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EXPERIMENTAL INVESTIGATION ON LIGHTWEIGHT CONCRETE BLOCK USING POLYPROPYLENE BALLS

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ABSTRACT:
Lightweight concrete is an innovatory system of concrete which contains spherical hollows as concrete saving elements. High density polypropylene spherical balls are used to replace the in-effective concrete in the centerof the concrete. Voids in the middle of the concrete provide thermal insulation and also leads to 30 to 50% lighter concrete. Polypropylene balls of diameter 65mm and 55mm was used in the concrete. Reduce the CO_2 emission in atmosphere towards eco friendly construction technique. The parameters studied include compressive strength, failure pattern, split-tensile strength, flexural strength and diameter of balls to achieve maximum strength. The test results indicated that when the compressive strength, split tensile strength, flexural strength of the concrete and increases irrespective of change in the diameter of the balls. It was also observed that the compressive strength, split tensile strength, flexural strength of the concrete in 55mm ball diameter was higher than the compressive strength, split tensile strength, flexural strength of concrete in 65mm ball diameter irrespective of the change in diameter of balls. There was a 3-7% reduction in use of concrete and compressive strength, split tensile strength, flexural strength of the concrete compared to the conventional concrete.

1.1 INTRODUCTION

Concrete is the most widely used construction material in civil engineering industry because of its high structural strength and stability. The secret of the popularity lies in the simple fact that except cement all other ingredients of concrete are commonly available local materials like aggregate and water. Earlier we know only about the conventional ingredients of concrete like cement, aggregate and water, but today we are well conversant of the importance of admixture too. The concrete industry is constantly looking for supplementary material with the objective of reducing the solid waste disposal problem. Leaving the waste materials to the environment directly can cause environmental problem. Hence the reuse of waste material has been emphasized. The potential application of industry by-products in concrete are as partial aggregate replacement or as partial cement replacement depending on their chemical composition and grain size. The service life of a structure depends upon durability which depends upon various factors such as: w/c ratio, compaction, and curing. Water cement ratio should be kept minimum and compaction and curing should be ensured to the fullest extent so as to reduce the permeability and increase durability.

1.2 OBJECTIVE

- The aim of this study is to investigate the effect of replacing of polypropylene ball by adding in various proportions to evaluate the performance of these replacement materials on the strength of specimens.

2 MATERIALS

2.1 CEMENT

Cement is the most important ingredient in concrete.Ordinary Portland cement (53 grade) conforming to IS: 1489 (Part 1) 1991 was used for casting all the specimens. The choice of brand and type of cement is the most important to produce a good quality of concrete. The type of cement affects the rate of hydration, so that the strength at early ages can be considerably influenced by the particular cement used.

2.2 FINE AGGREGATE

Clean and dry river sand available locally will be used. Sand passing through IS 4.75mm sieve will be used for casting all the specimens.

2.3 COARSE AGGREGATE

For making SCC maximum size of aggregate is 12.5mm. The aggregate used is sound free from deleterious materials and hacking crushing strength, at least 1.5 times that of concrete. Crushed stone angular shaped aggregate is used. Ordinary blue granite crushed stone aggregate confirming to IS: 383-1970 was used as a coarse aggregate in concrete.

2.4 POLYPROPYLENE

Polypropylene is in many aspects similar to polyethylene, especially in solution behaviour and electrical properties. The additionally present methyl group improves mechanical properties and thermal resistance, while the chemical resistance decreases. The properties of polypropylene depend on the molecular weight and molecular weight distribution, crystallinity, type and proportion of comonomer (if used) and the isotacticity.

2.4 WATER

Water is an important ingredient of concrete as it actively participates in chemical reactions with cement to form the hydration products, calcium-silicate-hydrate (C-S-H) gel. The strength of the cement concrete depends mainly from the binding action of the hydrate cement paste gel. Water confirming to the requirements of IS: 456-2000, is found to be suitable for making concrete. It is generally stated that the water used for drinking is fit for making concrete. In this present study, casting and curing of specimens were done with the potable water, i.e., available in the college premises.

3.LABORATORY TEST AND MATERIAL STUDY

3.1GENERAL

This chapter describes the quantity of materials and the mix ratio used in the project. The materials were checked for their accuracy and quality. The strength parameters required for the computation of mix ratio was tested according to Indian Standards. Grade of cement used was OPC 53. Grade of concrete used was M30. Size of coarse aggregate used was 10mm.

3.2 CEMENT

Sieve analysis method is used to determine the fineness of the cement. The fineness of the cement indicates about the particle size of the cement which should not be less than 90 microns. Generally the size of the cement should be 5 microns to 30 microns to develop earlier strength of cement. In case of sieve analysis, the size of sieve shall be 90 microns. About 100 grams of cement is placed on the sieve and the horizontal and vertical motions are given to the sieve to separate out the finer particles. The percentage residual on the sieve is determined which shall not exceed 10%.

TABLE 3.1 PROPERTIES OF ORDINARY PORTLAND CEMENT

PROPERTY OF CEMENT	VALUES
Fineness Of Cement	7.5%
Grade Of Cement	53
Specific Gravity	3.15

Initial Setting time	28 min
Final Setting Time	600 min

3.3 FINE AGGREGATE

As per IS 2386 (Part 1): 1963, for sieve analysis of fine aggregate the sieves are arranged from 80mm, 40mm, 20mm, 16mm, 12.5mm, 10mm, 6.3mm, 4.75mm, 2.36mm, 1.18mm, 600micron, 300micron and 150micron. Aggregate of known quantity is placed over the top sieve, and after sieving thought the test sieves, the residue in each sieve is weighted the percentage of weight retained to the total weight is calculated, from which the percentage passing is determined. The river sand conforming to **zone II** as per IS 383-1987 was used.

TABLE 3.2 FINE AGGREGATE PROPERTIES

DESCRIPTION OF TEST	TEST RESULT OBTAINED
Specific gravity	2.6
Fineness modules	2.79

TABLE 3.3 SIEVE ANALYSIS RESULT

IS SIEVE	% OF PASSING
4.75mm	100
2.36mm	90
1.18mm	71
600 microns	39.4
300 microns	10
150 microns	0

3.4 COARSE AGGREGATE

TABLE 3.4 SIEVE ANALYSIS RESULT

IS SIEVE	% OF PASSING
12.5mm	100
10mm	55
8mm	35
4.75mm	0

3.5 POLYPROPYLENE

Chemical formula	(C3H6) n
Density	0.855 g/cm3
Melting point	130 to 171 degree C

4.MIX DESIGN OF CONCRETE

Mix design for M30 grade of concrete was carried out as per IS 10262: 2009, recommended guidelines for concrete mix design and accordingly used in the casting of specimens.

4.1 Mix Ratio Computation

a) Grade of cement : OPC 53
b) Grade of concrete: M30
c) Specific gravity of cement : 3.15
d) Specific gravity of fine aggregate : 2.70
e) Specific gravity of coarse aggregate : 2.79
f) Size of coarse aggregate : 10 mm

5. TEST FOR SPECIMEN

5.1GENERAL

In this chapter the test results of Marsh cone test, workability and strength studies are discussed and its influence on various constituents of SCC. And deals with the result and discussions of the experimental investigation carried out to study the mechanical properties of hybrid concrete. The basic strength properties namely compressive strength, split tensile strength and flexural strength were studied.

5.2 COMPRESSIVE STRENGTH TEST

TABLE 5.1 MARSH CONE TEST RESULTS WITH DIFFERENT STEEL

SP% BY CEMENT	TIME IN SEC (T) STEEL1	TIME IN SEC (T) STEEL 2
0.1	168	175
0.3	77.30	83
0.5	50.38	58.23
0.7	38.54	47.12
0.8	38.57	41.03
0.9	38.61	40.67
1	39.31	**39.96**

5.3 SPLIT TENSILE TEST

TABLE 5.2 SPLIT TENSILE STRENGTH RESULTS

SL. NO.	MIX PROPORTIONS	SPLIT TENSILE STRENGTH		
		7-DAYS	14-DAYS	28-DAYS
1	SCC-0	2.33	3.18	4.6
2	SCC-1	2.55	3.61	4.8
3	SCC-2	2.02	2.9	4.35
4	SCC-3	1.91	2.86	4.14

A universal testing machine (UTM), also known as a universal tester, materials testing machine or materials test frame, is used to test the tensile strength and compressive strength of materials. The "universal" part of the name reflects that it can perform many standard tensile and compression tests on materials, components, and structure. Cross head- A movable cross head (crosshead) is controlled to move up or down. Usually this is at a constant speed: sometimes called a constant rate of extension (CRE) machine. Some machines can program the cross head speed or conduct cyclical testing, testing at constant force, testing at constant deformation, etc. Electromechanical, servo-hydraulic, linear drive, and resonance drive are used.

6.CONCLUSION

SUMMARY

Reinforced cement concrete is one of the important component in the construction industry.Now a days the use of concrete increased very much and alternate materials that can be used in concrete.Some locally available materials like fly ash, copper slag, rice husk etc. are evaluated.By using polypropylene balls will not affect the geometry and shape section.Indicated that when the compressive strength, split tensile strength, flexural strength of the concrete and increases irrespective of change in the diameter of the ball.It was also observed that the compressive strength, split tensile strength, flexural strength of the concrete in 55mm ball diameter and 65mm ball diameter

Then after casting and curing the specimen, then check the result of specimen concrete strength and deflection.

SCOPE FOR FUTURE WORK

The mechanical behavior of self-compacting concrete under various confinements can be studied.SCC can be tried with different super plasticizers and a comparison can be made with them.Hybrid fiber reinforced concrete with polypropylene and glass fibers has been adopted to cast and test Exterior beam-column joint under cyclic loading.To study the ductility performance of hybrid fiber reinforced concrete of exterior beam-column joint.

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