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ASSESSMENT OF STANDARDIZATION OF SANDCRETE BLOCKS PRODUCTION IN LAGOS: CASE STUDY OF ALIMOSHO LOCAL GOVERNMENT AREA, LAGOS NIGERIA

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ABSTRACT

The paper assesses the quality of sandcrete blocks in some selected areas of Alimosho Local Government Area (LGA), the north eastern part of Lagos state, Nigeria. With the view of enhancing the quality of the production of sancrete blocks in the state. The study is hybrid in its methodological approach. Combining, the quasi experimental research method with the survey and desk top method. A total of 24 manufacturers were randomly taken and all of whom had questionnaires administered on them, samples of their product- sandcrete blocks were taken and subjected to laboratory tests on, sieve analysis, water absorption capacity and compressive strength analysis. Results obtained were compared with the standards set by the Nigerian Standard Organization. While other relevant data obtained through the survey methods were descriptively analyzed and discussed. Results obtained that the tested sampled products significantly varies away from the prescribed standards. The paper recommends for routine check on the sandcrete manufacturers production base for the purpose of enforcing compliance with the prescribed standard. Regular education and enlightenment of the manufactures and the users of sandcrete blocks by the appropriate agency were also recommended among several others.

INTRODUCATION

Building construction activities have to do with the effective management of all resources namely, money, manpower, methods, materials and machine. Material, a substance of which a thing is made or composed and product, which is the act of producing something by efforts or some mechanical or industrial process are used for the construction and repair of buildings and structures, such products for building construction activities include amongst others, sandcrete blocks. The production and harvesting of raw materials for building purposes has attracted a worldwide attention so much so that it has become major trade key point between nations which has resulted in a multibillion dollar Building industry. The use to which these materials are put has elicited the emergence of specific specialty trades such as carpentry, plumbing, roofing, masonry and insulation work thereby providing quite a number of job opportunities for the nation. Sandcrete blocks, according to Abdullahi (2005) have no standard definition but the composition and method of their production has been spelt out by the Standard Organization of Nigeria. Sandcrete blocks are products made out of the mixture of sand, cement and water (Mortar) in a proportionate ratio. In its bid to achieve uniformity in the quality of blocks, the Standard Organization of Nigeria (SON) introduced a reference document, the Nigeria Industrial Standard (NIS) for Sandcrete block which presented the minimum requirement and uses of different kinds of Sandcrete blocks and other products, to prescribe the quality of materials; methods and procedure to be applied for production and testing of the final product in order to ensure compliance to prescribed standard. The first standard for sandcrete block developed in year 2000 is known as NIS 87: 2000 and had been subsequently reviewed in 2004 and 2007. Before now, manufacturing of sandcrete blocks have been as uncoordinated as many participants focus on the economic gain at the expense of both quality and suitability for local requirements. Sandcrete blocks being the most common and most popular masonry walling units in Nigeria possess an intrinsic low compressive strength making them susceptible to any tragedy such as seismic activity (Abdullahi, 2005). Baiden and Tuuli (as cited in Anosike and Oyebade 2011) also posited that over 90% of

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physical infrastructures in Nigeria are constructed using sandcrete blocks, this was also supported by Alamu and Gana (2014) that, the commonest walling material in Nigeria today is sandcrete blocks of various sizes. According to Alamu and Gana (2014), the rising incidents of building collapse are attributed to the use of substandard building materials amongst others hence Ukpata (as cited in Ewa and Ukpata 2013) suggested that materials used for building construction meet minimum standard to address the issue of sudden building collapse which was attributed partly to the quality of sandcrete blocks used for walling units.

Abdullahi (2005) concluded that the aggregate grading of the soils used for the manufacture of sandcrete blocks are within the limit specified by BS 882: 1992 and are therefore suitable for block making but found out that the compressive strength of the sandcrete so produced were below standard in Bosso and Shiroro areas of Minna, this was also supported by Oyetola and Abdullahi (2006). The results of the test carried out by Ewa and Ukpata (2013) also revealed that the compressive strength of sandcrete blocks produced in Calabar block industry are below the minimum requirements by the Nigerian National Building Code 2006, the British Standard and the NIS 87:2000 for load bearing walls. The values of the compressive strength obtained by Ewa and Ukpata (2013), according to them, do not differ much from those obtained in Minna by Abdullahi (2005) and in Abuja, Ota and Umuahia by Anosike and Oyebande 2012.

This, the researcher attributed to the high cost of cement as a binder in the production of sandcrete block being the most essential and expensive constituent which has necessitated the reduction in its quantity in sandcrete block production in order to maximize profit by the commercial producers as a result has adversely affected the quality of the finished product. Ewa and Ukpata (2013) also added that poor curing condition appears to be one of the main factors responsible for this low strength of the blocks. Over the years the city of Lagos has recorded a large number of incessant building collapsed which has resulted into colossal loss of economic investments and loss of lives while several inhabitants were rendered homeless. Sandcrete block is the largest component of every building development, its production is mostly abused as it is produced virtually by all –skilled or unskilled, hence standard compromise is largely expected.

Alimosho LGA is one of the cities that constituted the 20 Local Government structure of Lagos Metropolis, the Local Government is comprises of several emerging settlements which suggests that the area is one of the areas in the metropolis that expresses continuous demand for the use of Sandcrete block for its massive and daily construction of building. It is an attempt to reduce the incidence of building collapsed which has characterized the developed parts of the metropolis that this study was conceptualized. The study is therefore aimed at assessing the quality of Sandcrete blocks in Alimosho Local Government Area of Lagos metropolis using the NIS standard with the view of enhancing the quality and standard of building development in the area necessitated this research work to carry out test in order to check the level of compliance of commercial sandcrete blocks producers in the Alimosho Local Government area of Lagos state.

Related Studies

According to the National Building Code (2006) Sandcrete blocks **"**shall mean a composite material made up of cement, sharp sand and water", the blocks shall be moulded for sandcrete using metal (wood) moulds of 450mm x 225mm x 150mm, 450mm x 225mm x 225mm, 450mm x 225mm x 100mm and are usually jointed by mortar which is a rich mix of sandcrete. The British standard 6073:1981 part 1 defines a block as a masonry unit of larger size in all dimensions than specified for bricks but not exceeding 650mm nor height exceeding either its length or six times its thickness. The Standard Organisation of Nigeria (SON) is the sole statutory organization saddled with the responsibility of determining and regulating the quality of all products in Nigeria. The Nigeria Industrial Standard (NIS) for sandcrete block on its part is a standard reference document developed by SON which prescribes the minimum requirement and uses of Sandcrete blocks and other products including; Quality of materials; Methods and procedure to be applied for production and Testing of the final product in order to ensure compliance to prescribed standard. The first standard for sandcrete block developed in year 2000 is known as NIS 87: 2000 and had been reviewed subsequently in 2004 and 2007.

Materials used in making sandcrete blocks include aggregates, cement and water. However, the Portland cement intended for the production of sandcrete blocks, must adhere to the prescription of both BS 12 and NIS 444-1: 2003. According to NIS (2007), potable water is recommended for use in producing sandcrete blocks. Water absorption and compressive strength are the two major characteristics requirements specified by NIS for testing and verifying the quality of sandcrete blocks. Appearance and dimension are also specified. It is important to note that water absorption precedes compressive strength as the rate of water absorption influences the bond between the constituents, chemicals stability, resistance to abrasion and its specific gravity. Neville 2002 in Anosike and Oyebade defines water absorption as the ratio of the decrease in mass to mass of dry sample $((m_2-m_1)100/m_1$; where m_1 is mass of dry sample, $m_{2\ is}$ mass of wet sample in 24 hours duration. Available methods are batching by volume and by weight. The commonly used method is by volume. However, there are variances in the use of this method because of the relativity of what constitute a full volume to whomever is pushing the wheel barrow usually used or head pan as the case may be.

This implies that whatever the person involved can push or carry will constitute the right volume or weight. NIS 87:2007 specified 1:8 as the mix ration. No doubt for good product to result, machine mixing will be required. Large volume of material are usually involved which will not favor homogeneity and uniformity if mixed with hand. Adding water is usually left to the discretion of the operators and addition in excess of 0.45 Water: Cement ratio will prolong the setting time and result in strength reduction. Commonly used method of compacting among manufacturer is compacting machine. It may just be controlled. The NIS specified curing by water for seven (7) days in a covered area. Materials are required to be stored in appropriate environment to enhance high compressive strength. If materials are stored where wood

particle and grasses mix up with it while batching, product strength will diminish. However in the recent time as revealed in the works of Anosike and Oyebade (2012), production of sandcrete blocks has been at negative variance with the established standard. This portend danger for building development and construction. This study like the previous ones assesses the degree at which production of sandcrete blocks in Alimosho LGA comply with the general standard of production and expands the frontier of knowledge on factors affecting the standard of production in the study area.

Study Area

The study area is Alimosho Local Government Area (LGA) of Lagos state, western Nigeria. The LGA is one of the 774 LGAs in Nigeria and one of the 20LGAS of Lagos state. It comprises a total of six Local Development Areas (LCDAs) namely; Alimsho, Ayobo- Ipaja-Igbogila, Egbe-Idimu-Isheri-Olofin, Igando –Ikotun, Mosan-Okunola –Alhaji Ogun and Agbado-Oke-Odo LCDAs. It exists to the North East end of the state (see figure 1.1). It is the largest LGA in term of its land mass in Lagos Metropolitan area, occupying a total land area of 137.8km^2. Comprises a population of 2,047,026 (Lagos State Government, 2012). The LGA comprises of several emerging settlements and characterized with numerous building construction activities with a total of 324 registered sandcrete block making industries spread across the LCDAs.

MATERIALS AND METHODS

Method was quasi experimental, survey and desk top. A total of three LCDAs representing 50% of the LCDAs in the study area were randomly picked using the ballot box method. The selected LCDAs are Egbe-Idimu –Isheri Olofin, Igando-Ikotun and Ayobo –Ipaja-Igbogila LCDAs. There are total of 242 registred Sancrete block industries in these LCDAs, 24(10%) of these number of industries were picked as observation units using stratified sampling method.The quasi experimental method entails random collection of sandcrete samples from a total of 24 block industries accredited by Block Makers Association of Nigeria, Lagos state branch. Samples collected include the, 450mm x 225mm x 225mm and 450mm x 225mm x150mm sandcrete blocks selected from each manufacturer in the three selected LCDAs. Samples of the aggregates used for the production were also taken for sieve analysis test to check for compliance of grade of aggregate by the NIS standard.

The samples so selected have all been produced more than 28 days before the test and has so been cured naturally by the frequent rainfall during the period under consideration. The mix proportion of 1 part by volume of cement to 12parts by volume of aggregate) was used by all the commercial sandcrete blocks manufacturer as against the standard mix proportion of 1:6 prescribed by NIS 87:2007 and the National Building Code (2006). Granite fine were used as part replacement of sand in some samples selected in a 25% replacement format (25% by volume of sand used). The samples selected were hand mixed and machine vibrated though some were produced manually mixed, rammed into moulds for compaction and smoothed off with a face tool but not selected for the purpose of this study. The selected samples were weighed, crushed and tested for compressive strength using the compression testing machine in accordance with BS 2028 and the National Building Code (2006) which specified that 28 days compressive strength of load bearing walls shall be 1.75N/mm^2. Sieve analysis test was also conducted on the aggregates used for the production of the sandcrete blocks to ascertain the suitability of the aggregate for the blocks production. The survey method entails the use of questionnaire which was administered on the owner of each of the block industries where Sandcrete samples were taken. In all, a total of 24 questionnaires were administers raising queries about the background of the manufacturer, materials of production, production size and capacity, sales and pricing and quality control and regulation and factors affecting production. Data collected were descriptively analyzed and presented with inferences drawn from them. The desktop approach entails review of both published and unpublished literature on the different theme of the study. Such literature includes government publications, rules and gazettes relevant to the themes of the study.

RESULTS AND DISCUSSION

This section discusses results and findings obtained from the quasi experiment and the suryvey. Firstly discussed is the survey report followed by that of the quasi experimental exrcise.

The Respondents

The greater proportion 18 (75%) of the respondents are male, while only 6(25%) are females suggesting that most of the manufacturers of sancrete block in the sampled area are of masculine gender, A total 12(50%) have tertiary education but none of them in related building profession, a total of 8(33%) have secondary and technical education while 4(17%) have primary education. They all live within their areas of operation. Majority of them received informal training in the art of block making.

Production outlay, sources of materials, pricing and distribution

Average production output per day was measured at 350 units per day for the 450mm x 225mm x 225mm (popularly known as the 9inches block) with a standard deviation of 25 and400 units of 450mm x 225mm x150mm (popularly known as the 6 inches block) with a standard deviation of 20. The cost of production and distribution is averagely put at 80% of the sales price. The average distribution price is put at =N-170 and =N= 140 for each of the 450mm x 225mm x 225mm and 450mm x 225mm x150mm respectively giving an average profit margin of 20%. All of the sampled manufactures source their inputs from the local environment and their labor from their immediate environment. 18 of them used mechanized means to produce their sandcrete blocks while 6 produce their sandcrete blocks manually all those that produce theirs have vehicles they use in conveying their products to their respective customer's site while only one of those that produce manually has vehicle for conveying the products to customers 'site.The sampled manufactures identify, transportation cost, raw material cost, government taxes and levies and cost of labor, as factors affecting production cost while atmospheric

condition and their financial status as factors affecting production output size.

Quality of sandcrete blocks and manufactures awareness of existing standard

The qualities of the sandcrete blocks were subject to experimental tests and their results were compared with the Nigeria Standard Organization standard regulation on sandcrete blocks. The result as contained in the discussions below and graphically illustrated in appendix 1 reveals that the various sandcrete blocks obtained in the sampled areas vary significantly away from the required standard prescribed by the standard regulation body in the country –NSO. This conclusion is not surprising because none of the manufactures indicated that they are aware of the existence of any standard regulation for the production of sandcrete blocks.

Sieve analysis

The results of the sieve analysis test carried out on the aggregates used for samples collected showed that the aggregates used for the production of the samples fall within the range of sand fraction in fine, medium and coarse aggregate according to the National Building code specification. The results of the sieve analysis and particle size distribution are shown in Table 2.1 and Appendix 1 respectively.

and the cement paste, the resistance of concrete to freezing and thawing, chemical stability, resistance to abrasion and specific gravity are all influenced by the rate of water absorption of the aggregates. Oyekan and Kamiyo (2008) also posited that the determination of the coefficient of water absorption properties of sandcrete blocks will explain its performance when used in moist or dry environment. The result of the test carried out on the samples to determine the percentage water absorption shows that the samples selected fall below the required 12% water absorption with the closest having 11.21% and the least 3.79% as shown in Table 2..2 and appendix 2.

This is as a result of the presence of granite fine as part of the constituents of the selected samples which according to Oyekan and Kamiyo (2008) makes the samples less permeable for liquid flow which decreases as the percentage of granite substitute for sand increases. This also indicates that there is a good bonding between the cement and aggregates used. Table 2.3 and appendix 3 show the compressive strengths of the selected samples do no measure up to the minimum requirement of 1.75N/mm^2 as stipulated by the National Building Code (2006) neither are the values up to those specified by the NIS 87:2007 of 2.5N/mm^2 for non-load bearing nor 3.5 N/mm^2 for load bearing walls. The 28 days compressive strengths of the samples ranges from 1.28 N/mm^2 to 1.56 N/mm^2 with an average of 1.47 N/mm^2 and 1.35 N/mm^2 for non-load bearing and load bearing blocks respectively.

Table 2.1. Sieve analysis of samples used by various producers

Sample No.	Percentage Passing (%)							
	Sieve (2.36mm)	Sieve (1.18mm)	Sieve (600mcr)	Sieve (425mcr)	Sieve (300mcr)	Sieve (212mcr)	Sieve (150mcr)	Sieve (075mcr)
A	83	68	50	41	32	24	16	10
B	100	95	66	47	31	18	12	10
C	100	100	99	75	55	30	14	10
D	96	84	60	44	31	22	16	12
E	100	99	88	72	46	27	19	18
F	80	61	37	27	19	14	11	9
G	72	58	42	32	23	18	13	9
H	91	74	50	40	31	23	17	13
I	98	91	73	61	46	31	17	7
J	99	90	60	40	21	10	7	---
K	67	58	47	39	31	24	18	13

Source: Field survey and Laboratory test

Table 2.2. Water absorption test on samples collected

Sample No.	Sample No.													
	A		B		C		D		E		F		G	
Sample size (mm)	225	150	225	150	225	150	225	150	225	150	225	150	225	150
Initial weight (g)	2050	1575	1965	1545	1905	1455	2065	1580	2125	1425	2285	1495	2030	1620
Final weight (g)	2255	1725	2155	1680	2090	1640	2110	1705	2240	1735	2365	1585	2185	1780
Diff. in weight (g)	205	150	190	135	185	185	45	125	115	310	80	90	155	160
%age incr.	10.00	9.52	5.66	6.74	9.71	12.71	2.18	7.91	5.41	2.17	5.50	6.02	7.64	9.88

Source: Field survey and Laboratory test

Water absorption analysis

Water absorption test is one of the two major characteristics requirements specified by the Nigerian Industrial Standard (NIS 87:2000) for testing and verifying the quality of sandcrete blocks. According to Neville (2002) as cited in Anosike and Oyebade (2012) the bond between aggregates

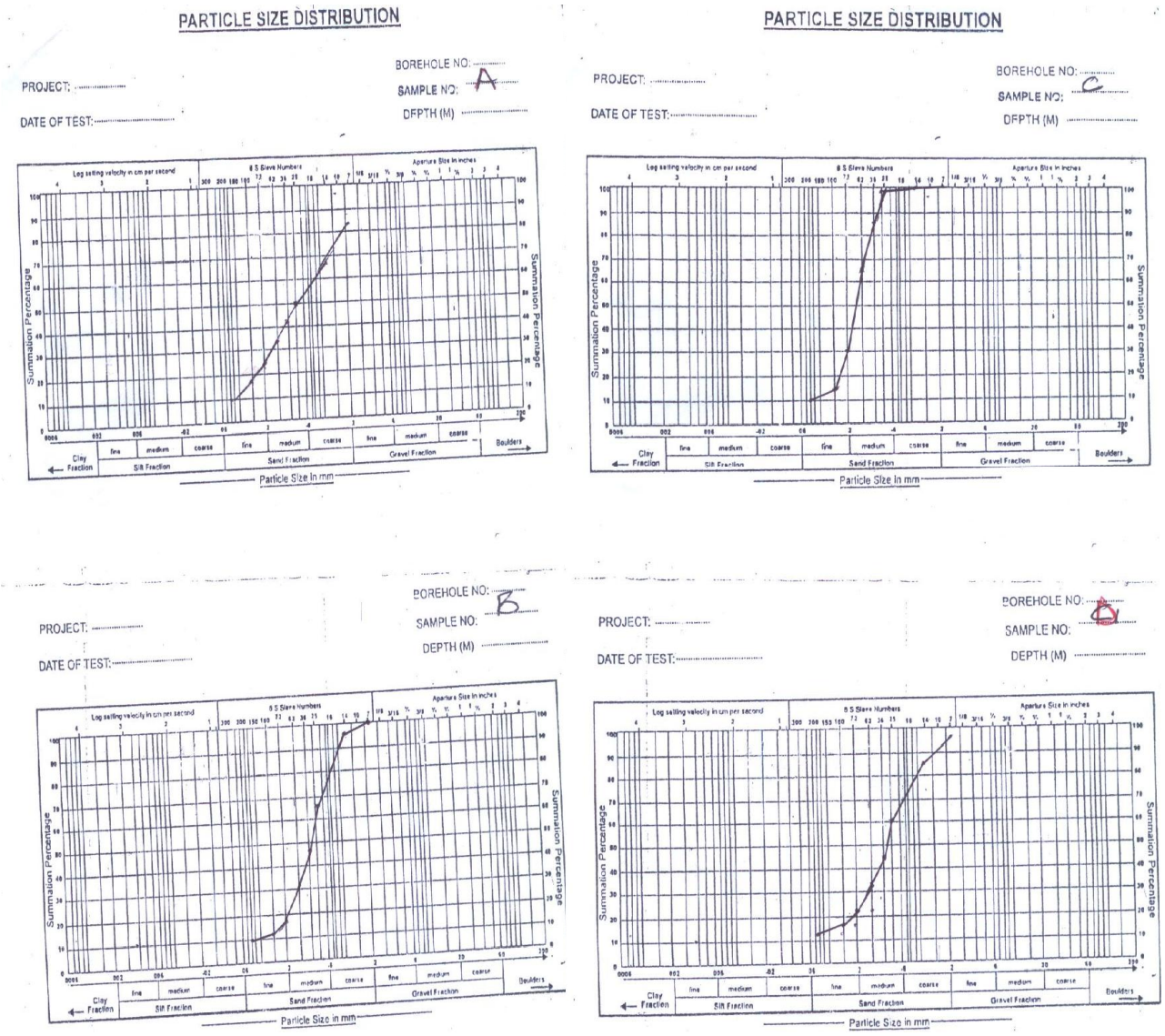
These values are higher than those obtained from studies carried out at Bosso and Shiroro areas of Minna (Abdullahi 2005), Calabar (Ewa and Ukpata 2013) and Ota (Anosike and Oyebade 2012). Though the compressive strength of the samples collected are not up to the minimum standard required but the closeness to the values as compared with tests conducted on samples in other areas within the country can be

Table 2.3. Compressive strength test on samples collected

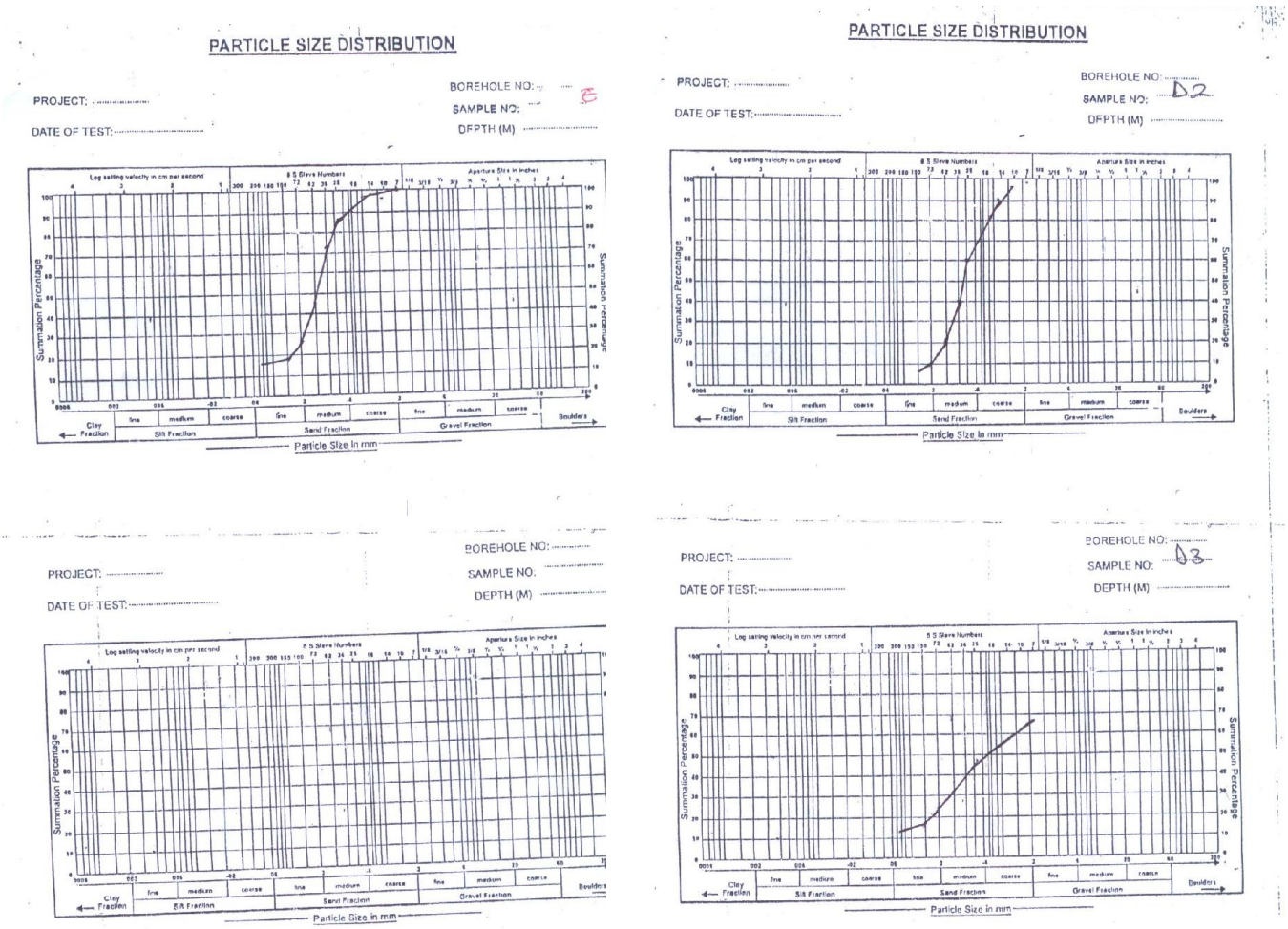
Sample No.	Sample size (mm)	V	Weight		Density (mg/m^3)		Holes Dimension (mm)	Blocks Dimension (mm)	Actual Area (mm^2)	Compressive Load (N/mm^2)		Compressive Strenght (N/mm^2)		Average Strenght (N/mm^2)
			1	2	1	2				1	2	1	2	
	225	9011250	20050	20500	2.22	2.27	170x180x225x2	450x225x225	40050	55000	50000	1.37	1.25	1.31
A	150	4590000	15450	15750	3.37	3.43	170x90x150x2	450x150x150	36900	60000	55000	1.63	1.49	1.56
	225	9011250	19250	18800	2.13	2.08	170x180x225x2	450x225x225	40050	68000	55000	1.65	1.37	1.51
B	150	4590000	15300	14600	3.33	3.19	170x190x150x2	450x150x150	36900	58000	53000	1.57	1.44	1.51
	225	9011250	19600	19050	2.85	2.77	170x180x225x2	450x225x225	40050	105000	118000	1.20	1.35	1.28
C	150	4590000	158004	16250	3.44	3.5	170x190x150x2	450x150x150	36900	58000	55000	1.57	1.49	1.53
	225	9011250	20500	21550	2.98	3.13	170x180x225x2	450x225x225	40050	58000	55000	1.45	1.37	1.41
D	150	9690000	15500	15900	3.04	3.46	170x90x150x2	450x150x150	36900	55000	50000	1.49	1.36	1.43
	225	10541250	20050	21200	1.90	2.01	170x180x225x2	450x225x225	46850	60000	72000	1.28	1.54	1.41
E	150	9690000	22850	22900	4.98	4.99	170x90x150x2	450x150x150	36900	48000	52000	1.30	1.41	1.36
	225	6120000	22850	22800	3.73	3.72	170x180x225x2	450x225x225	87650	110000	108000	1.25	1.23	1.24
F	150	9690000	22850	21580	2.36	2.23	170x90x150x2	450x150x150	36900	52000	55000	1.40	1.49	1.45
G	225	6120000	20300	21220	3.32	3.48	170x180x225x2	450x225x225	87650	108000	115000	1.23	1.31	1.27

Source: Field survey and Laboratory test

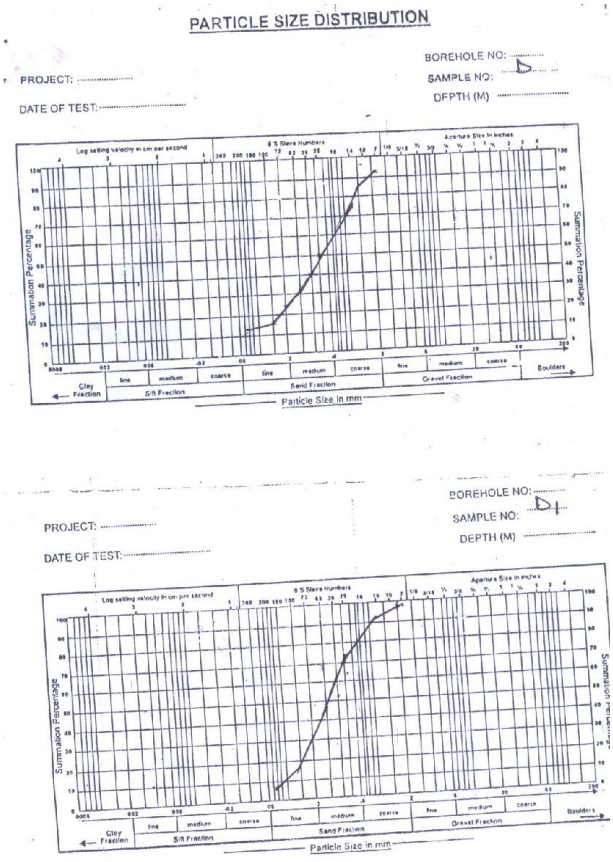
Appendix 1: Sieve analysis 1



Appendix 2: Water absorption analysis 1



Appendix 3: Compressive strenght analysis 1



attributed to the substitution of sand with granite fine up to 15% in the constituents of the mix, which increases the compressive strength of sandcrete blocks (Oyekan and Kamiyo 2008)

Conclusion and recommendations

The paper has shown that sampled of sandcrete blocks produced in Alimosho LGA is generally substandard in nature and varies significantly away from the prescribed standard. It is therefore recommended that the appropriate agency- NSO should regularly carry out routine check on the existing sandcrete block manufacturers. Education and regular enlightenment of the sandcrete block manufactures and their consumers should be carried out on regular basis. Standard requirements of this product should be published and circulated among the concerned stakeholders. Manufactures should be made to conspicuously display the standards in their respective locations. These will minimize the rate at which the manufacturers compromise standard in the production of sandcrete blocks.

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