Development Light Weight Concrete by Blending with LECA and Cinder

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Abstract— Light weight concrete is widely used in various civil engineering fields due to its low density compared to normal conventional concrete. The present study investigates on the development of light weight aggregate concrete by blending with leca and cinder. The mix design is carried out for both M20 and M30 grade normal conventional concrete mixes; the coarse aggregate proportion is fully replaced by blended aggregates (leca and cinder) in various percentages by volume. The experimental results shows that the full replacement of coarse aggregate proportion with 40% of leca and 60% of cinder aggregates have given the better results with high strength, less weight and low density.

Key words: leca, Cinder

I. INTRODUCTION

Concrete is one of the important adhesive material used in construction field. It is obtained by mixing of cement, fine aggregates, coarse aggregates and water along with some pozzolonas if required in a proportionate way as per the mix design.

Increased demand in the construction industry lead to increase in the cost of production of concrete .This increased cost of construction materials have paved the way for the researchers to introduce some new construction materials with low cost and high strength. Concrete, due to its high self weight increases the dead load on the structure. Many research works have been carried out in order to decrease the self weight of the construction materials on the structure which lead to the development of light weight concrete. With reference to this there is an increase in the demand for light weight concrete due to low density and high strength. The concrete whose density (1440 to 1840 kg/m3) is comparatively less than that of the normal conventional concrete (2240 to 2400 kg/m3) is termed as light weight concrete.

In the present study, the light weight concrete is developed by preparing the mix design for normal conventional concrete; by replacing the coarse aggregate proportion by blended aggregates at various percentages and then the optimum strength is determined with reference to various tests conducted on it.

II. MATERIALS AND THEIR PROPERTIES

The materials which are used for the experimental procedure are as follows;

1) Cement

Cement is the most important ingredient which determines the fresh & hardened properties of concrete. Ordinary Portland cement of 43 grade (sp gravity-3.15) confirming to IS 12269-1987 is used in this experimental program.

2) Fine aggregates

The aggregates which are passing through 4.75mm size IS sieve and contains only that much of coarse grained materials as permitted by the specifications are generalized as fine aggregates. Fine aggregates confirming to zone II passing through 4.75mm IS sieve (sp gravity-2.52) is used in this experimental program.

3) Coarse aggregates

The aggregates which are retained on 4.75mm size IS sieve and contains only finer materials are generalized as coarse aggregates. Coarse aggregates

Passing through 12mm sieve and retained on 10mm sieve (sp gravity-2.63) are used in this experimental program.

4) LECA:

It is abbreviated as LIGHT EXPANDED CLAY AGGREGATES. It is the special type of aggregate (sp gravity-0.510) which are formed by pyroclastic process in rotary kiln at very high temperature. LECA is non-Destructible, non-combustible & impervious to attack by dry-rot, wet-rot & insects.

5) CINDER:

Cinder is a naturally occurring light weight rock (sp gravity-1.512) of igneous origin. It is a pyroclastic material which is similar to that of pumice and has many cavities with low density which can float in water.

III. METHODOLOGY

The raw materials are firstly cleaned such that it should be free from impurities and then they are subjected to the basic tests. The results for the basic tests are determined. Based on the appropriate water cement ratio the mix designs are obtained for both M_{20} & M_{30} grade concrete as per the codal provisions. For the obtained mix design the light weight aggregates such as LECA & CINDER are fully replaced in place of conventional aggregates with various percentages. The fresh concrete, slump test is carried for each proportion. For each blended proportioned percentage the cubes, cylinders & prisms are casted in order to determine hardened properties of concrete. The above specimens are kept for curing for 28days and then the test results are determined. The above process is carried for the two grades of conventional concrete. After testing the light weight aggregate concrete the proportion at which optimum strength obtained is determined. Further the optimum light weight aggregate concrete is compared with that of conventional grade concrete, so that the amount of strength gained with respect to normal conventional concrete is determined.

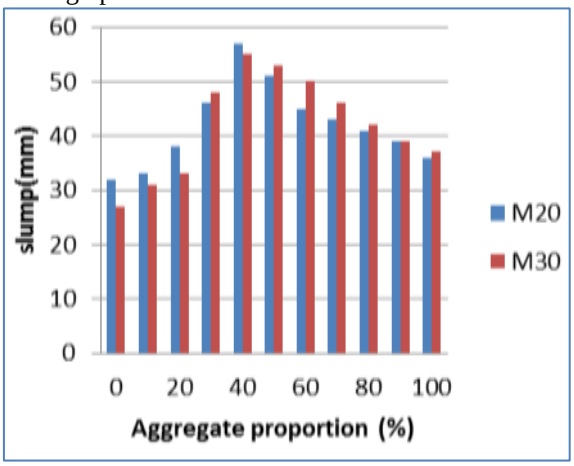
IV. EXPERIMENTAL ANALYSIS:

The fresh and hardened properties of concrete are determined by various tests as follows;

A. Test on Fresh Concrete: Slump Test

The slump test is carried out in order to determine the workability of concrete. Slump test is carried out for various

proportions of light weight concrete and the test results shown in graph 1 as follows

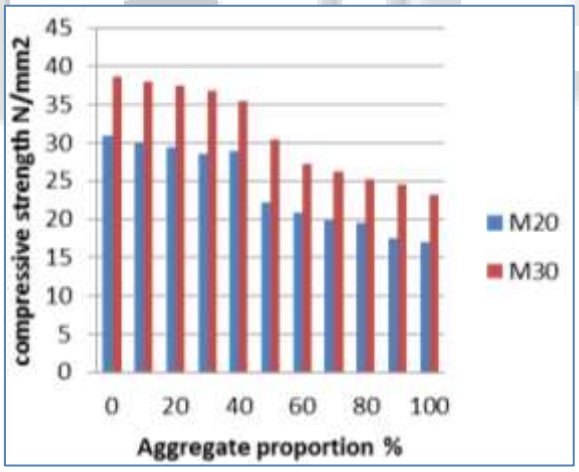


Graph1: comparison of aggregate proportion (%) verses slump (mm) for M_{20} and M_{30} grade concrete mixes

1) Discursion on the slump test: From the above slump values it is observed that the slump goes on increasing up to 40% replacement of leca and 60% replacement of cinder. Further the values of the slump goes on decreasing till the last proportion, therefore from the graph it is analysed that the slump is highest for the 40% leca and 60% cinder replacement proportion.

B. Test on Hardened Concrerte: Compression Test:

The cubes of 150x150x150mm are casted by varying the proportions of leca and cinder for both M_{20} and M_{30} grade concrete mixes. The results obtained are tabulated for the curing period of 28 days as shown below in graph 2



Graph 2: comparison of aggregate proportion (%) verses compressive strength for M_{20} and M_{30} grade concrete mixes

1) Discursion on the compression test: From the above compression test values it has been observed that the strength goes on decreasing from the first proportion to the last in a gradual sense.

V. CONCLUSIONS

From the above results the conclusion obtained are as follows

1) The slump value is found to increase gradually until the (40%,60%) leca and cinder proportions, and thereafter the slump goes on decreasing gradually .Therefore with 40% replacement of leca and 60% replacement of cinder the better workability are obtained for the both concrete mixes.
2) The compression test results are found to be decrease gradually until the (40%, 60%) leca and cinder proportion, but after this proportion there is a sudden decrease in strength to a larger extent.
3) Since the workability of 40% replacement of leca and 60% replacement of cinder is more, then it can be noted that strength for this proportion may give the better performance.
4) It is also observed that with the decrease in the strength of concrete, correspondingly there is decrease in weight and density of concrete in same aspect with respect to the proportions of leca and cinder.
5) Therefore it can be concluded that with the replacement of 40% replacement of leca and 60% replacement of cinder better performance can be achieved with less weight and low density.

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