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Experimental Study on Strength Characteristics of Concrete with Plastic Balls

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ABSTRACT*: Concrete blocks are the most important component of any building structure. Concrete Blocks provides great thermal comfort and great lifestyle for human beings. Concrete blocks consume more concrete in the casting. Concrete is heavy in weight and more than 5% of CO2 is created during the manufacturing of cement that goes into it. In this paper we studied that reduction of concrete in blocks may be suitable and useful for making lightweight and most effective concrete block after using High density polyethylene hollow spheres. The use of hollow spheres virtually eliminating all concrete from the middle of the blocks which is some percentage structural function, thereby reducing the self-weight and increasing the efficiency of the blocks. This method introducing the 30 to 50% lighter concrete blocks than can reduce the loads on the columns and foundations. It also useful in reducing the cost and emission of CO2.there is decrease in compressive strength of concrete as the usage of plastic ball increases when compared to conventional concrete.*

Keywords: *Recycling, bubble concrete blocks and conventional concrete blocks, comparison.*

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I. INTRODUCTION

Concrete is the most commonly used construction material due to its sustainability, durability, versatility etc. It is highly used in the construction of buildings, bridges, and pavements. The various constituents of concrete are cement, fine aggregate, coarse aggregate, and water in which 5% of the world's CO, is produced during the manufacture of the cement. In addition, the concrete is heavy, thus in order to reduce the self-weight of the structure, some portion of the concrete needs to be removed. Concrete is a composite material composed of fine and coarse aggregate bonded together with a fluid cement (cement paste) that hardens (cures) over time. Concrete is the second-most used substance in the world after water, and is the most widely used building material.

Its usage worldwide concrete is twice that of steel, wood, plastics, and aluminium combined. Globally, the ready-mix concrete industry, the largest segment of the concrete market, is projected to exceed $600 billion in revenue by 2025.This widespread use results in a number of environmental impacts. Most notably, the production process for cement produces large volumes of greenhouse gas emissions; leading to net 8% of global emissions other environmental concerns include widespread illegal sand mining, impacts on the surrounding environment such as increased surface runoff or urban heat island effect, and potential public health implications from toxic ingredients. Significant research and development are being done to try to reduce the emissions or make concrete a source of carbon sequestration, and increase recycled and secondary raw materials content into the mix to achieve a circular economy.

Concrete is expected to be a key material for structures resilient to climate disasters, as well as a solution to mitigate the pollution of other industries, capturing wastes such as Plastic Waste**,** E –Waste, coal fly ash or bauxite tailings and residue etc. Accordingtothenaturalbehaviouroftheconcrete,itisstrongincompressionandweakintension.

II. BUBBLE DECK TECHNOLOGY

Plastic balls are lighter than steel balls and have characteristics of being acid proof, alkali proof, heat and electric insulative, and antimagnetic. There are many kinds of plastic, and the proper plastic balls for customer requirement are used in many different industries such as electric, automobile, medical equipment, industrial machine, etc.

Bubble deck system is a new construction technologyusingrecycledsphericalballsinConcrete toreduce self-weight of thestructure as part of the concrete is replaced by the bubbles. The use of these spherical balls/bubbles tofill the voids in the middle of aConcrete Structure Reduce self- weight compared to solid

Concrete having same depth without affecting its deflection behavior &compressive strengthofconcrete.

III. OBJECTIVES

1) To study the basic properties of materials
2) To study the compressive strength characteristics of conventional concrete
3) To study the compressive strength characteristics of concrete with plastic balls
4) To compare the compressive strength characteristics of concrete with plastic balls and conventional concrete

IV. METHODOLOGY

The methodology adopted is as shown in fig-1

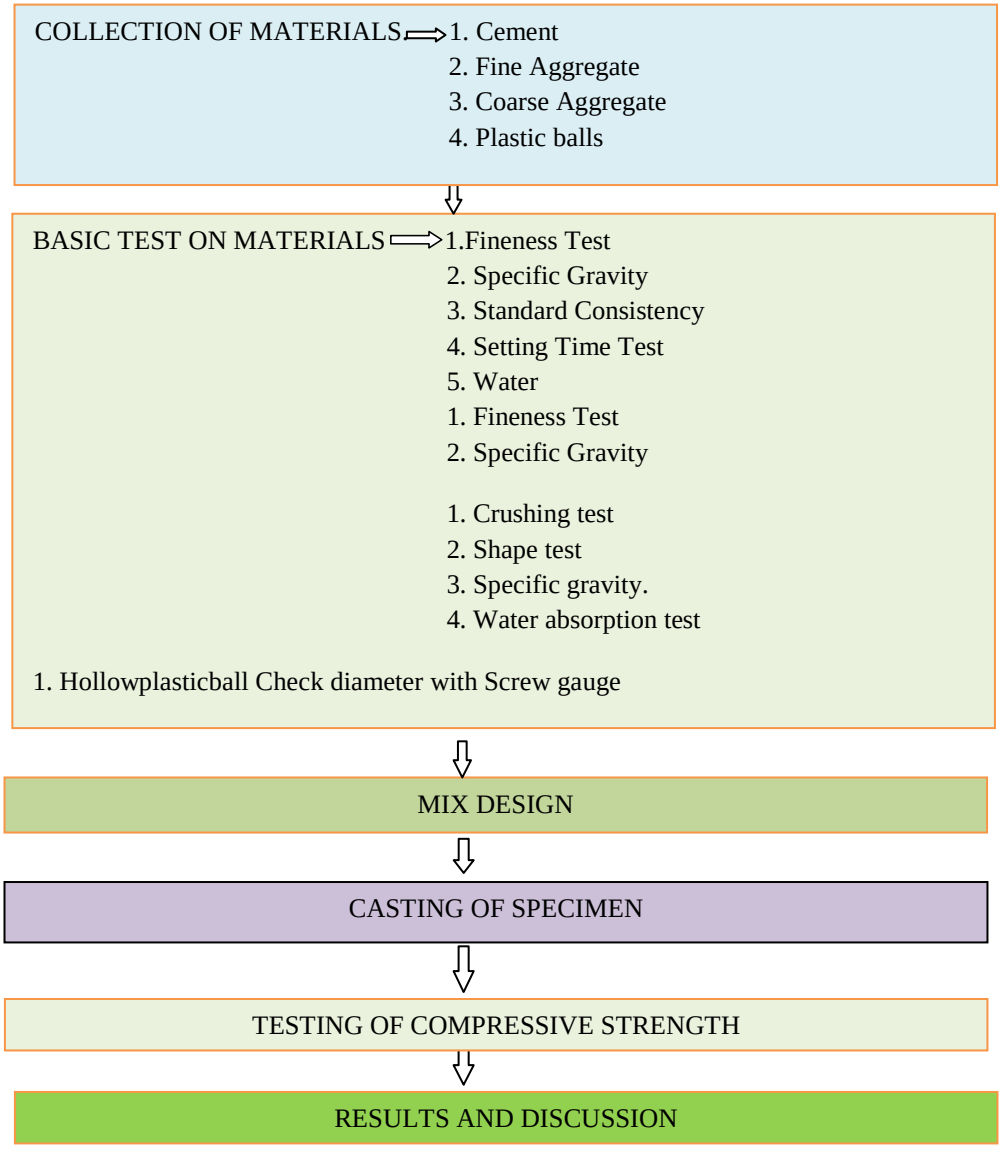

Fig.1-Methodology flowchart

V. MATERIALS

A. *Ordinary Portland cement (OPC) of 53 Grade*

It is available in the local market was used for the investigation. Care has been taken to see that the procurement was made from single batching in air tight containers to prevent it from being effected by atmospheric conditions.

Note: We have used Priya Cement to mix design M30 grade and w/c ratio is 0.45

B. Fine Aggregates

We used M-sandsize4.75mm andbelowconfirmingtozone3ofIS383-1970isbeingused as the fine aggregate.

C. Coarse Aggregates

We used Natural crushed stone of down size 20mm size Angular Coarse Aggregate.

D Hollow Plastic Spherical Balls

The hollow plastic spherical balls used in this project are manufactured from recycled plastic of diameter 64 mm and 67mm. The purpose of using recycled material is consumption of finite natural resources, therefore the recycling martial reduces inputs of new resources and limits the burden on the environment and reduces the risks to human health.

D. Water

Water is the key ingredient, which when mixed with cement, forms a paste that binds the aggregate together. The water causes the hardening of concrete through a process called hydration. The role of water is important because the water to cement ratio is the most critical factor in the production of "perfect" concrete. PH value of water used for concreting should be greater than 6 and should be potable.

VI. MIX PROPORTION

Concrete Mix Proportions for (M30) grade
Cement = 438.13 kg/m3, Water = 197 kg/m3
Coarse aggregate = 1066.89 kg/m3
Water-cement ratio = 0.45
∴ Mix Proportions = Cement: Fine aggregate: Coarse Aggregate = 1:1.527:2.435 (note: Here we not used TMT bars)

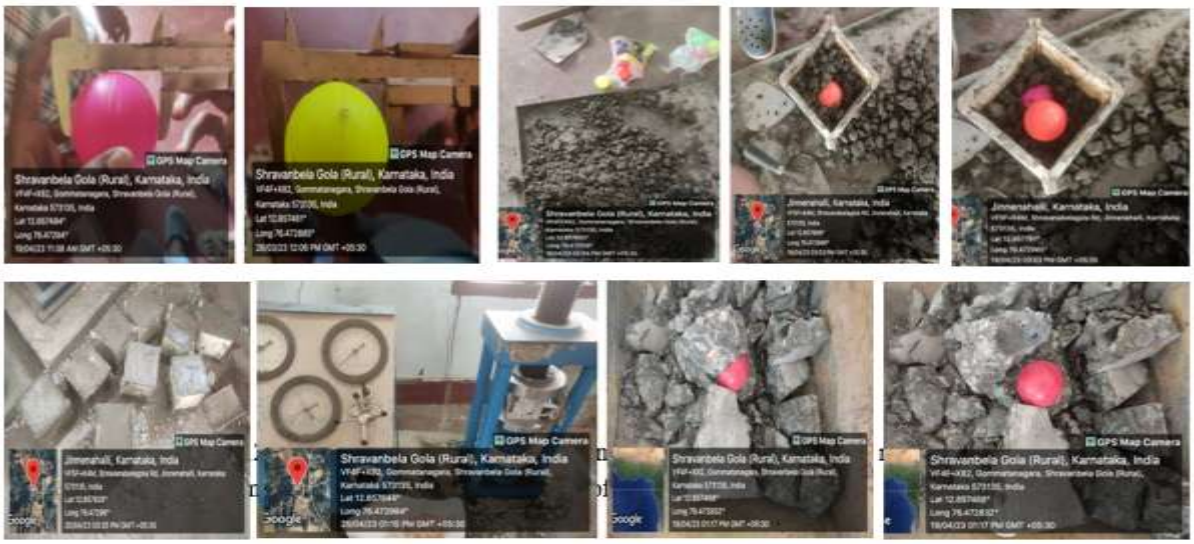

Fig-2 Materials and testing of concrete

VII. EXPERIMENTALTESTSRESULTS AND DISCUSSION

1) Basic test of materials

The various test on materials like cement and aggregates are tabulated as shown in table-1 to table-3

Table 1: Test results of cement

SL.NO	Properties	Test results	IS:4013-1963
1.	Standard consistency	34%	24%-34%
2.	Initial setting time	1.50 MIN	Minimum of 30min
3.	Specific gravity	3.048	3-4
4.	Fineness	1.66%	10%

Table 2: Test results Coarse Aggregate

Sl .No	Properties	Test Results	I.S Recommendation

1	Nominal Size Used	20mmanddown Size	----------
2	Specific Gravity	2.653	IS2386-1963
3	Moisture Content	0.1%	IS2386-1963
4	Water Absorption	0.350%	IS2386-1963
5	Crushing Strength	28.86%	IS2386-1963
6	Shape Test		
	Flakiness index	15.65%	IS2386-1963
	Elongation index	25.61%	IS2386-1963

Table 3: Test results of fine Aggregate

Sl. No	Properties	Test Result	I.S Recommendation
1	M Sand zone	Zone-III	IS383Table-3
2	Specific gravity	2.6	IS2386-1963
3	Fineness modulus	2.9	IS2386-1963

Fig-3 Basic test of materials

2) Compressive strength of conventional concrete and concrete with plastic balls is as shown in Table 4 and fig-4

Table- 4 Compressive strength of conventional concrete and concrete with plastic balls for different days of curing

Sl. No	Mix Proportion	No Of Days			Compressive Strength N/Mm^2		
					7 days	14days	28days
1	Conventional concrete	7	14	28	10.510	21.033	29.960
2	Conventional concrete + one plastic ball reduction of concrete(4.065)%	7	14	28	12.070	12.143	9.770
3	Conventional concrete + two plastic ball reduction of concrete(9.327)%	7	14	28	4.736	11.403	11.106

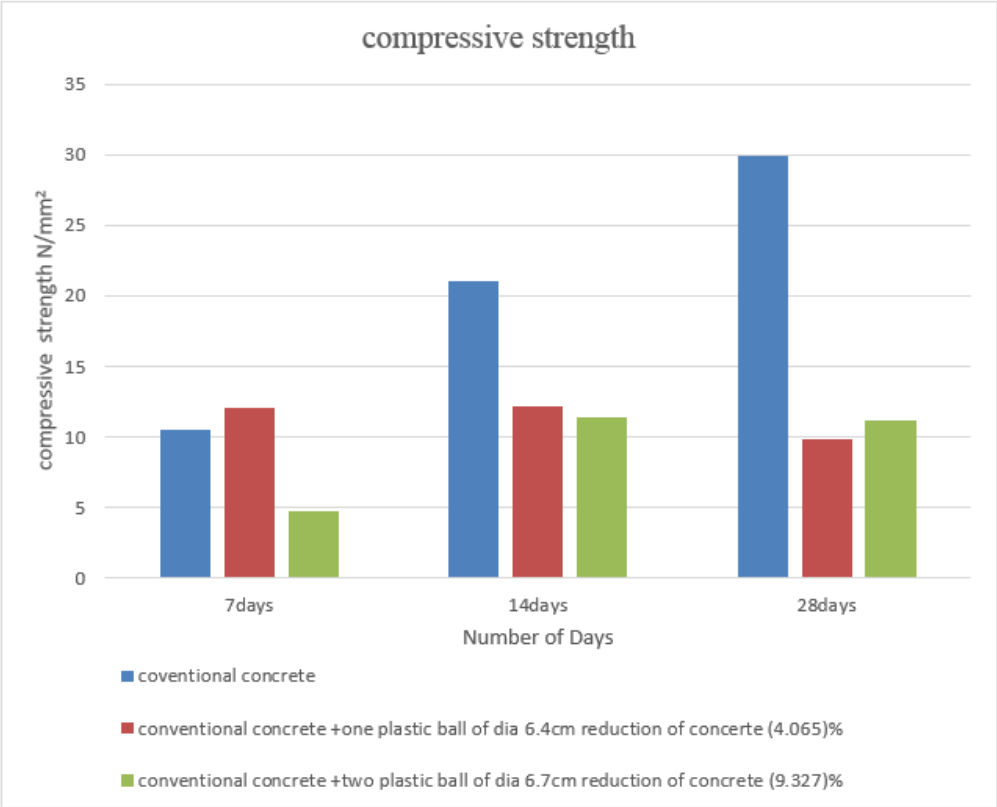

Fig-4Compressive strength of conventional concrete and concrete with plastic balls for different days of curing
From the above fig-2we can observe that the conventional concrete compressive strength gradually increased we get the targeted mix design strength for M30 grade. For one plastic ball the compressive strength has increased initially for 7 days and decreased suddenly after 28 days. When two plastic balls are used initial strength is also very less.

VIII. CONCLUSION

✓ We can observe that the conventional concrete compressive strength gradually increased we get the targeted mix design strength for M30 grade.
✓ For one plastic ball the compressive strength has increased initially for 7 days and decreased suddenly after 28 days.
✓ Two plastic balls are used initial strength is also very less..
✓ The compressive strength characteristics of conventional concrete is good for construction but concrete with plastic balls are not good for construction due to decrease in compresssive strength compare to conventional.concrete.
✓ 7days initial strength of concrete with plastic ball is 13% more compared to conventional concrete but at end of 28 days its compressive strength decreases by nearly 20% compared to conventional concrete

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