

Review Study on Bubble Deck Slab

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ABSTRACT

Slab is a structural element of building. Slab is flat and horizontal surface made up from concrete. Concrete slab providing flooring and roofing in building. Slab transfer the loads on the beams, columns and walls. Concrete is heavy in weight and during the manufacturing of cement 5% CO₂ is created. In this, paper we are studied how to reduce concrete in slab which may be suitable and useful for making a light in weight by using HDPE (High Density Polyethylene) hollow spheres balls. These balls will replace the in-effective concrete in centre of the slab. This will reduce the dead weight of the slab 30% to 50% by adopting this method.

1. INTRODUCTION

Slab plays a vital role for transmit the loads to others structural members. It provides a covering shelter. Its function is to transmit the load by bending in one or two dimension. In day to day life, cost of concrete is increasing so to overcome this problem we are using plastic balls in place of concrete. Bubble deck reduces almost 35 % concrete in slab and this method is effective in time saving also. This study firstly invented by Jorgen Bruenig in 90's and he developed the first biaxial slab in Denmark.

Bubble deck is most eco-friendly than any other concrete construction technique. It is a modern technique of construction in which recycled plastic materials are used to decrease the self-weight of slab. This flat slabs using in Parking's, Commercial Buildings, and Cinema Halls.

Objective:

1. 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.
2. To find out the loadbearing capacity of bubble deck slab as compared to the conventional slab.
3. To study the behaviour of conventional slab & bubble deck slab.
4. To estimate the amount of concrete saved as a result of spherical balls introduction into the core of the slab.
5. The effects of using Hollow plastic ball (HDPE – High Density of polyethylene) in the reinforced concrete slab.

2. LITERATURE REVIEW

M .Surendar, was completed the experimental study on Bubble Deck slab with the aim of eliminating the concrete from centre of slab by using the recycle plastic balls. This ball is used to replace in the place of concrete and makes light weight slab and decrease the dead weight and also increase the efficiency of the floor. The bubble deck slab carried the stress about 30.8 MPa by applying a UDL load about 320 KN and causes deflection of 12.82 mm. The bubble deck slab can with stand 80% of stress. From this evaluation of this results bubble deck slab gives better performance than any conventional slab.

Arti Shetkar & Nagesh Hanchewas completed the experimental study on Bubble Deck slab system with Elliptical Balls, the behaviour of Bubble Deck slabs is effected by the ratio of bubble diameter to slab thickness. In this experimental study the applied force from the bottom to top portion of slab until the cracks occurs in slab. From this results obtained by study, this study shows the preferable load bearing capacity in bubble deck slab achieve by using the hollow elliptical balls.

Marais.(2010) had studied the cost-effective value of SVF (spherical void formers) slab in South Africa and compared the cost of direct construction to those of two others large span slab system. They concluded that the firmness of SVF slab areas can be reduced up to 10% as compared to the solid slab of same thickness.

Harishma K R & Reshmi K N (2015): It says that, the combined advantages of manufactured elements and controlled condition of the work is finished in the form of floor finisher. The steel is also made in two form, a) universal mesh layer & b) vertical support of the diagonal of column and beam.

Purnachandra Saha (2014) says that the bubble deck slab are a way to the reduce the structure dramatically by virtually eliminating of all the concrete in the centre of the slab which does not perform the structural function. The HDPE hollow sphere balls replace unnecessary concrete in the centre of the slab and increase the floor efficiency. It is introduced the 30 to 50% of lighter slab that reduce the load on the foundation, columns and walls in entire building. The advantage of that the consumption of energy of gas mostly CO₂, production of industrial waste.

Calin S, and Asavaoie C (2010) Carried out an experimental program on the effects of concrete strength on the shape and diameter of plastic balls on the the overall behaviour of Bubble Deck. In this the results are showed the cracking, deformation & failing of slab are subjected to gravitational loading. The results also show that the performance can be improved by using hollow sphere balls for superior loadbearing capacity of bubble deck slab.



Materials Used and Method adopted

1. **Pozzolana Cement (PPC):** It is a variation of OPC which includes a mixture of a pozzolanic material which is known to increase the strength of concrete and reduce the Amount of OPC used. We have used M30 grade of cement.
2. **Fine Aggregates:** We used Natural River sand size 4.75mm
3. **Coarse Aggregates:** We used Natural crushed stone of size between 20mm to 40 mm.
4. **Hollow Plastic Spherical Bubbles:** The hollow plastic Spherical bubbles used in this project are manufactured from Recycled plastic of diameter 65 mm in Beam and 100 mm plastic balls used in slab.

3. EXPERIMENTAL TEST RESULTS

1. **Compressive strength test:** This test is determining compressive test of cube. The compressive strength of concrete can be calculated by dividing the load applied on the concrete cube at the point of failure by the cross-section area of the cube (15x15x15 cm) on which load was applied.

No of cubes casted for test	Age of concrete in (days)	Avg compressive strength (N/mm ²)
1	7	12.94
1	14	19.34
1	28	33.56

2. Flexure strength test:

Flexure tests are generally used to determine the flexural modulus or flexural strength of a material. It is performed on UTM. As per the test results observe in that all bubble beam and Conventional beam shows the nearly same deflection at Particular load.



No. of beams casted for test with reinforcement	No. of beams casted for test without reinforcement	Flexural strength (N/mm ²) of without reinforcement beam	Flexural strength (N/mm ²) of with reinforcement beam
1	1	3.00	4.00

1	1	3.22	4.24
1	1	3.25	4.58

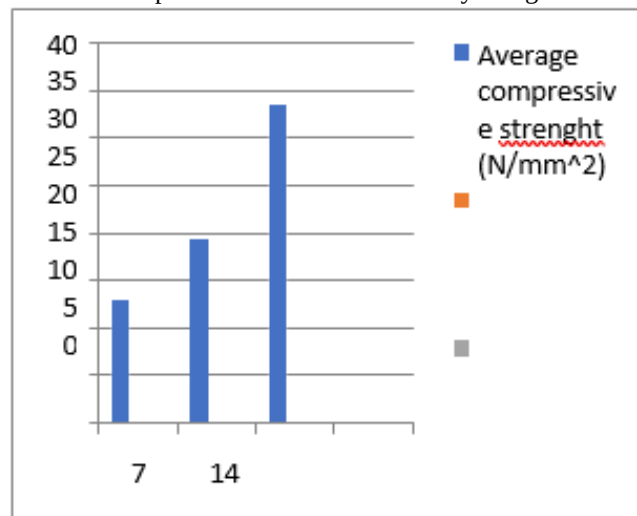
3. Conventional Bubble Deck slab:

The conventional slab with M30 grade of concrete it's dimensions is 0.98m * 0.69m * 0.13 m. Diameter of the reinforcement is 10 mm @ 130 mm spacing and the diameter of balls used in this slab is 100 mm and is placed continuously in grid form . Cover block of size 15 mm is used for maintain the cover.

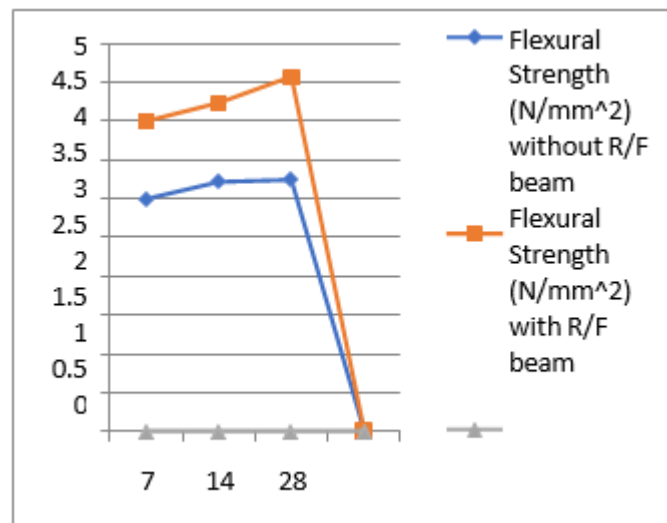


Testing Procedure :

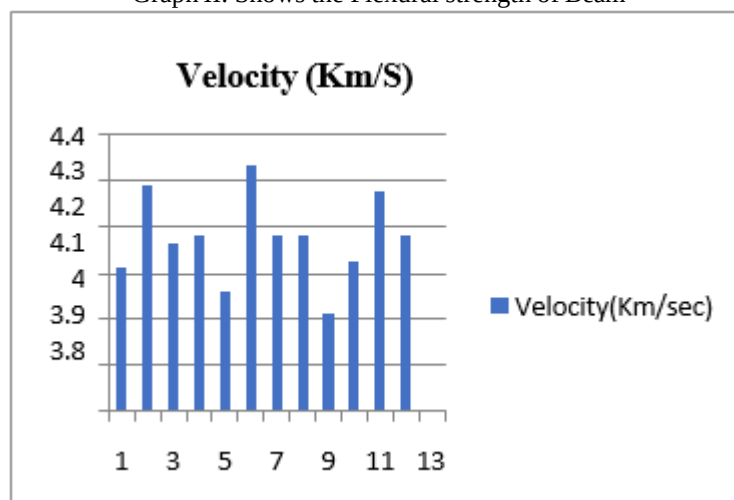
1. The ultrasonic pulse velocity (UPV) is used calculated the delamination in concrete.
2. UPV test is used to check the quality of concrete and also defects of concrete by passing electronic waves .
3. Tests were conducted on bubble deck slab of dimension 1025mm * 700 mm with a thuckness of 130 mm.
4. The slab is tested at the ages of 28 days .
5. The tests were conducted between top to bottom surface of slab by using UPV for different point.



Graph I. shows the compressive strength of cube



Graph II. Shows the Flexural strength of Beam



Graph III. Shows the Delamination of Slab

4. CONCLUSION

- It reduced foundation size since the structural dead weight is reduced it helps to achieve a greater fire proof design to using conventional slab.
- Advantages of Bubble deck system is cost saving and reducing material consumption to make construction time faster.
- By using hollow spherical balls, it can achieve the higher load bearing capacity in bubble deck.
- Concrete usage is reduced as 1 kg of recycled plastic ball replaces the 100 kg of concrete.
- Skilled labour is required for designing.
- Height / thickness of slab us not limited.
- It is provide a light weight structure

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