Experimental Behaviour of Light Weight Aggregate and Mineral Admixtures Based Light Weight Concrete

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Abstract – Light weight concrete plays an important role in concrete industry as it reduces the density. Light weight concrete plays an eminent role in current construction activity. Light weight aggregate along with mineral admixture improves concrete performance. In this work for M25 Grade of concrete along with standard mix light weight material pumice stone was added from 15%,25%,35% and silica fume, fly ash was added for 10% respectively.

Experiments such as Compression test, Tensile Strength and Flexural Strength tests were performed after 7days, 14days, and 28 days respectively. Mix ratio was found to be 1:1:2 and mix design was done as per IS 10262:2009. It is segregated as L1 L2 and L3. The test result shows that L2 seems to show higher strength in all the 3. Addition of mineral admixtures improved the strength.

Index Terms – Pumice Stone, Silica Fume, Fly Ash.

1. INTRODUCTION

There are large numbers of light weight material used for construction industry. Light weight material is achieved mainly by reducing the unit weight, one of the important material is coarse aggregate, specific gravity of coarse aggregate mainly decide the unit weight of concrete. There are lots of natural and artificial light weight materials. One of the main aim of using light weight material is to reduce the dead load .greater buoyancy can be achieved by using light weight material. Pumice stone is one of the naturally available stone which is used in this work to achieve light weight concrete. Mineral admixture such as fly ash and silica fume has good pozzolonic characteristics. These minerals help to improve the strength properties and to reduce the density. Density of light weight concrete normally lies below 2000kg/m^3 . Addition of pumice stone for different percentage along with fly ash and silica fume improves strength property. As light weight concrete has good thermal properties it can be widely used in construction activities The main objective of this work is to find the compression strength, flexural strength and split tensile strength of light weight concrete.

2. MATERIAL PROPERTIES

CEMENT

The cement used was ordinary Portland cement of 53- grade conforming to IS 12269. Specific gravity was found to be 3.15. Initial and final setting time was found to be 30min and 600min respectively.

FINE AGGREGATE

Fine aggregates conforming to grading zone III with particles size 2.36 mm ere used. Fineness modulus was found to be 2.98 and specific gravity was found to be 2.68

COARSE AGGREGATE

Coarse aggregate of size 12.5mm which passes through 12.5mm and retained in 10mm was used

PUMICE STONE

Pumice stone of volcanic origin from Ariyallur district was used. Specific gravity of pumice stone was found to be 1.88

FLY ASH

Fly Ash a by product from coal industry with specific gravity 2.72 was used in this work. Class F Fly ash was used in this work

SILICA FUME

Silica fume purchased from local market was used in this work. Specific gravity was found to be 2.70. size of silica fume was found to be 45micron

WATER

Water used in the mixing is to be fresh and free from any organic and harmful solutions

Super plasticizers High range water reducer from Forsoc was used in this work

MIX PROPORTION

Mix design was done as per IS: 10262 – 2009 for M25 Grade of concrete and mix ratio was found to be 1:1:2 and water cement ratio 0.46. slump was found to be 55mm

L1: Standard mix+10%silica fume+10%Flyash+15%Pumice stone

L2: Standard mix+10%silica fume+10% Flyash +25%Pumice stone

L3: Standard mix+10%silica fume+10% Flyash +35%Pumice stone

DETAILS OF SPECIMENS:

Test specimens used for the investigation are cubes, cylinder and prism specimens.

1. The dimension of the cubes used is 150 X 150 X150mm.
2. The dimension of the cylinders is 150mm dia and a depth of about 300mm.
3. The dimension of beams is 100 X 100 X 500mm

3. TEST RESULTS

Compression test, Tensile strength and flexural strength test was conducted as per IS 516:1959, curing was done for 7, 14, 28 days respectively and the results were tabulated in table 1, 2, 3

TABLE: 1 COMPRESSION STRENGTH TEST RESULT

SAMPLE	AVG 7 DAYS COMPRESSIVE STRENGTHOF CUBES N/mm^2	AVG 14 DAYS COMPRESSIVE STRENGTH OF CUBES N/mm^2	AVG 28 DAYS COMPRESSIVE STRENGTH OF CUBES N/mm^2
L1	9.56	19.60	25.76
L2	9.78	19.25	26.20
L3	9.60	19.15	25.86

TABLE: 2 SPLIT TENSILE STRENGTH TEST RESULT

SAMPLE	AVG 7 DAYS SPLIT TENSILE STRENGTH OF CYLINDERS N/mm^2	AVG 14 DAYS SPLIT TENSILE STRENGTH OF CYLINDERS N/mm^2	AVG 28 DAYS SPLIT TENSILE STRENGTH OF CYLINDERS N/mm^2
L1	1.56	2.87	3.72
L2	1.78	3.12	3.81
L3	1.72	3.00	3.79

TABLE: 3 FLEXURAL STRENGTH TEST RESULT

SAMPLE	AVG 7 DAYS FLEXURAL STRENGTH OF PRISMS N/mm^2	14 DAYS FLEXURAL STRENGTH OF PRISMS N/mm^2	AVG 28 DAYS FLEXURAL STRENGTH OF PRISMS N/mm^2
L1	2.93	5.12	6.81
L2	2.87	5.00	6.76
L3	2.74	4.95	6.59

4. CONCLUSION

From all the experiments the following conclusions were made

- The compressive strength test results for L1 is 25.76 N/mm².
- The compressive strength test results for L2 is 26.20N/mm².
- The compressive strength test results for L3 is 25.86 N/mm²
- The Tensile strength test results for L1 is 3.72 N/mm².
- The Tensile strength test results for L2 is 3.81 N/mm².
- The Tensile strength test results for L3 is 3.79 N/mm²
- The Flexural strength test results for L1 is 6.81 N/mm².
- The Flexural strength test results for L2 is 6.76 N/mm².
- The Flexural strength test results for L3 is 6.59 N/mm²
- When compared to control concrete all the light weight concrete gives good strength
- Density of concrete is minimum when compared to control concrete
- Using of light weight concrete is eco friendly and reduces the dead load.

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