ISSN XXXX XXXX © 2017 IJESC

Research Article Volume 7 Issue No.5

Suitability of Laterite Fines as a Partial Replacement for Sand in the Production of Sandcrete Bricks

B. N. Manjunath[1], Champa .N. P[2], Priya .D. V[3], Sahil kumar .S. Mehta[4], Swapna .R Channagoudar[5]
BE Student[1, 2, 3, 4], Assistant Professor[5]
Department of Civil Engineering
STJIT, Karnataka, India

Abstract:
This paper focuses on the use of laterite fines for the replacement of sand because it is more economical and environmental friendly. The production of sandcrete bricks by the replacement of sand with laterite fines for masonry walling units helps for low cost housing. With a mix ratio and water-cement ratio of 1:3 & 0.5 respectively, the laterite fines replacing the sand with batches 0%, 10%, 20%, 30% & 40% were adopted in this study. The bricks with these batches were tested and compared with that of sandcrete bricks i.e. nothing but 0% batch. Tested studied were dry compressive strengths, wet compressive strengths and water absorption. The test results revealed that the laterite fines could satisfactorily replace the sand up to 30%. The cost comparison also showed that the bricks replaced with sand could reduce the cost up to 30-40% when compared with sandcrete bricks.

Keywords: Sand, Cement, Laterite fines, Compressive strength, Water absorption.

I. INTRODUCTION

The natural process of rocks weathering in the hot humid climatic conditions and interaction with water, oxygen and carbon dioxide create the residual product which is called laterite. It is also inferred that pale climate dating back several million years has been a causative factor in laterite formation. The residue usually consists of enriched iron, aluminum and titanium oxides in varying proportions. Because of an imbalance between the demands for housing and expensive, the need for nearby manufactured building materials can hardly be overemphasized in many countries. The conventional building materials attached with the depletion of traditional building materials. To deal with this situation, concentration has been focused on low cost different building materials. Laterite has a place of special significance in Indian geology. It is commonly known either as a rock crust or as extensive soil mantles. Being the source of industrial minerals like bauxite, manganese ores etc, its economic potential is vast. It has been the source of iron ore for the local smelting industries from the immemorial. Lateritic soils compose a significant group of Residual soils of India, covering an area of about 1, 00,000sq.km. They are found mainly on the Western and Eastern Coasts over large areas and in small quantities in the Southern and Eastern states of India. The fines of laterite known to have some similar physical characteristics as conventional sand. Lateritic soils undergoes weathering and laterization processes which involve chemical and physical transformation of primary rock-forming minerals that are rich in secondary oxides of iron, aluminium or possibly both laterite constituents and clay minerals . It has been used in the construction of Adobe, Wattle and daub and making bricks for buildings. Although, its use as a construction material has been extensive, it is hardly accepted due to insufficient technical data, hence limiting its wider application in the analysis and design of structures built of laterite .In recent times, researchers have shifted focus on the alternative material like laterite for sand in the production of concrete referred to as laterized concrete.

While the use of laterite as a replacement for sand in concrete has been widely known, but it cannot be used in the production of sandcrete bricks. Since laterite varies broadly**,** the compressive strength of lateritic soil is dependent on the source from which they are collected. Therefore, to reduce cost and environmental damage due to its availability, it is necessary to find a way of utilizing laterite in the production of sandcrete bricks and to determine the possibility of using it as a partial alternative material for sand in the production of bricks for building construction works. By the cost and other factors, Sandcrete blocks appear to be a development over the clay bricks. Cost also is one of the major factors in construction that make people deny using of spurious materials if at all they are strong-minded to build. Therefore it means that the review of low-cost materials is approved for users even without compromising standards is going to be a useful mission. Moreover, in many countries of the world the need for locally manufactured building materials has been given importance. Attention has been focused on low-cost alternative building materials as there is imbalance between the expensive conventional building materials coupled with depletion of traditional building materials. The composition of a sandcrete brick is usually mix of cement and sand moistened with water and allowed to dry naturally. It is a compound material made up of cement, sand and water, moulded into different sizes.

II. EXPERIMENTAL METHODS

A. Materials

The materials used in this study include ordinary Portland cement obtained from market. The sand used for the study obtained from river bank. It was taken which is passing through 4.75 mm and retained on 75 microns. Laboratory tests were carried out to know the basic characteristics and suitability of the sand for masonry works. Water for the manufacture of the bricks was potable water. The laterite fines on the other hand were obtained from the Narasipura in

Karnataka .The soil is taken which is passing through 4.75 mm and retained on 75 micron.

B. Moulding & Casting of Specimens

Bathing of materials was done by the volume method using mix proportion of 1:3 ratios. Bricks of size 225*100*75 mm were produced, such that laterite fines partially replacing the sand in steps of 0 to40%. These were designated as B0, B10, B20, B30 &B40 which respectively represents specimens with 0%, 10%, 20%, 30% & 40% of laterite fines. The materials were thoroughly mixed before adding water. Mixing was done until a homogeneous consistency was obtained. Hand mixing was adopted while moulding of the bricks was done by production brick machine operated manually.

C. Tests on Specimens

1) Compression test:

This test was conducted in two conditions, Dry Compression test and Wet Compression test. Both tests used three bricks from each batch Bricks used for Wet compression test were cured for 28 days curing age by Hay Curing. After curing bricks were totally immersed in water for 24 hours. They were removed and wiped of air-dried for 15 minutes. The compressive strength of these cured bricks were determined using compressive testing machine, until the resistance of the specimen to the increasing load breaks down and no great load can be sustained. On the other hand, the bricks for dry compression test selected randomly without crakes, they were wiped and tested for their compressive strength using the same process.

2) Water Absorption test:

This test determines the change in weight of the specimen. After 28 days curing age. Specimen for this test was randomly selected 3 bricks from each batch and cleaned. They were oven dried at a temperature of 110^{0}c for 24 hours. It was weighed and weight was noted as dry weight of bricks M0. Specimens were immersed totally in water at normal temperature for 24 hours. The bricks were removed and their weight was recorded as wet weight M2. The absorbed water expressed in % and the equation is.

$$\frac{M2-M0}{M0} * 100 \ldots\ldots\ldots(1)$$

III. RESULTS AND DISCUSSIONS

Compressive strength:

Dry compressive strength:

The dry compressive strength characteristics of the bricks with increasing replacement level with laterite fines shown in table 1.

Table.1. Dry Compressive Strength Characteristics of bricks

SL.NO	LATERITE FINES IN %	DRY COMPRESSION TEST IN N/MM^2
1	0	7.3
2	10	5.9
3	20	4.6
4	30	3.94
5	40	3.31

It was observed that as the curing is increased the compressive strength of the bricks decreased as the laterite fines increased as shown in figure 1. The bricks were found to have strength above 3.5N/mm^2 at 28 days curing age as recommended by most standards which are suitable for masonry units.

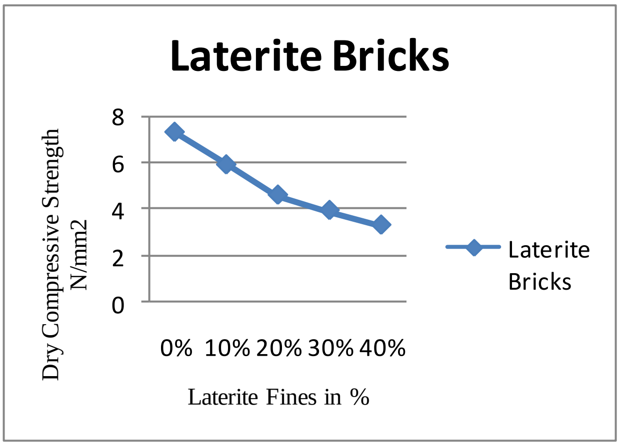

Figure.1. Variations of Compressive strength for Dry bricks with varying laterite fines

Wet Compressive strength:

The Wet compressive strength characteristics of the bricks with increasing replacement levels with laterite fines have been shown in table 2.

Table.2. Wet compressive strength characteristics of bricks

SL.NO	LATERITE FINES IN %	WET COMPRESSION TEST IN N/MM^2
1	0	40.53
2	10	37.45
3	20	35.97
4	30	34.67
5	40	32.41

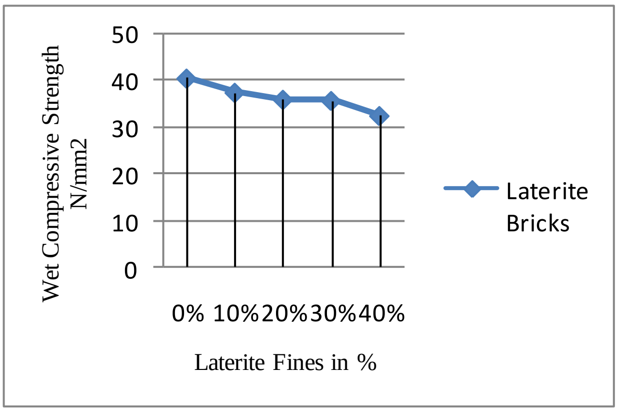

Figure.2. Variation of Compressive strength for wet brick with varying Laterite fines

The wet compression test results s shown in fig 2 also revealed that the bricks had relatively lower compressive strength as the laterite fines increased although they were suitable for non-structural masonry purposes. As the laterite fines increases there was declining in compressive strength could also be attributed to the increasing fine particles, which is excepted to bond with same quantity of cement paste, there by resulting in strength reduction. Results suggest that partial replacement of sand with laterite fines for structural purposes could be done under dry conditions but the conditions where humidity is more replacement should not exceed 30%.

Water Absorption test:

The variations in the water absorption characteristics of the bricks as the laterite fines increase as been shown in table 3.

Table .3. Water Absorption test

SL.NO	LATERITE FINES IN %	WATER ABSORPTION TEST IN %
1	0	13.99
2	10	14.79
3	20	15.61
4	30	17.02
5	40	20.17

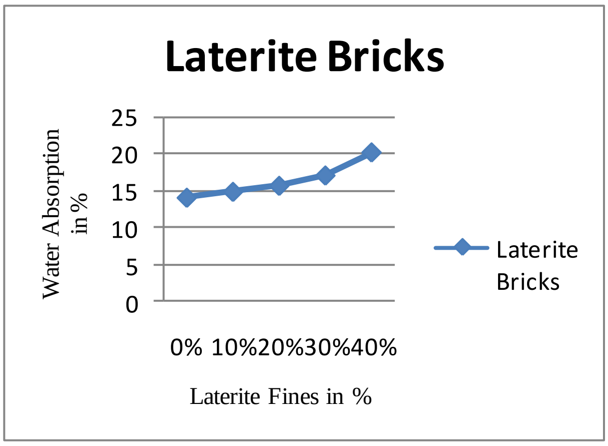

Figure.3. variation of water absorption characteristics of bricks with varying laterite fines

The water absorption characteristics variation of the bricks as the laterite fines increase has been shown in Fig. It was observed with higher quantity of laterite fines were more permeable because laterite fines tend to the more porous in nature. High water permeability in the bricks results with lesser density, low compressive strength and durability. Water existing in the pores of laterite bricks tend to cyclically expand and contract, thereby creating stress within the material resulting in the weakening of masonry units. These pores tend to absorb water which tends to weaken the bonds between the particles. Significantly, bricks with laterite fines from 0%to30%fell within the recommendable water absorption limit.

IV. CONCLUSION

1) The compressive strength characteristics of the brick were found to be inferior to sand Crete brick only, they were found to be suitable for both load and non load bearing masonry units after 28 days curing age.
2) Bricks with the laterite fines replacing the natural sand can satisfactorily used as a masonry units when the laterite fines content does not exceed 30%.
3) The most essential and expensive constituent of the brick is sand, to minimize the cost and maximize profit, commercial producers of these bricks reduce the quantity of sand and which gives acceptable quality required by various standards.
4) In order to prove adequate housing for the ever increasing population of people in India, the use of laterite cement bricks should be encouraged by individual and Government at all levels.
5) The laterite brick from the quarries of southwest part of India are week, but can satisfactorily be used for masonry units of low rise buildings and partition walls in high rise buildings.

V. REFERENCES

[1]. Wilson U.N., Raji S.A, et al, (2016), Comparative review on the use sandcrete bricks and laterite-cement bricks, ISSN 2349-5715, ISSN 2349-5707, Issue 2016.

[2]. Asiedu Emmanuel and Agbenyega Allan, (2014), Suitability of laterite fines as a partial replacement for sand in the production of sandcrete bricks, ISSN 2250-2459, vol 4, issue 10, October 2014.

[3]. George Rowland Otoko, (2014), The use of laterites for production of sandcrete bricks, ISSN 2327-0349, vol 2, no 4, April 2014, pp 1-11.

[4]. Issac Olufemi Agbede and Manasseh Joel,(2008), Use of cement and admixture in laterite brick production for low cost housing, ISSN 1583-1078, Issue 12, January-June 2008, pp 163-174.

[5].M S shetty and S Chand, Concrete Technology,7 Edition,1982.