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COMPARATIVE EVALUATION ON PHYSICAL PROPERTIES OF SANDCRETE BLOCKS USED IN BUILDING CONSTRUCTION IN ANAMBRA STATE

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ABSTRACT

Increasing concern has been raised regarding the declining quality and variability in the physical properties of sandcrete blocks employed in building construction across Anambra state, as frequent structural failures and poor housing durability highlights the need to evaluate the levels of standardization in block production across different locations. Therefore, this study evaluates the physical properties of sandcrete blocks employed in building construction across Anambra State, Nigeria. A quantitative experimental method was used involving dimensional measurement focusing on nine samples (A–I) comprising both machine-moulded (A–F) and hand-moulded (G–I) blocks of varying sizes and types (225mm hollow, 150mm hollow, and 150mm solid), density determination, water absorption, and thermal conductivity tests on nine sandcrete block samples following NIS, BS, and ASTM standard procedures. The findings revealed that machine-moulded sandcrete blocks demonstrated higher density, lower water absorption, and better thermal insulation than hand-moulded ones, meeting most Nigerian (NIS 87:2007) and British Standard (BS EN 771-3:2011) minimum requirements. Only machine-moulded samples B and C satisfied the BS minimum density (2000 kg/m³), while all hand-moulded blocks fell below NIS thresholds. All blocks, however, remained within the acceptable water absorption threshold of 12%. These differences stem from superior compaction and curing in machine production. Higher density correlated with improved strength and reduced heat transfer, enhancing structural performance and energy efficiency. The findings highlight the need for mechanized production, strict mix control, and proper curing to achieve durable, thermally efficient blocks suitable for structural use in Nigeria.

KEYWORDS: *Anambra State, Building Construction, Physical Properties, Quality Assessment, Sandcrete Blocks.*

INTRODUCTION

The construction industry remains a major contributor to Nigeria's economic development, accounting for a significant share of the nation's gross domestic product (Oloyede et al., 2020). In Anambra State, as in most parts of Nigeria, sandcrete blocks are the predominant building material used in residential, commercial, and institutional projects (Nwankwo et al., 2022). They are composite materials consisting of cement, sand, and water, moulded into standard shapes and sizes (Afolayan et al., 2021).

Their popularity stems from affordability, ease of production, and availability of raw materials (Ameh & Okechukwu, 2016). However, concerns persist about the quality and structural reliability of blocks used in local construction. Variations in material composition, curing methods, and manufacturing standards have been linked to poor durability and inconsistent strength (Chukwudi & Nwankwo, 2019).

Numerous researchers have examined the physical characteristics of sandcrete blocks, focusing on compressive strength, density, and water absorption (Olaniyan et al., 2021; Ogundipe et al., 2022). The consensus among scholars is that these properties are heavily influenced by the mix ratio, quality of materials, and curing regime (Olalusi & Adeoye, 2017). Improper mixing or inadequate curing significantly reduces compressive strength, rendering blocks unsuitable for load-bearing structures (Ibe & Okonkwo, 2019). Such deficiencies are common in many locally manufactured blocks across southeastern Nigeria.

Aggregate quality also plays a crucial role in determining block performance. Chukwudi and Nwankwo (2019) emphasized that the source and cleanliness of sand influence both density and porosity. Ugwu and Nwachukwu (2018) observed that unwashed or poorly graded river sand results in blocks with high porosity and reduced strength. Similarly, Eze and Anyaoku (2020) found that the presence of clay or organic impurities in aggregates compromises bonding and water resistance. These findings indicate that the prevalent local sourcing practices in Anambra State, which often ignore proper aggregate preparation, contribute significantly to the inconsistency in block quality.

Socio-economic constraints further exacerbate these issues. Rising cement costs compel many producers to adulterate mixtures by reducing cement content or substituting inferior materials, directly affecting structural integrity (Nwosu & Okafor, 2018). The largely informal nature of the block-making sector limits regulatory oversight, while lack of technical expertise hinders quality control (Chinedu & Onwuegbu, 2021). These economic and institutional weaknesses collectively undermine the safety and durability of buildings within the state.

The rising demand for housing and infrastructure in Anambra State has led to the proliferation of small-scale block-making enterprises, many of which operate informally and fail to comply with regulatory requirements. Studies have revealed that several blocks produced locally do not meet the minimum compressive strength of 3.5 N/mm² specified by the Nigerian Industrial Standard (NIS 87:2007), thereby posing risks of structural instability (Ezeokonkwo & Okereke, 2020). Despite these regulations, enforcement remains weak, allowing the circulation of substandard materials in the building sector. Despite widespread use, many sandcrete blocks produced and utilized in Anambra State fall short of established performance standards. Irregularities in mix proportions, aggregate quality, and curing practices continue to yield products with low density and inadequate compressive strength, threatening structural stability (Chukwudi & Nwankwo, 2019; Eze & Anyaoku, 2020). Although prior studies have examined sandcrete block properties across Nigeria, few have provided a comprehensive comparative evaluation of the physical properties of blocks produced in different parts of Anambra State. This lack of localized data creates a knowledge gap concerning material performance and compliance with standards under varying production conditions. Therefore, this study aims to evaluate the physical properties of sandcrete blocks used in Anambra State, focusing on density, water absorption, and thermal conductivity. The findings are expected to provide empirical evidence for improving production standards and ensuring that sandcrete blocks used in the region meet the minimum quality and safety requirements prescribed by the Nigerian Industrial Standards.

LITERATURE REVIEW

Material Properties of Sandcrete Blocks

The performance of sandcrete blocks is mainly governed by their material composition and microstructural characteristics. Critical parameters such as density, compressive strength, porosity, and thermal conductivity determine their quality and serviceability. Recent studies confirm that partial substitution of cement with industrial or agricultural residues like rice husk ash, cashew nut shell ash, and iron filament dust improves strength, impermeability, and density when applied judiciously. However, excessive substitution increases void content, weakening interparticle bonds and reducing load-bearing capacity (Usman et al., 2023).

Density strongly correlates with compressive strength and water absorption. Denser blocks resist cracking and moisture ingress, ensuring long-term durability (Ibrahim & Yakubu, 2021). Other studies show that compaction level and aggregate gradation greatly influence density and, by extension, thermal conductivity. Mechanically compacted blocks consistently display better cohesion and insulation performance than manually moulded ones (Oladipo et al., 2022).

Thermal efficiency is another vital aspect. High-density blocks limit heat transfer, maintaining thermal comfort in buildings located in tropical regions. To achieve optimal material balance, researchers emphasize controlling the water/cement ratio, ensuring proper curing, and maintaining aggregate cleanliness These practices ensure strong, dimensionally stable, and energy-efficient sandcrete blocks suitable for structural use.

Regulatory Standards

The physical composition of sandcrete blocks is guided by specific regulatory standards to ensure durability and strength. The Nigerian Industrial Standard (NIS 87:2007) prescribes a mix ratio of one part cement to six parts sharp, well-graded sand by volume, with clean water used to form a workable mix that must achieve at least 3.5N/mm² compressive strength after curing (Standards Organization of Nigeria, 2007). Similarly, the British Standard (BS EN 771-3:2011) emphasizes controlled cement–sand–water ratios and proper aggregate grading to ensure structural reliability (British Standards Institution, 2011).

According to these frameworks (see **Table 1**), the minimum density for load-bearing blocks under NIS is 1920 kg/m³, while BS allows 1500–2100 kg/m³ depending on block type. NIS restricts water absorption to a maximum of 12%, and BS to 16%, while acceptable thermal conductivity ranges from 0.5–1.0 W/m·K (NIS) and 0.35–1.2 W/m·K (BS). Both standards underscore that poor curing, incorrect ratios, or low compaction can compromise block integrity.

Regulatory compliance remains a challenge in many local markets, as field reports show that numerous blocks still fail to meet NIS benchmarks (Quality Assessment of Commercial Sandcrete Blocks, 2022). Mechanized production consistently produces conforming blocks, while manual producers often deviate due to inadequate supervision or lack of training. Scholars therefore recommend updating the NIS to include sustainability parameters, energy efficiency metrics, and traceable production methods.

Table 1. Physical Properties of sandcrete blocks

Parameter	NIS 87:2007 Specification	BS EN 771-3:2011 Specification
Common Block Sizes (mm)	100 × 225 × 450 150 × 225 × 450 225 × 225 × 450 (± tolerances)	100 × 215 × 65 102.5 × 215 × 65 Others per modular units (±5 mm)
Length Tolerance (mm)	±10 mm	±5 mm
Width/Height Tolerance	±5 mm	±5 mm
Density (kg/m³)	≥ 1920 kg/m³ (for load-bearing blocks)	1500–2100 kg/m³ (depending on category)
Water Absorption (%)	≤ 12% by weight (24 hrs immersion)	≤ 16% by weight
Thermal Conductivity (W/m·K)	0.5 – 1.0 W/m·K (approx., varies by density & moisture)	0.35 – 1.2 W/m·K (approx., varies by density & moisture)

Source: NIS (NIS 87:2007).

Quality Issues and Trends

Persistent quality variations in sandcrete block manufacturing continue to raise structural safety concerns. Inconsistent mix proportions, poor compaction, and inadequate curing remain the most critical causes of failure. Many local producers prioritize profit margins over standard compliance, leading to blocks with low density and high-water absorption. These shortcomings mirror earlier findings that hand-moulded blocks often exhibit irregularities and insufficient strength compared to mechanized alternatives (Oladipo et al., 2022).

Recent developments (Oladipo et al., 2022) show gradual improvements through mechanization and in-plant quality control. Mechanically compacted blocks yield improved particle bonding and dimensional uniformity, enhancing strength and durability. Sustainability-driven research now focuses on incorporating industrial and agricultural waste materials such as fly ash, rice husk ash, and iron filament dust to reduce carbon footprints while maintaining mechanical integrity.

Emerging trends emphasize continuous testing and certification-based systems to standardize production. Scholars advocate for automated monitoring of density, compressive strength, and water absorption as part of national building quality audits. Integrating sustainability and performance assurance will support a resilient, energy-efficient construction sector across Nigeria and other developing economies.

MATERIALS AND METHODS

Materials

The materials used for this study include nine sandcrete block samples labelled A to I, collected from different block manufacturing sites across Anambra State.

Samples A, B and C are 225mm hollow blocks, sample D is 150mm hollow, samples E and F are 150mm solid and were produced using machine moulding while samples G to I were hand moulded where sample. G is 225mm hollow, H is 150mm hollow and I is 150mm solid. Other materials and equipment used include: a digital weighing scale (0.01 kg sensitivity), a measuring tape (steel, 1 mm accuracy), a thermostatic oven (for drying), a water bath, a laboratory thermometer, and a thermal conductivity measuring device (heat flow meter apparatus or equivalent).

Methods

Size (Dimensional Measurement): Each block sample was measured for length, width, and height using a calibrated steel measuring tape. Measurements were taken at three different points on each dimension (top, middle, and bottom) to account for irregularities, and the average value was recorded. These were compared against NIS and BS standard tolerances.

Density Determination: Each block was weighed in air using a digital weighing scale to determine its mass. The volume was calculated using the average measured dimensions (Length × Width × Height). The density was then computed using the formula:

$$Density = \frac{Mass(kg)}{Volume(m^3)} \quad \text{equation (1)}$$

Water Absorption Test: Blocks were oven-dried at 105°C for 24 hours and then cooled to room temperature in a desiccator. The dry weight (W_1) was recorded. Each block was then fully immersed in water for 24 hours, removed, wiped gently to remove surface water, and reweighed to get the wet weight (W_2). Water absorption was calculated using the formula:

$$Water\ Absorption\ (\%) = \frac{W2 - W1}{W1} \times 100 \quad \text{equation (2)}$$

Thermal Conductivity Test: Thermal conductivity was determined using a heat flow meter apparatus, following standard procedures (e.g., ASTM C518 or ISO 8301). Each block sample was cut to the required flat dimensions and placed between the hot and cold plates of the apparatus. The thermal conductivity (λ) was automatically calculated by the device based on the heat flow rate, temperature difference, and block thickness.

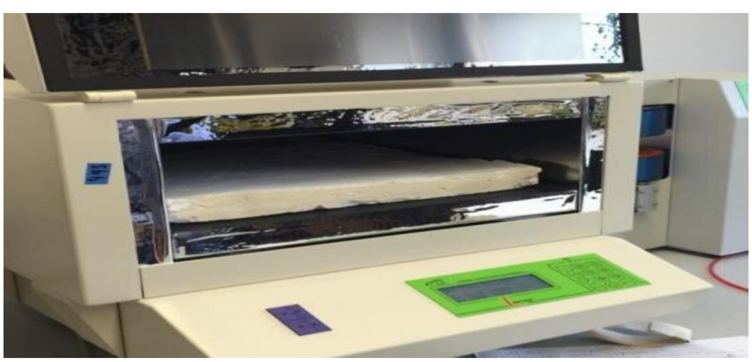

Plate 1: *Heat flow meter*

This method allowed for consistent and comparative analysis of the physical properties of both machine- and hand-moulded sandcrete blocks, providing data relevant to construction quality assessment in Anambra State.

RESULTS AND DISCUSSION

This section discusses the result of the physical properties of the sandcrete blocks. The samples A to I were experimented on and results below.

Table 2. Result of physical properties of sandcrete blocks used in Anambra state

Sample	Mould Type	Avg. Size (mm)	Density (kg/m ³)	Water Absorption (%)	Thermal Conductivity (W/m.K)
A	Machine	230 × 230 × 460	2024	8.0	0.69
B	Machine	226 × 226 × 459	2120	6.0	0.72
C	Machine	225 × 225 × 450	2049	8.0	0.75
D	Machine	150 × 225 × 450	1741	12.0	0.68
E	Machine	160 × 230 × 450	1877	9.0	0.71
F	Machine	155 × 230 × 450	1931	7.0	0.73
G	Hand	224 × 225 × 448	1870	10.0	0.85
H	Hand	148 × 220 × 446	1819	6.0	0.83
I	Hand	152 × 226 × 453	1765	7.0	0.88

Source: *Researcher's Field Survey (2024)*

Where;

- Sample A – 9 inch (225mm) hollow block (machine compacted)
- Sample B – 9 inch (225mm) hollow block (machine compacted)
- Sample C – 9 inch (225mm) hollow block (machine compacted)
- Sample D – 6 inch (150mm) hollow block (machine compacted)
- Sample E – 6 inch (150mm) solid block (machine compacted)
- Sample F – 6 inch (150mm) solid block (machine compacted)
- Sample G – 9 inch (225mm) hollow block (hand compacted)
- Sample H – 6 inch (150mm) hollow block (hand compacted)
- Sample I – 6 inch (150mm) solid block (hand compacted)

Discussion of results

The table (see **Table 2)** presents comprehensive data on the physical properties of nine sandcrete block samples produced using two different moulding techniques: machine and hand moulding. Machine-moulded samples (A–F) exhibited a wide range of average sizes but were generally more uniform compared to the hand-moulded blocks (G–I). In terms of density, machine-moulded blocks recorded values ranging from 1741 to 2120 kg/m³, with sample B having the highest density and sample D the lowest. Conversely, hand-moulded blocks showed lower density values ranging from 1765 to 1870 kg/m³, which may be attributed to less compaction during production. Water absorption was notably higher in some samples, with sample D reaching 12.0%, while the lowest value observed was 6.0% in samples B and H. Interestingly, thermal conductivity values varied significantly, with machine-moulded blocks showing lower thermal conductivity (0.68 to 0.75 W/m.K), whereas hand-moulded blocks had higher values (0.83 to 0.88 W/m.K). This implies that machine-moulded blocks may offer better thermal insulation due to their denser and more compact nature. Overall, the data suggests that machine-moulded blocks are generally of higher quality in terms of density and thermal performance than hand-moulded ones.

Comparative Review with NIS and British Standards

When compared to the Nigerian Industrial Standard (NIS 87:2007) and the British Standard (BS EN 771-3:2011), the minimum required dry density for load-bearing sandcrete blocks is 1920 kg/m³, and the maximum water absorption limit is 12%. The British Standard (BS 6073: Part 1:1981), which provides more stringent criteria, specifies a minimum density of 2000 kg/m³ for structural-grade blocks. Based on these standards, only machine-moulded samples B (2120 kg/m³) and C (2049 kg/m³) fully meet the BS density requirement. Meanwhile, samples A, B, C, and F (1931 kg/m³) meet the NIS minimum density. Hand-moulded blocks (samples G, H, and I), despite being within the acceptable water absorption limits (all ≤ 10%), fail to meet the NIS density threshold, rendering them potentially unsuitable for structural applications. Thermal conductivity is not explicitly covered by either standard, but the lower values observed in machine-moulded blocks suggest better thermal performance. This analysis highlights the variability in block quality and underscores the advantage of using mechanized methods to produce blocks that meet or exceed established standards.

Influence of Density, Thermal Conductivity, and Production Factors

The physical characteristics of sandcrete blocks are crucial indicators of their strength, durability, and energy efficiency. The results in Table 2 show considerable variation in density and thermal conductivity among the samples, reflecting differences in compaction, curing practice, and aggregate composition. The machine-moulded blocks consistently recorded higher densities (1741–2120 kg/m³) than their hand-moulded counterparts (1765–1870 kg/m³). This can be attributed to the uniform vibration and pressure applied during machine compaction, which ensures better particle packing and reduced voids. Similar findings were reported by Okafor and Eze (2019) and Oladipo et al. (2022), who observed that mechanical compaction improves block integrity by minimizing entrapped air and enhancing inter-particle bonding.

Density has a direct relationship with compressive strength and load-bearing capacity. Blocks with higher densities, such as samples B and C, are more capable of supporting structural loads and resisting weathering effects. In contrast, low-density units like sample D may exhibit reduced mechanical performance, leading to cracking or deformation under sustained stress. Studies by Abdullahi and Musa (2021)) confirm that insufficient compaction and improper mix ratios often yield porous blocks with weak structural characteristics.

Thermal conductivity values ranged from 0.68 to 0.88 W/m·K, indicating that block density also influences heat transmission. Machine-moulded blocks displayed lower conductivity values, implying better insulation performance compared to hand-moulded ones. This outcome is consistent with Aliyu et al. (2020), who reported that denser sandcrete reduces air permeability, thereby minimizing heat flow through walls. Practically, this means that walls built with properly compacted, machine-moulded blocks can maintain more stable indoor temperatures, lowering the energy demand for cooling — an important consideration in tropical regions like Anambra State.

Differences in water absorption (6–12 %) further highlight the impact of curing methods and aggregate quality. Blocks with high absorption, such as sample D, likely underwent inadequate curing or contained coarse aggregates with poor gradation. Ibrahim and Yakubu (2021) emphasized that continuous moist curing for at least seven days enhances cement hydration, leading to denser microstructures and reduced permeability. Similarly, (Oladipo et al., 2022) noted that the use of clean, well-graded aggregates contributes to stronger particle interlock and minimizes void formation.

From a production standpoint, improving block quality requires stricter control of the mixing ratio, proper grading of sand, and adherence to standard curing practices. Mechanization should be encouraged, as it produces uniform compaction and consistent block sizes that meet NIS 87:2007 and BS 6073 specifications. Regular quality monitoring, moisture regulation, and the introduction of supplementary materials such as fly ash or rice husk ash can further enhance density while reducing thermal conductivity.

Overall, the findings underscore that density and thermal behavior are governed not merely by material composition but also by workmanship and process efficiency. Ensuring adequate compaction, using clean aggregates, and maintaining proper curing conditions will significantly enhance the structural reliability and thermal comfort of sandcrete blocks produced within Anambra State and beyond.

CONCLUSION AND RECOMMENDATIONS

Conclusion

The findings of this study reveal significant differences in the physical properties of sandcrete blocks based on moulding method and block type used across Anambra State. Machine-moulded blocks consistently outperformed hand-moulded ones in terms of density and thermal conductivity, indicating better compaction and structural efficiency.

While all samples met the maximum water absorption limit set by Nigerian and British standards, only a few machine-moulded blocks met the required density benchmarks, with hand-moulded blocks generally falling short.

Recommendations

These results point to the need for stricter quality control in block production, particularly for hand-moulded units, and promote the adoption of mechanized block manufacturing as a standard practice. It is therefore recommended that Standards Organization of Nigeria (SON) and Anambra State Building Control Departments should strengthen the enforcement of quality standards in sandcrete blocks. Also, manufacturers should adopt standardize mix ratios, proper curing methods, and regular quality testing to ensure durability and safety in construction projects across Anambra State. Furthermore, future research should expand the scope of investigation to include chemical composition and microstructural characteristics of sandcrete materials across other States for comparative analysis. additional research is also necessary to explore the potentials of alternative local materials or industrial waste (like maize straw, rice husk and straw, raffia palm fibres) to increase strength and sustainability of sandcrete blocks in Nigeria's construction industry.

REFERENCES

Abdullahi, M., & Musa, S. K. (2021). Influence of compaction and curing on the mechanical performance of sandcrete blocks. *Journal of Building*

Materials and Environment, 9(3),54–62.

Adejimi, A. O., *et al*. (2020). Quality assessment of sandcrete blocks produced in Ilorin metropolis, Nigeria. *Journal of Building Engineering*, 32, 101744.

Afolayan, J. O., *et al*. (2021). Investigation on the properties of sandcrete blocks produced in Osun State, Nigeria. *Journal of Construction Engineering and Management, 147*(5), 04021043.

Aliyu, H. A., Bello, T., & Dangana, U. (2020). Thermal efficiency of machine-compacted sandcrete blocks in hot climates. *International Journal of Construction Research*, 12(2),115–128.

Ameh, John M., & Okechukwu U. Ogu. (2016). Construction Materials and Testing: A Nigerian Perspective. Lagos: Elite Publishing.

British Standards Institution. (2011). BS EN 771-3: Specification for Masonry Units – Part 3: Sand lime and Calcium Silicate Masonry Units. BSI.

Chinedu, K. C., & Onwuegbu, E. J. (2021). Challenges Facing Informal Block Production in Southeastern Nigeria. *Journal of Construction Management,* 12(3), 75–82.

Chukwudi, A. C., & Nwankwo, I. N. (2019). Evaluation of Fine Aggregates Used in Sandcrete Block Production in South-Eastern Nigeria. *Nigerian Journal of Civil Engineering and Construction Technology,* 5(2), 50–58.

Eze, C. A., & Anyaoku, E. C. (2020). Effect of Aggregate Contamination on Sandcrete Block Quality. *International Journal of Civil Engineering Research*, 7(1), 60–67.

Ezeokonkwo, J. U., & Okereke, O. A. (2020). Compressive Strength Assessment of Commercial Sandcrete Blocks in South-East Nigeria. *Journal of Building Performance*, 8(1), 110–120.

Ibe, K. N., & Okonkwo, P. C. (2019) Influence of Curing Duration on Sandcrete Block Strength. ” *Nigerian Journal of Engineering Science*, 9(2), 85–92.

Ibrahim, A., & Yakubu, J. B. (2021). Effect of curing regime on the physical properties of sandcrete blocks. *West African Journal of Engineering*, 28(4), 89–98.

Nigerian Industrial Standards (NIS 87:2007). Standard for Sandcrete Blocks. Standards Organization of Nigeria (SON), 2007.

Nwankwo, C. O., *et al*. (2022). Assessment of sandcrete block production in Awka, Anambra State, Nigeria. *Nigerian Journal of Engineering, 28*(1), 1-8.

Nwosu, J. O., & Okafor, T. I. (2018). Economic Constraints Affecting Block Production Quality in Nigeria. *African Journal of Construction Economics*, 5(10), 98–105.

Ogundipe, O. M., *et al*. (2022). Experimental investigation on the compressive strength of sandcrete blocks. *Journal of Building Engineering*, 45, 102731.

Oladipo, K. A., Adewale, T. O., & Idowu, R. L. (2022). Influence of compaction method on the density and strength of concrete blocks. *Built Environment Research Journal*, 20(1), 23 36.

Okafor, E. E., & Eze, G. O. (2019). Mechanical versus manual moulding: A comparative study of sandcrete block quality in Nigeria. *Journal of Housing and Sustainable Development, 14(2), 47–58.*

Okeke, F. N., & Mbanefo, C. O. (2022). Standards Compliance in Sandcrete Block Manufacturing. *Journal of Building Materials and Standards*, 11(2), 130–140.

Oladipo, K. A., Adewale, T. O., & Idowu, R. L. (2022). Influence of compaction method on the density and strength of concrete blocks. *Built Environment Research Journal*, 20(1), 23 36.

Olalusi, O. A., and Adeoye, A. O. (2017). Material Proportions and Mechanical Properties of Sandcrete Blocks." *Construction Materials Journal,* 6(1), 70–76.

Olaniyan, O. S., *et al*. (2021). Water absorption and density of sandcrete blocks produced in Nigeria. *Journal of Materials in Civil Engineering, 33*(10), 04021263.

Oloyede, S. A., *et al*. (2020). Construction industry's contribution to Nigeria's economic growth. *Journal of Construction in Developing Countries, 25*(1), 1-15.

Quality Assessment of Commercial Sandcrete Blocks. (2022). Nigerian Journal of Building Science, 16(1), 51–63.

Standards Organization of Nigeria. (2007). NIS 87:2007 – Standard for sandcrete blocks. Lagos, Nigeria: SON.

Ude, A. N., & Ekwueme, L. I. (2021). Training and Capacity Building for Block Producers in Nigeria." *International Journal of Construction Education and Research*, 10(1), 40–48.

Ugwu, A. C., & Nwachukwu, I. I. (2018). Assessment of Fine Aggregate Quality in Southeastern Nigeria." *Journal of Environmental Engineering and Construction*, 8(2), 55–62.