BUREAU FOR ECONOMIC RESEARCH

Updating the BER Building Cost Index: A review of indicator items and weights

Research Note for subscribers to the BER Building Cost Information Service

December 2022

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Executive summary

This paper details the process used to evaluate and, if necessary, implement changes to the list of items included in the **BER Building Cost Index** (BCI).

The BER BCI is a measure of the percentage change in average building costs in South Africa. It is based on an analysis of the tariffs (rates) in accepted tenders supplied by quantity surveyors (QS).

One of the main criticisms of the BER BCI is that the basket of items (or indicator items) included have not been properly reviewed since inception. As such, the index potentially includes items no longer used in the construction of a building.

An analysis of responses between 2014 and 2020Q2 revealed that eight of the 29 items included in the building cost survey had an unsatisfactory response rate (i.e. in more than 50% of projects no rate for the item was provided).

Following the analysis, a forum comprising the BER, the ASAQS and practicing quantity surveyors made recommendations regarding the currently surveyed items as to whether they should remain in the survey, be removed or replaced with another item. In addition, the forum also made provision for the inclusion of new items.

Between 2021Q3 and 2022Q3, the BER surveyed all the items in the existing BCI basket as well as the new items (both those proposed to replace an existing item and those entirely new).

In 2022Q3, the analysis focusing on the response rates was repeated, but only for the newly added items.

The results show that the replacement items all had an unsatisfactory response rate. The forum nonetheless deemed it necessary to make the substitution based on existing building practices.

The response rate for the new items were broadly acceptable.

Regarding the weights, it was decided that the Contractors Price Adjustment Provision (CPAP) formula would be adopted as the new weights for the BER BCI.

The major drawback is that, while the CPAP has weights for a residential building (CPAP 180 - lump sum residential) and non-residential building (CPAP 181 - commercial), it does not have a formulation for a "general" building.

This shortcoming was addressed by using the proportion of residential and non-residential building investment spend as reported by Statistics SA and applying it to the separate residential and non-residential building cost indices to generate a new BER BCI.

The changes to the index now yield a BCI which covers 92% of the workgroups (WG) for residential building and 87% for non-residential building.

Comparatively speaking, the average growth rate in the original BER BCI was 6.3% y-o-y between 2006Q3 and 2022Q3, compared to 6.0% y-o-y using the revised BER BCI formulation.

The new (i.e. "general" BCI) will replace the existing BER BCI as of the 2023Q1 publication.

Contents

List of figures

List of tables

List of annexures

Introduction

The BER BCI (Building Cost Index) is widely used in the building sector as well as the finance and insurance sector. However, the index has come under some scrutiny over the last few years due to, among other things, the appropriateness of the items included in the index.

This paper details a process which started at the end of 2020 to evaluate and, if possible, implement changes to the list of items (i.e. indicator items) included in the BER BCI.

Background

The BER BCI[1] has been in existence since the 1960s and is designed as a measure to calculate (or estimate) building output[2] price inflation (i.e. the escalation in the cost of building construction to clients or escalation in tender prices). In a theoretical sense it is comprised of the change in building inputs costs plus some measure of building contractors' profit margins. The latter, in turn, is a function of prevailing market demand.

The current index is comprised of 22 rates provided by a panel of quantity surveyors

The BER BCI is a Laspeyres index – similar to how Statistics South Africa (Stats SA) calculates the Consumer and Producer price indices. This means that the index measures price changes of a basket of items compared to a base period. Currently the BER BCI is based on the rates of 22 items used in the construction or refurbishment of a building as captured by the BER Building Cost Survey. The BER Building Cost Survey is conducted on a quarterly basis and is sent to a panel of quantity surveyors. The survey requires respondents to report the rates submitted for a tender adjudicated in their favour.

Importantly, while 22 items are used to compile the BER BCI, the Building Cost Survey collects rates on 29 items. The rates for items related to, for instance, plumbing and sanitary ware are collected, but excluded from the BER BCI.

The items are aligned to the

The individual items surveyed can broadly be compared to the so-called "work groups" as defined by the Association of South African Quantity Surveyors[3]

1 For more on the BER BCI as well as its use please click here https://www.ber.ac.za/Research/Indices/Building-Costs.

2 This differs from the building input cost indices published by Statistics SA (Stats SA) namely the Construction Material Input Price Index (CMPI) and the Contractors Price Adjustment Provisions Index (CPAP).

3 There are some differences between the WGs in the CPAP and the BER Building Cost Survey most notably that, because the WGs covers work conducted in a particular "trade", it also has a labour component.

WGs as defined by the ASAQS

(ASAQS) (see Annexure 1). According to the ASAQS, a work group (WG) is "*a grouping of work descriptions that are more commonly undertaken by a particular recognised tradesman, or that are generally recognised in the construction industry as sharing common characteristics*".

The index has hardly changed since inception, this presents a risk to its validity

It is standard practice for price indices to be revisited from time to time to gauge if they still accurately reflect that which they intend to measure. This is particularly true of the selection of items included in the basket. On this front, the BER BCI has remained largely unchanged since its inception. Even though building technologies arguably change at a slower pace than consumer preferences, the lack of survey and index maintenance means that there is a risk that the index in its current form is outdated.

Methodology

The review of the BER BCI was done in two phases. Phase one was to gauge the appropriateness of the current list of items (indicator items as they are representative of a WG) included in its compilation by interrogating the current item response rates.

The second phase was, along with industry experts and based on the research done in the first phase, to consider potential action to enhance the appropriateness of the basket of items included in the BER BCI.

Analysing the current item response rates

All projects between 2014 and 2020Q2 were analysed to gauge how often a rate is provided for an item

Using data from 2014 to 2020Q2, the response rates for each item surveyed were calculated. An arbitrary threshold of 50% was used to gauge whether the item was still relevant or not. In other words, a rate was provided in more than 50% of responses. The main thrust behind this method was that, even if the item was no longer the best item to use, if it is widely reported on (or used in the construction of a building) it can be deduced that it is still reasonable to include this item in the formulation of the index.

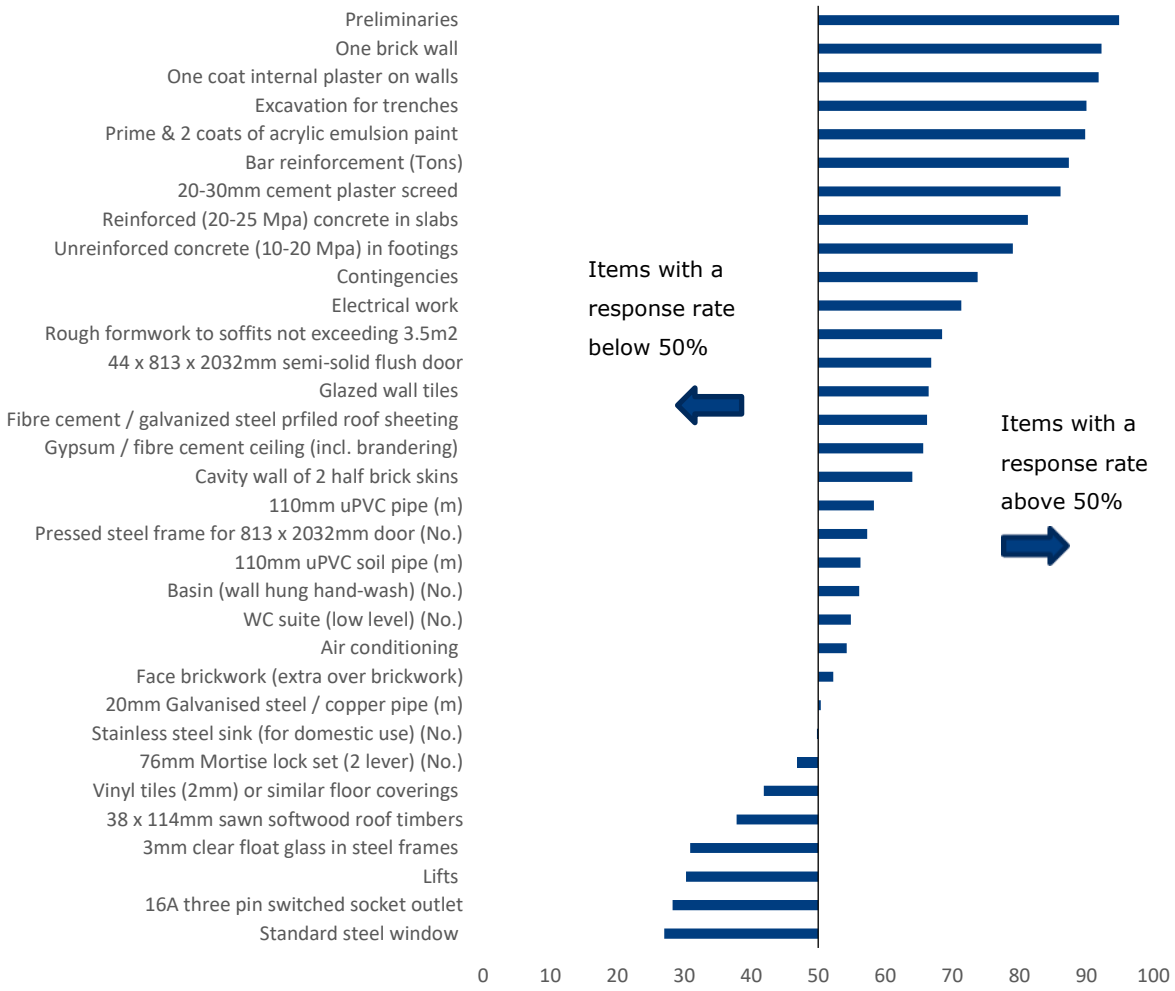
The analysis (Figure 1) revealed the following items had a non-response rate of more than 50% (in other words, in more than 50% of instances/projects no rate was provided for this item):

- Standard steel window
- 16A three pin switched socket outlet

Furthermore, CPAP includes the price of the raw material. The Building Cost Survey only measures the rate of the final item as used on the building project.

- 3mm clear float glass in steel frames (m2)
- 38x114mm sawn softwood roof timbers
- Vinyl tiles (2mm) or similar floor coverings
- 76mm mortise lock set (2 lever)
- Stainless steel sink
- Lifts

Figure 1: Response rate, by item



Source: BER

Eight out of the 29 items surveyed had a less than satisfactory response rate

This means that eight of the 29 items surveyed (or just under 30%) by the BER had an "unsatisfactory" response rate. This is a decent showing for an index where the items have been largely unchanged since the 1960s.

The aim of this step was to identify items which have a low response (less than 50%) rate and use this as a basis for determining possible changes. The second part of the exercise was to discuss potential changes with industry experts in light of these results.

Discussion with industry experts

A forum was established consisting of members of the BER, ASAQS and practicing QSs to review the list of items starting with those with a response rate below 50%

The focus was to build on the work done in the first step under the assumption that items with a response rate greater than 50% are still widely used and therefore, even if it is not the biggest cost component of that particular WG, the item is still relevant because (1) there is a long-term time series and (2) it reduces the number of changes required to the existing index.

In 2021 a forum[4] was established under the guidance of the ASAQS. The forum consisted of representatives of the BER as well as academics and practicing quantity surveyors. The results of the research on item response rates formed the basis of the discussion. The forum met via Zoom every second month in 2021 and when needed in 2022. The outcome of the discussions was that a number of changes to the composition of the BER BCI was needed regarding which items currently surveyed should be removed, replaced (and with some other indicator item) and added.

Items to be removed

The forum decided that the following items should be removed from the BER BCI:

- Stainless steel sink
- 38x114mm sawn softwood roof timbers
- Cavity wall of half brick skins and
- Lifts

Although it only had a response rate of 64%, the inclusion of *Cavity wall of half brick skins* to the list of items to no longer be surveyed was based on the inclusion of the item *One brick wall*. In the forum's opinion the two items measure a similar factor, namely, the WG named "*masonry*". As such both are not needed, and *One brick wall* fared better in terms of the non-response rate.

Items to be replaced

Table 1 lists the items the forum decided should be replaced to reflect current building construction practices instead, more accurately.

Also included is the proposed item which will replace the old.

[4] Members included: Karl Trusler and Gwen Mlondobozi (ASAQS), Prof. Hoffie Cruwagen, Dr. Gerhard Brummer (University of Pretoria (UP), retired), James Hanley (Schneid Libera Nieuwoudt Hanley CC Quantity Surveyors), Qabilah Abramjee (Aecom – in 2021), Craig Lemboe and Tracey-lee Solomon (BER). Dr Danie Hoffman (UP) and Nicolaas van der Wath (BER) joined in 2022.

Table 1: List of items to be replaced

Previous item	Replaced with
Vinyl tiles (2mm) or similar floor coverings	500x500 Carpet floor tiles to screeded floors
76mm mortise lock set (2 lever)	Three lever mortise lock set
3mm clear float glass in steel frames	6.5mm clear laminated glass.

Source: BER

Items to be added

The new items will cover the WGs related to Waterproofing, structural steelwork and electrical and mechanical work

Lastly, the forum decided that, in order to make allowance for WGs which are not accounted for in the BER BCI, the following items should be added (WG in brackets):

- 4mm Waterproofing system on concrete roofs (Waterproofing)
- Welded and bolted columns, beams, etc. (Structural steelwork)
- Cost (in R/m^2) of electrical work and (Electrical work[5])
- Cost (in R/m^2) of mechanical work (Mechanical works).

The new and replacement items were included in the survey from 2021Q3

The items to be added as well as the items that were to replace existing items were added to the questionnaire of 2021Q3 survey, along with all the previous items. This continued until 2022Q4.The reasons for the extended survey period are twofold. Firstly, the response rates and reliability of the data needed to be verified before including them in the BER BCI. Second, especially in the case where items were replaced, it was necessary to survey both the old and the new items in order to establish a relationship between the two so that the long-term time series for those items (or WG) are maintained.

Importantly, in order for the BER to continue with the publication of the BCI during the transitionary period, data on the "old" items still needed to be collected.

Results of the new survey questionnaire/data set[6]

Replacement items

The response rate for the

For the surveys covering 2021Q3 – 2022Q3, the response rates for the replacement items were much the same as for the items they were replacing

[5] Electrical works and mechanical works were previously surveyed although not included in the composite building cost index. In the case of electrical work, the Rand amount was surveyed. For mechanical work, the amount spent on lifts and air-conditioning was collected/requested.

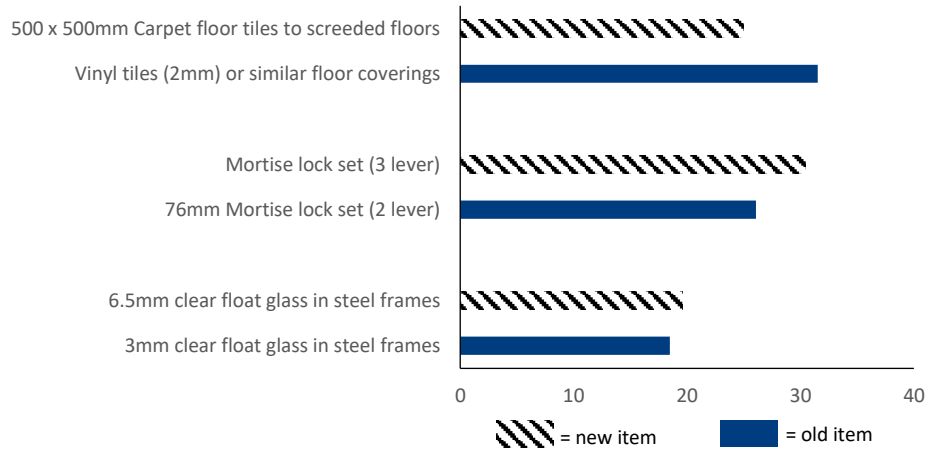
[6] As a point of departure, we used the same approach that was used to initially determine which items within the BER BCI should be reviewed (i.e. by considering the response rate)

replacement items was as low as for the items to be replaced

(Figure 2). In fact, the response rate for the item *500 x 500mm Carpet floor tiles to screeded floors (m^2)* was lower than for *Vinyl tiles (2mm) or similar floor coverings (m^2)*.

These results were presented to the forum and the opinion was that the replacement items, even though not presenting a much-improved response rate, was the more appropriate indicator for those particular WGs.

Figure 2: Response rate (%) - replacement items (2021Q3 – 2022Q3)



Source: BER

Interestingly, some respondents added rates for both the old and the replacement item. However, in order to keep the number of rates requested to a reasonable minimum, it was decided to nonetheless continue with the replacement of the old items.

As discussed earlier, the aim of surveying both the old and the replacement items was to maintain the long-term time series for the WGs (as represented by the item). To calculate the new rates a base price was calculated for 2021Q4 according to the filters used in the building cost software program. Then the annual percentage changes of the old items were applied backwards to the new base.

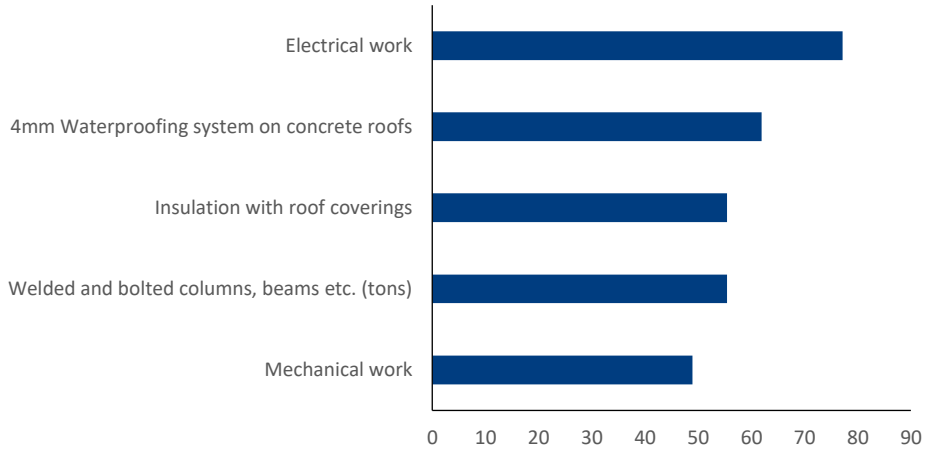
An index base period of 2021Q4 was selected

To correspond with the Consumer Price Index (CPI) we selected the base date (period) of 2021Q4. We then took the average rate of the four survey rounds (2021Q3 – 2022Q3) and applied it to the base date. We used this to determine the factors needed to maintain the long-term time series.

New items

The response rates for the new items were much more encouraging (Figure 3). Only one of the five items had a response rate below the 50% threshold.

Figure 3: Response rates - new items (2021Q3 – 2022Q3)



Source: BER

The non-response rate for new items were largely satisfactory

For *Welded and bolted columns, beams etc.* and *Mechanical works* the forum noted that these are very specific items and do not appear in all building projects. Indeed, the WGs that these two items represent has a weighting of zero in the CPAP 180 calculation (for lump sum residential). However, these two items have a combined weighting of 9% in CPAP 181 (commercial buildings). This explains the lower response rate. As such, the forum agreed that these two items should remain in the index.

As with the replacement items, the rates for these items between 2021Q3 and 2022Q3 were averaged and applied to 2021Q4. Then, in order to generate a long-term time series, the annual percentage changes of the "original" BCI (i.e. The BER BCI before these changes) were applied backwards to the 2021Q4 rate/tariff.

The BER BCI – revised composition

Following the revision and changes to the survey questionnaire, and based on the relative acceptability of the changes implemented, the revised (or new) **BER BCI now consists of 27 items**[7] and covers almost all of the WGs[8]. Previously, the rates for 29 items were surveyed, 22 of which were included in the BER BCI.

Importantly, we have also decided to include the rates for drainage and plumbing as part of the BER BCI. Because the actual historical rates are available, there was no need for any additional work in calculating a long-term time series.

[7]

[8] From here on reference will be made to the "revised" BER BCI formulation, which includes the changes discussed earlier, and the "original" BER BCI (i.e., BER BCI before these changes).

Item (WG) weights

Original weights based on a 100m^2 "quasi house"

The item weights in the original BCI were based on their usage in a typical 100m^2 "quasi house" in the 1960s[9]. With the changes implemented in this revision the old weights are no longer applicable.

The approach to derive new weights could potentially be done in two ways. First, a survey could be conducted among quantity surveyors to again gauge the usage of the items in a "quasi-house" of 100sqm. An average of this can be derived and compared to the rate (in the base period) for this indicator item. The sum of the cost of the indices are then used to calculate the total cost of the project. The weighting of the individual items is then calculated as a proportion of the total cost. It was decided against this approach for three reasons. Firstly, such a survey and analysis are costly and time consuming. Second, the idea of a "typical" building project is in itself subject to criticism. A house, for example, won't include the same items and in the same proportion as an office, a hospital or a school. Lastly, there already exists a system of acceptable weights for lump sum residential and commercial buildings applied to the CPAP (this is the second approach i.e. using existing industry accepted weights), namely WG 180 and WG 181 respectively, as calculated by the ASAQS[10].

To align with the CPAP 180 and 181 formula, the same WG weights were used to re-calculate the BER BCI given the changes to the items discussed earlier

Using CPAP weights has the added benefit of aligning the BER BCI with other price indices in the building construction sector[11].

Using the BER tariffs and the CPAP weights (in percentage terms) we are able to calculate the building cost index for residential and non-residential buildings. It is important to note that the methodology now differs from how the building cost index weights were previously compiled. In the "original" formulation the weights were determined by calculating the relative cost of the item (i.e. the rate/tariff multiplied by the quantities as a percentage of total cost). Either approach (using the percentage weights or the "original" formation) yields the same result.

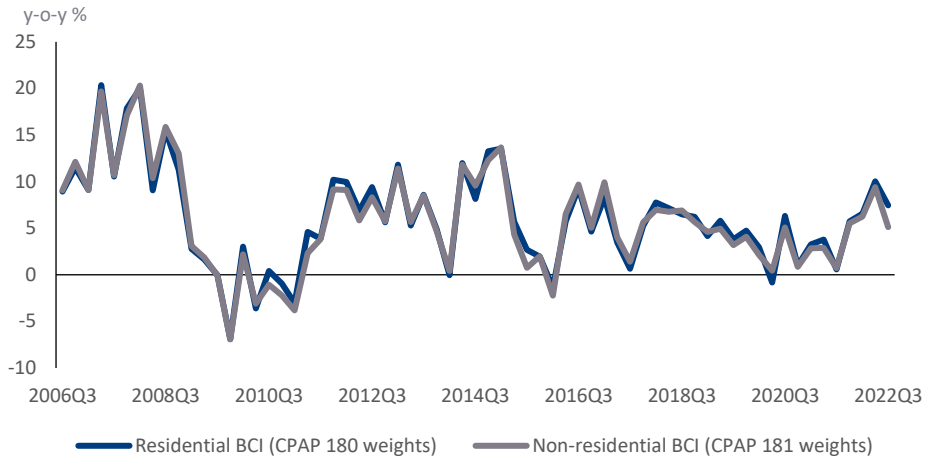
[9] This comes from the 1991 article by Ursula Segalla, however, it is disputed given that some items (such as "bar reinforcement") are not part of a typical house. The article by George Kershoff (2011) could also not conclusively determine how the weights were formulated at the start.

[10] Members of the forum shared their reservations about the weights used in the compilation of CPAP 180 and 181. While the BER cannot comment on this, the changes to the survey processing makes it possible to incorporate other weights for CPAP 180 and 181 (should changes be made in future) in the BER BCI.

[11] The Building Cost Survey also asks respondents what type of project is out to tender (home, office, warehouse etc.) and it would be possible to derive separate residential and non-residential building cost indices directly from survey results. This would constitute a third approach. However, the responses have been poor with many projects classified as "other".

The main constraint to using the CPAP weights is that it has weights for the WGs applicable to residential and non-residential buildings, but not for a "generic" building (Figure 4).

Figure 4: Building cost indices for residential and non-residential buildings



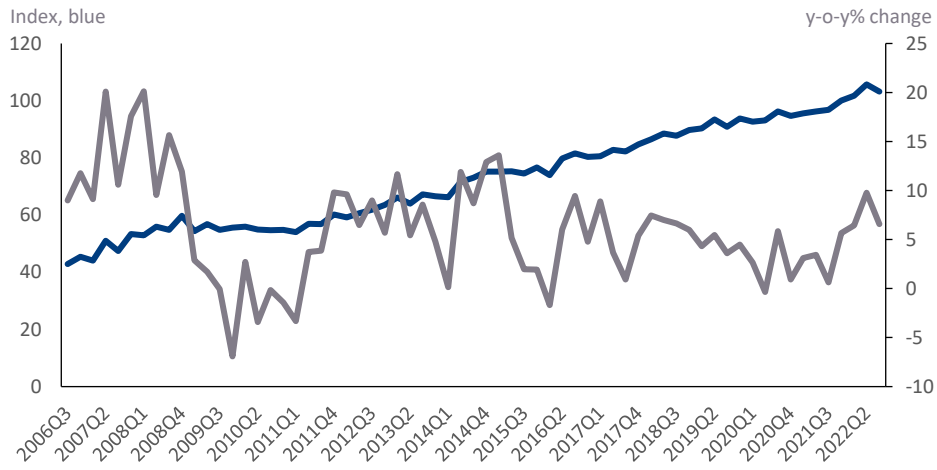
Source: BER

The proportion of spending on residential and non-residential investment was used to estimate a more generalised BER BCI

One way to overcome this is to apply the proportion of spending on residential and non-residential building investment, as provided by Stats SA as part of the national accounts, to the building cost indices for lump sum residential and commercial buildings. In 2021, spending on residential buildings in nominal terms accounted for 63% of total capital expenditure on buildings (i.e. the weighting for non-residential buildings was 37%). This is in line with the average between 2014 and 2019 (i.e. pre-COVID). This will be termed the "general" BCI.

These proportions are not static, but, given that the base period is 2021Q4, using the full year 2021 spending on fixed investment is appropriate. This can be adjusted if required in future. The results are below in Figure 5.

Figure 5: "General" BER BCI



Source: BER

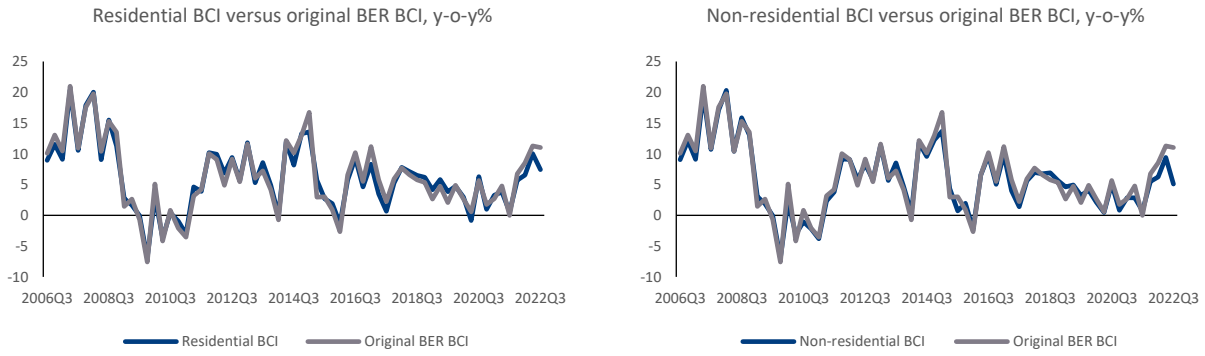
Implications

The BER is now able to publish a BCI for residential buildings and non-residential buildings separately

The new approach to compiling the BER BCI allows the analysis to be expanded to include a BCI for the residential building and non-residential building sectors separately and, using the spending on building as a point of departure, also a "general" BCI.

Since 2006Q3 (up to 2022Q3), average growth was 6.1% y-o-y for the residential BCI and 5.9% y-o-y for the non-residential BCI. This means that, over the period, escalation in residential tender prices has slightly exceeded that of non-residential buildings (Figure 6).

Figure 6: Comparing the indices with the original BER BCI



Source: BER

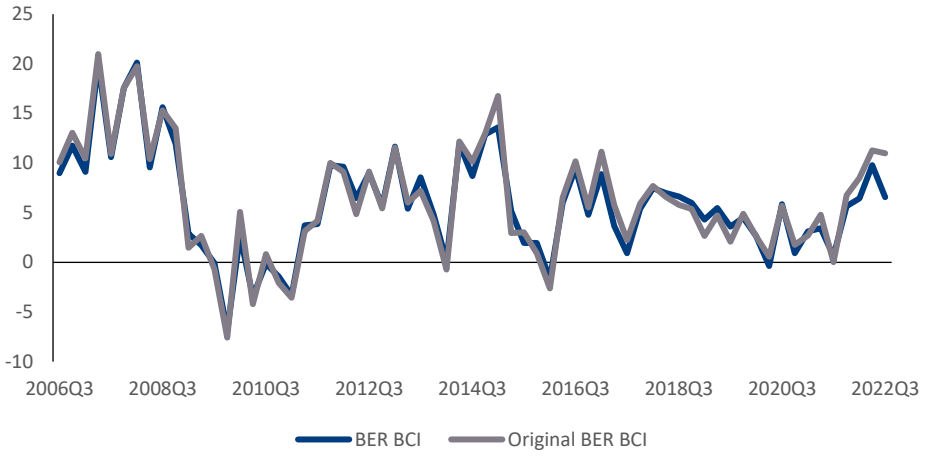
In comparison to the original BER BCI, growth in tender prices in the revised index is slightly higher on average. Importantly, the correlation is around 98%

Because of the bigger proportion allocated to the faster growing residential building costs, the acceleration in the "general" BER BCI index, at 6.0% y-o-y on average since 2006Q3, is marginally lower than the original BER BCI which grew at 6.3% y-o-y on average over the same period.

The correlation between the "general" BER BCI and the "original" BER BCI is 98%. This is partly due to the choice of methodology. Specifically, the process used to link the new items with the previous indicator for that WG and, in the case of the replacement items (where there was no previous indicator for that WG), with the "original" BER BCI may have played a role. Another plausible reason is that these findings once more indicate that the building cost index is not sensitive to the selection of indicator items and their weighting. At the end of the day, fluctuations in the rates of items determine the change in building costs over time. This finding agrees with those of earlier research from Marx (2005), and Kershoff (2011). The robustness of the results of the index is reassuring.

Following the research, and in discussion with the forum, it was decided that the "general" BER BCI will replace the existing BER BCI as of 2023Q1.

Figure 7: Original vs "general" BER BCI (y-o-y %)



Source: BER

Conclusion

To summarise, an update of the BER BCI in terms of the items surveyed was long overdue. With the assistance of the ASAQS, academic and practising quantity surveyors the BER was able to:

1. Identify items which can be removed from the Building Cost survey
2. Identify items which should be replaced and the replacement items, and
3. Identify new items to be included

From the 2021Q3 survey round, the replacement and new items were included. While the response rates for the replacement items were disappointing, the forum nonetheless decided that these were more relevant items than the ones they were to replace. For new items, the response rates were broadly acceptable.

With all these changes implemented, the survey now requests rates for 27 items (compared to 29 previously) all of which are included in the index. Importantly, the coverage in terms of the WG increased to 92% in the case of residential buildings and 87% in the case of non-residential buildings, with almost all WG now covered.

Using the weights for CPAP 180 and CPAP 181, along with the new indicator items, the BER is now able to produce a BCI for residential and non-residential buildings.

Using the proportion of spending on residential and non-residential buildings in 2021 as reported by Stats SA, the BER was able to derive a "general" BCI which, from 2023Q1, will become the official BER BCI. The y-o-y % growth in this revised BER BCI index has a correlation of 98% compared to the original BCI.

Clients will receive an updated BER BCI history table with the publication of the 2023Q1 report.

Craig Lemboe

Tracey-Lee Solomon

Technical work: Nicolaas van der Wath

The BER would like to acknowlegde the generous adminstrative assistance provided by the ASAQS, especially Karl Trusler and Gwen Mlondobozi

November 2022

The **BER Building Cost Index** is published quarterly. Click **here** for more information and to subscribe

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Annexure 1: List of original items in the BER BCI and WG

Workgroup/Category	Reference item
Earthworks (102)	Excavation for trenches / m3
Piling (104)	Unreinforced concrete in footings / m3
Concrete – excluding formwork (110)	Reinforced concrete in slabs / m3
Formwork (111)	Rough formwork to slabs / m2
Reinforcement (114)	Bar reinforcement / ton
Brick and blockwork (116 & 118)	One brick wall / m2
	Cavity wall / m2
	Face brickwork / m2
Roofing etc.	Fibre cement / gal roofing / m2
	Sawn softwood trusses / m
Carpentry and joinery (126)	Semi-solid flush door / unit
Ceilings, partitions and access flooring (129)	Gypsum fibre-cement ceiling / m2
Resilient floor and wall coverings (130)	Vinyl tiles or similar floor coverings / m2
Ironmongery (132)	76mm Mortice lockset / unit
Metal Work (136)	Standard steel window frame / m2
	Pressed steel door frame / unit
In situ finishes (142)	25mm Cement plaster screed / m2
	One coat internal plaster / m2
Tiling (144)	Glazed wall tiles / m2
Glazing (150)	3mm clear float glass in frame / m2
Paintwork (152)	Prime & 2 coats PVA on plaster / m2

Source: BER

Annexure 2: Revised BER BCI and workgroups (with 180 and 181 weightings)[12]

Workgroup/Category	Reference item	Weighting 180	Weighting WG 181
Earthworks (102)	Excavation for trenches / m3	2%	2%
Piling (104)	Unreinforced concrete in footings / m3	-	1%
Concrete – excluding formwork (110)	Reinforced concrete in slabs / m3	4%	6%
Formwork (111)	Rough formwork to slabs / m2	-	5%
Reinforcement (114)	Bar reinforcement / ton	1%	4%
Brick and blockwork (116 & 118)	One brick wall / m2	20%	4%
	Face brickwork / m2		
Waterproofing (120)	**4mm Waterproofing system on concrete roofs**	**1%**	**1%**
Roofing etc.	Fibre cement / gal roofing / m2	6%	3%
	Insulation with roof coverings		
Carpentry and joinery (126)	Semi-solid flush door / unit	10%	6%
Ceilings, partitions and access flooring (129)	Gypsum fibre-cement ceiling / m2	-	3%
Resilient floor and wall coverings (130)	**500x500 Carpet floor tiles to screeded floors**	**4%**	**4%**
Ironmongery (132)	**Three lever mortise lock-set**	**1%**	**1%**
Metal work (136)	Pressed steel door frame / unit	5%	2%
Structural steel work (134)	**Welded and bolted columns, beams, etc.**	**-**	**2%**
In situ finishes (142)	25mm Cement plaster screed / m2	8%	6%
	One coat internal plaster / m2		
Tiling (144)	**6.5mm clear laminated glass**	**3%**	**3%**
Drainage	**20mm Galvanised steel / copper pipe (m)**	**2%**	**2%**
	110mm uPVC pipe (m)		
Plumbing	**WC suite (low level) (No.)**	**10%**	**10%**
	Basin (wall hung hand-wash) (No.)		
Glazing (150)	**6.5mm clear laminated glass**	**1%**	**1%**
Paintwork (152)	Prime & 2 coats PVA on plaster / m2	4%	3%
Electrical work	**R/m²**	**10%**	**10%**
Mechanical work	**R/m²**	**-**	**7%**
Total weighting/coverage		92%	86%

Source: ASAQS, BER

[12] New items in bold, new WG in bold and italics

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