

Brickyard Practices in Nigeria: Improving Curing Techniques for Sandcrete Blocks.

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ABSTRACT: Structural failure and building collapse are common phenomena in modern Nigeria. As the pressure on housing increases with the population, the need to procure cheaper alternatives and improve on delivery time for construction are bearing heavily on quality. This is more evident in the erection of the new buildings. Since most of the modern buildings are framed in reinforced concrete, the low compressive strength of the blocks used for such buildings do not cause immediate failure. However when the structures are exposed to extra loading and use, they start to fail. Cracks, deflections, excessive moisture penetration and low bearing capacity are the bane of these structures erected with the sandcrete blocks.

This study was carried out to see how the average strength of sandcrete blocks produced in the Lagos area can be increased. The study concentrates on hitherto abandoned curing techniques to see how the present practices affect the strength of sandcrete blocks produced daily in Lagos area.

Keywords: Comprehensive strength, curing, brickyard, setting, drying, sandcrete blocks.

INTRODUCTION.

A lot of studies have been carried out on the prevalence of very low quality sandcrete blocks in Nigeria. **Abudullahi, M. [2005]** carried out comprehensive strength analysis of sandcrete blocks in Bosso and Shiroro areas of Minna, Niger state and concluded that selection of materials and curing be improved in future studies. This was against a backdrop of poor results of comprehensive strength tests on blocks in the area. The figures obtained ranged between 0.11 N/mm^2 and 0.75 N/mm^2 . **Wenapere, D. A. and Ephrain, M. [2009]**

concluded that the comprehensive strength of sandcrete blocks increased with the water – cement ratio for all mixes tested. **Ewa, D. E. and Ukpata, J. O. [2013]** posited that commercial block production in Calabar fall far below accepted National and International standards and may be the leading cause of structural failure in smaller buildings. The comprehensive strength of samples taken In Calabar area ranged between 0.23 N/mm^2 and 0.58 N/mm^2 .

Measured strength of commercially available sandcrete blocks in Nigeria was found

to be between 0.5 N/mm² and 1.0 N/mm², which is well below the 3.5 N/mm² that is legally required. [Wikipedia, sandcrete 2015]

Eight well established brickyards were visited and samples taken and tested. The brickyards are located in Ikeja, Lagos state, Ojodu, Lagos state and Opic/Isheri North, Ogun state. Despite having high reputation and being major producers of supposed quality sandcrete blocks in the area, the best result was 1.1 N/mm² at 28 days after curing. If we leave out the large construction companies who produce sandcrete blocks and stock bricks for their own projects, we can conveniently posit that all commercial sandcrete blocks in Lagos area are substandard. The company that produces the best sandcrete block tested sells at about 80% higher than the others and will not deliver the blocks within the higher price. Buyers will have to arrange for transport separately as patronage is high from all parts of Lagos.

All brickyards visited were told to cure samples before they were collected from them on the 8th day for further curing.

COMMON CURING PRACTICES.

Curing is generally neglected in most brickyards in Lagos. The general practice is to mould the blocks and leave out in the sun to dry. At best, the operatives spray cold water on the blocks the next morning after moulding and believe the block is cured. This may be as a result of the ignorance that persists in the industry. This is also noticeable in the paving stone industry. Curing as a brickyard procedure is lacking in the industry.

The general practice is represented as follows

DAY	ACTIVITY
1	Blocks are moulded on pallets and laid in the sun to dry.
2	Blocks are sprayed with water as the only curing procedure. Otherwise blocks are allowed to dry out more and delivery to site commences
3	Blocks are stacked to create space for the production since they can easily be moved without breaking, they are sprayed with cold water in the stacked position in the morning. Sales continue
4	Sales continue from the stacking position until all the blocks are sold out

The period between moulding and sale is largely determined by demand for the blocks. Immediately the blocks are produced, the brickyard is ready to deliver once the blocks are dry enough to be transported. It is generally believed that wetting the blocks in the mornings will suffice for curing. The essence of curing is lost in the quest to satisfy demand and save production costs.

The prevailing economic conditions do not favour extensive warehousing of goods produced small scale industries as it ties down capital in the face of very high cost of funds. This may be affecting the turnaround period for investment in the brickyard recurrent costs. Waiting for a whole month to allow blocks to cure before selling may put too much pressure on the proprietors. The net effect is that over the years, brickyard operators have been reducing their "curing period" since the construction boom of the early 1980s when the demand for construction materials stretched far beyond the supplies as Federal and State Governments tried to outpace each other in

mass housing provision. The trend, which brought about very poor brick quality and brickyard practices is yet to be reversed.

THE CURING PROCESS.

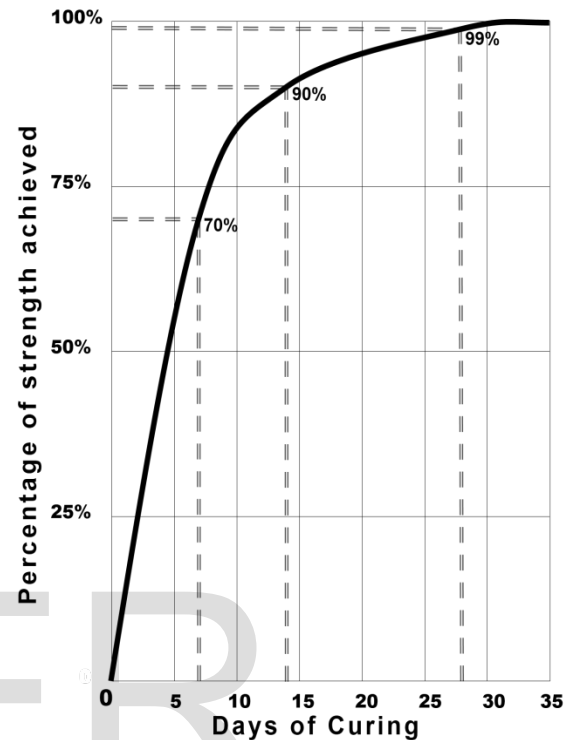
Curing is the process in which concrete is protected from loss of moisture and kept within a reasonable temperature range [Wikipedia, curing, 2015]. The process with necessarily result in increased strength and decreased permeability.

In the sandcrete blocks, we have three constituents. Sand [silica], cement and water. The sand is inert while the cement which is supplied inert becomes active once mixed with water. The reaction of water and cement produces a bonding chemical while giving off heat. The heat helps to promote further

reactions up till an optimum temperature of about 120°F [About 46°C] for the first day of curing [Paul klieger, Portland cement Association Research Bulletin 103, 1991]. Subsequently it reduces in a graduating scale till get it gets to about 73°F or 23°C on the 28th day.

Once the water or in this case the moisture in the mix dries out, the chemical reaction stops and cannot be resumed by addition of more water. Curing helps the mixture to attain about 70% of the strength in 7 days and 85% in 14 days. At 28 days, 99% of the strength is already attained. It is thus most important that sandcrete blocks are not allowed to dry out within the first seven days.

Compressive strength of Sandcrete blocks



TEST CURING CARRIED OUT IN MAY/JUNE 2014.

Generally the rule of thumb is to keep the blocks covered after setting to keep the moisture and retain heat. The blocks should then be sprinkled with water daily to introduce more water for reaction and allow excess heat to dissipate, then covered back for the chemical reaction to continue with retained heat.

Exposing the blocks will result in moisture loss and heat loss.

A roadside brickyard was approached in Alagbole, Ogun state to assist in a test case. 3 samples of sandcrete blocks were bought and subjected to compressive tests at Lagos State Materials Testing Laboratory in Ojodu. The results were as follows.

Sample	Comprehensive strength
1	0.22 N/mm ²
2	0.25 N/mm ²
3	0.16 N/mm ²

The samples were those that were made with river sharp sand only. The mix of the concrete and the curing process employed by the brickyard was not considered. The proprietor of the brickyard was encouraged to prepare 10 samples of 6" sandcrete blocks using his normal mix for an experiment. After moulding the blocks, they were laid to set, next

to the moulding machine which was in a covered area for six hours before they were covered with tarpaulin. The next morning, an operative was on hand to wet the blocks and cover them back. On the third day they were moved to Ikeja,, stacked together and the process continued under a tree with enough foliage. After the 14th day they were left out in the sun to dry out. Three of the samples were tested after 28 days and they all had a comprehensive strength of 1.78 N/mm²

INFERENCE.

From the little experiment carried out it is obvious that brickyard procedures are the major culprits in the low comprehensive strength of Nigerian sandcrete blocks. By observing proper curing procedure, the compressive strength in the test case was increased from 0.2 N/mm² to 1.8 N/mm². The reality is that the further curing carried out after the initial samples were collected from the brickyards was ineffective as the chemical bonding of the constituents had ceased. Other

factors like sand quality, cement quality, water purity and presence of dissolved salts in the water will also affect the final strength of the blocks. These factors all put together do not account for as much damage as our brickyard practices do to Nigerian sandcrete block industry.

PROPOSAL.

For better sandcrete block quality, the following proposals may be useful for the brickyards.

1. Nigerian brickyards are mainly open plots. It may be better to have a roofed shed or pavilion for block moulding and curing. Afternoon ambient temperatures in Western Nigeria will hardly go below 25°C and may approach 38°C at certain times of the year. When the freshly laid blocks are directly exposed to such temperatures, they will never get to the optimum temperature for the first day. If they are covered, the Mean Radiant Heat Gain and the Direct

Short Wave Solar Radiative Component trapped within the covered blocks will far exceed the 46°C optimum curing temperature and result in lower quality sandcrete blocks. Except during cold weather, the blocks should not be cured under the sun.

2. A mandatory 7 days curing period should be encouraged among the brickyards. This will ensure that the blocks attain at least 70% of their potential strength before being sold.
3. A massive enlightenment campaign should be carried out by the Builders Institute and Ministry of Works to encourage better brickyard practices

CONCLUSION.

While research is on going on aggregate sizes for block making [**Abdullahi, M. 2005**], use of quarry dust for making sandcrete blocks [**Ikechukwu, U. F. 2012**], effects of admixtures on the comprehensive strength of blocks [**Omopariola, S. S. 2014**],

use of rice husks and other materials in brick making [**Oyekan, G. L. and Kamiyo, O, M. 2011**], more research should also be carried out on the processes for making the blocks especially the curing processes. The economic realities in the third world necessitate a slightly modified approach to problem solving. Solutions proffered to technical and production problems must be adapted to the socio-economic realities that permeate the environment. The range of compressive strength obtained from random sampling of brickyards in Nigeria will never occur in developed economies. The brickyard processes are also at variance with all known formal procedures. There is need to get the right and adaptable processes for the socio-economic environment.

Once the process is properly outlined and the right materials are used, sandcrete block compressive strength will definitely improve.

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