Review Paper on "Bubble Deck Slab"

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Abstract – ***Bubble deck slab is a method of virtually eliminating all concrete from the middle of a floor slab, which is not performing any structural function, thereby dramatically reducing structural dead weight. High density polyethylene hollow spheres replace the in-effective concrete in the center of the slab, thus decreasing the dead weight and increasing the efficiency of the floor. By introducing the gaps, it leads to 30 to 50% lighter slab which reduces the loads on the columns, walls and foundations, and of course of the entire building. The advantages are less energy consumption - both in production, transport and carrying out, less emission - exhaust gases from production and transport, especially CO2 and reduce the material, the load, lower the cost and it is also a green technology. The aim of this paper is to discuss about the various properties of Bubble deck slab based on various studies done abroad. In the deck technology concrete volume is reduced by replacing it with spherical bubbles, this are locally available which is called as Pepsi balls this balls are made up of high density polyethylene (HDPE).in this experimental program conventional slab and bubble deck slab are cast. This implies the realization of monolithic slab element which will be subjected to two point loading in order to determine the deflection, cracking and failing characteristics. The resultant conclusion will be used in defining failing mechanism.***

Keywords: Bubble Deck Slab, HDPE Balls in Slab, Light Weight Slabs, Conventional Slab, Recycled Plastic Balls.

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1. INTRODUCTION

In building constructions, the slab is a very important structural member to make a space and it is one of the largest member consuming concrete. A slab being the essential part of the structure has to be effectively designed and utilized. It tends to use more concrete than requirement, hence has to be optimized. When the load acting on the slab is large or clear span between columns is more, the deflection of the slab is also more. Therefore the slab thickness is on increasing. Increasing the slab thickness makes the slabs heavier because of this self-weight of slab also increase, and will increase column and foundations size. Thus, it makes buildings consuming more materials such as concrete and steel reinforcement. The new prefabricated construction technology using Bubble Deck slab is recently applied in many industrial projects in the world. Bubble Deck slab uses hollow balls made by recycled plastic and therefore it is an innovator method of eliminating the concrete part in the middle of conventional slab which does not contribute to the structural performance. Bubble Deck is a two-way spanning hollow deck in which recycled plastic bubbles serve the purpose of eliminating non-structural concrete, thereby reducing structural dead weight, void formers in the middle of a flat slab eliminates 25% of a slabs selfweight. Bubble deck produces floors 20% faster with less formwork and beams, reduces construction costs by 10% and agrees with the 35% reduction in concrete use.

1.1 Objectives

1. The main objective of this study is using hollow Plastic ball (hdpe- high density of polyethylene) in the reinforced concrete slab (below the neutral axis rather than whole depth of the slab as used in regular bubble deck slabs)and its effects.

2. To estimate the amount of concrete saved as a result of spherical balls inserting in to the core of slab.

3. Use of waste plastic material in the form of plastic balls, thereby reducing burning of plastic and harm full environmental pollution.

4. To determine load carrying capacity of bubble deck slab and compare with conventional slab.

5. To study the bending (deflection) behavior of Conventional slab & bubble deck slab

1.2 Scope of Project

1. Use for constructing all type of building specially sky scrapers.

2. Best for large span halls like theater and auditorium.

3. Pedestrian bridge deck slab.

4. Use in parking areas as less number of columns are required.

2. LITERATURE REVIEW

In June 2016, **Bhagyashri G. Bhade, S.M.Barelikar** offered the idea named "An experimental study on Two Way Bubble Deck Slab with Spherical Hollow balls" in International Journal of Recent Scientific Research. In this paper,they tested slab which was simply supported and loaded with single point load,the slab has been tested at the age of 28 days.the slab specimen were placed on the testing machine and adjusted the centre line,supports,point load and dial guage were in their correct location.the deflection of the specimen measured at their mid span beneath the lower face of the tested slab was found out to be 9.20 mm at 320 KN point load and conventional slab was 8.70 mm at 260 KN point load.the result was found out to be reduction in weight by 25% compared to solid slab and also saving cost and time by using bubbles in the slab.

3. METHODOLOGY

1. Basic Test on cement, fine aggregate and coarse aggregate.

2. Mix design for M25.

3. Design of slab and Preparation of slab Specimen.

4. Testing of Specimen

5. Obtaining the results and comparing the results of both conventional and bubble deck slab.

4. MATERIALS REQUIRED

Cement

Ordinary Portland cement 53 grade was used. The test were carried out according to the IS 456-2000 Standard.

Aggregate

Fine aggregates

The river sand is being used as Fine aggregate.

Coarse aggregate

The Coarse Aggregates of size 20mm is used.

Water

Potable water is used for mixing and curing.From durability consideration water cement ratio should be Restricted as in case of normal concrete and it should preferably Be less than 0.45.

Concrete

M25 Grade concrete was used for preparing both, the Conventional and Bubble deck slab panels (size 700mm x 700mm).

Reinforcement bars

High strength deformed steel bar Fe500 of size !0mm in dia, is used for both main steel and distribution steel.

Hollow bubbles

The bubbles are made using high density polyethylene Materials. These are usually made with nonporous material that does not react chemically with the concrete or reinforcement Bars. The bubbles have enough strength and stiffness to support safely the applied loads in the phases before and during Concrete pouring. The diameter of bubble is 60 mm and the. The bubbles are spherical in shape.

5. EXPERIMENTAL PROCEDURE

Conventional slab

The conventional slab is prepare of the M30 grade of concrete In the form work it's dimension is 0.7m x 0.7m x 0.15m.Cover block of size 15mm is used for maintain the cover. Diameter of the reinforcement is 10mm @ 240mm c/c spacing. Total length of bars is 960mm.as shown in fig. 1.

Fig 1 Reinforcement of conventional slab.

Bubble deck slab

The bubble deck slab is prepare of the M25 grade of concrete In the form work it's dimension is 0.7m x 0.7m x 0.15m.Cover block of size 15mm is used for maintain the cover.Diameter of the reinforcement is 10mm @ 240mm c/c spacing. Total length of bars is 960mm. The dia. of the balls used in this slab is 60mm and is placed continuously in a grid form as shown in the fig. 2.

Fig. 2 Balls (bubbles) placed continuously over the reinforcement in grid form.

6. TESTING PROCEDURE

The tested slabs were simply supported on the rollers of the U.T.M. machine and loaded with a Two-point load. The slabs have been tested at ages of (28) Days. The slab specimens were placed on the U.T.M. machine And adjusted the centre line, supports, two point load were in their correct or best locations. At the end of each load Increment, observations and measurements were recorded, for the mid-span deflection and crack development and Propagation on the slab surface. The deflection of the specimens was measured at their midspan beneath the lower face of the tested slabs. When the slab reached advanced stage of loading, smaller increments were applied until failure, where the load indicator stopped recording anymore and the deflections increased very fast without any increase in applied load.

Fig. 3 Two-point loading by using metal balls.

Fig.4 Crack patterns in Bubble deck slab.

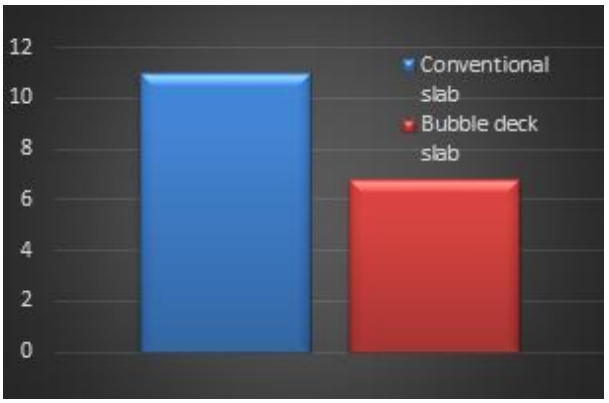
Fig.5 Crack patterns in Conventional slab.

7. RESULTS AND DISCUSSION

Results on the slabs is as shown in Table1.

Table 1. Shows the load, deflection, weight of the slab

Type of slab	Load (KN)	Deflection (mm)	Weight (kg)
Conventional slab	60	3	186.88
	70	3.4	
	80	3.6	
	90	4	
	100	4.5	
	110	4.9	
	120	5.4	
	130	5.9	
	140	6	
	147.80	6.8	
Bubble deck slab	30	0.2	153.86
	40	0.7	
	50	1.2	
	60	1.5	
	70	1.9	
	77.15	2.5	



Graph 1 shows the deflection of the slab

DISCUSSION

In the experiment we found that in the bubble deck (continuous) the volume of concrete is reduced due to which weight of slab ultimately decrease. Simultaneously, bubble deck slab has improved the elastic property of slab, such as Conventional slab deflect less as compared to Bubble deck slab. Weight reduction is the important factor is found in bubble Deck slab. Weight of the conventional slab is more than the Bubble deck slab.

8. CONCLUSION

1. Concrete usage is reduced as 33.02 kg as recycled plastic replaces concrete. This avoids the cement production and allows reduction in global CO2 emissions. Hence this technology is environmentally green and sustainable.

2. Reducing material consumption made it possible to make the construction time faster, to reduce the overall costs. Besides that, it has led to reduce dead weight up to 18%, which allow creating foundation sizes smaller.

3. The Bubble Deck configuration gives much improved flexural capacity, stiffness and shear capacity when the same amount of concrete and the same reinforcement is used as in the solid slab.

4. Advantage of Bubble Deck system is the significant cost saving, because of the Possibility of obtaining great spans with less support elements.

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