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Study on behavior of Bubble Beam

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Abstract - In modern era we cannot imagine structures without concrete and reinforcements every structure has basic skeleton of reinforcement embedded in concrete. So the basic structural members are also made up of reinforcement and concrete the rising cost of construction material is a matter of concern. The reason for increase in cost is high demand of concrete and scarcity of raw material. Hence the concrete technologists must search for some economical alternative to the coarse aggregate. In this study, plastic bubbles are used as light weight material in concrete. The properties of bubble is examined and the use bubble in construction is tested. . The project paper aims at analyzing flexural and compressive strength characteristics with partial replacement of concrete by bubbles using M20 grade concrete. We choose M20 concrete because it is used in general practice for every kind of construction like roads, apartments, houses and channels. So we focused on concrete on general practice which made this project more realistic and practical.

1. INTRODUCTION

In case of reinforced Concrete, concrete is strong in compression and steel is strong when under tension. Together they can bear all type of forces acting on it.While considering a reinforced concrete beam, the loads applied to the beam result in reaction forces at the beam's support points. The total effect of all the forces acting on the beam is to produce shear forces and bending moments within the beam, that in turn induce internal stresses, strains and deflections of the beam. Upon having more concrete in beam, it shall contribute to increased dead load of the structure. This dead load which is additional in nature and does not serve any positive purpose can be removed. This is done by introducing voids in the beam. Since voids cannot be made to form on their own, hollow balls or low weight balls are placed in the concrete to reduce the overall weight of the concrete. This concept bubble beam has hollow spheres made from recycled plastic placed between two layers or meshes of reinforcement. In this paper, we are going to study on bubble beam and design of bubble beam. (Both conventional and bubble beam and its types).

1.1Objectives and significance.

The main objective of this is to study the practicality in using hollow spherical plastic balls in reinforced concrete slab, which is called as bubble deck slab.

1. To determine the load bearing capacity of bubble beam and compare with conventional beam.
2. To estimate the amount of concrete saved as a result of inducing spherical bubbles into the beam.

2. MATERIAL

2.1 Cement: Ordinary Portland cement whose 28 day compressive strength was 43 N/mm^2 was used. Ordinary Portland cement confirming to **IS: 1489-1991(Part1)** was used. The properties are determined as per relevant IS standards and the test results obtained are satisfying the code requirements.

2.2 Fine Aggregate: Natural River sand confirming with specific gravity is 2.65 and fineness modulus 2.9% was used. River sand (Belgumpuri) obtained from local river is used.

Table no 2.1 Properties of fine aggregates.

Fine Aggregate	Specific Gravity	Bulk density (kg/m^3)
River sand	2.65	1567

2.3 Coarse Aggregate: The shape and particle size distribution of the aggregate is very important as it affects the packing and voids content. The coarse aggregate satisfying IS 383-1970 is used. The properties of coarse aggregates are to be determined as per IS: 2386-1963.The tests are conducted to find the properties of coarse aggregate. Crushed Coarse aggregate of 20mm and 10 mm procured from local crusher grading with specific gravity is 2.89 and 2.78 was used

2.4 Water: Portable water free from any harmful amounts of oils, alkalis, sugars, salts and organic materials was used for proportioning and curing of concrete.

2.5 Reinforcement: The longitudinal reinforcements used were high-yield strength deformed bars of 10 mm diameter. The stirrups were made from mild steel bars with 8 mm diameter. The yield strength of steel reinforcements used in this experimental program was determined by performing the standard tensile test on the three specimens of each bar.

2.6 Hollow bubbles: The bubbles are made using high density polypropylene materials. These are usually made with nonporous material that does not react are to be used and the quantity of reinforcement from transverse ribs of the slab.

2.7 Form work: Size of the formwork is 150 X 150 X 700 mm

Fig. 2.1: Beam Reinforcement (hollow bubbles)

3. CONCRETE MIX DESIGN

Table no. 3.1 Design mix proportion of M20 Concrete

Materials	Proportion by Weight
Cement	1
FA	1.63
CA	2.58
W/C	0.45

4. TEST

The flexural test in performed on beams. The beams are tested in the loading frame of the "Structural Engineering" Laboratory. The testing procedure for the all the specimen is same. The two-point loading arrangement is used for testing of beams. Two-point loading is conveniently provided by the arrangement shown in Figure. The load is transmitted through a load cell on to a spreader beam. The spreader beam is installed on rollers seated. The test member is supported on roller bearings acting on similar spreader plates. The specimen is placed over the two steel rollers bearing leaving 50 mm from the ends of the beam. The remaining 600 mm part goes under two Point load is placed on the center of the mid span of the beam.

5. EXPERIMENTAL TESTS RESULTS

5.1. Compressive strength test:

The result obtained from 7days and 28days curing for cubes

Table no. 5.1Compressive strength test

No. of cubes casted for test	Age of concrete (Days)	Avg. comp. strength (N/mm^2)
3	7	15.9
3	28	23

5.2. Flexure Strength Test:

The result obtained from 28days of curing for Beams.

Table no. 5.2 Flexure strength test

Tested beam	Peak Load(KN)	Displacement (mm)	Flexural Strength
Conventional Beams	62.55	4.79	2.85 (N/mm^2)
	62.55	4.79	
	62.55	4.79	
Bubble Beams	57.40	6.60	2.51 (N/mm^2)
	57.40	6.60	
	57.40	6.60	

6. CONCLUSION

1. Load and flexure strength is nearly about same
2. Reduction of concrete 7 % as compared to conventional beam
3. Reduction of weight 8.37 % as compared to conventional beam
4. Waste plastic and rubber material can be used

7. FUTURE SCOPE

1. We can extend study on behavior of bubble in concrete members
2. Currently we can also use them in PCC concrete.
3. Other concrete members like foundation and columns can also include in further study.
4. Useful in case of light weight precast structure.
5. Minimizing dead load of structure.
6. As bubble beam lacking in strength further study can be made by using higher grades of concrete.
7. Use for constructing all type of buildings, especially single story & Each and every roof floor.
8. Use for parking, Slum clearance projects

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