

DETERMINATION OF QUALITY OF SANDCRETE BLOCKS USING COST ANALYSIS OF MATERIAL INPUT

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ABSTRACT

Sandcrete blocks are the most commonly used blocks in the construction of building in Nigeria. The importance of sandcrete blocks cannot be overemphasised. Despite all the government effort to ensure good quality production of sandcrete blocks in Nigeria, many block industries are still producing blocks that are below standard. Many researches have proved this beyond reasonable doubt. In order to make this proof clearer this paper focussed on using the cost of materials input to determine the quality of the blocks produced by these block industries. In achieving this two commonly used types of blocks and mix proportions were considered. After a careful and detailed analysis it was found out that the total material cost of producing 467 blocks of 150mm thick (6") using 1:6 mix was ₦ 82,698.00 while the selling price in the market was ₦ 46,667.00. Also the cost of producing 304 blocks of 225mm thick (9" size) using 1:6 mix was ₦82,698.00 and the selling price was ₦45,652.50. With this analysis the questions is how are the block industries making profit? it was concluded that, if the block industries are really producing their blocks up to the set standards, they cannot break even on the prices these blocks are being sold by the industries. It was also concluded that the blocks are not up to the standard set by standard organisation of Nigeria SON. The researcher recommended that the organisation and law enforcement agency should put more effort in monitoring the block industries so as to ensure good quality in the production of the sandcrete blocks.

Keywords: Blocks, Building, Construction, Quality, Sandcrete, Standards,

INTRODUCTION

Sandcrete blocks are a major walling material component. According to Brett (1989) block walling forms about 40% of a building structure. With this, block work is an essential element in the construction of a building. Brett (1989) also defined a block as a walling unit which is larger than bricks. In Nigeria sandcrete blocks are widely used as walling units. The quality of blocks produced, however differs from each manufacturer due to different methods employed in the production and the properties of the constituent material (Obande 1996).

Sandcrete blocks is the main building material for walls of single-storey buildings (such as houses and schools) in countries such as Ghana and Nigeria. Measured strengths of commercially available sandcrete blocks in Nigeria was found to be between 0.5 and 1 N/mm², which is well below the 3.5 N/mm² that is legally required there. This may be due to the need of the manufacturers to keep the price low, and since the main cost-factor is the Portland cement, they reduce that, which results in a block that starts behaving more like loose sand.

Quality is defined as "fitness for purpose" or compliance with specification (Anosike, 2011, Taylor, 2002) the totality of features required by a product or service to satisfy stipulated and implied needs (Eze et al, 2005). ISO 8402-1986 standard defines quality as "the totality of features and characteristics of a product or service that bears its ability to satisfy stated or implied needs". Similarly, in manufacturing Business dictionary, defined quality as a measure of excellence or a state of being free from defects, deficiencies, and significant variations, brought about by the strict and consistent adherence to measurable and verifiable standards to achieve uniformity of output that satisfies specific customer or user requirements. In a similar development (Ogunsanmi et al, 2011) identified quality as one of the three key elements for developing risk classification model for design and build projects. This therefore follows that quality is a significant factor that cannot be undermined in the construction of projects. Quality management and quality assurance on the other hand have been adopted to include all aspects of producing and accepting a construction project which meets all required quality standards (Nunnally, 2007). He further asserts that quality management

includes such activities as specification development, process control, product, laboratory and technician certification, training and communication. Consequently, (Nunnally, 2007) concluded that quality control, which is a part of the quality management process, is primarily concerned with the process control function. The SON established through Act 56 in 1971 is the sole statutory body that is vested with the responsibility of standardising and regulating the quality of all products in Nigeria including sandcrete blocks. The Nigerian Industrial Standard (NIS) for sandcrete block is a standard reference document developed by the SON which prescribes the minimum requirement and uses of sandcrete blocks. These requirements include the quality of materials, the methods and procedure to employ for production and testing of the final products to ensure compliance to prescribed standard. The first standard for sandcrete block in Nigeria was developed in 2000 and known as NIS 87:2000; Standard for sandcrete blocks. In 2004, the document was reviewed and NIS 87:2004; standard for sandcrete blocks became the country's standard reference document for sandcrete block. The last review was done in 2007 from which NIS 87:2007; standard for sandcrete blocks emerged as the latest standard reference document for sandcrete block production in Nigeria.

Sandcrete Block

Block is a composition of usually (1:6) mix of cement and sharp sand with the barest minimum of water mixture, and in some cases admixture, moulded and dried naturally. NIS 87:2000 defines sandcrete block as a composite material made up of cement, sand and water, moulded into different sizes. According to them, they are masonry units which when used in its normal aspect exceeds the length or width or heights specified for bricks. The block can therefore be made either in solid and hollow rectangular types (for normal wall) or decorative and perforated in different designs, patterns, shapes, sizes and types (for screen wall or sun breakers). The jointing of beddings and perpends are 25mm thick in both the normal and screen wall. Sandcrete blocks are widely used as walling units and over 90% of houses in Nigeria are being constructed of sandcrete blocks (Baiden and Tuuli, 2004). In the hardened state, sandcrete has a high compressive stress and this strength increase with density. The

range of minimum strength specified in NIS 87:2007 is between 2.5N/mm² to 3.45N/mm². According to Abdullahi (2005) the quality of sandcrete blocks, however, is inconsistent due to the different production methods employed and the properties of constituent materials. Abdullahi (2005) studied the compressive strength of sandcrete blocks produced in some parts of Minna, Niger State, Nigeria and discovered that they were below the minimum NIS standard requirement. The NIS specified two types of blocks, types A (load bearing) and Type B (non-load bearing) and these blocks can also be solid or hollow. Approved sizes for sandcrete blocks specified by NIS are presented in Table 1.

Table 1. Types of Sandcrete Blocks and Their Usage

Type	Work size (mm) Length x Height x Thickness	Work size (mm) Web Thickness	Usage
Solid Blocks	450 x 225 x 100	-	For non-load bearing and partition walls
Hollow	450 x 225 x 113	25	For non-load bearing and partition walls
Hollow	450 x 225 x 150	37.50	For load bearing walls
Hollow	450 x 225 x 225	50.00	For load bearing walls

Source: NIS 587: 2007

This paper focus on using the cost analysis of cost of producing sandcrete blocks to determine the quality of blocks that is been produced in the study area that is Bida and the environs. The type of blocks to be considered is the last two in the table 1 above.

Methods

Considering two standard mix for mortar for the block moulding. The two mix ratios are 1:4 and 1:6.

- For a cubic metre of cement
- For 1:4 mix, four cubic meter of sand will be used.
- For 1:6, six cubic meter of sand will be used.
- A cubic metre of cement contains 29 bags of 50kg mass
- A trip of sand in Nigeria is 3.8m³ of sand
- Four cubic metre of sand is $4/3.8 = 1.053$ trips of sand

- Six cubic metre of sand is $6/3.8 = 1.58$ trips of sand
- There are two main sizes of blocks sold generally in Nigeria especially in Bida town where the study was carried out. They are; the 150mm x 225mm x 450mm blocks and the 225mm x 225mm x 450mm blocks.

To calculate the volume of blocks;

- Volume of 150mm x 225mm x 450mm blocks = $0.15 \times 0.225 \times 0.45 = 0.015\text{m}^3$
- Volume of the 225mm x 225mm x 450mm blocks = $0.225 \times 0.225 \times 0.45 = 0.023\text{m}^3$
- With a cubic metre of cement which is 29 bags of cement four cubic meter of sand which is 1.053 trips of sand will be used for a ratio of 1:4
- With a cubic metre of cement which is 29 bags of cement six cubic meter of sand which is 1.56 trips of sand will be used for a ratio of 1:6
- Volume of cement sand mortar used to produced blocks with 29 bags of cemet at 1:4 = $1+4 = 5\text{m}^3$ of mortar.
- Volume of cement sand mortar used to produced blocks with 29 bags of cemet at 1:6 = $1 +6 = 7\text{m}^3$ of mortar.

Calculation Of The Quantity Of Blocks Moulded From 29 Bags Of Cement And 1.053 Trips Of Sand That Is; 1:4 Mix Proportion.

- For The 150mm x 225mm 450mm blocks is: $\frac{5\text{m}^3}{0.015\text{m}^3} = 333.33$ blocks
- For The 225mm x 225mm x 450mm blocks is: $\frac{5\text{m}^3}{0.023\text{m}^3} = 217.39$ blocks

Quantity Of Blocks Moulded From 29 Bags Of Cement And 1.58trips Of Sand That Is; 1:6 Mix Proportion.

For the 150mm x 225mm x 450mm blocks is: $\frac{7\text{m}^3}{0.015\text{m}^3} = 466.67$ blocks

For the 225mm x 225mm x 450mm blocks is: $\frac{7\text{m}^3}{0.023\text{m}^3} = 304.35$ blocks

- Cost of cement in bida Nigeria = ₦ 1800 per bag

➤ For 29 bags of cement cost is $29 \times 1800 =$
 $\text{₦}52,200.00$
 Add 33% for shrinkage waste e.t c = $0.33 \times 52,200 =$ $\text{₦}17,226.00$
 Total = $\text{₦}69,426.00$

➤ Cost of a trip of sand in Bida Nigeria is $\text{₦}7000$
 ➤ Cost of 1.053 trips of sand = $1.053 \times 7000 =$
 $\text{₦}7,371.00$
 ➤ Add shrinkage and waste 20% $\text{₦}1,474.20$
 Total $\text{₦}8,845.20$
 Cost of 1.58 trips of sand = $1.58 \times 7000 =$
 $11,060.00$ ₦
 Add shrinkage and waste 20% $\text{₦}2,212.00$
 Total $\text{₦}13,272.00$

Cost of sandcrete blocks in Bida, Nigeria

The 150mm x 225mm x 450mm blocks cost $\text{₦}100$ per block

- 333.33 blocks will cost $333.33 \times \text{₦}100 = \text{₦}33,333.00$
- 466.67 blocks will cost $466.67 \times \text{₦}100 = \text{₦}46,667.00$

The 225mm x 225mm 450mm blocks cost $\text{₦}150$ per blocks

- 217.39 blocks will cost $217.39 \times 150 = \text{₦}32,608.50$
- 304.35 blocks will cost $304.35 \times 150 = \text{₦}45,652.50$

Table 2: Cost of materials to produced 150mm x 225mm x 450mm blocks and selling cost of blocks

Mix proportion	1:4	1:6
Cost Cement	$\text{₦}69,426.00$	$\text{₦}69,426.00$
Cost of sand	$\text{₦}8,845.20$	$\text{₦}13,272.00$
Total Cost	$\text{₦}78,271.20$	$\text{₦}82,698.00$
Quantity of blocks produced	333.33	466.667
Selling price	$\text{₦}33,333$	$\text{₦}46,667$

Source; (fieldwork February 2014)

Table 3: Cost of Materials to Produce 225mm X 225mm X 450mm Blocks and Selling Cost of Blocks

Mix proportion	1:4	1:6
Cost Cement	₦ 69,426.00	₦ 69,426.00
Cost of sand	₦ 8,845.20	₦ 13,272.00
Total Cost	₦ 78,271.20	₦ 82,698.00
Quantity of blocks produced	217.39	304.35 blocks
Selling price	₦ 32,608.50	₦ 45,652.50

Source: (fieldwork February 2014)

DISCUSSION

From the issues raised in the methodology and the tables presented one will see that at the standard mix with the present price of cement, sand and blocks, a block moulder will hardly make profit. This analysis was done directly without considering overhead cost and profit to the block industry. This paper shows that at the present, the price of a ready moulded blocks, the blocks sold at the current price will not meet the required quality. This is because at the present price there is no way the block industry will maintained the required mix and be able to brake even. The question now arose. How have our block industries been surviving with the current price of blocks. The answer seemed not far-fetched. The answer can only be found in the use of low quality and non-standard mixed blocks.

CONCLUSION

From the methodology and discussion of result it is well established that the block industry are not truthful in their mix, that is why they can sell at the price of 100 and 150 naira and still break even.

RECOMMENDATION

This paper recommends that a close look and proper monitoring should be done on the block industry by the authorities concern so as to have a good quality blocks. Also the authorities concern should bring out a uniform standard that the block industries are to follow. Nigerians deserve good quality blocks even if it will

require them paying more for it as the common saying nothing good comes easy and cheap.

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