International Journal of Academic Pedagogical Research (IJAPR)
ISSN: 2643-9123
Vol. 5 Issue 6, June - 2021, Pages: 37-40

Effects of Different Brands of Cement On The Strength Of Pavers in Nigeria

Aluko, K.A[1], Elesho, R.O[2], Olatunji, B.T[3], Ogunwale, O.G.[4], Adewoye, A.A[1], Majekodunmi, O.A[1]

1. Horticulture and Landscape Technology Department, Federal College of Forestry, Ibadan, Nigeria.
2. Agricultural Technology Department, Federal College of Forestry, Ibadan, Nigeria.
3. Forestry Research Institute of Nigeria, Ibadan, Nigeria.
4. Agricultural Extension and Management, Federal College of Forestry, Ibadan, Nigeria.

Correspondence author's email – aderemi.am@frin.gov.ng
Phone no: 08035637542, 08079713340

Abstract: *The research was carried out to determine the effect of different brands of cement on the strength of payers. Stone dust plus Cement A (4:1), stone dust plus Cement (B) (4:1), stone dust plus Cement (C) (4:1), stone dust plus pure Cement (D) (4:1). sharp sand plus Cement (A), sharp sand plus Cement(B) (4:1), sharp sand plus Cement (C) (4:1), sharp sand plus Cement (D) (4:1), formed 8 treatment and were replicated five times. The pavers were analyzed for compressive strength at the materials testing laboratory, Materials Testing Laboratory, Ministry of Works and Transport, Oyo State Secretariat, Ibadan. The data collected were subjected to analysis of variance (ANOVA) and Duncan Multiple Range Test (DMRT) was used to separate treatment means. The result shown that Treatment C (stone dust and Dangote cement), G (sharp sand and Dangote cement), were not significantly different with respect to compressive strength. Treatment B (stone dust plus Diamond cement), produce the least value of (133 KN), while Treatment C (sharp sand and Dangote cement) has the highest value (285 KN) which agrees with recommended standard of pavers of 150-300 Kilo Newton by the Nigerian Standard Organization (N.S.O). Also, the cost of production of pavers produced with stone dust is costly than pavers produced with sharp sand. Cement (C), Cement (A) and Cement (B) produced very neat and strong products while Cement (D) does not produce good finished product.*

Keywords: Stone dust, Sharp sand, Cement, Pavers, Compressive.

Introduction

Landscape design is the act of designing, planning and management of land or open space and arrangement of natural and man-made elements through application of cultural and scientific knowledge which concern resource conservation and stewardship resulting to environmental service as useful, healthy and enjoyable purpose. (Catriona, 2003).

Interlocking concrete pavements are a special dry mix pre-east of concrete commonly use in exterior hardscaping pavement application. Paving stone are installed over a compacted stone sub-base and a leveling bed of sand. Concrete paving stones can be used for walk-way, patios, pool decks, drive-ways and airport or loading decks. Instead of connecting the pavers by pouring grout, between the joint as one would with tiles, sand particles are spread over the pavers and tamped down. The sand stabilizes the interlocking pavers, yet allows for some flexibility. This type of pavement will absorb stress such as small earthquakes, freezes and thaw and slight ground erosion by flexing. Therefore, they do not easily creak, break or buckle like poured asphalt or poured concrete. Benefit of pavers than asphalt and poured concrete include high compressive strength, pleasant look, time saving, easy removal and replacing. (Timothy *et.al.,* 1997).

The most vital aspect of landscape construction is the choice of appropriate materials that will satisfy the basic principles of modem landscaping in order to achieve a balance between safety, elegance and economy. (Adeniran, 2001). Cement is any material that hardens and become strongly adhesive after applied in plastic form. The term cement is often used as a similar meaning to glue and adhesive. Cement is used for different reasons one is to hold sand and gravel together. It is also used to put different surfaces together made up of various materials, another use can be for coating surfaces to protect them from being damaged by some outside forces of nature or by chemical reasons. The hardening of cement is mostly caused by the hydration of tricalcium silicate, which from the watering substance becomes harden. This substance bind together, the particle of sand or stone, which are always include in a concrete mixture to a hard mass. (DCCM, 2006)

In Nigeria, production of cement with different trade names is increasing daily. There is availability of more than ten types of cement in the market, Cement is very essential in human's life as regard building, construction and other landscape materials. (Justrus *et al*., 2005)

There is need to determine the strength properties of various cement types available in the market in order to identify the best for producing pavers. This project is designed to determine the effect of different brands of cement on the strength of pavers used for landscape construction project.

Over the years, paving stones have generated a lot of attention, hence, the demand for it has greatly increased. It is environmentally friendly and its beautification also goes a long way in promoting its use. The occurrence or frequent collapse structure due to poor quality and construction materials has stirred up the researchers concern on how to test for strength and durability of landscape materials. There is need to determine the strength properties of various brands of cement available in the market in order to identify the best for producing pavers.

Materials and method

The experiment was carried out at Federal College of Forestry, Ibadan, Oyo State, Nigeria. The materials used for this study are the following: Stone dust, sharp sand, cements, shovel, hand trowel, field book, water, moulds (didalo 5 inch), brush, lubricant (diesel), and weighing balance.

The moulds were cleaned and lubricated, with water and diesel for easy demoulding, the amount of all aggregate used were measured and the materials were mixed thoroughly and equal amount of water was added to the aggregate. Each treatment were poured into the mould and vibrated manually, each treatment were placed in aerated surrounding for quick and proper drying of the specimens. The treatment were de-molded after 48 hours.

Table 1: Mixing ratio (treatment combination) for the production

Treatments	Stone dust	Sharp sand	Cement(A)	Cement(B)	Cement(C)	Cement(D)
A	4	-	1	-	-	-
B	4	-	-	1	-	-
C	4	-	-	-	1	-
D	4	-	-	-	-	1
E	-	4	1	-	-	-
F	-	4	-	1	-	-
G	-	4	-	-	1	-
H	-	4	-	-	-	1

The above table shows the different proportion of the materials being used for the experiment which form various treatments. The proportion goes thus, T_A constituted four buckets of stone dust and one bucket of Cement (A), T_B consisted four buckets of stone dust and one bucket of Cement (B), T_C consisted four buckets of stone dust and one bucket of Cement (C), T_D consisted four buckets of stone dust and one bucket of pure Cement (D), T_E consisted four buckets of washed sharp sand and one bucket of Cement (A), T_F consisted four buckets of washed sharp sand and one bucket of Cement (B), T_G consisted four buckets of washed sharp sand and one bucket of Cement (C), T_H consisted four buckets of washed sharp sand and one bucket of Cement (D). The weight of cement used for each treatment was approximately 12.5kg. For even mixture and to prevent airspace within the pavers, the mixture is shaken thoroughly during casting operation. For each treatment, 8 pavers were produced.

The data obtained was subjected to Analysis of Variance to determine the difference in the weight before and after curing. The experimental design used for their study is Completely Randomized Design (CRD). Testing of the quality of the materials was designed and performed to ensure adequate quality of construction project being executed. It involved laboratory test of the paving stone which was done at the materials testing laboratory, Ministry of Works and Transport, Oyo State secretariat, Ibadan. Nigeria.

The compressive strength property in the laboratory was done after four days of immersion in water. The procedures are as follows: Each replicate were placed in between the flat plate one by one. The machine was switch on and the plate pull up the pavers until it touches the metal plate at up and compressed the treatment until it get weaken and then the meter stopped reading. The values of each treatment showed on the meter were recorded and the average was written down in KN/M^2

Cost analysis of the production of pavers

The cost of production was determined using the formula of economic theory cost of Production:

Total Cost of Production = Fixed cost + Variable cost

Results and discussion

Table 2: Cost of production for each treatment (per 8 pavers)

Treatments	Cost of production (₦)
A	1060.4
B	1060.4
C	1060.4
D	1060.4
E	740.4
F	740.4
G	740.4
H	740.4

Table 2 shows the cost of producing 8 pavers of each treatment, values obtained ranges from ₦4,928.4 to ₦743.4k. The cost of producing paver with stone dust and each brands of cement is costly which ₦928.4k is per treatment. The pavers produced with sharp sand and each brands of cement process lesser cost of N743.4k compared to the one produced with stone dust. The difference in cost is a direct reflection of the cost of materials acquisition. Treatments with sharp sand and different brands of cement are less costly than that of stone dust. Considering the present government policy whose trust or focus is toward encouraging self-employment and beautification of environment at a reduced cost and utilization of readily available materials. This may justify the choice of Treatment E. F, G, H, as a better replacement of Treatments A, B, C, D.

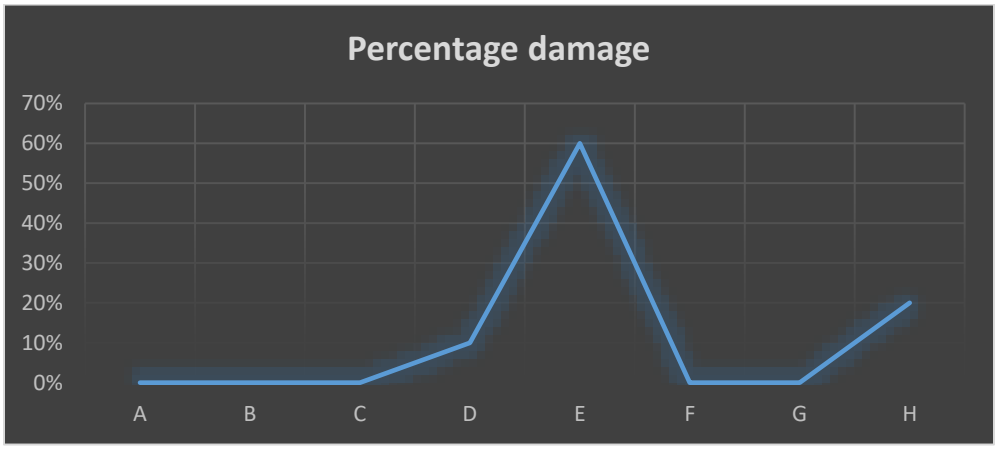

Fig. 1: Percentage damage during demoulding

Figure 1 shows that Treatments A, B, C, F, G recorded zero percentage or no damage, T_E (60%) recorded high percentage of damage while T_H (20%) recorded the second to the highest damage percentage after demolding. Cement (G) and Cement (B) does not damage when applied with stone dust and sharp sand after demolding.

Table 3: The compressive strength (KN) of the pavers

Treatments	Compressive strength
A	260^{a}
B	133^{c}
C	285^{a}
D	200^{a}
E	165^{bc}
F	205^{b}
G	280^{a}

H	205[b]

*Means of the same alphabet following in the same column are not significantly different from each other at 5% level of probability.

Table 3 shows the values of compressive strength of the pavers. Treatment C had the highest value of 285 KN. Treatment H, D, F was not significantly different from each other. Treatment B has the lowest value of 133 KN. The result showed that Treatment C produced the best compressive strength, in terms of cement mixed with sharp sand and stone dust even at the same proportion.

Table 4: LSD result before and after curing

Treatments	Before curing	After curing
A	4.9[b]	5.10[a]
B	5.0[a]	5.12[a]
C	5.0[a]	5.24[a]
D	5.0[a]	5.36[a]
E	5.09[ab]	5.21[b]
F	5.05[ab]	5.05[ab]
G	5.05[ab]	5.05[ab]
H	4.93[ab]	4.93[b]

*Means of the same alphabet following in the same columns are not significantly different from each other at 5% level of significant.

Table 4 shows the LSD value of pavers before and after curing. Before curing, there is no significant difference between treatment E,F,G and H. Treatment E has the highest water absorption of 5.09 before curing which agrees with Ajayi (2000), that sharp sand enhance water absorption in concrete constructed object due to its high porosity. The least water absorption before curing was Treatment A with a value of 4.9. After curing, Treatment A, B, C, E, were not significantly different. Treatment D has the highest water absorption rate of 5.36. Treatment H has the least water absorption rate of 4.93.

Conclusion

The study revealed that it is highly feasible to produce pavers from sharp sand and Cement (C) at a much cheaper cost. It also showed that water absorption of paver increases in sharp sand indicating characteristics of lasting longer.

The paver produced wholly of sharp sand provides a good substitute to stone dust with each cement brands. The three variables (cement, stone dust, sharp sand) used in pavers production has significant effect on the strength properties examined. Pavers produced wholly from sharp sand can satisfactorily be used for both heavy and light traffic construction work. There is need to create awareness of the possibility of replacing stone dust with sharp sand in the production of pavers. However, the effect of the difference in cements on the pavers is another important factor to be considered in other to avoid collapse building or construction damage. This will guide layman who would have interest in beautification of his environment with durability and aesthetic purpose.

It is therefore recommended for the strength properties of the production of pavers that Treatment G should he used in paver production.

REFERENCE

Adeniran, T. K. (2001) A Lecture Note on Pavement Design. The Polytechnic of Ibadan, Oyo State.

Ajayi, O. O (2000): Strength and Dimensional Stability of Cement Bonded Structure, Pp 45- 46.

Catriona, T.E (2003); Complete Home Landscaping. Creative Home, Upper Saddles, River New Jersey, Text Book, Pp 21-55.

Design and Control of Concrete Mixture (2006) Construction Specification Guideline for Concrete Street and Local Hpc Bridge Views Issues 45, 15th Edition Inter-pave (2003); http://www.paving.org Uk.

Justrus, H. Elfgreen, L. Romin, V. (2005): Mechanism for Performance of Energetically Modified Cement versus Corresponding Blended Cement. Cement And Concrete Research 35(2): 315-323.

Timothy, O. B., Jeff Dey, D. S. (1997); Wall, Walks, and Patios, Plain, Design, Build. Pp6, 44-5, 101,145.