"COMPARATIVE STUDY OF LECA AS A COMPLETE REPLACEMENT OF COARSE AGGREGATE BY ACI METHOD WITH EQUIVALENT LIKENESS OF STRENGTH OF IS METHOD"

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Abstract: In design of concrete structures, self weight occupies very large portion of total load coming on the structures critically in cases such as weak soils and tall structures. also impressive benefits in lessening density of concrete ,thus contributing towards economy of work. The light weight concrete gives low density than conventional concrete and has better thermal insulation comparatively. Main intention of carrying out this project is to compare the densities of concrete and strength properties viz. cube compressive strength, split tensile strength cylinders and flexural strength of light weight concrete against conventional concrete by 100% replacing natural aggregates by LECA. Lightweight aggregate has been effectively utilized for well more than two millennia. use of lightweight total adds to the maintainable advancement by moderating energy, bringing down transportation prerequisites, boosting outline and construction proficiency and expanding the service life of the item it is utilized as a part of With expanding concern over the intemperate abuse of common aggregates, lightweight aggregate delivered artificially is a feasible new resource of structural aggregate objects. LECA lately, turned into a vital basic material and the interest for it is expanding.

Key words: LECA, Density, Compressive strength, Tensile strength, Flexural strength

1. INTRODUCTION:

Light Weight Concrete is produced using light weight aggregates. For the most part light weight concrete is not as strong as concrete made with typical aggregates. It is in this way typically utilized when the lightness of the concrete is useful and when high quality is not needed. Because of high self weight of traditional concrete with ordinary aggregates, a few endeavors have been made in the past to decrease the self weight of concrete called light weight concrete which is lighter than the conventional concrete made with typical weight aggregates. There are numerous favorable circumstances of light weight concrete over the typical concrete, one of them being its low density of concrete aides in decrease of dead load. As officially clarified it is more obliged where lightness is more imperative than the strength, for instance for developing elevated structures. It might likewise be utilized as a part of concrete curve spans, where the dead weight of the concrete makes a noteworthy commitment to the loads thus the strength/weight proportion is imperative instead of without a doubt the concrete strength. Another element for utilizing light weight concrete may be its low warm conductivity, which comes about because of its high void substance. Since the strength is affected fundamentally by the coarse aggregates while the workability depends basically on the fine aggregates, concrete is some of the time made with

ordinary weight fine aggregates and light weight coarse aggregates. Usually light weight aggregates must be wetted for 24 hours prior to utilize.

Air entrainment is frequently utilized as a part of light weight concrete to reduce the density, to enhance workability, to enhance imperviousness to frost and to lessen warm conductivity. Especially if ordinary weight aggregates is utilized for the fine aggregates, air entrainment likewise serves to balance the densities of the cement/fine aggregates glue and of the coarse aggregates thus lessens the tendency of the coarse aggregates to float to the top point of concrete.

It is extremely hard to deliver steady light weight concrete. One specific issue is that numerous light weight aggregates absorb water quickly. It is undesirable to utilize aggregates in the immersed, surface-dry condition subsequent to the water substance of the aggregates should be minimized with a specific end goal to keep the concrete density low. For the most part dry aggregates are utilized. Furthermore, the amount of water consumed by the aggregates in the time in the middle of blending and setting of the concrete, which will differ generally as indicated by conditions, must be assessed.

Light weight concrete has turned out to be more famous in the late years attributable to the tremendous points of interest it offers over the normal concrete. Advanced innovation and a superior comprehension of concrete have likewise helped much in advancement and utilization of light weight concrete. Uncommon sort of light weight concrete, however in the meantime sufficiently strong to be utilized for the structural purposes. This sort of concrete has extraordinary future in the years to come.

The main objective of this project is to study the different strength parameters like compressive, tensile, flexural strength, Comparing Density of conventional concrete with light weight concrete for M_{20} grade of concrete and also study the workability characteristics of concrete.

2. MATERIALS AND METHODS

Cement: The cement used in this study was 43 grade (Ultra tech) ordinary Portland cement (OPC). It is brought from aishwarya enterprises near ram mandir, Kalaburagi. The properties of cement used are given in Table 1.

Coarse aggregate: Locally available Coarse aggregate of passing through 20mm sieve and retained on 4.75mm sieve were used for this study. Coarse aggregate of 20 mm down size were procured from Lahoti Crushers in Shahabad road from Kalaburagi, Karnataka. Results of preliminary tests on coarse aggregate are presented in Table 2.

Properties	Results
Specific gravity	3.15
Soundness of cement	6mm
Normal consistency	33 %
Initial setting time	50 minutes
Final setting time	220 minutes

Table 2: Physical Properties of Coarse aggregate

Properties	Results
Shape of coarse aggregate	Angular
Water absorption	0.5 %
Specific gravity	2.8

Fine aggregate: Fine aggregates used for normal concrete were natural waterway sand with Zone II determination going through 4.75mm sieve according to IS 383-1978 and India. The river sand is brought from Bheema river bed

near Shahapur. The physical properties of fine aggregate are shown in Table 3

Table 3: Physical properties of Fine aggregate

LECA: LECA is procured from GBC INDIA, Ahmedabad.

Properties	Results
Type and Zone	River sand and Zone II
Specific gravity	2.57
Fineness modulus	2.82(Medium sand)
Moisture Content	1.39%

The material used for the present study is shown below,

Fig 1: Sample of LECA

Table 4: Physical properties of LECA

Properties	Results
Specific Gravity	1.0
Moisture content	0.257%
Water Absorpton	24.03%
Shape	Spherical
Bulk density	306 kg/m^3
Fineness modulus	1.735

Water: Potable water which is available in laboratory is used for casting of specimen and as well as curing of specimen as per IS 456-2000.

3. CONCRETE MIX DESIGN

In this study, M20grade of concrete was used. The Concrete mix design was done using IS 10262:2009.The water- cement ratio adopted is 0.55 for conventional concrete and .05 for LECA. cubes, beams, cylinders are casted cured for 3, 7 and 28 days strengths. The Mix proportions are shown in table 7

Table 7: M20 Concrete Mix Proportion

Materials	Quantity	Ratio
cement	348.2 kg/m^3	1
Fine Aggregate	689.63 kg/m^3	1.98
Coarse Aggregate	1211.73 kg/m^3	3.48
Water	191.5 litres	0.55

Table 8: M20 Concrete Mix Proportion for LECA

Materials	Quantity	Ratio
cement	401.20 kg/m^3	1
Fine Aggregate	776.65 kg/m^3	1.93
LECA	210.20kg/m^3	0.52
Water	252.92 litres	0.63

Admixture used **: Sikament 581**(water reducer)

Admixture quantity : 0.5% by weight of cement

4.RESULTS AND DISCUSSIONS

Cubes and cylindrical specimens were tested for compressive strength in the Compression testing machine of capacity 2000KN.The cylindrical specimens also were tested to determine split tensile strength. The prism

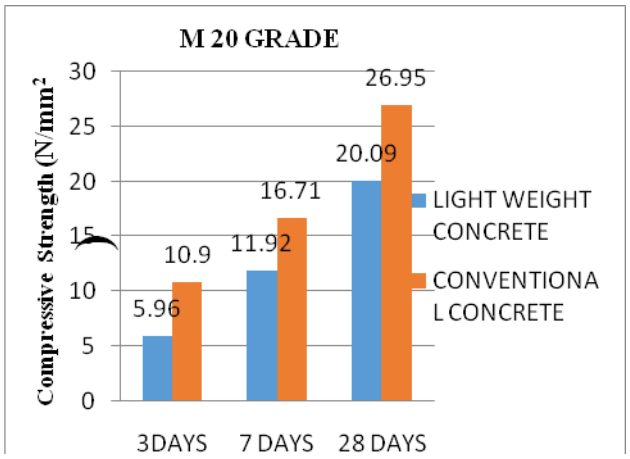
specimens were tested in Universal testing machine of capacity 2000KN.An average of three specimens was tested for each strength tests.

1. COMPRESSIVE STRENGTH TEST

Tests Results of Cube compressive strength are listed in table 8

Table 8: Compressive Strength of M20 for 3 days 7days and 28 days

Days	Strength of conventional concrete N/mm²	Strength of Light weight concrete N/mm²
3 Days	10.90	5.96
7 Days	16.71	11.92
28 Days	26.95	20.09

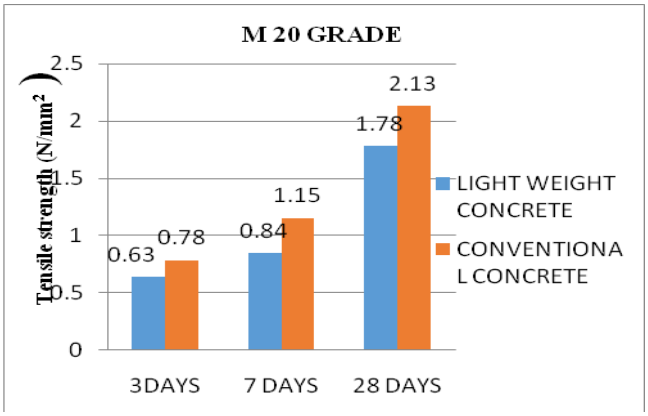


Graph 1 – Comparison of Cube compressive strengths for M 20 grade

2. SPLIT TENSILE STRENGTH: Tests Results of Split tensile strength are shown in table 9

Table 9: Split Tensile Strength of M20 for 3 days 7days and 28days

Days	Strength of conventional concrete N/mm²	Strength of Light weight concrete N/mm²
3 Days	0.78	0.63
7 Days	1.15	0.84
28 Days	2.13	1.78



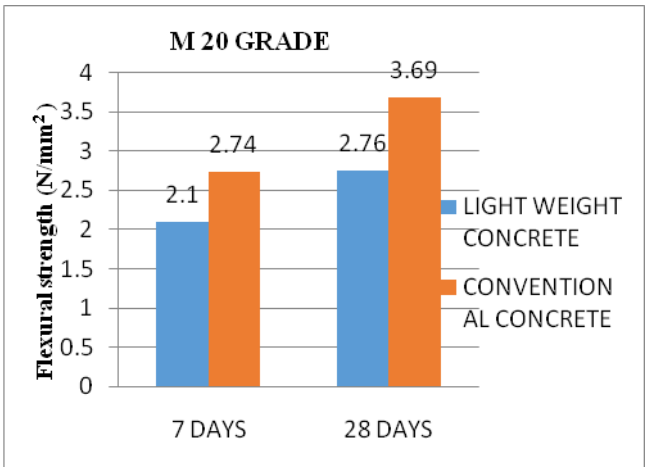
Graph 2– Comparison of Split tensile strengths for M 20 grade

3. FLEXURAL STRENGTH TEST

Tests Results of Flexural strength are shown in table 10

Table 10: Flexural Strength of M20 for 3 days 7days and 28days

Days	Strength of conventional concrete N/mm²	Strength of Light weight concrete N/mm²
7 Days	2.74	2.10
28 Days	3.69	2.76

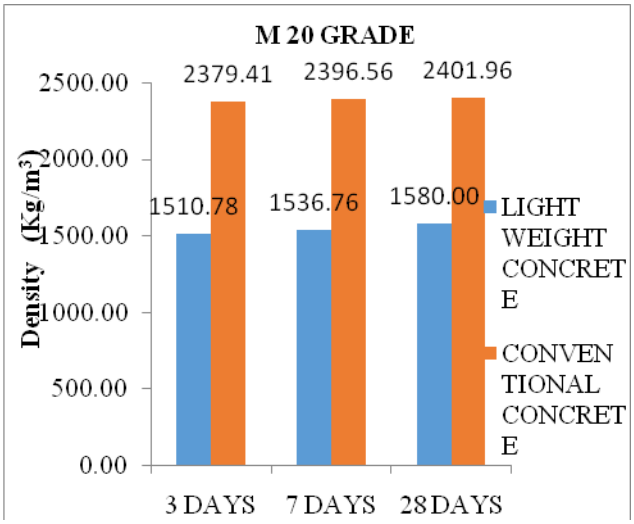


Graph 3– Comparison of Flexural strengths of beams for M 20 grade

4. DENSITY OF SPECIMENS

Table 11–Comparison of density of cubes

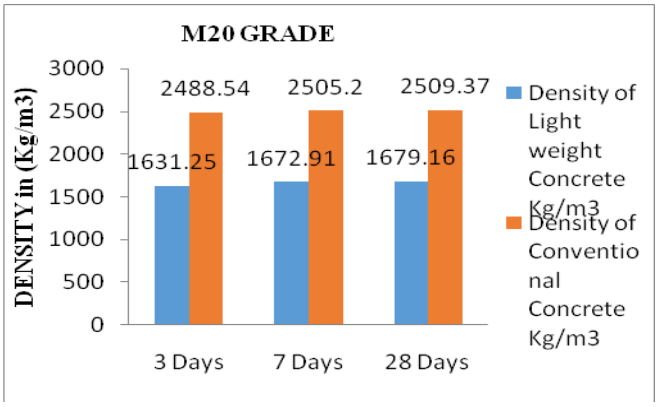
Days	Density of conventional concrete N/mm²	Density of Light weight concrete N/mm²
3 Days	2379.41	1510.78
7 Days	2369.57	1536.76
28 Days	2401.96	1580.00



Graph 4 – Comparison of Density of Cubes for M 20 grade

Table 12 –Comparison of density of Cylinders

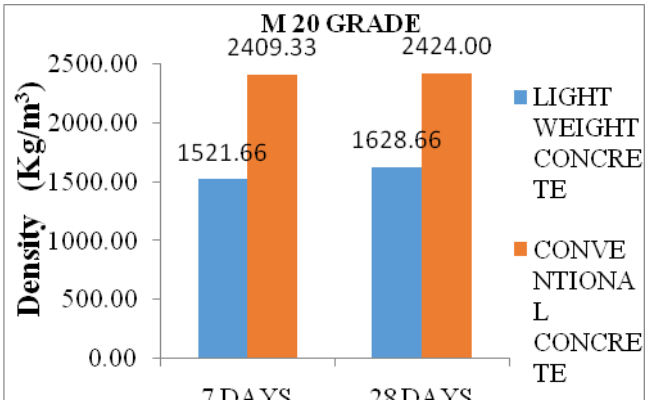
Days	Density of conventional concrete N/mm²	Density of Light weight concrete N/mm²
3 Days	2488.54	1631.25
7 Days	2505.20	1672.91
28 Days	2509.37	1679.16



Graph 5 – Comparison of Density of Cylinders for M 20 grade

Table 13 –Comparison of density of Beams

Days	Density of conventional concrete N/mm²	Density of Light weight concrete N/mm²
7 Days	2409.33	1521.66
28 Days	2424.00	1628.66



Graph 6– Comparison of Density of Beams for M 20 grade

5.CONCLUSIONS

- The main aim of the project is to reduce the density of concrete without affecting the strength
- Cube compressive strengths achieved for M20 grade of LWAC are 20.19N/mm^2 for 28 days.
- The cube Compressive strength, Split tensile strength of cylinder and beam Flexural strength of light weight aggregate concrete is reduced as compared to conventional concrete .
- There is reduction in density of light weight aggregate concrete using LECA as compared to conventional concrete.
- The percentage reduction in density of cubes as compared to conventional concrete for M $_{20}$ grade of LWAC is 34.22% for 28 days.
- The percentage reduction in density of cylinders as compared to conventional concrete for M $_{20}$ grade of LWAC is 35.18% for 28 days
- The percentage reduction in density of beams as compared to conventional concrete for M $_{20}$ grade of LWAC is 32.81% for 28 days
- The Workability of LWAC gets considerably increased when LECA is used as coarse aggregate.

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