

# Establishing a relevant national tender price index for the local building industry

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**Construction cost indices are used on a daily basis in the construction industry for a number of reasons. As there is currently only one tender price index in use in South Africa, a study was conducted to examine the use and compilation of cost indices, which may lead to the construction of a new tender price index for the South African building industry.**

According to Steyn, Smit, Du Toit and Strasheim (2007), "an index is a ratio that measures relative change", while Flemming and Tysoe (1991) state that "index numbers of cost and prices provide a convenient means of expressing changes over time in the cost or prices of a group of related products in a single measure".

Steyn et al. (2007) are of the opinion that one must distinguish between simple and composite indices on the one hand and unweighted and weighted indices on the other. A simple index is used to represent the price change of a single commodity, while a composite index represents the price changes of more than one commodity. Furthermore, when an unweighted composite price index is calculated, the price changes of all commodities are regarded as equal, while different weights are allocated to the different commodities in a weighted composite index. All the important indices used in the construction industry are weighted composite indices.

Flemming and Tysoe (1991) state that three main types of indices are used in the construction industry. Input price indices reflect local market prices and can be used to reimburse the contractor in respect of cost increases in labour and material. Examples of such indices are the Construction

Price Adjustment Provision indices published by Statistics South Africa on a quarterly basis (Statistics South Africa, 2009). Output/tender price indices attempt to measure the total cost of the construction of a completed structure in each location, taking local conditions into account, changes in productivity, as well as contractors' profit margins. For these types of indices, both a Laspeyres index, such as Stellenbosch University's Bureau of Economic Research (BER) building cost index, and a Paasche index, such as the Building Cost Information Services (BCIS) index in the United Kingdom (UK), may be used. According to Statistics Norway (2007), seller's price indices not only include all the costs of the completed construction project, but also the cost of land, finance costs, professional fees, value-added tax (VAT), as well as the seller's profit. This type of index is not used much in the local building industry.

## Indices in South Africa

During the early 1960s, a quantity surveyor responsible for research and development at the erstwhile Department of Public Works (DPW) in Pretoria, developed an index for the DPW. In the mid-1960s, the BER was looking for a deflator for building prices and, according to Kilian (1980), obtained permission from

the DPW to take over this index.

Marx (2005) reports that the index is based on a 100 m<sup>2</sup>, single-storey building to which a concrete slab was later added. From this building, 22 cost components were selected and expressed as quantities. Segalla (1991) states that these components were used because they represent items from the original building and are weighted in proportion to the role that they play in the total cost.

Another index is the little-known Contract Price Index for buildings (Van der Walt, 1992). All that is known about this price index is that it was compiled by a quantity surveyor at a private practice in Pretoria. The research that was done during the compilation of the index was adapted and presented at the University of Pretoria as part of a PhD thesis in 1992, but the study was conducted in the early 1970s. The details of the index were made available to the erstwhile Central Statistical Services (CSS), today known as Statistics South Africa.

When constructing a new index, the following factors should be considered:

- **Choice of formula:** It was decided to steer the investigation in the direction of a fixed-weight, short-list method with priced

bills of quantities as the basis (Laspeyres index). The main reason for not using the Paasche index is because of the unavailability of a so-called “price book” as in the UK. Such a price book is compiled every year and can be used to reprice bills of quantities with base rates, as the BCIS has done.

- **Preliminaries:** This forms an important part of any contract and can fluctuate between contracts, as well as varying economic climates. Segalla (1991) notes that the BER allows a 5% fixed amount per project. For this study, however, it was decided to spread the preliminaries as priced for each project as a percentage across all rates.
- **Provisional sums:** Neither the BER nor the BCIS makes provision for provisional amounts in their indices. Because provisional amounts, as currently priced in contracts in South Africa, can be as high as 40 to 50% of the contract amount, it is considered an important item that should form part of a new index. The decision was therefore made to include the amounts for the main items such as electrical and mechanical installations on own merit in the index.
- **Influence of region and site:** Although it is anticipated that there

will be differences in the prices of labour and material across different regions, only the rates will be influenced by it. This problem could be overcome if a sufficient number of priced bills of quantities could be sourced and average rates could be used. It is considered that on-site conditions will be reflected in the rates for poor soil conditions and that it would not influence any other rates.

It was therefore decided to base the calculation of a new index on a fixed-weight, shortlist of indicator items, mostly because priced bills of quantities are freely available, as it is still one of the preferred procurement methods in South Africa. In order to establish weights for such an index, it was decided to use the analysis of different buildings to compose an “average” representative building. This is an accepted method of calculating construction price indices, as indicated by Van der Walt (1992), who states that a set of standard weights may be used for all buildings. In Finland, the weights of the building cost index are based on the estimated share of four different types of projects (flats, houses, offices and warehouses) (Statistics Finland, 2001).

In order to obtain a representative sample, another purposive sample was done by requesting priced bills of quantities from quantity surveying firms. Firms across South Africa were requested to submit priced bills

of quantities for new or so-called “green fields” projects that were executed between 2005 and 2012. Ultimately, the bills of quantities of 231 projects received from 37 firms were used. The projects covered the period January 2006 to June 2012 and represent 26 quarters in total.

The first step after the collection of bills of quantities was to analyse these projects. This was done on a Microsoft Office Excel spreadsheet by going through the bills of quantities of each project and listing the tariff of the various items that were selected as indicator items to make up the weighting. In the first phase of the analysis, more items were extracted from the bills of quantities than those that had been listed. The reason for this was that, in some instances, the exact item

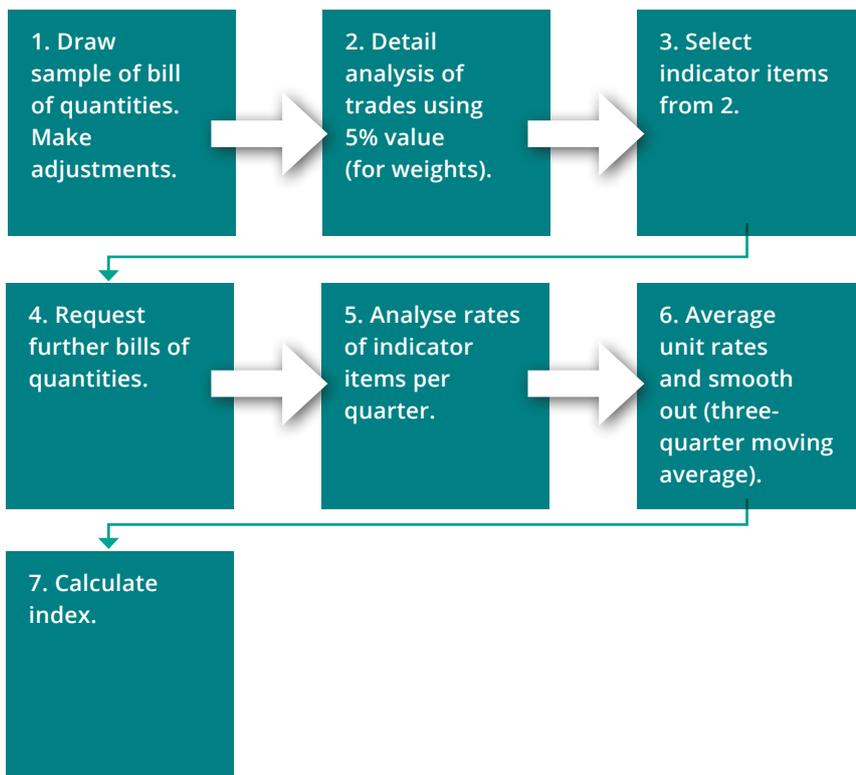
as listed might not have been available, but a close substitute was. An example of such items could be found in the formwork trade, where items with different propping heights and/or different slab thicknesses were similar to the original indicator item. The amount for preliminaries for each project was added proportionally to the rate of that project. After this process had been concluded for all projects, the analysis was refined by compiling another spreadsheet. This time, the spreadsheet contained only the rates for one indicator item (those that matched or were closest to the original).

When analysing the captured unit rates, substantial differences were found in the unit rates for the same item during the same period. This concurred with literature on the subject. Various options were considered on how to deal with such outliers in the rates. One option was to set upper and lower limits to the mean rate, for example, 30% above and 20% below. If any rates exceeded these upper or lower limits, they were substituted with either the maximum or minimum rate. Another option was to calculate the standard deviation from the mean rate and use this as a limit. However, this method allowed too many rates to fall outside this limit and would therefore change the distribution dramatically (Van der Walt, 1992).

Both options were tested in this study, but after consultation with the Department of Statistics at the University of Pretoria,



The Construction Price Adjustment Provision Index is one of the indices used in the construction industry.



→ Figure 1: A flow chart of index calculation

it was decided to use a more simplistic method where only the highest and lowest rates was discarded from a series of similar rates and the mean of the remaining rates were calculated. These figures would then be used as the base rate for that quarter. The advantage of using this method is that the majority of the rates in a series are considered, which is beneficial where a low number of rates have been received in a particular series.

After doing the above calculations, the averaged rates were transferred to another spreadsheet. Even though the rates had been averaged, it became apparent that there was still a large amount of fluctuation among the rates that appeared from one quarter to another. After further discussions



A tender price index indicates the movement of a basket of rates over a period of time.

with the Department of Statistics, it was decided to smooth the rates further by calculating a three-quarter moving average for each rate for the period under investigation.

Figure 1 gives an overview of the various stages of the index leading up to the calculation of the actual index.

After completing the abovementioned steps, the complete index for the period under investigation could be calculated. This was achieved by calculating the total of the base year quantities at current rates, divided by the total of base year quantities at base year rates, multiplied by 100 (for each quarter in the study period).

A tender price index is an indication of the movement of a basket

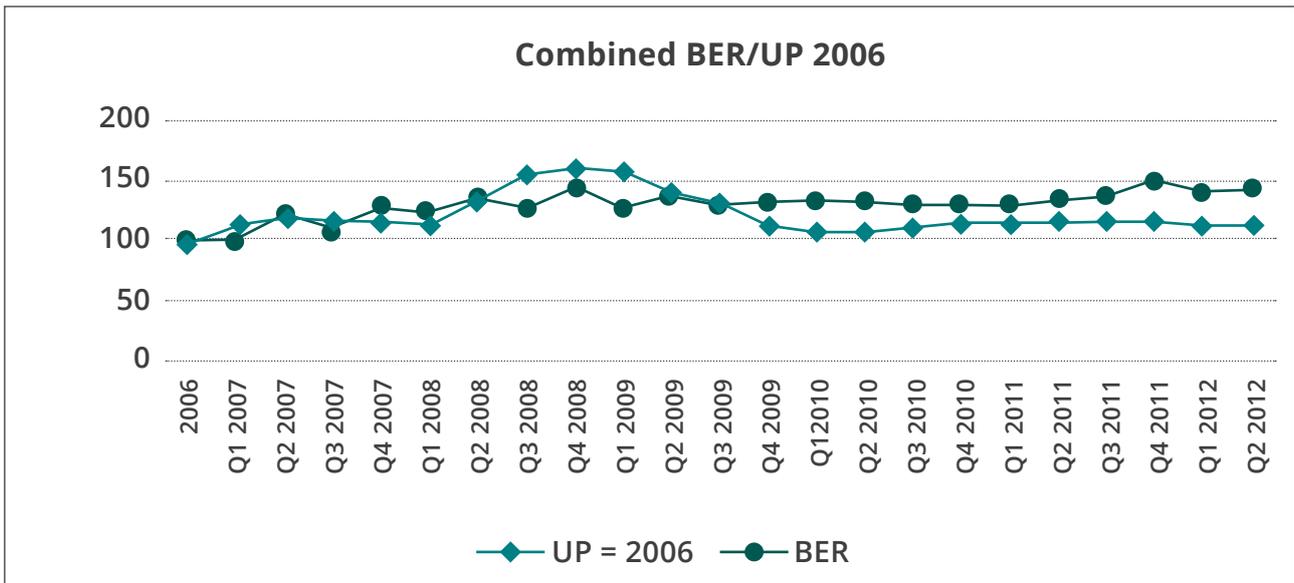
of rates over a period of time. The new index under scrutiny should be examined in this context.

For research purposes, the index can be referred to as the "UP 2006" index. The index showed an upward curve as of 2006 (UP 2006 = 100) to about the end of 2008 where it peaked at 158.99. This represents an increase in prices of almost 60% over the two-year period (or eight quarters), or an average of approximately 7.5% per quarter.

This period in the history of the South African building industry overlapped with a worldwide boom in construction activity, especially in the light of the 2010 Soccer World Cup that was upcoming at that time. The general movement of this peak in the UP 2006 index therefore seemed to be justified.

The boom in construction activities was followed by a sharp decline. This could be attributed to the conclusion of the 2010 Soccer World Cup projects, as well as the worldwide economic recession, which also had an impact on the South African economy.

The UP 2006 index showed a similar movement with the trend declining from 158.99 in the fourth quarter of 2008 to a low of 106.24 in the second quarter of 2010. This represented a decline of 33.18% over a six-quarter period with an average of approximately 5.5% per quarter. After this, the UP 2006 index showed a relatively consistent movement over the next two years until the end of the research period.



→ Figure 2: Combined BER/UP 2006 indices.

This movement seemed to be consistent with what emerged from the projects that were investigated during this period, namely that tendered rates did not show a significant increase during this two-year period.

It was a logical step to do a comparison between the BER's building cost index and the UP 2006 index. In order to compare the two indices over the same period, it was necessary to extract information for the BER index from information published by Medium-term Forecasting Associates for the same time period (2008 to 2012), and then to extrapolate the data.

As can be seen from Figure 2, there is a reasonable degree of correlation between the two data sets. The biggest difference is shown from the second half of 2009, where the UP 2006 trend is sharply downwards, whereas the BER trend is more gradual.

### Conclusion

It may be concluded from the data presented that it is possible to construct a new tender price index based on accepted norms and standards regarding index theory, and on studies conducted on other similar indices.

In order to test the validity of the UP 2006 index, it is suggested that comparisons be made with the movement of the economy in general over a longer period. It will also be beneficial if a larger sample of priced bills of quantities could be obtained to make it statistically more stable.

To achieve this, a new method of collecting these projects will have to be considered. This could be done in collaboration with the Association of South African Quantity Surveyors (ASAQS). The UP 2006 index can also be made available to the quantity surveying community on a quarterly basis for comments and testing in a commercial environment. ➔



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