Nyameka Zunguzane, John Smallwood & Fidelis Emuze

Perceptions of the quality of low-income houses in South Africa: Defects and their causes

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Abstract

A number of low-income houses recently built in South Africa are reportedly defective. The sheer number of low-income houses that failed to conform to quality expectations, especially in certain provinces, has become a source of concern for the national Department of Human Settlements (DHS) and other construction industry stakeholders.

This article assesses issues related to non-conformance to quality requirements in low-income houses from the perspective of both owners and contractors. A quantitative survey was conducted among housing beneficiaries in a post-1994 township in Port Elizabeth in the Eastern Cape. The initial findings were further complemented with the perceptions of contractors registered with the National Home Builders Registration Council (NHBRC).

Selected findings suggest that the principal causes of defects in low-income houses is perceived to be related to the use of emerging contractors who are presumably not experienced enough, and to the use of unskilled labour by the contractors. By implication, the respondents were of the opinion that poor workmanship could be the primary cause of defects in low-income houses. It can, therefore, be argued that, apart from adequate monitoring and inspection of projects, stakeholders in the form of emerging contractors and their labour should endeavour to improve their competencies pertaining to quality.

Keywords: Construction, contractors, low-income housing, owners, quality

Abstrak

'n Aantal lae-koste huise in Suid-Afrika wat onlangs gebou is, het verskeie foute. Die groot aantal lae-koste huise wat nie aan die kwaliteitsverwagtinge voldoen nie, raak 'n kommer vir die nasionale Departement van Behuising en ander aandeelhouers in die konstruksiebedryf.

Nyameka Zunguzane, BSc (Hon) Graduate, Department of Construction Management, Nelson Mandela Metropolitan University, PO Box 77000, Port Elizabeth 6031, South Africa. Phone: +27 41 504 2790, Fax: +27 41 504 2345, E-mail: <s206019751@live.nmmu.ac.za>
Prof. John Smallwood, Professor and Head, Department of Construction Management, Nelson Mandela Metropolitan University, PO Box 77000, Port Elizabeth 6031, South Africa. Phone: +27 41 504 2790, Fax: +27 41 504 2345, E-mail: <John.Smallwood@nmmu.ac.za>
Fidelis Emuze, Research Associate, BERC School of the Built Environment, Nelson Mandela Metropolitan University, PO Box 77000, Port Elizabeth 6031, South Africa. Phone: +27 41 504 2399, Fax: +27 41 504 2345, E-mail: <Fidelis.Emuze2@nmmu.ac.za>

Hierdie artikel wys aspekte aan, uit die perspektief van die huiseienaars asook die kontrakteurs/aannemers, wat nie aan die kwaliteitsvereistes vir lae-koste huise voldoen nie. 'n Kwantitatiewe opname is gedoen onder huiseienaars in 'n na-1994 woonbuurt in Port Elizabeth in die Oos-Kaap. Die finale bevindinge is ook verkry uit die persepsies van kontrakteurs wat by die Nasionale Huisbouers Registrasie Raad (NHRR) geregistreer is.

Bevindinge wys daarop dat die hoofoorsaak van foute in lae-koste huise te wyte is aan die gebruik van onervare opkomende kontrakteurs wat onopgeleide arbeiders in diens neem. Die respondente het swak vakmanskap uitgewys as die hoofoorsaak van foute in lae-koste huise. Daar kan aanbeveel word dat opkomende kontrakteurs hul vaardighede/bekwaamheid in projekinspeksies asook arbeidskwaliteit behoort te verhoog.

Sleutelwoorde: Konstruksie, kontrakteurs, lae-koste huise, eienaars, kwaliteit

1. Introduction

Quality is a fundamental term in the construction industry. The non-achievement of such a crucial aspect of construction can result in the failure of a construction project and in the dissatisfaction of clients and/or building occupants. Furthermore, the non-achievement of quality can result in delays in building projects and the need for rework, which can result in a significant financial loss. Quality focuses on eliminating defects and variations and seeks to avoid waste of time, materials, and financial resources due to rework (Love, Edward & Smith, 2005: 197).

In the case of low-income houses, Carmona, Carmona & Gallent (2003: 3) contend that poor-quality housing, whether poorly planned in the wider sense, or badly designed, has been the hallmark of a commodity culture whereby housing is viewed as merely a 'demand good' to be thrown up wherever the price is right. According to Carmona *et al*. (2003: 7), quality should be provided with the end-user in mind in order to create a healthy and safe living environment. However, the features of inadequate housing quality include:

- Overcrowding;
- Relatively small sizes of houses;
- Poor building standards in terms of inadequate sound attenuation or heat insulation, and
- Lack of basic urban design amenities, and inadequate supply of services (Carmona *et al*., 2003: 7).

In brief, research studies indicate that the quality in the building of low-income houses is one of the reasons for dissatisfaction expressed by occupants. For instance, a case study investigation conducted in Pelindaba, Bloemfontein, revealed that in general

74% of the respondents recorded negative perceptions about the quality of their public sector-built low-income houses (Mehlomakulu & Marais, 1999). The respondents observed prevalence of cracks in their houses (78%), roof leakages (58%) and, in general, they were not satisfied with the physical structure of the houses.

Similarly, the study conducted by Madzidzela (2008) at Nyandeni Local Municipality discovered that 85% of the respondents experienced problems with the low-cost houses they are occupying. Reported problems include flooding (27.5%), lack of water (25%), lack of electricity (12.5%), and drainage-related issues (35%). Therefore, as state-delivered subsidy or low-income houses will continue to dominate the South African landscape in terms of housing provision for lower income households (Landman & Napier, 2010), it is imperative to address the quality issue in low-income housing with a view to finding a practical solution. Hence, the issue examined in this article concerns the non-attainment of quality in low-income housing, which has exacerbated wastage in financial resources and contributed to an increase in the housing backlog in the country. Perhaps, according to anecdotal evidence, the occurrence of rework, defects, and increases in the housing backlog may be responsible for the perception that low-income houses seldom conform to the National Building Regulations (NBR). For instance, the Minister of Human Settlements, Tokyo Sexwale, explained that a total of 40 000 houses must either be rectified or completely demolished countrywide as a direct consequence of poor workmanship (Dalgish, 2009: 4). The minister further states that two of such houses have claimed the lives of two people - a woman and a boy.

1.1 The research objective

In this context, the primary objective of this article is to determine the underlying factors that have seemingly engendered the production of poor-quality low-income houses in South Africa. Doing this could provide additional insights related to the problem and lead to the identification of interventions that can be considered to be useful in South Africa. The assumed research problem, therefore, states that 'non-achievement of quality constitutes a significant barrier to the delivery of low-income houses in South Africa'.

The importance of the article is underpinned by the need to examine why there are excessive numbers of defects in low-income houses in South Africa, because failure to conform to quality requirements

usually has negative consequences related to money in terms of budgetary control either in client or contractor organisations.

2. Quality issues in construction management corpus

According to research conducted by the Building Research Establishment (BRE) (Egbu, Ellis & Gorse, 2004: 308), 90% of building failures are due to problems arising in the design and construction stages. These problems include poor communication; inadequate information or failure to check information; inadequate checks and controls; lack of technical expertise and skills, and inadequate feedback leading to recurring errors. Egbu *et al*. (2004: 308) note that most of these problems are mainly 'people'-related problems. A great number of the defects in low-income houses occurred during the construction stage and were mostly due to poor communication and inadequate checks and controls (Sommerville, 2007: 395). As an illustration, Alink (2003: 18) states that failures have resulted from incorrect building procedures and poor on-site supervision and workmanship. This is in accord with the contention of Egbu *et al*. (2004: 308). According to Alink (2003: 18), factors contributing to the lack of success and the non-achievement of quality in the low-income housing sector include:

- Lack of sufficient finance;
- Use of unskilled labour;
- Use of emerging contractors;
- Lack of contribution by the private sector;
- Lack of management commitment toward quality achievement, and
- Substandard quality of workmanship.

2.1 Challenges related to low-income houses in South Africa

Despite the considerable modifications and revisions to the housing policy over the years, concerns related to quality, efficiency, effectiveness and sustainability of housing programmes still define and frame discussions (Khan & Thring, 2003: 18). The challenges usually dominating the low-income housing sector include poor design of houses; houses that are environmentally unsound; houses that are not suitable to the local climate, and houses that entail high maintenance costs. According to Goebel (2007: 292), other problems associated with low-income housing processes include:

- New houses and townships continue placing poor and low-income blacks in 'ghettos' on urban peripheries, far from jobs and services;
- New houses and infrastructure such as sewerage services are of poor quality, are rapidly deteriorating and require maintenance;
- People dislike the model of housing used, and would prefer larger houses – the main model was changed in 1998 when the DHS increased the minimum size of new houses to 30m^2, and
- Because of these problems, people often sell or rent out their subsidised low-income houses bought through the subsidy, and move back to squatter or other informal settlements closer to their economic activities.

2.2 Defects in low income houses in South Africa

According to Khumalo (2010: 2), one of the reasons for violent demonstrations and riots in South Africa is the lack of housing and the fact that available housing is likely to be badly constructed low-income houses with cracks. This is a problem that affects most provinces in South Africa. Media reports reveal that a contractor at Kumani and MP Stream villages in Bushbuckridge in Mpumalanga was stopped by residents after building ten (10) subsidised (otherwise called RDP) houses using bricks laid upright (Magagula & Mnisi, 2010: 2). The holes in the bricks were such that one could see right through to the next room and were not filled with mortar. The contractor had not built any foundations to save on bricks and cement.

Kota (2010: 26) also observed that government-subsidised houses in Vukani in Grahamstown were falling down, because of poor workmanship and inferior quality. Weak bricks, leaking water pipes, roofs, drains and toilets were some of the problems encountered in houses. Residents claim that they have been given black plastic by the municipality to cover the leaking areas when they complained about the leakages in the houses and that government-subsidised housing in that area is characterised by fraud, mismanagement and corruption (Kota, 2010: 26). Some defects in low-income houses, as stated by Zincume (2010: 7), include unstable door frames; usage of weak cement mortar, and some houses were without roofs. Similarly, the media reports that some of the issues in the N2 gateway project in the Western Cape, cited in Mtyala (2010: 4), included the delay to install electricity in other areas of the project. In the case of low-income houses in the communities of Boipatong and

Tshepiso, 75 houses in Boipatong and 35 houses in Tshepiso have to be demolished due to quality problems (Kunene, 2010: 11). In the Eastern Cape, Gibbon (2010: 5) states that 30 000 houses that were built since 1994 have "constructional defects". Most of these houses were in a state where they have to be demolished and completely rebuilt and, according to Gibbon (2010: 5), in a schedule of 80 building contractors who were allocated contracts in the province, 42% have disappeared, leaving behind unfinished units.

2.3 Causes of defects in low-income houses in South Africa

According to Gibbon (2010: 5), poor workmanship in housing construction, and poor management and control of building contractors have contributed to the housing problem. Poor workmanship often leads to delays in projects. Lubisi & Rampedi (2010: 2) contend that the primary causes of delays are related to the perception that emerging subcontractors with capacity challenges were always appointed to execute projects, and to poor performance by the contractor. Another media report noted that the use of alternative building technologies by less experienced contractors has also contributed to the housing problem. In a study conducted in Limpopo, Mpumalanga, the Western Cape, Eastern Cape and Gauteng, which investigated the use of alternative building technologies such as compressed earth, interlocking blocks, shutters and concrete, and eco-frame, it was found that there is little knowledge or awareness on the part of beneficiaries of low-income housing with regard to building systems approval requirements, and whether the building method used carried an *Agrément* certificate (Mgiba, 2007: 16).

The study also showed that 4 of the 5 developers who were part of the study had used construction methods that were not certified. Advantages found in the study were that these alternative construction methods were cost-effective on the part of developers, enhanced speedy delivery, and some construction methods were found to be easy to maintain. The disadvantages were the inability of the houses to resist extreme weather conditions, structural defects such as cracks that are not easy to repair in some materials, poor workmanship, and structures that are not compatible to future extensions (Mgiba, 2007: 16).

3. Research methodology

The study, which was quantitative in nature, addressed quality in low-income housing projects in terms of causes of defects in low-income houses; the quality of built low-income houses; challenges experienced by housing beneficiaries/occupants; selection of materials used in low-income housing projects; selection of workers for projects; construction methods used in projects, and the means or ways that could promote conformance to the NBR among contractors (home builders).

The sample strata consist of housing beneficiaries from Wentzel Park in Alexandria and housing contractors identifiable through the NHBRC database. The Wentzel Park township in Alexandria was chosen because of accessibility for the primary investigator. Table 1 summarises the response rate. Forty-five (45) out of the fifty (50) questionnaires delivered by hand to housing beneficiaries were collected, which constitutes a 90.0% response rate. From the sample extracted from the NHBRC database, only twenty-nine (29) of eighty-eight (88) low-income housing contractors completed and returned questionnaires. This constitutes a 33.0% response rate.

Table 1: Summary of the response rate

Sample	*Sent*	*Returned*	*Not returned*	*Response rate (%)*
Housing beneficiaries	50	45	5	90.0
Contractors	88	29	59	33.0

3.1 The data

The survey instruments posed questions that provided answers to the research problem. The questions were designed to be easily understood and to be answered in minimal time to optimise the response rate. The questionnaires consisted of predominantly close-ended five-point Likert scale-type questions, and open-ended questions. Open-ended questions were included so that participants could express and explain their views in order to reveal issues not captured in the literature reviewed.

The questions for housing beneficiaries were compiled in Xhosa and English to accommodate people who can only speak one of these languages. The questionnaires were also short and to the point in order to avoid reducing the interest of the participants. The questions

were designed in such a way that respondents were not required to reveal confidential information of any kind. The questionnaires were accompanied by a covering letter which explained the purpose of the study. It assured confidential treatment of responses and anonymity of respondents. In brief, the instrument related to housing beneficiaries was delivered by hand, while the instrument meant for contractors was posted and e-mailed to them individually.

3.2 Results: Housing beneficiaries (owners)

The beneficiaries who participated in the study formed part of a sample extracted from the community of Wentzel Park in Alexandria in the Eastern Cape. 55.6% of the respondents confirmed that they are the legal owners of their respective houses. The majority of the houses have either 2 (20.0%), 3 (22.2%), or 5 (17.8%) occupants. In addition, the majority of the respondents took over the ownership of their houses in 2000 (11.1%), 2002 (15.6%), 2004 (15.6%), and 2009 (11.1%). 53.4% of the respondents mentioned that they have occupied their low-income houses for more than eight (8) years.

As indicated in Table 2, when asked about the state of their low-income houses in terms of percentage responses to a scale of 1 (strongly disagree) to 5 (strongly agree), nearly half of the respondents strongly agreed that they have used their personal income to enhance the quality of their houses (46.2%). However, 65.4% were unsure as to whether their houses were inspected and approved before occupation; only 25.0% and 12.5% agreed or strongly agreed that the quality of their houses was of acceptable standard, and with 2.8% for neutral, 16.7% for disagree, and 30.6% for strongly disagree, it can be observed that the majority of the respondents were not very satisfied with the house allocated to them.

Table 2: Perceptions of the occupants of low-income houses related to the state of their houses

Statement	*Response (%)*						*MS*	*Std. Dev*	*Rank*
	U	*Strongly……...……Strongly disagree agree*							
		1	*2*	*3*	*4*	*5*			
Have you ever had to use your own money to maintain your house?	2.6	0.0	2.6	0.0	48.7	46.2	4.38	1.92	1

Statement	Response (%)						MS	Std. Dev	Rank
	U	Strongly……...……Strongly disagree agree							
		1	2	3	4	5			
Do you know if your house was inspected and approved?	65.4	3.8	0.0	0.0	15.4	15.4	3.38	2.02	2
Was the quality of the house of an acceptable standard?	15.6	28.1	6.3	12.5	25.0	12.5	2.87	2.14	3
Are you satisfied with the house allocated to you?	8.3	30.6	16.7	2.8	19.4	22.2	2.86	2.13	4

Given this level of dissatisfaction, the respondents were asked to rate problems that they may have encountered with their low-income houses on a scale of 1 (minor) to 5 (major), as indicated in Table 3. It is notable that accidents or injuries due to defects in the house are rated the most by respondents. In fact, 71.4% of the respondents perceive that accidents or injuries due to defects in the house constitute a major problem. Similarly, the respondents perceived that leaking water pipes (29.2%), problems associated with stability (27.3), cracks in the walls (32.5%), inability of the house to resist extreme weather conditions and water penetration through the walls (23.5%) constitute major problems experienced in their low-income houses.

Table 3: Problems experienced by housing beneficiaries

Problem	Response (%)						MS	Std. Dev	Rank
	U	Minor……..……..Major							
		1	2	3	4	5			
Accidents or injuries due to defects in the house	0.0	14.3	14.3	0.0	0.0	71.4	4.00	4.00	1
Leaking water pipes	0.0	29.2	16.7	8.3	8.3	29.2	2.92	2.67	2
Problems associated with stability	0.0	31.8	4.5	13.6	0.0	27.3	2.86	2.18	3
Cracks in the walls	0.0	35.0	25.0	2.5	5.0	32.5	2.75	2.75	4

Problem	Response (%)						MS	Std. Dev	Rank
	U	Minor……..Major							
		1	2	3	4	5			
Inability of the house to resist extreme weather	10.0	38.2	2.9	2.9	0.0	23.5	2.68	1.71	5
Water penetration through the walls	0.0	35.3	17.6	11.8	5.9	23.5	2.65	2.47	6
Roof leaks	0.0	35.5	19.4	9.7	9.7	22.6	2.65	2.55	7
Roofs which make noise or even blow off when windy	0.0	42.9	10.7	10.7	3.6	25.0	2.57	2.36	8
Incomplete house	0.0	40.0	3.3	0.0	3.3	16.7	2.53	1.43	9
Dampness	0.0	51.4	8.6	5.7	0.0	28.6	2.46	2.29	10
Door frames which shake and faulty doors	0.0	40.5	27.0	5.4	5.4	18.9	2.35	2.27	11
Water penetration through window frames	0.0	43.2	24.3	8.1	2.7	21.6	2.35	2.35	12
Leaking drains and toilets	0.0	57.7	11.5	0.0	7.7	19.2	2.19	2.08	13
Collapsing of walls	0.0	50.0	25.0	0.0	8.3	16.7	2.17	2.17	14
Water penetration through the floor	0.0	50.0	15.6	6.3	9.4	6.3	2.06	1.69	15

Apart from the problems listed in Table 3, the respondents also observed that "having to fix the house all the time; unplastered walls; unfinished houses; house not painted; leakage from the ceiling; rusty window frames; ceiling not fitted correctly; unstable roofs in windy situations, and door without proper locks" constitute the plethora of problems they have experienced while living in their low-income houses. When asked about what the reasons could be for the defects they have observed in their low-income houses, the housing beneficiaries answered as indicated in Table 4. Table 4 indicates that 32.6% agreed and 34.9% strongly agreed that the use of emerging contractors results in defects in low-income houses. A further 45.2% also strongly agreed that the use of unskilled labour can cause defects in low-income houses. In general, other causes identified by the owners include:

- "Contractors always underpay local labour and claim that government does not provide sufficient funding for housing projects";
- "Contractors tend to employ their friends and relatives", and
- "Some of the houses are not durable and do not last long because they have been built by inexperienced people."

Table 4: Beneficiaries' perceptions related to the causes of defects

Causes	*Response (%)*						*MS*	*Std. Dev*	*Rank*
	U	*Strongly disagree*				*Strongly agree*			
		1	*2*	*3*	*4*	*5*			
Use of emerging contractors	4.7	11.6	0.0	16.3	32.6	34.9	3.68	1.75	1
Use of unskilled labour	9.5	19.0	2.4	7.1	16.7	45.2	3.67	2.13	2
Insufficient building funds from the government	35.9	7.7	2.6	17.9	15.4	20.5	1.92	2.21	3

3.3 Results: Contractors

Given that low-income housing beneficiaries have established that they were not overtly satisfied with the quality of their houses, a further survey was conducted among contractors in order to shed more light on the issue. In terms of background checks, 86.2% of the contractors confirmed that they are registered with the NHBRC. Based on the perceptions of the contractors, Table 5 indicates the causes of defects in low-income housing in terms of percentage responses to a scale of 1 (minor) to 5 (major), and a mean score (MS) between 1.00 and 5.00. It is notable that seventeen (17) of the twenty MSs are above the midpoint of 3.0. The three causes that have MS below 3.0 include the lack of involvement of professional designers; inadequate information, and incorrect designs issued by the architect or engineer. From these results, it can be argued that, in general, the respondents were of the opinion that these causes can be deemed to be minor causes of defects in low-income housing. However, poor workmanship that is ranked first can be considered to be the main cause of defects in low-income housing. This is followed by workers not being committed to the implementation of quality standards, trying to save more than necessary on materials,

focusing more on production and less on quality, contractors not understanding the National Building Regulations (NBR), and poor on-site supervision.

Table 5: Contractors' perceptions of the causes of defects in low-income houses

Cause	*Response (%)*						*MS*	*Std. Dev*	*Rank*
	U	*Minor……..Major*							
		1	*2*	*3*	*4*	*5*			
Poor workmanship	0.0	0.0	6.9	10.3	27.6	55.2	4.31	0.93	1
Workers are not committed to the implementation of quality standards	0.0	3.5	6.9	3.5	37.9	48.3	4.21	1.05	2
Trying to save more than necessary on materials	0.0	3.5	3.5	10.3	41.4	41.4	4.14	0.99	3
More focus on production and less on quality	0.0	3.5	6.9	13.8	27.6	48.3	4.10	1.11	4
Contractors do not understand the National Building Regulations	10.3	0.0	6.9	13.8	41.4	27.6	4.00	0.89	5
Poor on-site supervision	0.0	0.0	6.9	27.6	24.1	41.4	4.00	1.00	6
Use of unskilled labour	0.0	0.0	13.8	17.2	27.6	41.4	3.97	1.09	7
Use of inappropriate, unsuitable alternatives or cheap materials	0.0	3.5	13.8	20.7	20.7	41.4	3.83	1.23	8
Use of emerging contractors	3.5	6.9	6.9	20.7	24.1	37.9	3.82	1.25	9
Faulty construction (incorrect building procedures)	0.0	10.3	6.9	20.7	27.6	34.5	3.69	1.31	10
Insufficient or no inspections of work in progress	0.0	3.5	10.3	27.6	34.5	24.1	3.66	1.08	11
Inadequate checks and controls	6.9	6.9	13.8	20.7	17.2	34.5	3.63	1.33	12
Management is not committed to quality management	0.0	6.9	17.2	17.2	24.1	34.5	3.62	1.32	13

Cause	*Response (%)*						*MS*	*Std. Dev*	*Rank*
	U	*Minor……..……..……...Major*							
		1	*2*	*3*	*4*	*5*			
Poor communication	3.5	3.5	20.7	17.2	34.5	20.7	3.50	1.17	14
Inadequate feedback	13.8	6.9	10.3	27.6	17.2	24.1	3.48	1.26	15
Lack of sufficient finances	3.5	13.8	13.8	27.6	10.3	31.0	3.32	1.44	16
Failure to check information	6.9	13.8	10.3	41.4	13.8	13.8	3.04	1.22	17
Lack of involvement of professional designers (architects and engineers)	6.9	27.6	27.6	17.2	6.9	13.8	2.48	1.40	18
Inadequate information	6.9	27.6	20.7	34.5	0.0	10.3	2.41	1.25	19
Incorrect designs issued by the architect or engineer	6.9	37.9	27.6	6.9	6.9	13.8	2.26	1.46	20

What is notable with respect to the findings in Table 5 is the level of unsure responses, which can be deemed minimal. This suggests that the contractors who responded to the questions could be assumed to be sure of their responses pertaining to the causes of defects in low-income housing. In response to a further open-ended question, the contractors contend that other causes include:

- "Use of unskilled labour which has been recommended by the initiating municipality";
- "Lack of involvement of building professionals such as land surveyors to check contours and engineers to inspect stormwater systems in the planning phase of housing projects";
- "The main reason is that the 'quantum' (grant from government) currently at R66 000 is not sufficient to build the top structure to the required quality. The government should increase the quantum by approximately R20 000 and contractors should refrain from tendering for low-income housing jobs until the quantum has been increased. Who builds at a loss over and above the risks associated with low-income housing? Contractors are forced to cheat on materials and quality due to a lack of work";

- "Contractors should be evaluated before being awarded tenders to prevent unqualified contractors from being awarded tenders. Political awarding of tenders should cease, because it does not benefit the process";
- "The allocation of projects to unqualified and unmotivated contractors remains an issue";
- "Lack of training of workers and sense of responsibility or ownership";
- "Theft of materials, especially cement, by the very community for whom the houses are being built, The concrete and mortar end up being weaker and the house cracks as a result, because the cement content has been reduced", and
- "The Department of Human Settlements and its authorised persons are involved in bribery and incorrect tender processes."

Table 6 indicates the degree of concurrence with statements pertaining to quality by contractors in terms of percentage responses to a scale of 1 (strongly disagree) to 5 (strongly agree), and a mean score between 1.00 and 5.00. The table suggests that 35.7% of the respondents strongly agreed that most defects in low-income houses occur during the construction stage, and that a large number of houses have to be fixed due to the non-achievement of quality standards. In addition, 21.4% of the respondents equally strongly agreed that the majority of low-income houses do not conform to NBR requirements, and that the neglect of health and safety (H&S) negatively affects the quality of houses built. When asked who is responsible for carrying out inspections on projects in order to prevent defects, the respondents mentioned government engineers, project managers, architects, municipal officials, and provincial authorities as external inspectors. Although 78.6% of the respondents confirmed that they use quality standards when constructing low-income houses, the type of standard to which the individual contractor adheres differs. Some of them mentioned that they adhere to design specifications provided to them by engineers, whereas others listed ISO 9001, NHBRC standards, and SABS as the standard to which they adhere.

Table 6: Extent of agreement with statements pertaining to quality by contractors

Statement	*Response (%)*						*MS*	*Std. Dev*	*Rank*
	U	*Strongly disagree*				*Strongly agree*			
		1	*2*	*3*	*4*	*5*			
Most defects in low-income houses occur during the construction stage	0.0	7.1	17.9	0.0	39.3	35.7	3.79	1.32	1
A large number of houses have to be fixed due to the non-achievement of quality standards	3.6	14.2	3.6	7.1	35.7	35.7	3.78	1.40	2
The majority of low-income houses do not conform to the National Building Regulations	0.0	14.3	14.3	7.1	42.9	21.4	3.43	1.37	3
Neglecting health and safety negatively affects the quality of houses built	3.6	10.7	17.9	32.1	14.3	21.4	3.19	1.30	4
Fast-tracking building projects result in the non-achievement of quality standards	0.0	14.8	22.2	22.2	25.9	14.8	3.04	1.32	5
The high demand for RDP houses causes contractors to work fast and ignore quality standards	0.0	10.7	39.3	21.4	21.4	7.1	2.75	1.14	6
Quality is an obstacle to productivity and is associated with high costs	0.0	39.3	17.9	21.4	14.3	7.1	2.32	1.33	7

However, pertaining to the need to adhere to principles identified in the NBR, the contractors were asked "How can conformance to NBR be promoted among contractors?". As indicated in Table 7, 74.1% of the respondents strongly agreed that regular inspections and performance audits can promote conformance to the NBR. A further 73.1% also strongly agreed that training and education related to low-income house building standards can promote conformance to the NBR. In addition to these interventions, the selection of materials for building purposes was investigated, as poor material selection and

usage could potentially result in defects and/or non-achievement of quality. Table 8 suggests that 46.4% of the respondents strongly agreed that materials should be selected based on either design specifications or compliance to building regulations. As indicated in Table 8, 35.7% of the respondents also agreed that affordability and availability of financial resources could influence material selection. Although 7.1% of the respondents were unsure about the contribution of availability of material, the mere fact that 39.3% of them agreed or strongly agreed with the statements suggests that material availability can affect material selection, which could determine the level of defects in lo- income houses.

Table 7: Contractors' perceptions related to how to promote conformance to the NBR

Statement	*Response (%)*						*MS*	*Std. Dev*	*Rank*
	U	*Strongly disagree*				*Strongly agree*			
		1	*2*	*3*	*4*	*5*			
Regular inspections and performance audits	0.0	3.7	3.7	7.4	11.1	74.1	4.48	1.05	1
Training and education on low-income house building standards	0.0	3.9	3.9	11.5	7.7	73.1	4.42	1.10	2
Workshops and seminars	0.0	3.7	14.8	22.2	7.4	51.9	3.89	1.31	3
Ensure registration with a quality assurance body	0.0	7.4	14.8	14.8	25.9	37.0	3.70	1.32	4

Table 8: Contractors' perception related to the selection of materials

Factor	*Response (%)*						*MS*	*Std. Dev*	*Rank*
	U	*Strongly disagree*				*Strongly agree*			
		1	*2*	*3*	*4*	*5*			
Material specified by the designer or developer	0.0	0.0	7.1	25.0	21.4	46.4	4.07	1.02	1

Factor	*Response (%)*						*MS*	*Std. Dev*	*Rank*
	U	*Strongly…….…… Strongly disagree …. .agree*							
		1	*2*	*3*	*4*	*5*			
Suitable material according to building regulations	0.0	3.6	7.1	25.0	17.9	46.4	3.96	1.17	2
Affordability of material	0.0	10.7	14.3	10.7	35.7	28.6	3.57	1.35	3
Available financial resources	0.0	17.9	14.3	10.7	35.7	21.4	3.29	1.44	4
Availability of material	7.1	21.4	10.7	21.4	14.3	25.0	2.88	1.53	5

Table 9, which indicates respondents' perceptions pertaining to criteria used for the selection of workers in low-income housing projects in terms of percentage responses ranging from 1 (strongly disagree) to 5 (strongly agree), suggests that 57.1% and 32.1% strongly agreed that contract requirements as well as the level of skills and training possessed by workers could affect the selection of workers for low-income housing projects.

Table 9: Contractors' perception related to the selection of workers for low-income housing projects

Factor	*Response (%)*						*MS*	*Std. Dev*	*Rank*
	U	*Strongly…….. . Strongly disagree agree*							
		1	*2*	*3*	*4*	*5*			
Contract requirements, e.g. the use of local labour	3.6	3.6	10.	7.1	17.9	57.1	4.19	1.21	1
Skills and training which the worker has	0.0	3.6	7.1	25.0	32.1	32.1	3.82	1.09	2
Available financial resources	0.0	10.7	3.6	42.9	21.4	21.4	3.39	1.20	3
Community empowerment such as using beneficiaries to build their own houses	0.0	28.6	3.6	7.1	32.1	28.6	3.29	1.63	4

Table 10 indicates that 50.0% of the contractors strongly disagreed with the notion that acceptable methods according to building regulations affect the preferred construction method used for low-income housing projects. A further 35.7% and 33.3% also strongly disagreed that less time-consuming methods and less expensive methods influence the choice of construction methods used for low-income housing projects. In fact, only a minority (3.7%-10.7%) strongly agreed with the statements tabulated in Table 10.

Table 10: Construction methods used when building low-income houses

Factor	*Response (%)*						*MS*	*Std. Dev*	*Rank*
	U	*Strongly disagree*				*Strongly agree*			
		1	*2*	*3*	*4*	*5*			
Acceptable methods according to building regulations	0.0	50.0	17.9	14.3	7.1	10.7	3.89	1.40	1
Less time-consuming methods	3.57	35.7	28.6	14.3	3.6	14.3	3.70	1.41	2
Less expensive methods	3.70	33.3	22.2	14.8	22.2	3.7	3.62	1.30	3

4. Conclusions and recommendations

The provision of low-income housing to the poor in South Africa is performing below expectations due to a number of factors. There are major problems in all aspects related to the provision of low-income houses. Starting at governmental departments, such as municipalities that award and oversee low-income housing projects, to the contractors who build the houses, problems seem to abound.

The study revealed that there is a major problem in terms of defective houses in the low-income housing sector. It was confirmed that the major cause of defects is poor workmanship. Poor workmanship, as cited in the literature reviewed, was confirmed by the results of the conducted survey. In fact, poor workmanship was ranked first and confirmed as the main cause of defects in low-income housing by the respondents to the survey.

In addition, the majority of the contractors who participated in the survey agreed that the use of unskilled labour and faulty construction are among the causes of defects in low-income houses. As a result, recommendations arising from the study include:

- Project monitoring and inspections during the construction phase should be ensured by project stakeholders such as municipal inspectors and NHBRC officials;
- There should be a set of uniform standards to be adhered to by all contractors involved in the provision of low-income houses;
- Low-income housing projects should be awarded to competent contractors: contractors' experience and capabilities should be evaluated before contract award;
- Formal training requirements in the built environment disciplines should be promoted among emerging contractors, especially in terms of construction materials and methods;
- Training and education related to low-income housing building standards should be provided through workshops and seminars at regular intervals;
- All contractors involved in low-income housing projects should be encouraged to register with a quality assurance body in order to facilitate performance audits, and
- There is a need to engender a culture of excellence related to quality in the industry.

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