



Experimental Investigation on Partial Replacement of Laterite as Fine Aggregate in M20 Concrete

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ABSTRACT-

Concrete is the most crucial engineering material. The Concrete made by resource of mixing cement, FA, CA and water and sometimes admixtures in minute quantities. As a consequence the increased need to grow to be aware of an appropriate replacement, this is green and less highly-priced may be used as an alternative to the sand inside the production of concrete. The laterite can use in construction.

In this research work, effortswere made to decide the usageof laterite as an option to natural sand and manufactured sand. Natural sand is partially replaced by laterite sand at 10, 15, 20, and 25%. Tests results are.

Keywords- Laterite soil, Construction, Concrete, Compressive Strength, Tensile Strength, Flexural Strength Cement, Natural Coarse Aggregate (NCA).

Introduction

In emergingnations, the available building materials are over accentuated because there is a vastdisproportion between the demand for construction activities and the shortage of conventional building materials which in turn increases the cost of construction. The need for concrete is very high due to the quick growth of infrastructure development in India. FA is a main constituent of concrete. Hence the readiness and cost of fine aggregate decide the viability and economy of concrete. In this experimental study, performance of M-20 grade Laterite sand concrete is investigated by partially replacing fine aggregate with laterite sand.

Objective

The main focus of this work is to study the performance criteria of concrete made with laterite as partial replacement of FA. For laterite to be used in concrete, it is essential to carry out a profound study of their material properties and how these properties in turn affect the quality of the second-generation concrete in presence of material like laterite.

Therefore following objectives of present work-

- 1) To analyze the Compressive strength, Flexural Strength and Tensile strength of concrete made by partially replacing of natural fine aggregate with laterite sand.
- 2) To analyze the possibility for use of laterite sand in concrete in core construction rather than using it as infill material.

Experimental work

Materials:

Cement: Ordinary Portland cement (OPC) 53 grade is used.

Laterite sand: commercially available was used as 10, 15, 20, 25% replacement of natural sand.

Fine aggregates: Fine aggregate which is obtainable river sand.

Natural coarse aggregates: Coarse aggregates used in the experimental study were 20 mm down size.

Water: Normal water was used in this experimental study.

Mix design

The mix proportions are by weight (1:1.5:3). The proportioning of concrete mix is carried out in accordance to IS 456-2000 and as per the guidelines of IS 10262:2009 (draft 2007).

Compressive Strength Test:

Compressive strength was calculated through proper procedure with cube size 150*150*150 mm and is cured for 7 and 28 days before testing.

Flexural Strength Test

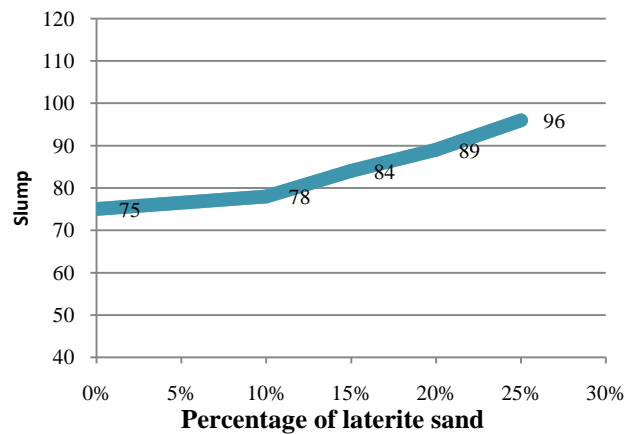
Flexural strength was calculated through proper procedure with the beam size 15*15*70 cm and was cured for 7 and 28 days before testing respectively.

Split Tensile Strength Test

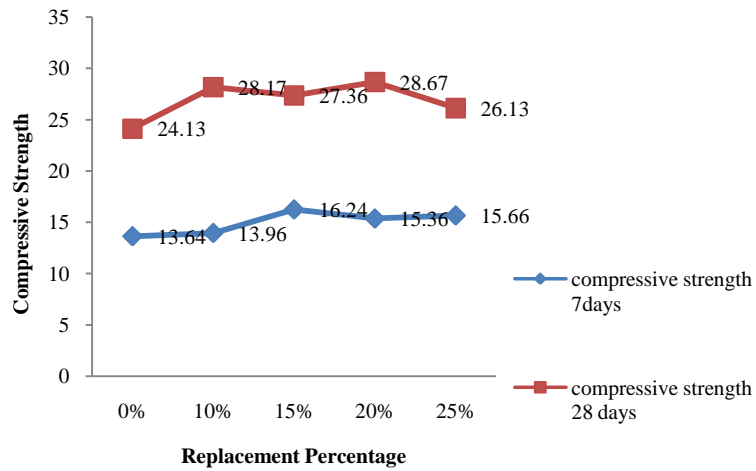
Cylindrical dimension is about 15 cm in diameter and height is 30 cm.

Results & Discussion**Workability Test:**

Batch Mix	Percentage of LS	Slump (mm)
Mix 01	0 %	75
Mix 02	10 %	78
Mix 03	15 %	84
Mix 04	20 %	89
Mix 05	25 %	96

Slump Cone Test**COMPRESSIVE STRENGTH TEST RESULT****Variation of compressive strength with age**

% of LS	0%	10%	15%	20%	25%
7 Days	32.07 MPa	32.96 MPa	33.62 MPa	34.16 MPa	30.21 MPa
28 Days	44.81 MPa	45.70 MPa	47.18 MPa	48.81 MPa	44.22 MPa

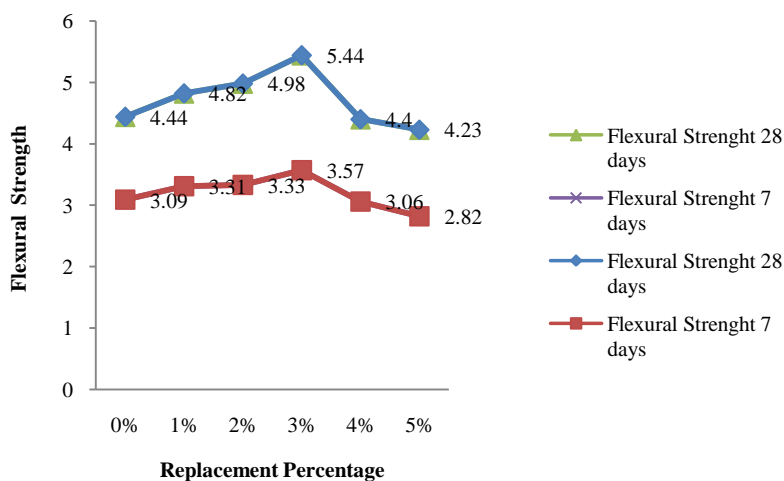


As shown in the graph: (7 days strength), when sand is partially replaced 20% by Laterite sand, compressive strength is increased by 7.67%. As shown in graph: (28 days strength) show an increment of 10.12% of strength of 15% replacement of Cement as compared with conventional concrete.

Flexural Strength

Variation of flexural strength with age

% of LS	0%	10%	15%	20%	25%
7 Days	3.09 MPa	3.31 MPa	3.33 MPa	3.57 MPa	3.06 MPa
28 Days	4.44 MPa	4.82 MPa	4.98 MPa	5.44 MPa	4.40 MPa

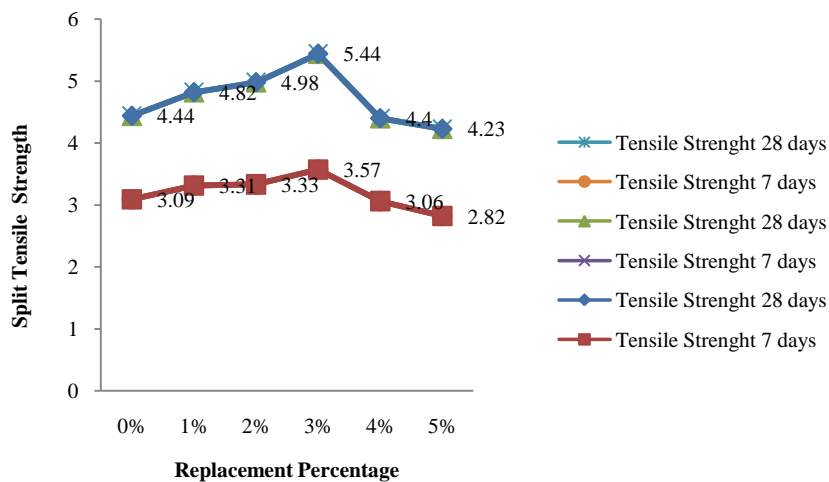


As shown in the graph: 5 (7 days strength), when cement is partially replaced 20% by Laterite sand, Flexural strength is increased by 15.57%. As shown in graph: 6 (28 days strength) show an increment of 22.22% of strength of 15% replacement of Laterite sand as compared with conventional concrete.

Split Tensile Strength

Variation of Tensile strength with age

% of LS	0%	10%	15%	20%	25%
7 Days	2.62 MPa	2.87 MPa	3.28 MPa	3.33 MPa	2.69 MPa
28 Days	4.70 MPa	5.10 MPa	5.26 MPa	5.64 MPa	4.60 MPa



As shown in the graph: (7 days strength), when cement is partially replaced 15% by Laterite sand, Tensile strength is increased by 27.07%. As shown in graph: (28 days strength) show an increment of 20% of strength of 20% replacement of Laterite sand as compared with conventional concrete.

Conclusion

Based on the investigations, the following conclusions were drawn.

The absence of deleterious and the mineral compositions of laterite reveal the possibility of using the laterite as partial replacement of natural and manufactured sand.

Also, the combined use of both Laterite sand and Natural Coarse Aggregate demonstrated excellent performance due to efficient micro-filling capacity. Therefore Laterite sand can be used as a good alternative to natural sand in concrete mix.

Compressive strength, Flexural strength, Split tensile strength test of concrete Mixes made with and without Laterite sand has been determined at 7 & 28 days of curing. The strength gained has been determined of Laterite sand added concrete with addition of 10%, 15%, 20%, & 25% for M20 grade as a partial replacement of sand in conventional concrete. After performing all the tests and analyzing their result, the following conclusions have been derived:

1. Workability of concrete increases as proportion of laterite sand increases.
2. Maximum compressive strength was observed when laterite sand replacement is about 20% of cement.
3. Maximum split tensile strength was observed when laterite sand replacement is about 20% of cement.
4. Maximum flexural strength was observed when laterite sand replacement is about 20% of cement.

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