confidence that services are priced efficiently and there is access to public transport markets for competitors.

Under the new PTOM, bus lines that share some operational interdependencies or serve common areas will be grouped into units and contracted out to individual operators. These units incorporate the all-day operation of each line. For example, the current network redesign in Auckland will result in approximately 140 individual lines, which will be grouped into 40-47 units.

Some units will be tendered by competitive bidding for a period of nine years. Others will be tendered by negotiated bids for a period of six years, with potential renewal at the end of this period. The aim of this is to provide a greater degree of certainty and to facilitate more investment by operators.

Different units will have different farebox recovery rates (driven, basically, by ridership per bus) and as a result will require varying levels of subsidies. NZTA is currently targeting 50% farebox recovery nationally. In larger markets where there is sufficient benchmarking data available, it is expected that contracts for units with lower required subsidies will be negotiated, while those with higher subsidies will be let out for competitive bidding.

The need for a benchmarking method

One of the key mechanisms in the new approach is the use of a cost benchmarking mechanism which will be used to provide information to regions commencing contract negotiations in circumstances where not all contracts are put to an open tender.

NZTA has previously contracted Covec to prepare background papers on benchmarking mechanisms for PT operator bids. NZTA has used these papers to develop a draft policy paper for peer review and feedback.
**Main findings**

There are three main findings of our peer review:

First, we found that the proposed methodology, Data Envelopment Analysis (DEA), is fit for purpose. The model specification is sound, and this methodology is frequently used for benchmarking or comparing efficiency in PT operations.

Second, we suggest that no precise recommendation can be made about the amount of data points (ie competitive PT bids) required for benchmarking purposes. While we have discussed some possible guidelines for selecting data points, this issue will have to be considered once data on contracts let out under the new PTOM becomes available.

Third, the reporting of benchmarking results will have a significant influence on the usability of the model. We suggest that the best approach would be to use DEA to rank negotiated bids against winning bids from competitive tenders as proposed in Covec’s report to NZTA.
Is DEA fit for purpose?

In this section, we consider the appropriateness of DEA as a tool for benchmarking PT operator bids. We discuss this issue from three perspectives:

- The main features of the DEA model
- Comparisons with alternative models
- Typical uses of DEA.

**Features of the model**

DEA is a method that will allow PT operator bids to be benchmarked against a selection of other winning bids. It will allow you to compare the relative efficiency of PT operator bids that consist of one input (gross contract price) and several different outputs (peak vehicles required, service kilometres, and service hours).

Whereas component cost analysis allows users to assess the ratio of contract price to a single service output in isolation from other outputs, DEA takes a more holistic view of PT operators’ efficiency in producing multiple outputs. It uses linear programming techniques to analyse the tradeoffs between efficiency on multiple outputs. DEA generates a frontier of efficiency, or a set of points that are all equally efficient, and benchmarks other points against that frontier.

The model developed by Covec uses Excel Solver to calculate the shape of the frontier and benchmark other points. Excel Solver is a standard, widely-recognised tool for solving optimisation problems of this nature.

DEA has certain key features that should be considered when selecting it as a benchmarking methodology and interpreting its outputs:

- DEA benchmarks against a selection of existing data. It focuses on efficiency relative to existing data points (ie winning PT operator bids) rather than estimating efficiency relative to theoretical maximum efficiency.

- DEA is a nonparametric method – meaning that it makes no statistical assumptions about the distribution of variables on the basis of observed data. It relies solely upon observed values. This is both a strength – because it means that model results will not be skewed by correlations between variables or skewed distributions of variables – and a weakness – because selection of an adequate number of appropriate data points is crucial.

- DEA does not require any information about the “production function” of the entities that it is analysing (ie the way in which they transform inputs into outputs).

- DEA benchmarking is sensitive to the selection of points on the frontier, as changing the frontier points will affect the relative efficiency of individual bids and potentially result in marginal changes in the ranking of different bids. As this is an issue with the selection of data points rather than the model specification, we discuss it in more depth in the next section.

These features mean that the results of DEA benchmarking will be robust and internally consistent given an appropriate selection of data points to populate the model.

**Choice of model**

DEA offers significant advantages over other benchmarking mechanisms. Here, we briefly discuss two possible alternatives: component cost benchmarking, which is discussed in Covec’s report to NZTA, and stochastic frontier analysis.
Component cost benchmarking analyses the cost of providing one unit of output. It allows a comparison of the relative efficiency of different bids with respect to a **single** type of output. For example, if the only required output from PT operators was service kilometres, it would be possible to benchmark negotiated bids by comparing the ratio of contract price to service kilometres.

Component cost benchmarking does not, however, provide a robust basis for benchmarking bids that include more than one output. In these cases, DEA is more appropriate as it can compare PT bids that include multiple output specifications.

As Covec’s report notes, component cost benchmarking can be used to provide supplemental analysis of PT operator bids.

Stochastic frontier analysis (SFA) is an alternative frontier benchmarking methodology that focuses on estimating the theoretical maximum frontier of efficiency rather than benchmarking against existing data. It is a parametric method, meaning that it makes statistical assumptions about the distribution of input and output variables based on existing data. In addition, SFA requires users to specify a production function for the units that it is analysing.

For benchmarking PT bids, DEA has several advantages over SFA or other benchmarking methods that use parametric methods to estimate a theoretical maximum frontier. Because DEA is nonparametric and requires no assumptions about the production function of PT operators, the results that it provides are likely to be more robust. They are less likely to be affected by correlations between output variables or skewed distributions of model variables.

Furthermore, discussions with NZTA indicate that the results obtained from a benchmarking model like SFA are not likely to be relevant or usable by stakeholders due to the focus on estimating theoretical maximum efficiencies.

### Typical uses of DEA

A review of the literature suggests that DEA is appropriate for benchmarking efficiency of public transport units. DEA is frequently used to measure the efficiency of public services, frequently including public transport, and utilities and infrastructure.

These are typically cases where there may be multiple outputs that are not all put on the market (or, at any rate, not directly put on the market). In these cases, business units use multiple inputs to produce a combination of outputs. This makes it difficult to directly compare efficiency. (By comparison, business units operating in a purely market environment in which they sell all outputs can measure their efficiency in terms of productivity – ie value added per worker or per unit of input.)

Studies of PT operations conducted using DEA studies of PT units tend to follow a comparable approach to that proposed by Covec. The underlying benchmarking method is the same. However, these studies often specify a different set of input and output variables. They tend to use multiple measures of capital input (eg bus numbers, fuel consumed) and labour input, rather than gross contract price. On the output side, they often narrowed down to a single output metric – eg vehicle kilometres, passengers.

We have included a list of some studies that have used DEA to compare efficiency in infrastructure and public transport in the “References” section. In addition to these references, the literature indicates that DEA benchmarking is frequently used by public sector agencies and consultants to benchmark efficiency in operational units.
How to populate the model?

In this section, we consider any issues related to the choice of model inputs. We examine this issue from two perspectives:

- First, we discuss the behaviour of the input and output variables used for benchmarking PT operator bids – winning bid contract price, peak vehicle requirement (PVR), service kilometres, and service hours.

- Second, we discuss options for including group tenders and supplier quality premiums in the DEA benchmarking model. We note that, in principle at least, it is possible to include this information in the DEA model.

- Third, we consider the selection of data points (ie winning PT operator bids) for use in the model. We note that it will not be possible to make decisions about this until actual data on PT operator bids under the new PTOM becomes available, although we discuss some possible “rules of thumb” that could be applied.

**Behaviour of model variables**

In our assessment, the PT bid variables proposed in the Covec report and NZTA’s draft paper are fit for purpose.

Covec has set up the DEA benchmarking model to accept four variables. (They have also included a simplified model with only three variables.) In their model:

- **Gross winning bid contract price** is the sole input to PT operators’ activities. After discussion with NZTA, we agree that it would be appropriate to use actual contract price, provided that the same approach is followed for all competitive and negotiated bids. (We discuss the issue of supplier quality premiums in “Treatment of group tenders and supplier quality premiums” below.)

- **PVR, service kilometres, and service hours** are the three outputs produced by PT operators.

These variables fully account for the factors that are relevant to the benchmarking of PT operator bids. Their selection reflects the fact that NZTA is principally interested in the amount of PT service provided on individual units and the cost of doing so. While the examples of DEA benchmarking of PT operations and infrastructure discussed above use some alternative variables, they are either encompassed within these variables (eg capital and labour inputs to PT operations will both be counted in the gross winning bid contract price) or are not relevant to negotiations.

There is no need to add additional variables to the model due to the fact that any additional variables would either be related to the outputs (eg congestion on a route is essentially the relationship between service kilometres and service hours) or not relevant to bid assessment (eg population density will affect the farebox recovery but not the gross contract price).

When benchmarking with the DEA model, it is important to note that the results may be affected by expected correlations between PVR, service kilometres, and service hours. For example, we would expect service hours to increase as service kilometres increase, after factoring in the effects of congestion.

This is likely to have two main impacts on the DEA model:

- It will affect the shape of the frontier. Because the points that define the frontier will be grouped in a more or less linear fashion, it is likely that the frontier will be defined by only a couple of clustered points.
- It will affect relative efficiencies (ie the distance of less efficient PT bids from the frontier). Because output variables (kms, hrs, PVR) are correlated, bids that are less efficient on one dimension will also tend to be less efficient on others. As a result, winning bids that are not close to the efficiency frontier may appear to be a significant distance away. This should be interpreted as a consequence of correlations among variables rather than unusually poor-quality bids for some units.

**Actual data is required to fully test the model**

It will not be possible to fully test the model or determine how many data points are required until actual data on PT operator bids under the new PTOM is available.

Covec noted that no comprehensive historical data on PT operator bids was available from regional transport agencies or NZTA\(^1\). As a result, hypothetical data points generated by Covec were used to test the functioning of the model. This sample data was based on:

- A range of PVR requirements
- Three options for average speed on the unit
- Three options for average kilometres travelled per bus
- Three hypothetical cost structures for bidders – ie different costs per PVR, per service kilometre, and per service hour.

This enabled us to examine the model’s behaviour and ensure its technical robustness. However, it does not allow us to make any quantitative or qualitative judgments about the selection of data points.

**Treatment of group tenders and supplier quality premiums**

In its draft policy paper, NZTA has noted some challenges around the inclusion of group tenders and supplier quality premiums in the DEA benchmarking model. Here, we consider the implications of including these factors in the model. In doing so, we note that it will not be possible to fully consider these issues until actual information is available.

NZTA expects that operators may submit group tenders to operate multiple PT units as a single group. In these cases, operators may be able to offer a cheaper price for multiple units than they could for any single unit due to the existence of economies of scale. The DEA benchmarking methodology is capable of analysing and benchmarking group tenders, although it may not necessarily be appropriate to use for all group tenders.

The appropriateness of using DEA to benchmark an individual group tender is likely to depend upon the magnitude of the economies of scale that it offers over a single unit. For example, if a large group tender offers significant operational efficiencies, the range of prices obtained from DEA benchmarking against winning bids for individual units may be too high to take into account all cost savings.

In general, it is more likely that DEA benchmarking will be appropriate for group tenders that encompass a relatively small number of units, as economies of scale are likely to be less dramatic in these cases. Given the size and geography of New Zealand’s main urban areas, we would expect some PT units to be considerably larger (in terms of service kilometres and other output measures) than others. Consequently, a group tender composed of several smaller units may be comparable in size to some of the larger units. However, a group tender composed of a large number of units may exceed the size of the data points in the DEA benchmarking model by a considerable margin.

\(^1\) The most recent version of Covec’s report to NZTA included some data on 41 PT units in the largest urban areas. In addition, the Ministry of Education provided some data on contracts for school bus routes, although they only collected information on contract price and service kilometres.
As a rule of thumb, we would suggest that group tenders whose size is comparable (ie on the same order of magnitude) as the units included in the model could be benchmarked using DEA. However, an alternative approach may be needed for significantly larger group tenders.

We note that it would not be possible to include large group tenders in the DEA model by breaking them down into individual units and proportionally allocating the gross contract price to those units. Due to the way that the DEA model calculates relative efficiencies, each individual unit would have the same efficiency score as the group tender as a whole. Consequently, splitting up group tenders would not add any information to the model or alter the benchmarking results.

A supplier quality premium (SQP) is the additional amount that an agency is willing to pay for a better supplier, based on a weighted assessment of the bid’s attributes. When contracting out a PT unit, transport agencies calculate the SQP associated with each individual bid separately from gross contract price. They then choose a preferred supplier based on the lowest gross bid price less SQP. The SQP is not, however, deducted from the contract price itself. Accordingly, NZTA intends to use winning bid contract price, without any adjustment for SQP, as an input to the DEA benchmarking model.

SQPs allow transport agencies to compare bids with different quality attributes on a like-for-like basis. Consequently, we note that they could in theory be included in the data input into the DEA benchmarking model, as long as the SQP was deducted from the winning bid contract price for all data points in the model and all negotiated bids being benchmarked. This would allow transport agencies to factor in quality attributes into benchmarking. However, it is also likely to make the benchmarking results more difficult to interpret and use, due to the fact that SQPs reflect a number of different factors. We do not recommend any changes to NZTA’s approach, which is to use gross winning bid contract price.

**Number of data points required**

There is not likely to be a firm minimum or maximum number of data points. However, we recommend that NZTA develop and apply some rough rules of thumb after data on PT operator bids under the new PTOM becomes available. Here, we discuss some relevant considerations for doing so.

First, we recommend that NZTA and regional transport agencies include all available data in the DEA benchmarking model. Every winning competitive bid should be added to the benchmarking database. This will allow for more reporting options and enable NZTA and other agencies to track the relative competitiveness of the market over time.

The only potential drawback of including more data points is that it may increase the run time of the model. (The Excel Solver function used to calculate the frontier requires more time when applied to more data points. Based on testing of the model with up to 100 sample data points, this is not likely to be a significant constraint.)

We agree with NZTA that only winning bids should be considered when benchmarking negotiated PT operator bids. However, data on losing compliant bids should also be collected and potentially analysed using the same benchmarking methodology. This may provide some insights on the competitiveness of the market – eg by analysing differences between the relative efficiency of winning and losing bids.

Second, we have not identified any firm guidelines for the minimum number of data points required. In order to define a frontier using DEA, you only need to input the points on the frontier. Consequently, it would be possible to use the model to identify points on the frontier, and leave out all other data points. This would allow users to compare negotiated bids against the most efficient units, but it would not allow them to be ranked against the full range of winning bids.

However, populating the model with only a limited number of data points may mean that the frontier has not been adequately defined. As we discuss above, a choice of different frontier points may have implications for both estimates of relative efficiencies and the ranking of individual bids.
We have considered the option of using statistical hypothesis tests (e.g., analyses of the distribution of model variables or relative efficiency scores) to provide some guidance on whether a sufficient number of data points has been included. However, any such analysis would be complicated by two factors:

- The nonparametric nature of the DEA model makes it difficult to conduct hypothesis testing using the results.
- The expected correlations between output variables complicate any attempt to conduct hypothesis testing on DEA model results, as they will affect the distribution and standard deviations of results.

After discussion with Covec, we suggest that NZTA should revisit the issue of the minimum number of bids required once actual data on PT operator bids becomes available.

Finally, the minimum number of data points included in the model will be affected by NZTA’s proposed reporting format. We understand that NZTA is seeking to compare negotiated bids with a range of winning bids. Accordingly, Covec’s report recommends benchmarking negotiated PT operator bids against a range of winning bids – i.e., the most efficient, least efficient, and 75th percentile of efficiency. In order to implement this approach, it is necessary to include all winning competitive bids in the DEA model.

Benchmarking against different percentiles, or ranking negotiated bids against previous winning bids, has implications for the minimum number of data points. For example, reporting results by quartiles implies a need for at least eight to ten data points, and preferably more.

**Selecting comparable data points**

For benchmarking purposes, PT operator bids should only be compared with winning bids for comparable time periods and service areas. After discussions with NZTA and Covec, we recommend that selection of a comparable data panel be done on a qualitative basis according to broad guidelines.

There are two main considerations. First, when choosing a time period over which to collect data points it will be necessary to ensure that enough data is available to conduct benchmarking.

We agree with NZTA that data points should be drawn from multiple years, with costs inflated to current dollar figures using NZTA’s existing price index.

Under the new PTOM, competitively tendered units will be contracted for a period of nine years, while negotiated units will be contracted for a period of six years. Due to the difference in contract lengths, it will be necessary to plan to ensure that enough data is always available for benchmarking negotiated bids.

This could be done in one of two ways. The first option would be to input nine years’ worth of data into the DEA model – in other words, to select the most recent winning competitive bid for each individual PT unit. This would be the simplest option to implement. In addition, the PT market is unlikely to experience significant changes over the life of existing contracts.

Alternatively, transport agencies could stagger competitive bids across a multiple-year cycle to ensure that the data points used in the DEA model were continually being refreshed. In this case, data could be drawn from a shorter time period such as six years.

In addition, if there are any significant policy changes that affect how PT operations are contracted, or any changes to the PT operator market that may materially affect its competitiveness, we recommend excluding any data points that date from earlier years. This is a qualitative judgment that would have to be made by NZTA or other stakeholders.

Finally, we note that there are some things that can be done in advance to plan for data availability. For example, where the lifespan of current PT contracts is known, it will be possible to determine when the next round of competitive bidding will occur. This information can be used to influence the timing of negotiated bids - ensuring there is sufficient data on competitive bids beforehand.
Second, we agree with NZTA and Covec that data points should be grouped according to the market that they serve. There are two potential options for doing so, each of which has some advantages and drawbacks. After discussion with NZTA, we agree that it would be more appropriate to benchmark negotiated bids against all competitive bids from the same urban area or region.

- At a minimum, we recommend benchmarking PT operator bids in individual urban areas or regions against a panel of winning bids from the same region. (In other words, use Auckland data to benchmark Auckland PT bids.) PT operators’ cost structures and the degree of competition in the market are likely to vary between different regions.

  The advantage of benchmarking against all winning bids from the same region is that it will make it easier to populate the model with a sufficient number of data points. However, this approach may fail to account for some intra-regional variations between different PT units.

- Alternatively, Covec mentioned the option of grouping bids according to a more finely-grained set of criteria. This could mean, for example, using factors such as terrain, area covered by a PT unit, or population served to group bids.

  The advantage of this approach is that, if carefully implemented, it could control for some other factors that may confound the analysis. However, it would also make it more difficult to populate the model with a sufficient number of data points.
Reporting benchmarking results

The reporting and presentation of benchmarking results will be a key element of making the DEA model useful for stakeholders. In this section, we briefly discuss the advantages and disadvantages of some possible methods of reporting outputs.

Covec’s report includes several examples of report outputs in Section 3.4, Data Presentation. They include options for displaying the percentiles of efficiency scores, ranking negotiated bids against previous winning competitive bids in a table, and reporting a range of prices for a contract that correspond to different relative efficiencies. We have recreated these options using data from Covec and the NZTA draft policy paper.

Data from NZTA’s draft policy paper is summarised in Table 1. This table reports the variables associated with each individual unit – PVR, service kilometres, service hours, and winning bid contract price – and the efficiency of that unit relative to the frontier.

The data in this table can be used to rank bids according to their relative efficiency and report the position of the negotiated bid being benchmarked within this ranking. This option would present the same information as Figure 1 but uses a numerical rather than graphical format. Consequently, choosing between these two options is more a matter of users’ preferences about data display.

### Table 1 Hypothetical bid data from NZTA draft policy paper

<table>
<thead>
<tr>
<th>Unit</th>
<th>PVR</th>
<th>Kms</th>
<th>Hrs</th>
<th>Winning bid</th>
<th>Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20</td>
<td>880.000</td>
<td>36.667</td>
<td>$3,905,000</td>
<td>97.23%</td>
</tr>
<tr>
<td>2</td>
<td>25</td>
<td>880.000</td>
<td>73.333</td>
<td>$4,737,333</td>
<td>100.00%</td>
</tr>
<tr>
<td>3</td>
<td>18</td>
<td>880.000</td>
<td>24.444</td>
<td>$3,556,867</td>
<td>97.59%</td>
</tr>
<tr>
<td>4</td>
<td>23</td>
<td>440.000</td>
<td>18.333</td>
<td>$2,874,667</td>
<td>100.00%</td>
</tr>
<tr>
<td>5</td>
<td>25</td>
<td>440.000</td>
<td>36.667</td>
<td>$2,202,444</td>
<td>92.24%</td>
</tr>
<tr>
<td>6</td>
<td>17</td>
<td>440.000</td>
<td>12.222</td>
<td>$2,590,000</td>
<td>95.00%</td>
</tr>
<tr>
<td>7</td>
<td>20</td>
<td>1,320.000</td>
<td>55.000</td>
<td>$5,390,000</td>
<td>98.79%</td>
</tr>
<tr>
<td>8</td>
<td>23</td>
<td>1,320.000</td>
<td>110.000</td>
<td>$6,600,000</td>
<td>99.53%</td>
</tr>
<tr>
<td>9</td>
<td>18</td>
<td>1,320.000</td>
<td>36.667</td>
<td>$4,873,000</td>
<td>100.00%</td>
</tr>
<tr>
<td><strong>Negotiated</strong></td>
<td>20</td>
<td>1,000.000</td>
<td>40.000</td>
<td><strong>$5,000,000</strong></td>
<td><strong>83.58%</strong></td>
</tr>
<tr>
<td><strong>Weights</strong></td>
<td>0.007405</td>
<td>0.0000005</td>
<td>0.0000041</td>
<td>0.0000002</td>
<td></td>
</tr>
</tbody>
</table>

A second reporting option is shown in Figure 1, which replicates Figure 19 in the Covec report. (This figure does not use the data from Table 1, as the small range between the frontier and least efficient units in that data makes it difficult to visualise the output). This chart estimates and displays the price for a negotiated bid that would result in it matching the most and least efficient winning bid as well as various percentiles of efficiency. This would entail use relative efficiency scores to calculate the necessary contract price reduction to achieve a certain level of efficiency.

This option is likely to be useful for negotiating a contract with PT operators, as it makes it easy to determine how competitive the contract is in terms of cost. However, it provides less information on the distribution of efficiency scores. The information that it includes does not make it as easy to understand where a negotiated bid falls relative to all winning competitive bids.
A third option, Figure 2 (based on Figure 18 in the Covec report), graphs efficiency scores by percentile. It shows the distribution of efficiency scores among all competitive bids included in the model.

The advantage of this option is that it makes it relatively easy to observe the distribution of efficiency scores within previous winning bids and straightforward to see where a negotiated PT operator bid falls within that distribution. However, it does not enable users of the DEA model to easily calculate the price reductions that would be necessary in order to bring a negotiated bid up to a certain percentile of efficiency.

Figure 2 Percentiles of relative efficiency – NZTA draft policy paper data
In our view, a combination of reporting outputs would be desirable. For example, DEA model users could be provided with graphs like Figure 1 and Figure 2, as well as supplementary information from component cost benchmarking or other rankings.

Finally, it is worth reiterating that correlations between model variables will mean that less efficient bids may appear excessively far from the frontier. Bids that are less efficient on one dimension may also tend to be less efficient on others. This should be considered when using these report outputs, as it suggests that a wide distribution of relative efficiencies may not necessarily be the result of poor competition.
References


Tongzon, Jose (2001), “Efficiency measurement of selected Australian and other international ports using data envelopment analysis”, in Transportation Research Part A.
Appendix A Restrictions

This report has been prepared for the New Zealand Transport Agency (“NZTA”) to provide a peer review of the proposed Data Envelopment Analysis for benchmarking PT operator bids. This report has been prepared solely for this purpose and should not be relied upon for any other purpose. We accept no liability to any party should it used for any purpose other than that for which it was prepared.

To the fullest extent permitted by law, PwC accepts no duty of care to any third party in connection with the provision of this report and/or any related information or explanation (together, the “Information”). Accordingly, regardless of the form of action, whether in contract, tort (including without limitation, negligence) or otherwise, and to the extent permitted by applicable law, PwC accepts no liability of any kind to any third party and disclaims all responsibility for the consequences of any third party acting or refraining to act in reliance on the Information.

We have not independently verified the accuracy of information provided to us, and have not conducted any form of audit in respect of NZTA. Accordingly, we express no opinion on the reliability, accuracy, or completeness of the information provided to us and upon which we have relied.

The statements and opinions expressed herein have been made in good faith, and on the basis that all information relied upon is true and accurate in all material respects, and not misleading by reason of omission or otherwise.

The statements and opinions expressed in this report are based on information available as at the date of the report.

We reserve the right, but will be under no obligation, to review or amend our report, if any additional information, which was in existence on the date of this report, was not brought to our attention, or subsequently comes to light.

This report is issued pursuant to the terms and conditions set out in the letter of engagement between NZTA and PwC, dated 5 November 2012.