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EXPERIMENTAL STUDY ON CONCRETE WITH PARTIAL REPLACEMENT OF COARSE AGGREGATE WITH LECA

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ABSTRACT

Minimizing the density obviously requires a higher volume fraction, but this usually causes aggregates segregation in a conventional mixing process. Thus to reduce the density of concrete, lightweight expanded clay aggregate is used and an optimum volume fraction is maintained in mix, keeping a low replacement ratio to determine the density of lightweight concrete. The grades of the concrete investigated are M40 which consist of standard and high strength concretes. The density of LWC typically ranges from 1800 to 2100 kg/m^3 compared with that of 2500 kg/m^3 for normal-weight concrete (NWC). Choosing of 2-8mm size of the material in angular shape and partially replacing LECA by 20% and 30% in two variants for achieving the final result. The Experimental results in the investigation of lightweight expanded clay aggregate shows an increase flexural strength when compared to conventional concrete.

KEYWORDS: Light weight concrete, LECA, Flexural Strength of concrete.

I. INTRODUCTION

Lightweight concrete (LWC) has been used for structural purposes for many years. The density of LWC typically ranges from 1400 to 2000 kg/m^3 compared with that of 2400 kg/m3 for normal-weight concrete (NWC). The use of high-strength LWC can reduce the self-weight of structures and cross-sectional areas of structural elements. Both can increase the effective usable space for high-rise buildings and increase the span length for bridges. Some of the LWC may not have strengths as high as those of normal weight concrete (NWC), they have high specific strengths (defined as compressive strength/unit weight) similar .to those of high-strength normal weight concrete (HSNWC).

The seismic analysis of the structure is functionally depending on dead load and the earthquake forces acting on that. The LWC structure which is subjected to seismic analysis resulted in less bending moments and shear forces which may pave way either to reduce the cross section of members or to reduce the steel in moment and shear resisting section

II. METHODOLOGY

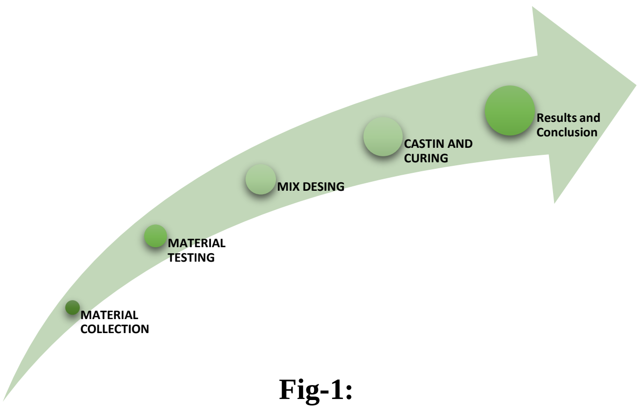

Fig-1:

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III. EXPERIMENTAL TESTS

The experiments were carried out with two replacement ratios of 20% and 30% of LECA with coarse aggregate with conventional concrete of M40 grade and the compressive, split tensile and flexural strength tests were conducted.

Compressive strength test was conducted for conventional, 20% and 30% coarse aggregate replaced with LECA with specimens of size 150mm × 150mm × 150mm respectively. Three specimens were casted for each trial test totally three trail test for 7, 14 and 28 days curing period. The average values are shown tabulated below

Table-1: Compressive Strength Test

Specimen	7 DAYS N/mm²	14 DAYS N/mm²	28 DAYS N/mm²
Conventional Concrete	23.97	39.86	47.8
LECA 20%	22.4	39.26	44.37
LECA 30%	21.33	39.4	42.6

Split tensile strength test was conducted for conventional, 20% and 30% coarse aggregate replaced with LECA with specimens of size 150 mm diameter cylinder. Three specimens were casted for each trial test totally three trail test for 7, 14 and 28 days curing period. The average values are shown tabulated below

Table-2: Split Tensile Strength Test

Specimen	7 DAYS N/mm²	14 DAYS N/mm²	28 DAYS N/mm²
Conventional Concrete	2.02	2.72	3.1
LECA 20%	1.91	2.67	2.87
LECA 30%	1.79	2.57	2.99

Flexural strength test was conducted for conventional, 20% and 30% coarse aggregate replaced with LECA with specimens of size 500mm×50mm×50mm prism. Three specimens were casted for each trial test totally three trail test for 7, 14 and 28 days curing period. The average values are shown tabulated below

Table-3: Flexural Strength Test

Specimen	7 DAYS N/mm²	14 DAYS N/mm²	28 DAYS N/mm²
Conventional Concrete	2.05	3.8	4.28
LECA 20%	3.67	6.93	7.75
LECA 30%	4	8.08	9.03

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IV. DISCUSSION

The results of all the tests were compared with the conventional concrete to conclude

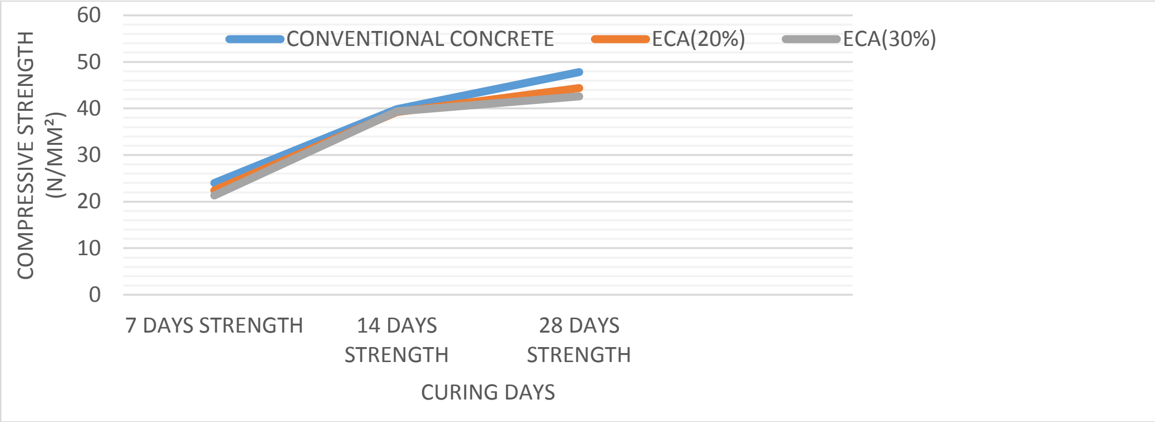

Fig-2: Comparison of Compressive Strength Test

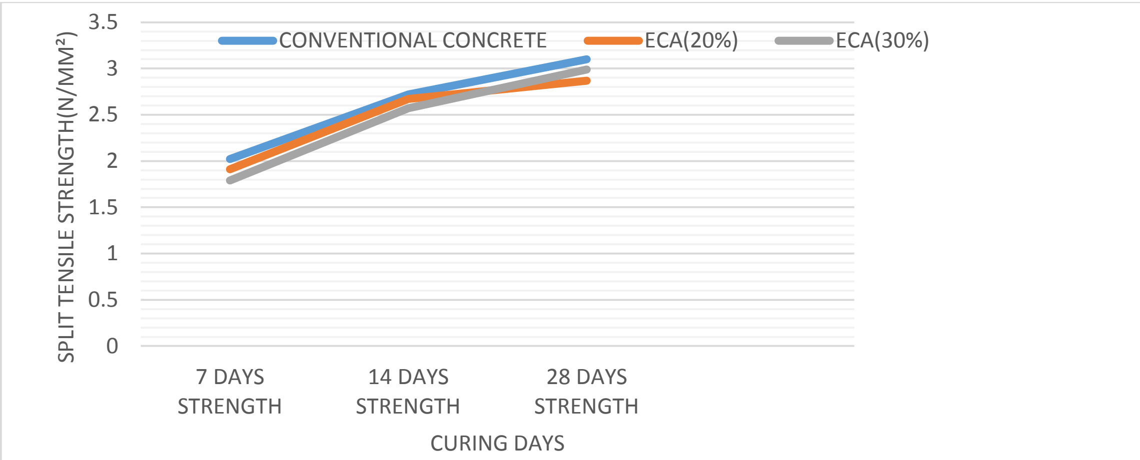

Fig-3: Comparison of Split Tensile Strength Test

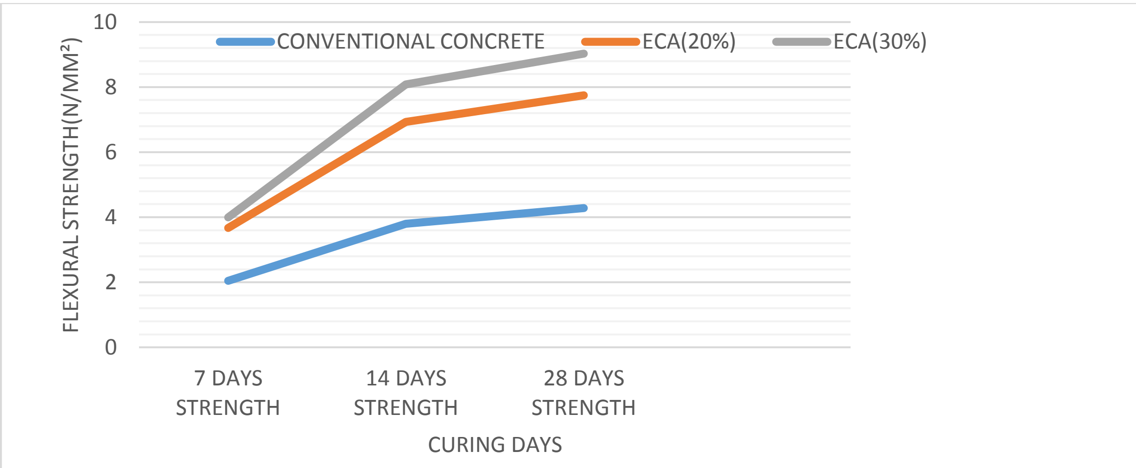

Fig-4: Comparison of Flexural strength test

V. CONCLUSION

- The properties of LECA shows their suitability and potential for replacing natural aggregates in RCC works.
- Pre-wetted LECA gives higher stability of rheological behaviour of fresh concrete.
- Light weight concrete class was achieved using LECA as a partial replacement of coarse aggregate with a density value of 2100kg/m^3 which adheres to LWC classification.
- Partial replacement of coarse aggregate with LECA gives the desired strength required for a high strength concrete.
- An increased flexural strength was observed, which is an excellent property of a concrete that could be used in RCC structures prone to seismicity.
- However the compressive strength was less compared to the conventional concrete but the target strength was achieved and thus is recommended for construction.

VI. ACKNOWLEDGEMENTS

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