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Investigation of the Compressive Strengths of Commercial Sandcrete Blocks in Calabar Nigeria

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ABSTRACT

The study investigates the compressive strength properties of sandcrete blocks produced within the Calabar metropolis. Ten blocks moulding sites were visited and twelve sandcrete blocks were randomly selected from each site, and cured for 3, 7, 14 and 28 days respectively. The aggregates used for the moulding of the blocks were also collected and their particle sizes analysed. The results show that the 28-day compressive strengths of sandcrete blocks produced in Calabar block industry range between 0.23N/mm^2 and 0.58N/mm^2. These are below the minimum requirements of 1.75N/mm^2 by the Nigerian National Building Code (2006) for individual block, and 2.0N/mm^2 by the British Standard for non-load bearing walls.

Keywords: *Sandcrete blocks, compressive strength, aggregates, curing.*

1. 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 (Fakere, Fadairo, & Fakere, 2012; Oyekan & M., 2008). 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 (Ukpata, 2006). In some cases, even though the building has not totally collapsed, the aesthetics value is lost to cracks and other defects. Part of this problem is due to the poor quality of sandcrete blocks used as walling units. Sandcrete block is a common building material used in Nigeria and sub-Sahara Africa, and accounts for more than 60% of materials in most buildings.

2. PREVIOUS STUDIES

According to Abdullahi (2005), the word sandcrete has no standard definition, what most workers have done were to define it in a way to suit their own purpose. The qualities of the blocks are inconsistent due to the different constituent materials.

The composition of a sandcrete block is usually (1:6) mix of cement and sand moistened with water and allowed to dry naturally, (Anosike & Oyebande, 2012). It is a composite material made up of cement, sand and water, moulded into different sizes (NIS 87, 2000).

Sandcrete blocks are the commonest and most popular masonry walling units in Nigeria. The most essential and expensive constituent of the block is cement; to minimise cost and maximise profit, commercial producers of these blocks reduce the quantity of cement needed to give acceptable quality required by various standards. (F.O.Okafor & Ewa, 2012), Sandcrete blocks are the most widely used walling unit in Nigeria, accounting for 90% of houses (Baiden & and Tuili, 2004).

The Nigerian Industrial Standard (NIS 87, 2000), provide the range of minimum compressive strength of sandcrete blocks between 2.5N/mm^2 and 3.45N/mm^2. The objective of Nigeria Industrial Standard (NIS 87:2007) is that all blocks manufacturers meet the minimum standard. Improper use of these blocks leads to micro cracks on the wall after construction (Anosike & Oyebande, 2012; Baiden & and Tuili, 2004). In most cases, the producers and users of these blocks lack adequate engineering knowledge on the strength requirement of sandcrete blocks.

Abdullahi (2005) revealed that the compressive strengths of commercial sandcrete blocks in Minna, Nigeria were below the standard recommended by Nigerian Industrial Standard (NIS 87:2000). The compressive strengths of the blocks were found to vary between 0.11N/mm^2 and 0.75 N/mm^2.

The poverty level amongst West African countries and particularly Nigeria has made these blocks widely acceptable among the people so as to minimize the cost of construction (Oyetola & M., 2006) . These blocks are produced with low amount of ordinary Portland cement.

For a long time in Nigeria, sandcrete blocks have continued to be manufactured in many parts of the country without reference to suit local and building requirements or quality (Oyekan & M., 2008).

3. METHODOLOGY

10 block moulding sites were visited and 12 sandcrete blocks randomly selected from each site. The blocks were cured for 3, 7, 14 and 28 days and their compressive strengths determined in accordance with BS 2028. The sand used for moulding the blocks were also collected and sieve analysis test conducted on them to determine the particle size distribution in accordance with BS 1377. The cement used by all manufacturers was the UNICEM cement manufactured by the United Cement Company of Nigeria.

4. RESULTS AND DISCUSSION

4.1 Chemical Properties of Cement used

From Table 1 above, the properties of cement used by all ten sites for moulding of the blocks meets the specification for Ordinary Portland Cement, Neville (2000).

Table 1: Chemical Properties of Cement used

Cao	SiO_2	Al_2O_3	Fe_2O_3	MgO	SO_3	K_2O	NaO_2
64.34	20.79	4.51	2.64	1.66	1.48	1.26	0.18

4.2 Particle Size Distribution of Sand used

Results of the sieve analysis test conducted on the sand used by each site are presented in Table 2 below with charts for the 10 sites shown in the appendix. The results show that the River sand used fall between the fine gravel to medium sand and is uniformly graded which satisfy the grading limit of BS 882. The sand used is a good construction material especially for the production of sandcrete blocks.

Table 2: Sieve Analysis

Sieve Sizes (mm)	Percentage Passing (%)									
	Site1	Site2	Site3	Site4	Site5	Site6	Site7	Site8	Site9	Site10
3.35	78.06	78.96	84.03	96.3	98.57	99.37	93.37	95.55	94.05	94.18
2.38	76.79	77.5	72.62	93.87	70.74	-	87.96	92.51	82.61	82.00
1.18	58.22	57.92	43.26	23.51	29.65	59.62	57.00	56.07	32.27	31.09
600mm	20.81	21.84	28.24	12.56	6.37	17.62	31.69	24.29	16.71	12.44
425mm	6.89	7.92	15.39	5.54	2.86	6.37	14.00	10.53	6.42	3.35
300mm	0.56	0.64	6.6	1.22	1.17	0.87	3.19	1.83	1.39	1.12
212mm	0.00	0.01	0.28	0.00	0.00	0.62	0.00	0.01	0.02	0.12

4.3 Compressive Strength

The results of the compressive strength of the blocks shown are in Table 3. The 28 day compressive strength of the blocks ranges from 0.23N/mm^2 to 0.58N/mm^2, with an average compressive strength of 0.35N/mm^2. These values fall below the minimum prescribed value for Load bearing sandcrete block specified by NIS 87:2000 which is 2.5N/mm^2 and 1.75N/mm^2 by Building Code, (2006). Furthermore, these values do not differ much from those obtained in Minna by Abdullahi (2005), and, in Abuja, Ota and Umuahia by Anosike & Oyebande (2012). Low cement content in order to maximize profit and poor curing conditions appear to be the main factors responsible for these low strengths of the blocks.

Table 3: Compressive Strength

Site	Curing Period in days			
	3	7	14	28
site1	0.04	0.18	0.2	0.32
site2	0.04	0.23	0.35	0.47
site3	0.05	0.08	0.15	0.34
site4	0.05	0.13	0.29	0.52
site5	0.03	0.11	0.11	0.23
site6	0.04	0.19	0.33	0.47
site7	0.05	0.17	0.29	0.45
site8	0.05	0.08	0.34	0.54
site9	0.04	0.13	0.33	0.47
site10	0.04	6.07	0.35	0.58

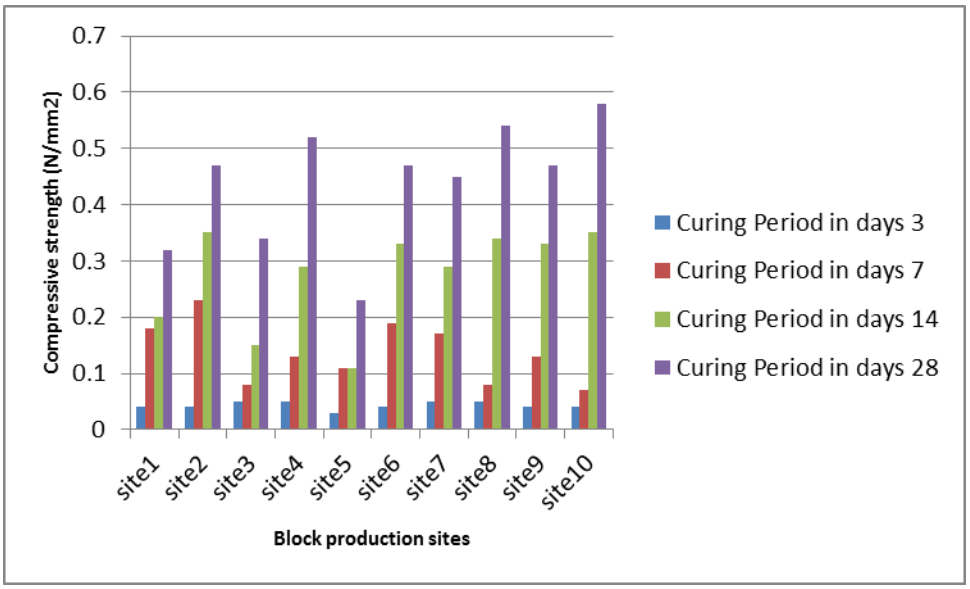

Figure1: Compressive Strength of Calabar Blocks

5. CONCLUSION

This study has shown that the compressive strengths of sandcrete blocks produced in Calabar commercial block industries fall below acceptable national and international standards. The findings from this study also agree with similar studies in other parts of Nigeria. As sandcrete blocks account for virtually all wall construction in the Nigerian building industry, there may be great danger in using these blocks especially for bungalows where heavy loads of the buildings such as roofs are left to be entirely supported by block walls. This is a possible reason for most building collapses recorded in Nigeria. There is therefore the need for the various arms of government and professional bodies to take urgent actions in regulating the production of commercial blocks in Nigeria. This will ensure that blocks which do not meet minimum requirements are destroyed before being sold to the public.

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APPENDIX