

Experimental study on strength properties of Laterite concrete

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Abstract - Concrete is extremely used construction material. Concrete is made from cement, sand and coarse aggregate. It is important to avoid wastage of natural resources. Hence concrete should be made of some eco-friendly materials to avoid wastage of natural resources. Laterite is one of important construction material used from ancient times. Research is already made for the use of laterite sand in concrete.

In this study mainly deals with the use of laterite sand as a partial replacement of fine aggregate in concrete. A mix designed was prepared for M20 and M25 grade concrete. Fine aggregate was partially replaced with laterite sand to 10, 20, 30, 40 and 50% for both M20 grade and M25 grade concrete. Mix proportion obtained for the M20 grade was 1:1.7:2.73 and for M25 grade mix proportions were 1:1.37:2.56

Key Words: Concrete, Laterite sand, Cementitious material, Compressive strength test, Split tensile strength test.

INTRODUCTION

The construction sector is developing rapidly whereas new techniques are coming which helps in comfort in work circles. Concrete is most important construction materials for any construction. As consumption natural ingredients which are one important ingredient of concrete, which results in high cost in future. It's an importance to recover the usage of virgin materials to be used in concrete with a variety of different substances. As some substances can be used which are natural origin thereby avoiding degradation in natural-aggregates.

Concrete which is derived from the Latin word "concretus". Concrete is a binding material which is primarily used with other natural aggregates. It is very important to know that production of various construction materials requires power, which is one of economic factor. It is known that power consumed for production of concrete may be minimal when compared to manufacturing of steel, bricks, glass, plastic, and aluminum materials. As now a day's production of concrete consumes less water than steel manufacturing industries were they cause environmental contamination. Steel which is a backbone of reinforced concrete construction adds in consumption of large proportion of steel.

LATERITE SAND

Lateritic soils are natural occurring which is widely used building material in the globe. Laterites are used for masonry wall rural and urban areas. Mainly use of laterite is for making low-cost concrete. They can be replaced partially

or fully with sand in concrete. Research needs to be done for use of laterisation sand in concrete for analysis of structural behavior. In order to utilize eco-friendly materials, their investigation needs, to be carried out for noting properties of unsterilized and non-stabilized behavior in concrete. Laterite is mainly formed by weathering of rock at hot and wet regions. The color of laterite is generally in red or rusty-red color. Various modes of lateritic formation depend on tropical weathering process in the rocks.

The main advantage is that the composition in its surface does not change according to the time. Laterite which is a source of rich aluminum ores were this ore is formed by clay resources, in which hydroxide, gibbsite which combine to form bauxite mineral. The layer of laterite may be co-regulated broken or homogeneous type. They may be small or in large quantity depending on weathering process involved.

OBJECTIVE

The objective of present study is a utilization of laterite sand in concrete for partially replacing of Fine aggregate with various proportions and thereby reducing the cost of construction.

Following are specific objectives have been set for investigation considering curing period up to 28days and then comparing it with normal concrete.

1. To evaluate the effect of various percentage of replacement with laterite sand with fine aggregate on the compression strength.
2. To find out an effect of various % of replacement of laterite sand with fine aggregate to split tensile strength.

MIX DESIGN

MIX DESIGN CALCULATION M20 GRADE

Table -1: M20 GRADE

Grade of Designation	M20
Cement type	OPC 43 grade
Size of aggregate used	20mm
Min. the content (cement)	320kg/m ³
Max w/c ratio	0.50
Workability	100mm
Supervision type	Good

Condition exposure	Severe
Type	Crushed aggregate

Following results are obtained for compressive strength of Concrete cubes.

Concrete proportions

Cement	F.A	C.A
394	668.8	1075.0

MIX PROPORTION - 1: 1.70:2.73

Table -2: M25 GRADE

Grade of Designation	M25
Cement type	OPC 43 grade
Size of aggregate used	20mm
Min. the content (cement)	320kg/m ³
Max w/c ratio	0.45
Workability	100mm
Supervision type	Good
Condition exposure	Severe
Type	Crushed aggregate

Concrete proportions

Cement	F.A	C.A
437.37	588.86	1123.85

MIX PROPORTION - 1: 1.37: 2.56

TESTING OF CONCRETE CUBES

Compressive strength test

- It was carried in cubical specimen having size 150 ×150 ×150 mm.
- The mix designed is of M20 and M25 grade, the compressive test is conducted for cubes for curing period of 7 and 28 days in accordance with IS 516-1959.

Split tensile strength test

- Test was carried in a cylindrical specimen of size 150 mm and 300 mm in dia and length are used.
- Mix designed are of M20 and M25 grade, split tensile test is conducted for a cylindrical specimen for curing period of 7 and 28 days in accordance with IS 516-1959.

RESULTS

M20grade

Replacement	0%	10%	20%	30%	40%	50%
7 days	16.52	16.60	17.25	16.47	14.66	11.21
28 days	20.81	20.95	21.40	19.05	17.85	16.31

M25 grade

Replacement	0%	10%	20%	30%	40%	50%
7 days	19.40	20.45	21.15	18.15	16.87	14.15
28 days	27.13	27.50	28.76	26.95	23.17	20.60

Following results are obtained for Split tensile strength of Concrete cubes

M20 grade

Replacement	0%	10%	20%	30%	40%	50%
7 days	1.18	1.20	1.34	1.06	0.97	0.76
28 days	1.63	1.81	1.93	1.59	1.41	1.29

M25 grade

Replacement	0%	10%	20%	30%	40%	50%
7 days	2.16	2.38	2.98	1.96	1.64	1.49
28 days	2.98	3.18	3.62	2.30	2.05	1.95

CONCLUSIONS

1. The obtained compressive strength, a property of concrete was increased with the replacement with laterite sand for certain percentages and thereafter it decreased.
2. Compressive-strength of concrete for M20 & M25 grade showed its peak strength at 20% replacement of sand with laterite sand when compared to normal mix without laterite sand at 28 days curing.
3. The obtained splitting-tensile strength, a property of concrete was increased with the replacement with laterite sand for certain percentages and thereafter it decreased.
4. Tensile strength of concrete for M20 & M25 showed its peak strength at 20% replacement of sand with laterite sand when compared to normal mix without laterite sand at 28 days curing period.

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