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An Appraisal of Sandcrete Blocks Quality

A Case Study of Katsina, Nigeria

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***Abstract*—Part of Katsina city in Northern Nigeria experienced serious building collapse during the previous and current rainy season. The collapsed buildings turned into heap of rubbles which can hardly be used as hardcore. This study assessed the quality of sandcrete blocks manufactured by block industries in Katsina city where sample of blocks from various block-making industries were collected in the study area. Water absorption ratio was determined prior to the determination of the compressive strength of individual blocks. The values of water absorption ratio for samples D1, H1 and H2 are above the maximum water absorption of 12% recommended in the Nigerian Industrial Standard. The result of the compressive strength indicates that none of the block-making industry in Katsina city conforms to the NIS minimum 2.5 N/mm^2 standard for strength characteristic. All stake holders should put hands together to salvage the hopeless situation in the block-making industries in Nigeria.**

***Keywords*— absorption ratio, collapsed buildings, compressive strength, NIS standard, sandcrete block, water.**

I. Introduction

The frequent failure of buildings in Nigeria is a concern to all stakeholders. In the past incessant building failures have been reported resulting in the loss of lives and properties in Nigeria [6,7] The global concerns for sudden collapses of buildings across the world, and in Nigeria in particular demand that materials used for construction of buildings meet minimum requirement[4,8].

Sandcrete hollow block is made from a mixture of sharp sand, cement in the ratio of usually 1:6 with the minimum amount of water, in some cases with admixture, moulded and dried naturally.

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They are used extensively in many countries of the world including Africa. In many parts of Nigeria, sandcrete block is the major cost component of the most common buildings. [3] They are used to provide shelter, protection, conveniently divide space, privacy and also to provide security for man and his properties. [1] Over 80% of the blocks used in construction of buildings are produced by the block-making industries in Katsina city in Nigeria. However some customers often compromise quality because of their poverty level [4] and therefore purchase blocks of poor quality which consequently result into collapse of buildings. Walls built with poor quality blocks that falls short of the standard strength are likely to fail, thereby causing severe damage to the structure and sometimes even lost of lives and properties. This shows that there is need to know the compressive strength of blocks in order to minimize the huge loss of money by the block users in the course of handling and transporting substandard blocks [1]. [3] Observed that the high and increasing cost of constituent materials of sandcrete blocks has contributed to the non-realization of adequate housing for both urban and rural dwellers [3]

It has been reported by [2&3] that for a long time in Nigeria, sandcrete blocks are manufactured in many parts of the country without any reference to suit local building requirements or good quality work. In the year 2000, and in an attempt to enhance the best materials and manufacturing practice, the Standard Organization of Nigeria (SON) developed a reference document which prescribed the minimum requirements and uses of different kinds of sandcrete blocks (NIS 87:2000)[9]. 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. Among the objectives of this NIS document are to ensure that all block manufacturers meets a minimum specified standard, as well as to control the quality of blocks produced by these manufacturers. But to this moment variation in the quality of sandcrete blocks manufactured by commercial block industries still exist despite the provision of NIS document referred above. The NIS document has identified assignable variations as one of the factors that cause variation in the quality of sandcrete block which can be attributed to man, machine, raw materials and method. Under this factor, the study is intended to assess the quality of sandcrete blocks manufactured in Katsina city, Nigeria.. The objectives of the study are to investigate the level of compliance of the manufacturers to NIS standard specifications and to evaluate the production process employed in the production of sandcrete blocks.

II. Literature Review

Sandcrete blocks must satisfy building specification byelaws with respect to the compressive strength. British standard BS2028, 1364 defines blocks as a walling unit with dimensions greater than brick specified in BS 3921. According to [11], block is defined as a masonry unit of larger size in all dimensions than that specified for bricks and not exceeding 650mm in all dimensions of height, length or thickness.

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/mm^2 to 3.45N/mm^2. [2] According to [5] the quality of sandcrete blocks, however, is inconsistent due to the different production methods employed and the properties of constituent materials.[2] The compressive strength of hollow sandcrete block increases by adding optimum quantity of water, which will also have an impact on the mix and workability.

III. Materials and Method

A. *Materials*

The materials used for making the sandcrete blocks were cement, sand and water. The cement used by all manufacturers was Dangote cement manufactured by the Dangote Cement Company of Nigeria. The water used is usually tap water and water from bored hole which satisfy minimum requirement for general civil engineering works.

B. *Method*

Sandcrete block samples were collected from 12 block industries in the four corners of Katsina city, 3 samples from each industry were marked and labelled. The blocks were already cured for 7days at the respective industries. The blocks were weighed before immersing in water for 24 hours in the civil engineering concrete laboratory of Hassan Usman Katsina Polytechnic in order to determine the water absorption ratio. The blocks were then weighed and allowed to dry completely. The compressive strengths of the blocks were determined in accordance with BS 2028.

C. *The mix proportion*

The mix proportion used by most of the manufacturers is 1:20 and some others add cement directly on a heap of sand containing impurities and then begin to mix manually with shovel. By this attitude, consistent mix cannot be assured and ultimately leads to the production of poor quality blocks.

D. *Block Molding*

About 95% of the block industries use machine mould with vibrator for the production of the blocks. The mixed materials are poured into the moulds and compacted by machine vibration. Excess materials are removed with a piece wooden. The blocks are then released onto a flat board laid under the machine. The blocks are then taken away manually to the drying bed where it is left until it gains strength.

E *Curing*

The blocks are left on the wooden boards for 24hrs before spraying them with water twice daily for 7 days, however, the blocks are sometimes sold out in a period less than 7 days when there is high demand in the market.

F *Water Absorption Ratio*

All specimens were first subjected to water absorption tests before compressive strength tests were conducted. According to [12] the rate of water absorption of aggregate is influenced by the bond between aggregates and the cement paste, the resistance of concrete to freezing and thawing, chemical stability, resistance to abrasion and specific gravity. Water absorption ratio is the ratio of the weight of water absorbed by a material, to the weight of the dry materials. This is given by:

$$[(w2 - w1)/w1] * 100 \quad (1)$$

Where W1 is the dry weight of the sample and W2 the wet weight

IV. Result and Discussion

A. *Water Absorption rate*

The water absorption rate of the blocks is presented in table I. The values range between 5.12 and 18.45. The values for sample H is above the maximum water absorption of 12% recommended in the Nigerian Industrial Standard (2004). Perhaps insufficiency of cement content in the mix might be responsible for the high absorption as reflected in the literature.

TABLE I. THE MEAN WATER ABSORPTION RATE

Sample ID	Average absorption Rate (%)
A	5.92
B	6.36
C	6.29
D	7.64
E	5.62
F	7.06
G	7.61
H	18.45
J	6.23
K	5.95
L	6.42
M	5.12

B. *Compressive Strength*

The result for the compressive strength of blocks is shown in Table II. Test result indicates that the average values for respective industries range between 0.75N/mm^2 to 1.25N/mm^2 These values fall below the 2.5 N/mm^{2}standard prescribed for load bearing sandcrete blocks as specified by Nigerian Industrial Standard [8]. It can also be understood from the result that there is poor quality control at some of the block industries (B, E, F, H & M) since there is wide range in the strength within the same environment.

Table II: The mean Compressive strength

Sample ID	Average compressive Strength (N/mm^2)
A	1.10
B	1.00
C	0.78
D	1.03
E	1.17
F	0.75
G	1.12
H	1.14
J	1.12
K	1.07
L	1.17
M	1.25

It was also observed that the water for curing applied is sometimes not sufficient which makes the blocks to develop cracks due to the effect of hydration and that some industries add clay soil in their mix in order to save more cement which should have been added. This may also be responsible for the shear cracks appearing on the blocks. This is apparent when about 8% of the samples collected, got broken despite all precautions taken, and before delivering to the laboratory for the tests.

v. Conclusion

This study has shown that the compressive strengths of sandcrete blocks produced in Katsina commercial block industries fall below acceptable national and international standards. The findings from this study also agree with similar studies as reported by [5,8] in Nigeria. Experimental results also reveal that Commercial block producers are ignorant of the existence of any relevant code or specifications relating to block production and properties It remain to say that, using cheap and inferior building materials produced from these block-making industries and which do not satisfy the minimum strength requirements may be a great danger as they contribute to a greater extent in building failures recoded recently and in the past. All stake holders should put hands together to salvage the hopeless situation in the block-making industries in Nigeria. Other suggestions that may proffer solution to this predicament may include the following:

1. Govt of Katsina in particular and the Nigerian Government should check the activities of sandcrete producers and enforce compliance to set out standards.
2. Professional organizations should ensure compliance at planning, design or construction stages.
3. The NIS in particular should carryout massive enlightenment campaign to educate producers of sandcrete blocks on their activities. They should also make it mandatory for all blocks manufacturers to register with them and obtain the necessary training
4. Check corrupt tendencies
5. Manufacturers should be carrying out quality test on their products at recognized institutions.

Plate 1: Collapsed Residential Building under Construction at Barhin Quarters

Plate 2: Wall built with poor Quality Blocks

Plate 3: Collapsed block wall fence around public School

Plate 5: Collapsed block wall fence around Residential Building

REFERENCES

[1] A., Fakere, G., Fadairo, & R. A Fakere, "Assessment of Building Collapse in Nigeria:A Case of Naval Building, Abuja, Nigeria" International Journal of Engineering and Technology Volume 2 No. 4, , 584-591, 2012.

[2] G., Oyekan, & M., K. O. effect of Granites Fines on the Structural and Hygrothermal Properties of Sandcrete Blocks, 2008.

[3] D. E. Ewa and J. O. Ukpata Investigation of the Compressive Strengths of Commercial Sandcrete Blocks in Calabar Nigeria *International Journal of Engineering and Technology*, *Volume 3 No. 4,* 2013.

[4] J. Ukpata, Structural Design As A Panacea For Building Failures In Nigeria. *Nigeria Society of Engineers Calabar* 2006.

[5] G. L. Oyekan and O. M. Kamiyo A Study on the Engineering Properties of Sandcrete Blocks Produced with Rice Husk ash Blended cement *Journal of Engineering and Technology Research Vol. 3(3), pp. 88-98,* 2011

[6] S. Yusuf and A. A. Hamza, Compring the compressive strength of six and Nine inches hand moulded sandcrete block. *Journal of Engineering and Applied sciences* 2 Cenresin Publications, Volume 3, 2011.

[7] M.N. Anoske and A. A. Oyebade, Sandcrete Blocks and Quality Management in Nigeria Building Industry. *Journal of Engineering, Project and Production Management,* 2012

[8] Nigerian Industrial Standard, Specification for sandcrete Blocks. Standard Organization of Nigeria, Lagos, Nigeria, NIS 87: 2000

[9] British Standards Institution. *1981 Precast concrete masonry units. Part 1. Specifications for precast concrete masonry units. BS 6073: Part 1:,BS London, England, 1981.*

[10] Abdullahi M. Compressive Strength of Sandcrete Blocks in Bosso and Shiroro Areas of Minna, Nigeria AU J.T. 9(2): 126-132, 2005.
[11] A.M. Neville, Properties of Aggregates. Pearson Education Asia, London, England, 2000.