A Study of Engineering Properties of Cement Modified Termitarium Soil Found within Ado- Ekiti Metropolis for Bricks Production

Oluwafemi Ifetayo[1], Aigbavboa Clinton[2,] and Jan-Harm Pretorius[3]

[1,3]Postgraduate School of Engineering Management, University of Johannesburg, 2006, RSA

[2]Department of Construction Management and Quantity Surveying, University of Johannesburg.

johnifetayo@gmail.com, caigbavboa@uj.ac.za, jhcpretorius@uj.ac.za

Akinwamide Joshua[4]

[3]Civil Engineering Department, Federal Polytechnic,

P.M.B 5351 Ado -Ekiti, Ekiti State, Nigeria.

Abstract

A study of the Suitability of Cement Modified Termitarium Soil for Brick Production in Ado-Ekiti, Ekiti State, Nigeria was evaluated. Three Samples of termite soil was collected from four different locations within Ado-Ekiti, Nigeria. The soil samples were pulverized, Grain size test, compaction test, and atterberg limit were conducted on the termitarium soil at its natural state to determined its index properties into a class of Inorganic silt of low plasticity and Inorganic clay of low plasticity (ML, CL, CLand CL) respectively using the Unified Soil Classification System (USCS). The bricks were molded using the manual method at different percentage of cement ranging from 0% - 50% of the sample measured using the optimum moisture content (OMC %) of each sample for mixing and blending was with cement content by weight of the soil. Ninety Termite soil-cement bricks were produced. The brick was molded of size 100mm × 100mm × 100mm, the bricks were cured under laboratory conditions and subjected to compressive strength test, absorption test, impact test, and Abrasion Test. The average compressive strength was determined from five bricks crushed in each mix at the curing age. The strength of the bricks ranges from 1.3 to 13N/mm^2, the absorption test varied between 6% -14.5% which is in compliance with the regulatory body. Results obtained showed that the effect of cement on the termitarium soil enhances strength, lowered the absorption, lower shattering effect on the bricks and lower abrasion effect as the cement content increases in the mix, which make them suitable for construction of bungalow and low rise building.

Keywords: Abrasion test, Bricks, Compressive strength, Impact test, Termitarium, Water absorption.

I. INTRODUCTION

The main priority of the economic restructuring programme practiced the by Nigerian government is aimed at ensuring all means in converting the country's natural resources into valuable goods and services to enhance the sustainability of every citizen. (Bailey 1988, Olokode, Aiyedun 2011a) .The modern construction industries are compelled to advance in various researches and upgrade their standard of services, it becomes highly imperative to ensure good building materials are in place to solve the increasing need for shelter, overwhelming forces of construction and fast contaminating environment (Bakar, Putrajaya et al. 2010, Brownell 2010). The problems besetting construction industry observed by Hashim (1992) and Olaoye(2000) are numerous: these include shortage and price of construction constituents, increase in number of request for housing, deficiency in sensitization on the use of locally accessible resources for the construction work. The country has set their priority in exploring the solid minerals available in the country as a means of exploring other economic resources of the country which is another milestone for diversification thereby increasing the general internally generated byproducts known as the Gross Domestic Product and encouraging more business actions (Olokode, Aiyedun 2011a). An identified naturals gift of nature with great potential for economic exploitation is termitarium soil. Termite clay is an extraction from a termite mound, the mound is known to be a pile of earth formed from resembling a small hill. Formed by clay whose plasticity has gone through some stages of advanced secretion from the termite which is eventually used in building the mound (Mijinyawa, Lucas et al. 2007). It is appreciated as an improved material than the regular clay in terms of utilization for constructing lateritic bricks according to (Mijinyawa, Lucas et al. 2007). Statistics show that this type of clay has been reported to be more reliable than ordinary clay in dam construction (Visser 2011) The majority of a residential building in the UK uses masonry cavity wall construction. This involves building the external walls of a house as a double layer of masonry with a cavity in between. The external leaf is generally built of facing brick, but can also utilize concrete blocks which are then usually covered with cladding, render, tiles or other material. The inner leaf will usually be constructed with blocks, and then plastered or dry lined. (MPA,2013). The clay obtained in the termite mound can be used in upholding lasting figure after molding due to its flexibility; certainly not too disposed to crack, unlike the usual clay. Besides, its conductivity is very low. (Mijinyawa, Lucas et al. 2007, Folorunso), Termitarium soil is a coarse earth, soft when watery, solid and condensed when dry. (Adegoke 1980, Olokode, Aiyedun 2011a). The termitaria are made of soil and earth particles which are clustered to produce solid brick in natural material, known to be resistant to weathering, hard to chip with a sharp pick. Clay goods like ceramics wares, cooked bricks as well as roofing and floor tiles are inexpensive, strong and reliable building materials, unlike the conventional cement under humid environments(Kamalu, Okolie, Olokode, Aiyedun 2011b). This work, therefore, investigates the suitability of cement modified termitarium soil, of Ado Ekiti, Ekiti State, South Western Nigeria for brick production

II. JUSTIFICATION

Clay bricks are said to be the utmost broadly utilized materials in the construction industries, owing to its respectable and reliable abilities, little price, as well as its adaptability, likened to the known usual resources used in construction work (Nwakonobi, Anyanwu et al. 2014). The necessity for locally made building resources has been discussed and analyzed in several countries across the globe. A case of unevenness is always experienced in comparing the highly costly old known building resources or constituents in relation to the depletion of traditional building materials. To find a lasting solution to the situation, more attention is targeted to low-priced alternative building constituents (AGUWA 2010). Sourcing for suitable raw resources or materials from the huge natural gifts of nature in Nigeria for construction works and to combat the hike in the cost of building materials in construction world today, giving rise to the high cost of erecting a building for an average man who deserves a shelter and to help reduce failure in buildings. Hence the reason for this research arises

III. MATERIALS AND METHOD

The research work was done in Ado-Ekiti, with DD coordinate of 7.6166642 5.2166658 and DMS Coordinate 7°36'59.99" N 5°12'60.00"E. Samples of termitarium soil were taken during dry season towards November ending in the year 2017 in four strategic location within the metropolis. The termitarium was taken from all the location and bearing as shown in the chart below, the soil was collected using a digger and spade and later pulverized. The sample was properly labeled and transported to the laboratory for further analysis.

Location	Co-ordinates
Ado-Ikere road Sample	7.574^0 N, 5.210^0 E
Ado-Ijan road Sample	7.594^0 N, 5.299^0 E
Ado-Afao road Sample	7.595^0 N, 5.300^0 E
Ado-Iworoko road Sample	7.733^0 N, 5.260^0 E

IV. STUDY LOCATION

Ado-Ekiti an ancient city in Nigeria is located between latitude 70 034' and 70041' North of the equator and longitude 50011' and 50016' east of the Greenwich meridian(Adefisoye, Ogunlade 2017). Geologically, Ado Ekiti is situated within the Cambrian basement complex rock group, which underlies much of Nigeria. It falls within Koppen's 'a' climatic belt that is tropical wet climate(Awosusi 2010, Sola 2015). It has a population of 313,650 according to 2006 population estimation. An area of 293km^2, Density of 1,070.6inh/km2.The inhabitant is Ekiti-Yoruba sub-ethnic group. (Olubayode, Akinwamide 2015)

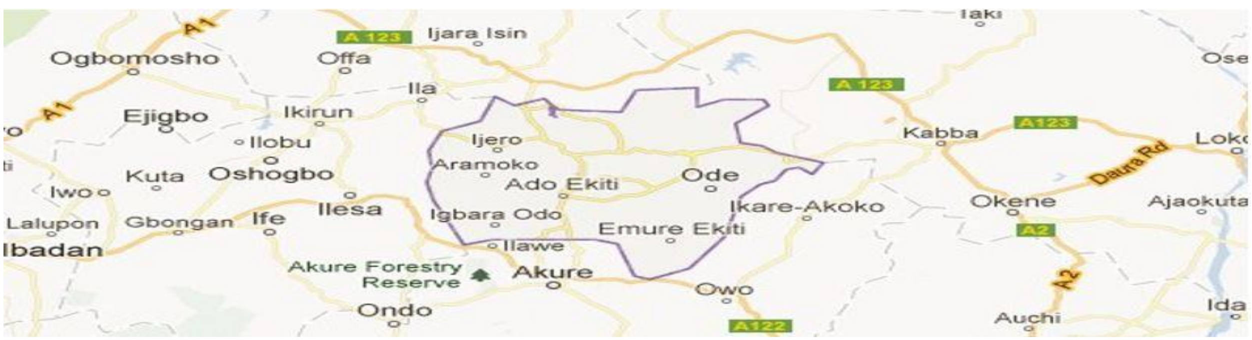

Figure 1: location map. Olodipo et al (2013)

V. METHOD OF BRICK PRODUCTION

The bricks were molded using the manual method at different percentage of cement ranging from 0% - 50% of the sample measured using the optimum moisture content (OMC%) of each sample for mixing. The size of the brick molded is (of size 100mm × 100mm × 100mm), was mixed in this cement content of 0% -50% of the total mass of the sample within continual intermission of about 10% to make thirty bricks for each mix. Ninety Termite soil-cement bricks were produced; the bricks were preserved under suitable laboratory conditions and later exposed to compressive strength test for 14days according to Standard Organization of Nigeria rules and regulation, repeated up to about five times in individual cement mixing with accordance with the ratio. The mean value of the compressive strength was gotten from the bricks pounded in each blend at the curing age.

EXPERIMENTAL PROCEDURE

A listed laboratory test performed on natural termite soil and the modified termite soil with cement follow the SON [2007] and BS 1377 [1990].

ATTERBERG LIMITS TEST

This is achieved to investigate the plastic limit (PL) and liquid limit (LL) of the clay soils (Guney, Sari et al. 2007). Atterberg limits are known to be the main sources at which the serious water contents of definite fine-grained soil are determined, likes of the level of contraction boundary, plastic boundary, and liquid boundary are all determined. The more dehydrated, clay soil absorbs a large percentage of water, it tends to experience significant and distinct changes in behavior and consistency(MacRobert 2013, Elbadry 2017), Wikipedia).

LIQUID LIMIT

200g oven-dried sample of the soil passing the 425mm sieve was mixed with water on a glass plate to property saturate it and was covered for approximately twenty-four hours, after which the sample was properly remixed using spatulas. The cone penetrometer was properly adjusted in position in readiness for the test. The sample cup was filled with the mixed sample and the initial reading was observed. It could penetrate the sample for five seconds and the final reading was equally noted. Some quantity of soil was then taken from the cup for moisture content determination. The water content was slightly increased and the soil was properly re-mixed, the cup was properly cleaned. The whole process was repeated five times.

PLASTIC LIMIT (PL)

Refers to moisture content limit after which the soil changes into a malleable, plastic mass. From the same soil sample, threads of about 3mm diameter were obtained by kneading and rolling and the moisture content determined.

LINEAR SHRINKAGE

Linear shrinkage (LS) is defined as the change in length divided by the initial length when the water is reduced to the shrinkage limit.it is expressed as a percentage, and reported to the nearest whole number.

$$\text{Thus} \quad LS = \frac{\text{Initial length-final length}}{\text{Initial length}} \times 100 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

The linear shrinkage can be determined in a laboratory (IS: 270-XX). A soil about 150gm in mass and passing through a 425q sieve is taken in a dish. It is mixed with distilled water to form a smooth paste. The sample is placed in a brass mold, 140mm long and with a semi-circular section of 25mm diameter. The sample can dry slowly first and then in an oven. The sample is cooled and its final length measured. The linear shrinkage is calculated using the following equation.

$$LS = 1 - \frac{\text{length of oven-dry sample}}{\text{The initial length of the specimen}} \times 100$$

COMPRESSIVE STRENGTH

The compressive strength of concrete determines to a great extent the ability of the structure to withstand the load imposed on it. In order to predict the load bearing capacity of a structure, therefore, the compressive strength of the concrete of the prescribed mix could be used. This characteristic I usually determined by the cement component. The aggregate and the sand quality also play major roles in determining the compressive strength of a concrete. The compressive strength of concrete determines to a great extent the ability of the structure to withstand the load imposed on it. In order to predict the load bearing capacity of a structure, therefore, the compressive strength of the concrete of the prescribed mix could be used. This characteristic is usually determined by the cement component. The aggregate and the sand quality also play major roles in determining the compressive strength of concrete (Olodipo et al, 2013).

The specimen was placed horizontally on its flat side and the mortar filled side was placed in an upright position between plates of the testing machine. The specimen was then loaded axially at unvarying rate till failure occurs and the maximum load at failure was noted as L(KN). The strength was then determined in the illustration below

$$\text{Compressive Strength} = \frac{\text{Max load at failure (N)}}{\text{The average area of bed face (mm}^2)} \ldots\ldots\ldots\ldots\ldots (2)$$

WATER ABSORPTION TEST

Absorption test was conducted to observe the response of the concrete samples to immersion in water and the rate at which they imbibe water. This is necessary to predict the concrete behavior under moist condition A condition that may arise in the flooded area. At the peak of the rainy season, the surface flow may rise to inundate our structures. The capacity of such a structure to withstand the flood will be determined by the absorption rate of the material with which it is constructed. Groundwater table can rise particularly in the wet season or if water from a reservoir intrudes into an area. Such an area is prone to wetness. Any structure built in that vulnerable area could come under threat of instability. This is why the absorption test of the concrete is necessary. (Olodipo et al, 2013)

The water absorption test was done using a flat bar specimen of both pure and blended clay. The bars used for this test were weighed with the aid of an automated weighing balance, drenched in a container of water for 24 hours (ASTM C373 - 14a). samples were removed from the water, allowed to outflow and the remaining was gently wiped to guarantee that no water was connected to the surface and was re-weighed once more. The variance in weight was used in computing the percentage of water absorption using the formula below:

$$\%\ \text{Water Absorption} = \frac{soaked\ weight - dry\ weight}{dry\ weight} \times 100\% \quad \text{--------------------(3)}$$

IMPACT TEST

The impact test was conducted to check for the effect of crushing and breaking when such brick falls from a particular height during construction activities. The fired sample was weighed using a beam balance and then allowed to drop from a height of about 1m. The shattered pieces are then picked up and the largest piece is weighed to determine the shattered (final)

$$\text{Impact} = \frac{W_i - W_f}{W_i} \times 100\% \quad \ldots\ldots\ldots\ldots(4)$$

Where W_i = initial weight , W_f = final weights

ABRASION TEST

The abrasion test was performed to evaluate the effect of wearing and surface of the bricks during and after construction operation. Two separately samples were weighed as Wi(g) of the sandcrete blocks was brushed using iron file was reweighed as Wf(g). The same effort and number of motion was used on each sample, then the final weight of each sample was taken

$$AB = \frac{W_i - W_f}{W_i} \times 100\%. \quad \ldots\ldots\ldots\ldots(5)$$

Where Wi(g) is the Initial weight and Wf is the final weight of the sample after brushing. (Brand 2015)

VI. RESULTS AND DISCUSSIONS

SOIL CLASSIFICATION

The termitarium soil samples were classified into a class of Inorganic silt of low plasticity and Inorganic clay of low plasticity (Osinubi, Amadi 2010)(ML, CL, CLand CL) respectively by means of Unified Soil Classification System (USCS). As shown in the table: 1 and Figure 2 and 4

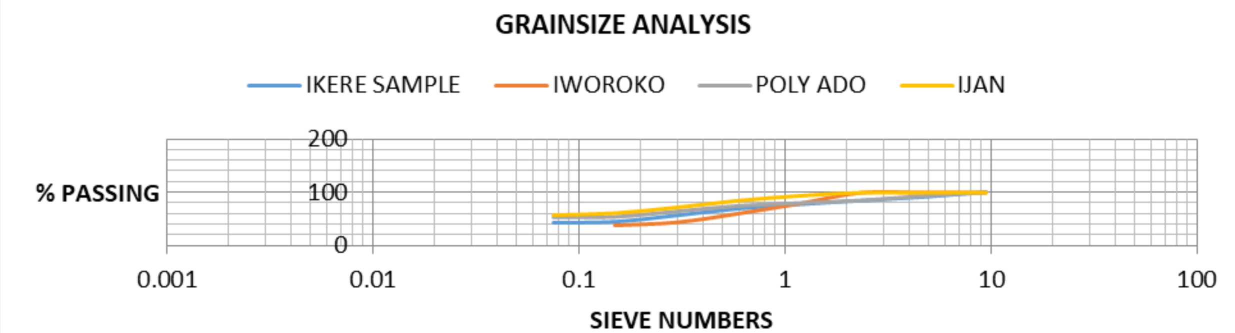

fig 2.0 showing gaph of grain size analysis

Table 2: Laboratory test on the Natural Termitarium Soil

LOCATION OF SAMPLES	LABORATORY TEST ON THE NATURAL TERMITARIUM SOIL						
	Atterberg limit			Compaction test		%passing sieve 200	USCS
	LL	PL	PI	OMC%	MDDkg/m3		
IKERE	21	13	7.9	13.5	1670	54	ML
FEDERAL POLY	33	20	12.8	8.5	1850	51	CL
IJAN	26.5	17	8.8	14.0	1900	52	CL
IWOROKO	28	14.2	14	15.5	720	57	CL

COMPRESSIVE STRENGTH

Table: 2 and figure:5 show the strength of the bricks which ranges between 1.3 to 13N/mm^2, where ijan and poly samples observed to reach their optimum strength at 30% cement content in the mix while there and work reach their optimum strength at 40% cement content in the mix. Which make both locations suitable for use in compliance with the SON (2007) specification. The results complement other parameters already established i.e., the lower the impact, the abrasion and the absorption values the higher the strength value and vice versa. The above results showed that ijan and poly samples have the highest compressive strength value compared to other locations. It is therefore beneficial to use the ijan and poly samples as construction materials.

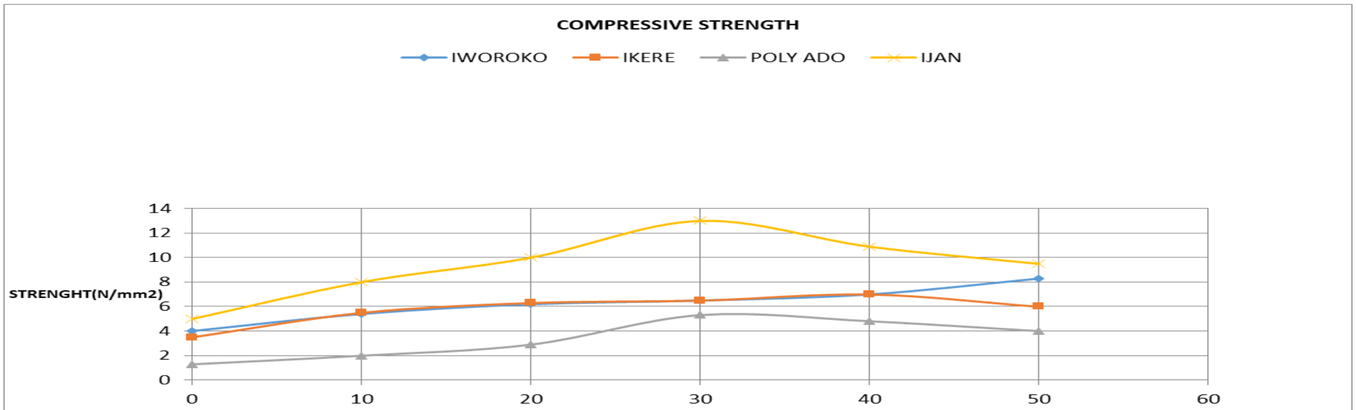

FIG 5.0 showing percentage of cement%)

ABSORPTION TEST

Table: 2 and figure: 3 show the absorption test performed on the bricks varied between 6 to14.5percent for all the cement variation in the mix. The maximum absorption was attained at 0% iworoko where the minimum strength was attained. The implication of the above results shows that the higher the cement content the lesser the absorption value It is therefore appropriate to modify soil sample in other to reduce the rate of absorption in bricks production for durability and strength as construction materials since it gives a higher resistance to surface puffiness or shattering.

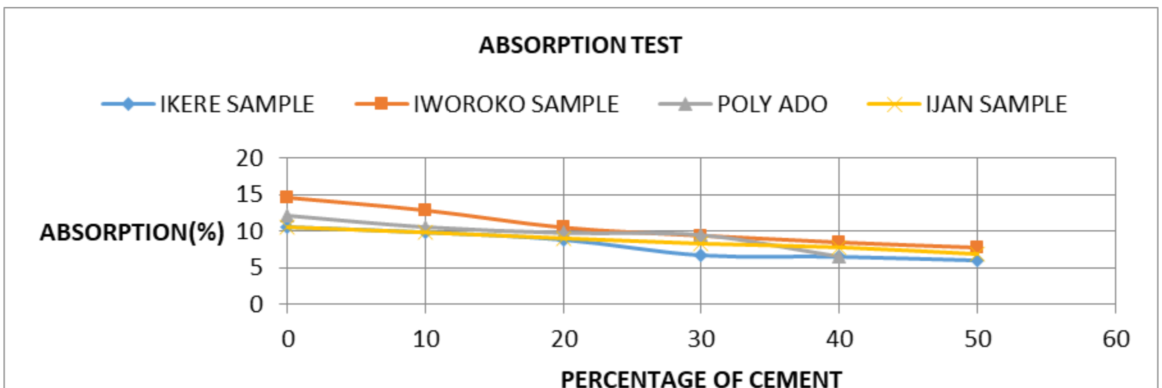

fig 3.0 showing graph of absorption test

ABRASION TEST

Table: 2 and figure: 8 show the abrasion test performed on the bricks varied between 1.1 to 4.5% for all the cement variation in the mix. The maximum abrasion was attained at 0% iworoko where the minimum strength was attained.it is noteworthy that the cement modification on the termite soil sample has positively improved the resistance to wearing of the bricks which have enhanced its strength

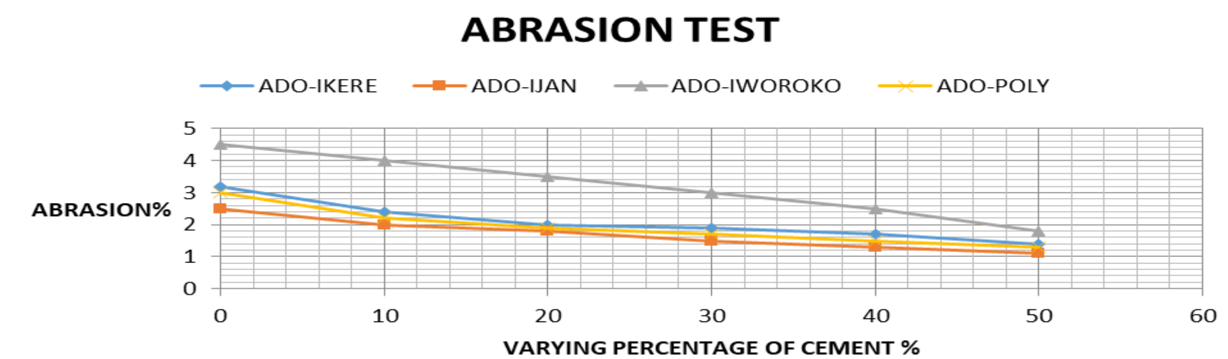

FIG 8.0 showing the graph of abrasion test

IMPACT TEST

Table: 2 and figure: 7 show the impact test performed on the bricks varied between 2 to10 percent for all the cement variation in the mix. The maximum impact value was attained at 0% iworoko where the minimum strength was attained. The results reveal that as cement contents increase the impact strength increases which showed that the modification by cement has enhanced the impact strength

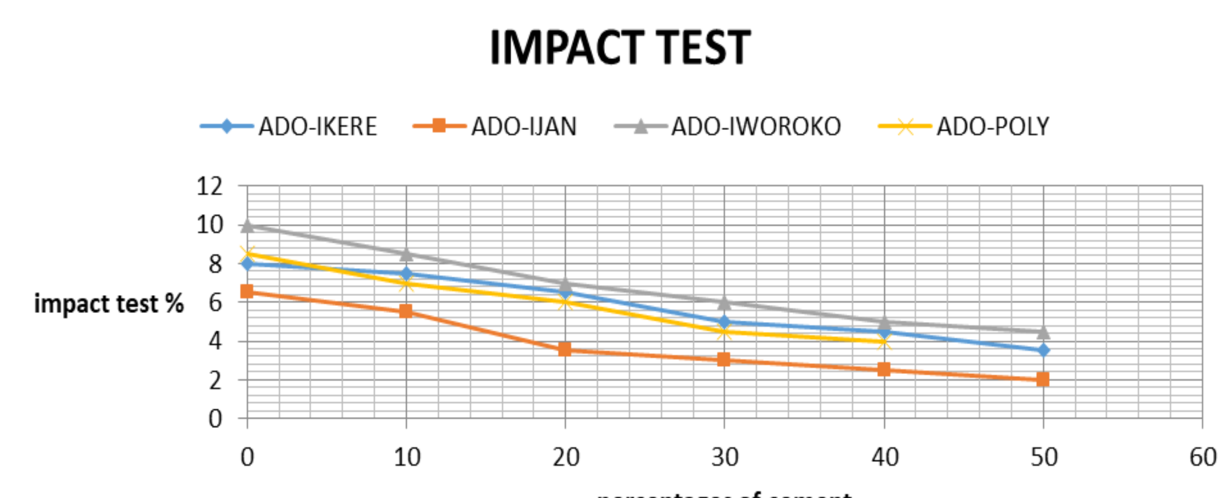

FIG 7.0 showing the graph of impact test

Table 3: SUMMARY OF LAB EXPERIMENT FOR CEMENT MODIFIED TERMTARIUM SOIL

Location of termite soil samples	Percentage Of cement (%)	Absorption (%)	Compressive strength(n/mm^2)	Average Density(kg/m)	Impact Test	Abrassion test
ADO-IKERE	0	10.5	3.5	1142	8.0	3.2
	10	9.8	5.5	1211	7.5	2.4
	20	9.4	6.3	1366	6.5	2.0
	30	6.7	6.7	1400	5.0	1.9
	40	6.5	7.0	1531	4.5	1.7
	50	6.0	6.0	1460	3.5	1.4
ADO-IJAN	0	10.0	5.0	1313	6.5	2.5
	10	9.8	8.9	1644	5.5	2.0
	20	8.5	10.3	1887	3.5	1.8
	30	8.0	13	1950	3.0	1.5
	40	7.0	10.9	1730	2.5	1.3
	50	6.5	9.5	1650	2.0	1.1
ADO-IWOROKO	0	14.5	1.3	1320	10	4.5
	10	12.8	2.0	1400	8.5	4.0
	20	10.5	2.9	1450	7.0	3.5
	30	9.4	5.3	1500	6.0	3.0
	40	8.5	4.8	1600	5.0	2.5
	50	7.8	4.0	1650	4.5	1.8
ADO-POLY	0	12.2	4	1130	8.5	3.0
	10	10.6	5.4	1200	7.0	2.2
	20	9.8	6.2	1250	6.0	1.9
	30	9.5	6.5	1310	4.5	1.7
	40	6.5	7.0	1430	4.0	1.5
	50	6.0	6.0	1550	3.5	1.3

VII. CONCLUSION

Based on the results of the analysis of the grain size test, compaction test, and atterberg limit which were conducted on the termitarium soil at its natural state to determined its index properties into a class of Inorganic silt of low plasticity and Inorganic clay of low plasticity (ML, CL, CLand CL) respectively using the Unified Soil Classification System (USCS). The sample obtained from Ijan and Ado-poly area reached their optimum strength at 30% cement content in the mix while iworoko reach their optimum strength at 40% cement content in the mix. Which make both locations suitable for use in compliance with the SON (2007). Results obtained showed that the effect of cement on the termitarium soil enhances strength, lowered the absorption, lower shattering effect on the bricks and lower abrasion effect as the cement content increases in the mix, which make them suitable for construction of bungalow and low rise building

The termite collection spot that was found appropriate will make more supply paucity, increase the economic return to the landowners in this community and guide the producer of earth bricks on the choice of quality material available within this metropolis

VIII. REFERENCES

ADEFISOYE, T.O., and OGUNLADE, I., 2017. Effect of Waste Management Control on Tourism Development: Ado-Ekiti as a Case Study.

ADEGOKE, O., 1980. Guide to the Non-Metallic Mineral Industrial Potential of Nigeria. *Proceedings of the Raw Materials Research and Development Council.Pp110-120, .*

AGUWA, J.I., 2010. Performance of laterite-cement blocks as walling units in relation to sandcrete blocks. *Leonardo Electronic Journal of Practices and Technologies,* **9**(16), pp. 189-200.

AWOSUSI, A.O., 2010. Assessment of environmental problems and methods of waste management in Ado-Ekiti, Nigeria. *African Research Review,* **4**(3),.

BAILEY, S.W., 1988. *Hydrous phyllosilicates (exclusive of micas).* Mineralogical Society of America.

BAKAR, B.H.A., PUTRAJAYA, R. and ABDULAZIZ, H., 2010. Malaysian rice husk ash–improving the durability and corrosion resistance of concrete: Pre-review. *Concrete Research Letters,* **1**(1), pp. 6-13.

BRAND, A.S., 2015. *Interfacial transition zone composition and bonding in cementitious materials with asphalt-coated particles. The* University of Illinois at Urbana-Champaign.

BROWNELL, B., 2010. *Transmaterial 3: a catalog of materials that redefine our physical environment.* Princeton Architectural Press.

ELBADRY, H., 2017. A simplified reliable prediction method for determining the volume change of expansive soils based on simple physical tests. *HBRC Journal,* **13**(3), pp. 353-360.

FOLORUNSO, D., The Purification and Adaptation of Termite Hill Clay for Furnace Lining by Graphite and Rice Husk Addition.

GUNEY, Y., SARI, D., CETIN, M. and DUNCAN, M., 2007. Impact of cyclic wetting-drying on swelling behavior of lime-stabilized soil. *Building and Environment,* **42**(2), pp. 681-688.

KAMALU, I.C., and OKOLIE, I., Chemical Composition and Modeling of the Functions of Termitarium. *Journal Of Environmental Science, Toxicology And Food Technology (IOSR-JESTFT),* **5**(4), pp. 36-42.

MACROBERT, C.J., 2013. *A field study of beaching behavior and the in-situ moisture regime of tailings during active deposition,*

MIJINYAWA, Y., LUCAS, E. and ADEGUNLOYE, F., 2007. Termite mound clay as a material for grain silo construction.

OLOKODE, O. and AIYEDUN, P., 2011a. Mineralogical characteristics of natural kaolins from Abeokuta, South-West Nigeria. *The Pacific Journal of Science and Technology,* **12**(2), pp. 558-565.

OLOKODE, O. and AIYEDUN, P., 2011b. Mineralogical characteristics of natural kaolins from Abeokuta, South-West Nigeria. *The Pacific Journal of Science and Technology,* **12**(2), pp. 558-565.

OLUBAYODE, S. and AKINWAMIDE, J., 2015. The investigation into the Suitability of Sandy Soil Found within Ado-Ekiti Metropolis for Sandcrete Block Production in South Western, Nigeria.

OSINUBI, K. and AMADI, A., 2010. Comparative Assessment of Contaminant Sorption in Lateritic Soil—Bentonite Mixtures. *Florida 2010: Advances in Analysis, Modeling & Design.* pp. 2779-2786.

Oladipo I. O.[1]*, Adams, J. O. and Akinwande, J. T(2013).Using Cassava Peelings to Reduce Input Cost of Concrete: A Waste-to-Wealth Initiative in Southwestern Nigeria. Universal Journal of Environmental Research and Tec Volume 3, Issue 4: 511-516

SOLA, O.O., 2015. The trend in the Pattern of Vehicular Traffic Flow in Ado-Ekiti, South-West Nigeria.

VISSER, A.A., 2011. *On the ecology and evolution of microorganisms associated with fungus-growing termites.*

Biography

Professor Clinton O. Aigbavboa is an Associate Professor in the Department of Construction Management and Quantity Surveying, University of Johannesburg, South Africa; with a multidisciplinary research focus on the built environment. Before entering academia, he was involved as quantity surveyor on several infrastructural projects, both in Nigeria and South Africa. He holds a Ph.D. in Engineering Management and has published over 500 research papers in his areas of interest. He has extensive knowledge in practice, research, training, and teaching.

PROF JAN HARM C PRETORIUS (Pr Eng, SMIEEE, USA IEEE) holds a BSc Hons (Electrotechnics), MSc (Pulse Power and Laser Physics), and MIng and DIng degrees in Electrical and Electronic Engineering. He was a senior consulting engineer at the South African Atomic Energy Corporation, technology manager at the Satellite Applications Centre at the CSIR, and is currently Head of the Postgraduate School of Engineering Management at the University of Johannesburg. He is involved in measurement and verification of energy savings. He has authored 150 research papers and supervised over 30 Ph.D. and 180 master's students.

Engr. Oluwafemi Ifetayo is a Ph.D. Researcher in the Postgraduate School of Engineering Management, University of Johannesburg, South Africa; a lecturer at Afe Babalola University Ado Ekiti, Ekiti State Nigeria, with a broad knowledge of Management, holds a master's in Business Administration (Operations management option), Masters in Management, B.Eng in Electrical, He is a Registered Electrical Engineer by Council of Regulation of Engineering in Nigeria (COREN). He has a multidisciplinary research focus on the engineering management, communication is the basis of my academic pursuit, Energy measurement and verification, Energy savings, construction engineering

Engr. Akinwamide Joshua is a specialist in the field of geotechnical engineering/Civil Engineering Materials His key sector experience is varied across-Highways and Transportation Engineering, water and Waste Water, Urban Infrastructure. He is equipped with excellent Engineering/Civil Engineering Project Quality Control. He is a Registered Civil Engineer by Council of Regulation of Engineering in Nigeria (COREN). He is a corporate Member Nigerian Association Technologist in Engineering (NATE) and a graduate member Nigeria institute of civil Engineer (NICE). He holds M. ENG in Geotechnical Engineering. He has over 15years working experience as a civil engineer (Quality control analyst). He is a staff member of Federal Polytechnic Ado Ekiti southwestern Nigeria, he is currently the Head of materials testing laboratory from 2008 till date.