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Design of Compressive Strength of Concrete by Using Laterite Aggregate

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Abstract

Integration of new material as a partial course aggregate and fine aggregates replacement in local concrete production would be able to reduce the high dependency of concrete manufacturer on current aggregate supply that may lead to ecological imbalance when natural material is used excessively. This project presents the assessment on the characteristic of laterite aggregate obtained from Konkan region before discussing further on the influences of this local material towards engineering properties of normal concrete. Concrete mixes containing 0%, 10%, 20% and 30% laterite aggregate and 25% and 50% of laterite sand replacement level were cast before subjected to water curing for 7 and 28 days. Compressive strength test and flexural strength will be conducted in accordance to the existing standard.

The present experimental investigation examines the effect of laterite aggregate, as partial replacement to cement and aggregate various properties of concrete block. Investigation is doneon M30 grade mix using laterite aggregate as partial replacement by weight of cement. Experimentation is carried out to find the compressive strength, flexural strength of the concrete blocks. Experimentation is also carried out analysis the production cost of concrete blocks by using laterite aggregate.

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Keywords: *Laterite aggregate, Compressive Strength, Flexure strength.*

I. INTRODUCTION

The need to utilize other types of material as a partial aggregate replacement in concrete stems from the escalating demand of construction industry for concrete material leading to increasing use of conventional aggregate exploited from the environment.

This creates a unique problem where the supply of raw materials required for construction (cement, sand, steel etc) is falling short of demand.

This problem has been foreseen and exhaustive research exists on use of waste materials and industrial by-products in construction to make small scale construction more sustainable. This research attempts to focus on providing a local solution to small scale construction firms by utilizing an indigenous material for local works that will be well known to local builders and masons and will not create logistical and technical problems that are usually associated with integrating a new material into the construction process. Laterite is a reddish brownish rock found mostly in tropical belts of the world. The majority of the land area containing laterites is in between tropic of Cancer and Capricorn. The availability of laterite facilitated the integration of these aggregates as partial replacement for coarse & fine aggregates in local concrete production. The high intensity rainfall, high temperature, intensive eluviations, and good drainage promote the development of thick laterite weathering covers in tropical regions. These aggregates are also used as construction building materials owing to their availability in large quantities in some parts of the world. Laterite could be used as sole fine aggregate for making structural concrete. Such laterized concrete would be especially useful for concrete elements under mild conditions of exposure that are reasonably protected from the effects of harsh weather therefore, integrating other alternative material as partial replacement of aggregate in concrete making is anticipated as one approach to reduce the high consumption of raw materials by concrete industry. Concrete is considered as durable and strong material. Reinforced concrete is one of the most popular materials used for construction around the world. Reinforced

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concrete is exposed to deterioration in some regions especially in coastal regions.

II. OBJECTIVES

The following are the objectives of the research:

- To replace the coarse aggregate in concrete with laterite aggregate in varying percentages of 10%, 20%, 30%.
- To replace river sand in concrete with laterite sand in percentages of 20 % and 10 %
- To carry out testing on cylinder and cube cast using laterite concrete
- Comparison of the results compiled to find optimum percentage for replacement of aggregate and sand in concrete while maintaining desirable properties like strength, durability etc.
- Increase sustainability in local construction works
- Decrease pressure on current raw materials require for conventional concrete

III. PROPERTIES LATERITE AGGREGATE

Properties	Laterite coarse aggregate (LCA)	Laterite fine aggregate (LFA)
Water absorption	8.4% 8.4%	14% 14%
Specific gravity	2.74 (E.g method)	2.6
	2.4 IS method	2.24
Compressive strength	2.35 N/mm^2	
elongation	11.96 %	-
flakiness	1.3%	
Crushing value	34.8 %	-
Fineness modulus		3.2

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IV. RESULTS

Table 1: 7 & 28 days gain for LFA 10 cubes

	7 days	28 days	% gain
Control	18.81	28.43	66.16%
LCA10,LFA10	28.22	39.56	71.33%
LCA20,LFA10	22.07	35.85	61.56%
LCA30,LFA10	22.4	30.66	73.06%

Table 2: 7 & 28 days gain for LFA 20 cubes

Variation	7 days	28 days	% gain
Control	18.81	28.43	66.16%
LCA10,LFA20	29.4	41	71.70%
LCA20,LFA20	26.8	37.85	70.80%
LCA30,LFA20	23.4	35	66.86 %

V. CONCLUSIONS

1. Early strength gain is observed in concrete containing laterite compared to conventional concrete,

2. This gain in initial strength is more rapid for concrete samples where higher % of laterite fine aggregate was used.

3. This maybe because the Fine Aggregate increases the contact area for a better bond within concrete, however as we increase the LCA for concrete samples with LFA 20 % replacement the early strength is seen to gradually drop going from 71.7% (LCA10,LFA20) to 66.86% (LCA30,LFA20).

4. As we increase the % replacement of coarse aggregate the compressive strength (28 days) is seen to decline for both combinations. This may be due to the fact that laterite is a softer stone

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than conventional aggregate and also has significantly higher water absorption than conventional aggregate. However laterite also has a property of hardening when it comes in contact with water this may contribute to overall final strength achieved.

5. The highest strengths in all variations was achieved by concrete which had lowest LCA content and higher LFA.Though all variations were above the strength of conventional concrete (M20) the highest was recorded for LFA10,LFA20 at 41 N/mm2.Hence it is recommended that the optimum percentage of replacement of aggregate for improving sustainability of concrete is 10 % for coarse aggregate and 20 % for fine aggregate.

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VI. REFERENCES

1) K. Muthusamy and N.W.Kamaruzaman- Assessment of Malaysian Laterite Aggregate in Concrete

2) Biju Mathew, Dr. Benny Joseph - Strength Performance of Concrete using Laterite as Sand Replacement, August – 2013

3) Kasthurba. A. K (Department of Architecture, NIT Calicut, India)- Characteristics of Malabar Laterite as a Building Material Field and Laboratory Studies 2012

4) Indian Minerals Yearbook 2014 (53rd edition) laterite

Page 31-36 © MANTECH PUBLICATIONS 2017. All Rights Reserved

5) Amar R Dongapure-Study on Strength of Concrete using Lateritic Sand and Quarry Dust as Fine Aggregates,(IJERT 2014)

6) IS 3620-1979-Laterite Masonry blocks

7) Syed ZaighumAbbass-Clean Development Mechanism: Laterite as Supplementary Cementing Material (SCM) to Reduce Greenhouse Gas Emissions (GHGs) 2013

8) A K Kasthurba, Krishna R Reddy-Use of Laterite as a Sustainable Building Material in Developing Countries August 2014

9) S. K. Jain-Engineering properties of laterite stone scrap blocks,September, 2011

10) L. O. Ettu, O. M. Ibearugbulem-The Suitability of Using Laterite as Sole Fine Aggregate in Structural Concrete, May-2013

11) IS 10262-2009 & IS 456 : 2000 - Plain and Reinforced Concrete

12) Vadagbalkar Shrinivas Krishnaji - Study of laterites around Talmod, Maharashtra state, India, Volume- 1 Issue-2 (2014) ISSN: 234

13) Mike Widdowson- Evolution of Laterite in Goa (2009)

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